



Chinese Shu Embroidery: Patterns for Culturc Heritage Development in Sichuan

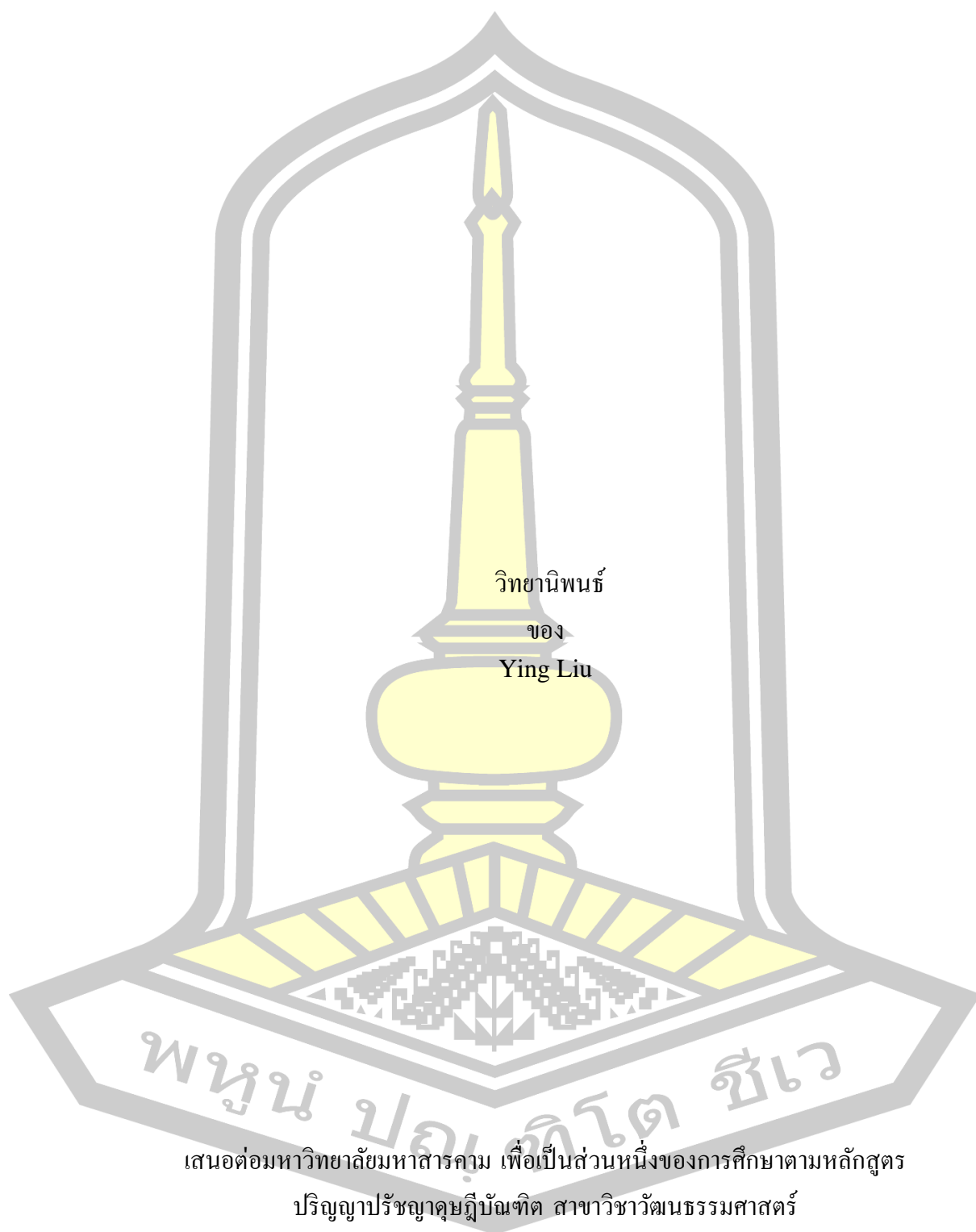
Ying Liu

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Doctor of Philosophy in Cultural Science

April 2025

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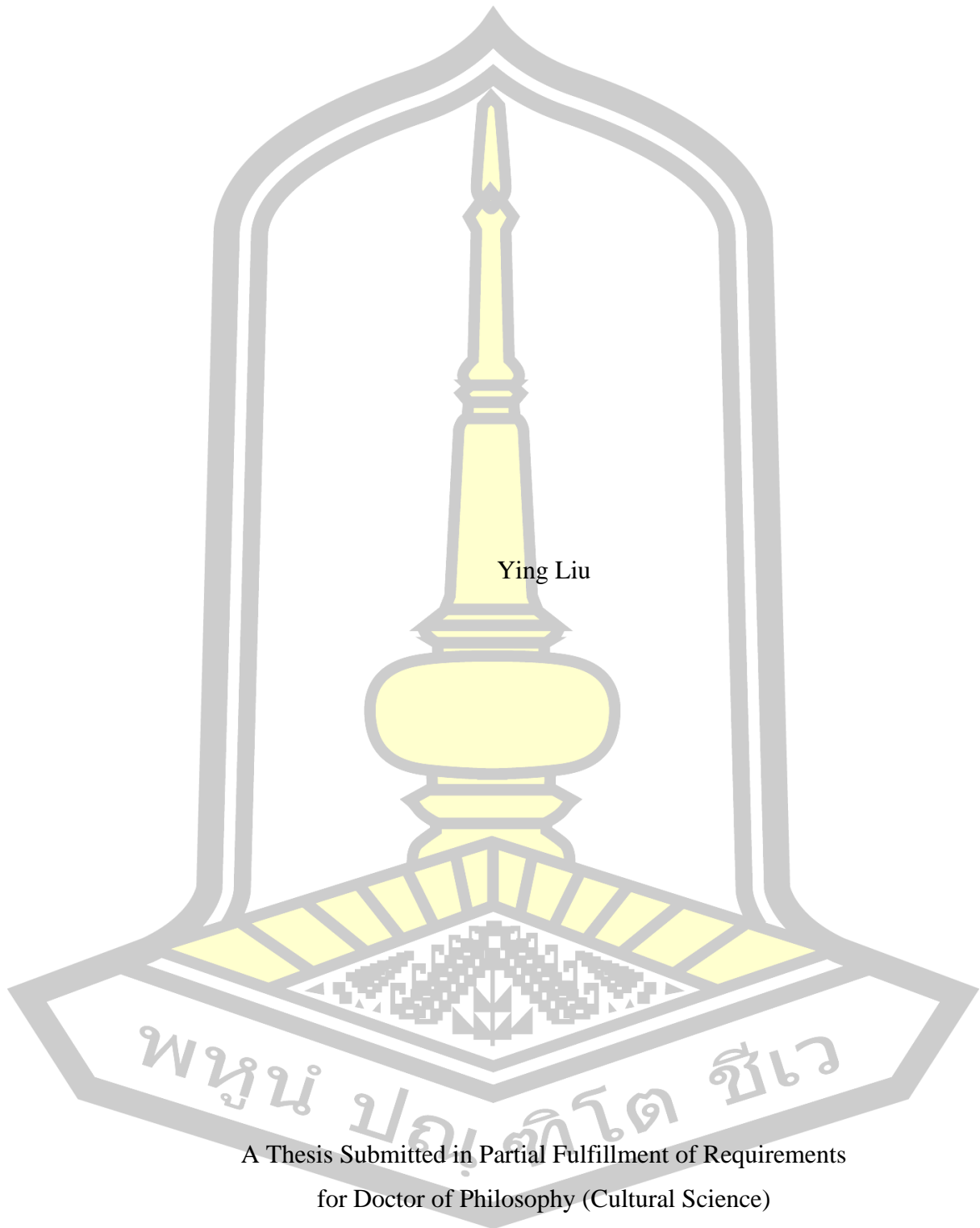
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Chinese Shu Embroidery: Patterns for Culturc Heritage Development in Sichuan



Ying Liu

A Thesis Submitted in Partial Fulfillment of Requirements
for Doctor of Philosophy (Cultural Science)

April 2025

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ABSTRACT

The purpose of this study is to study the development model of Chinese Shu embroidery: Sichuan cultural heritage. Taking the embroidery pattern of Chengdu in Sichuan Province as the research object, a qualitative study was carried out. Research data were collected through relevant literature analysis, surveys, observations, interviews, in-depth interviews, and group discussions. Research tools include survey methods, observation methods, interview methods, structured and unstructured focus group discussions. The population sample for this study consisted of 32 people and the data were analyzed using cultural theory. The results of the study were presented through descriptive analysis. The results of the study are as follows.

Research objectives: 1) to study the history of traditional patterns of Shu embroidery, 2) to study the current situation and problems of traditional patterns of Shu embroidery, and to study the development mode of traditional patterns of Shu embroidery. Researchers collect data through surveys, observations, formal and informal interviews, focus group discussions, museum collections, and more. The participants included cultural experts, national Shu embroidery inheritors, digital media designers and related professional and technical personnel. According to the research framework, the data was summarized, the knowledge graph ontology of Shu embroidery was constructed, and the multi-dimensional information system of the cultural connotation, historical background, theme meaning, stitching skills, and color structure of Shu embroidery patterns was formed to form a structured digital resource. On this basis, through the combination of knowledge graph and AIGC technology, a pattern creation method based on text generation image was developed, and the innovative design and efficient generation of Shu embroidery patterns were realized. In the process of research, class, object attributes, data attributes and axiomatic reasoning models were constructed, and verified with actual pattern examples. The introduction of AIGC technology enables the design of Shu embroidery patterns to meet the diversified and personalized market demand, and at the same time enhances the communication and influence of Shu embroidery culture. The results of this study are as follows:

First of all, the study of the historical and cultural origin, cultural value and cultural identity of the traditional patterns of Shu embroidery will help to improve its cultural value and influence. Secondly, the inheritance and protection of the traditional

patterns of Shu embroidery were analyzed and studied. The results show that the inheritance method of traditional patterns of Shu embroidery can no longer meet the current state of inheritance and protection. In addition, the heirs are seriously aging and lack the participation of younger groups. The low recognition and vague understanding of cultural values and connotations limit the inheritance and protection of Shu embroidery patterns. Finally, the combination of artificial intelligence knowledge graph and AIGC technology plays a significant role in the digital protection and innovation of Shu embroidery patterns, which not only realizes the modern inheritance of traditional culture, but also provides new ideas for the industrialization development of Shu embroidery art. The research in this paper has important theoretical value and practical significance for the digital protection, intelligent innovation and global dissemination of intangible cultural heritage.

Keyword : Shu embroidery pattern, intangible cultural heritage, knowledge graph, visualization, AIGC



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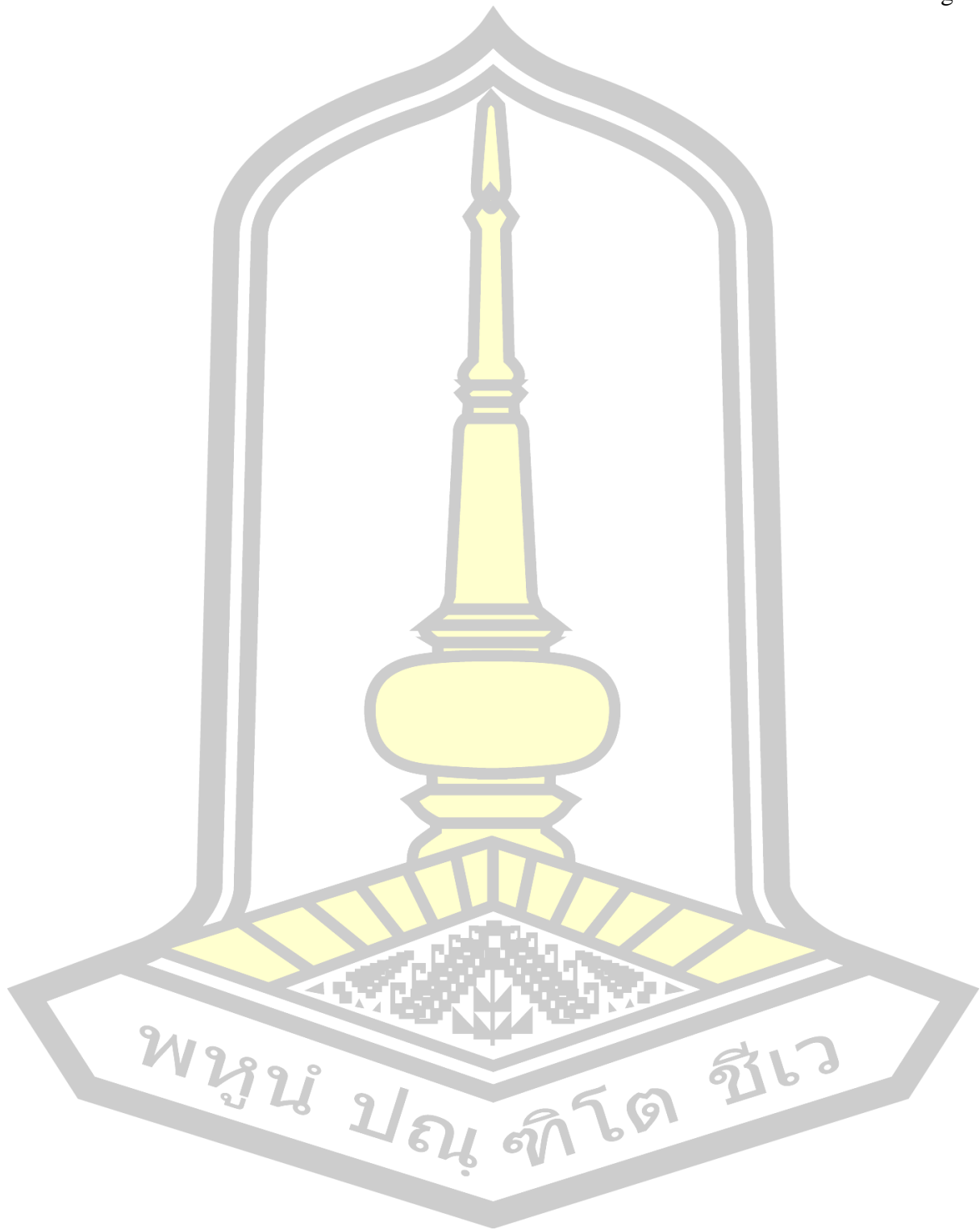


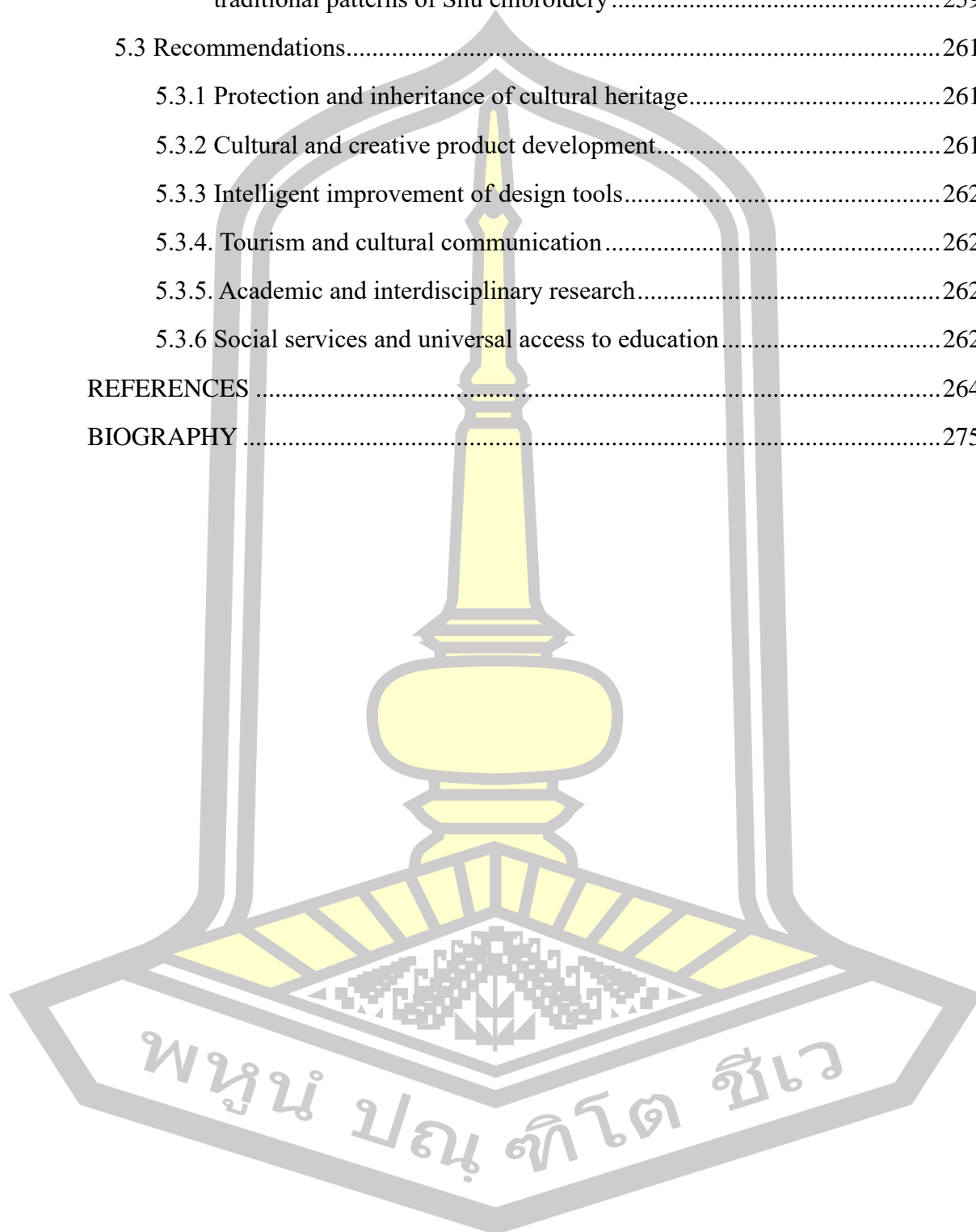
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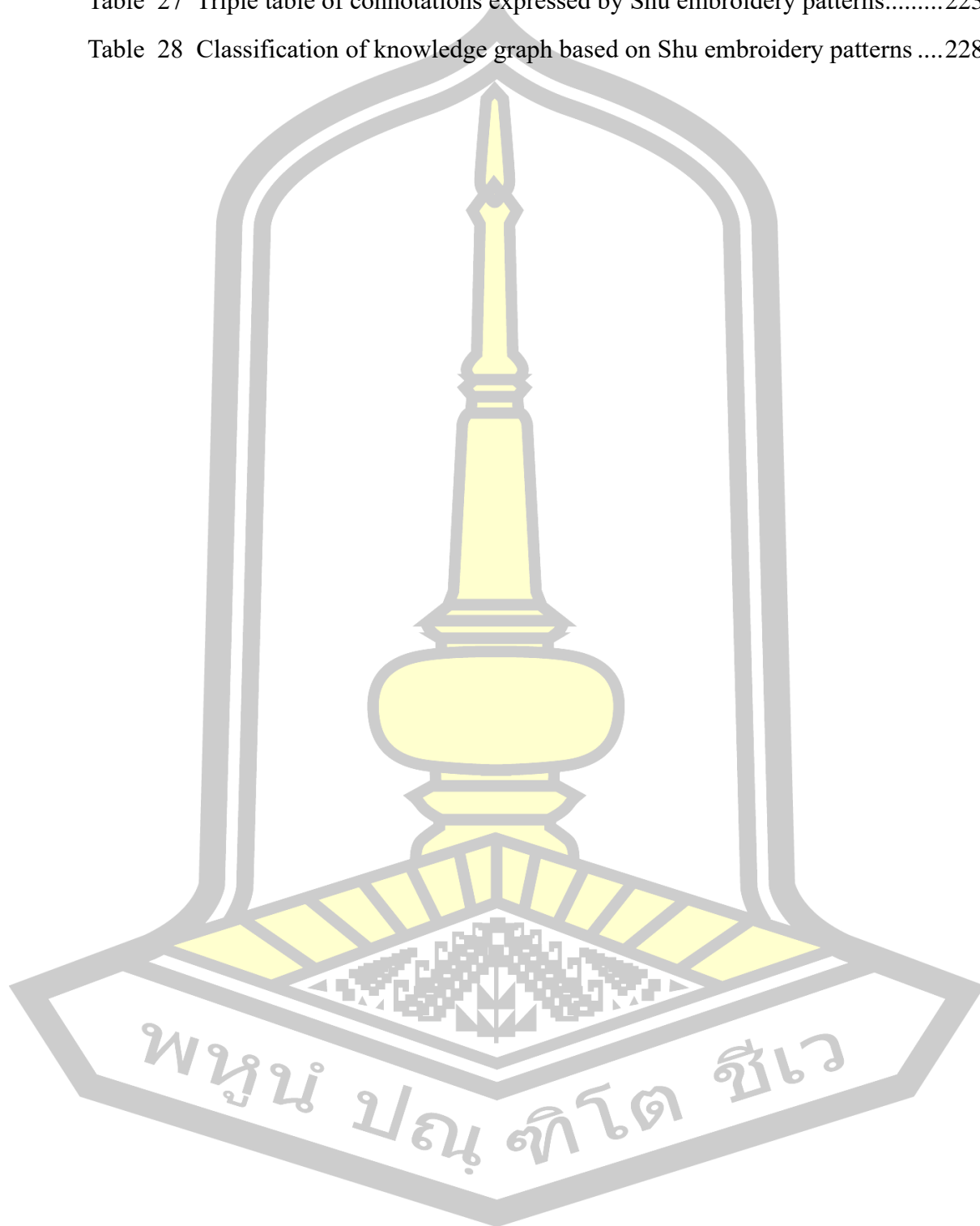
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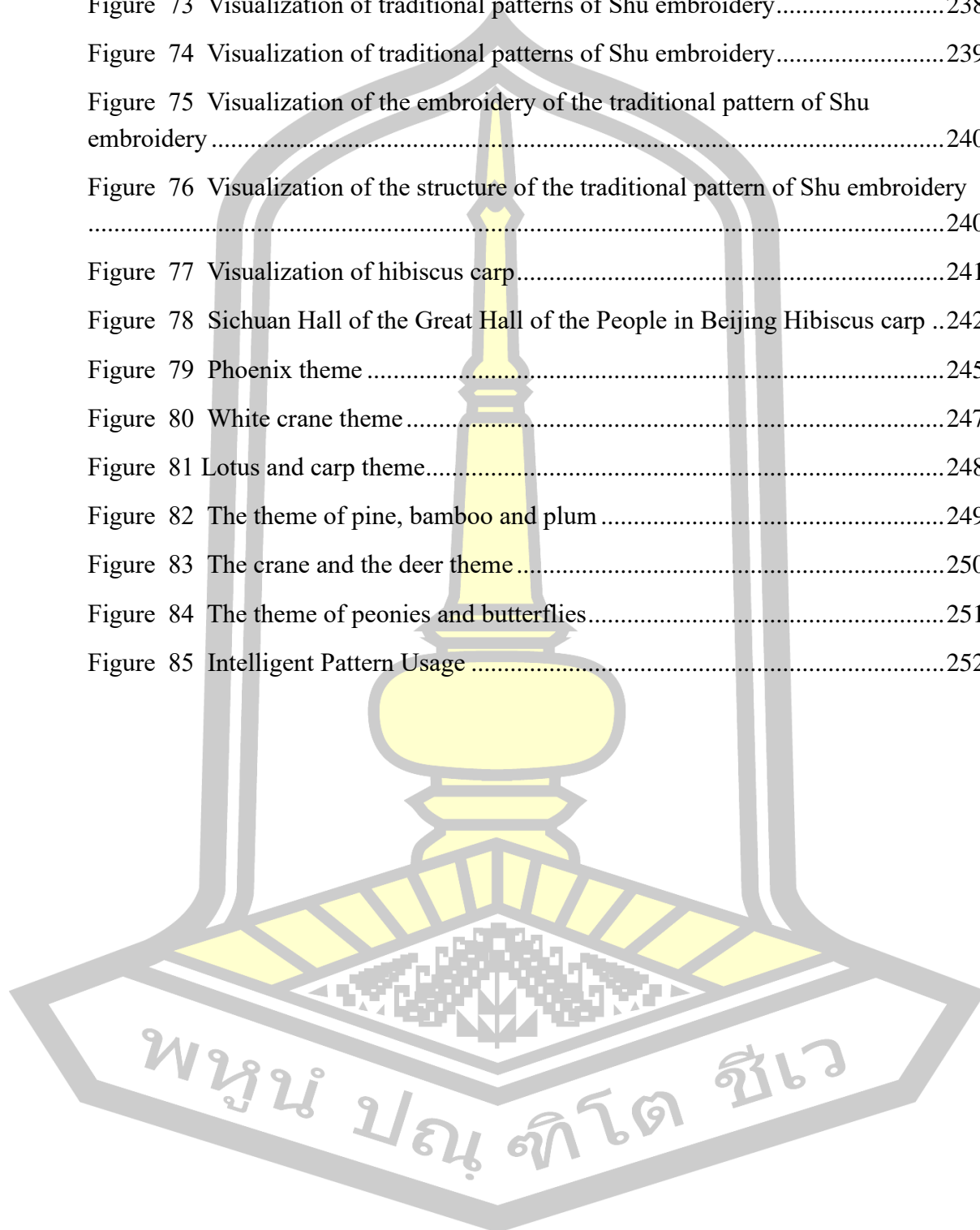
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CHAPTER I

INTRODUCTION

1.1 Background of the Study

Shu embroidery has a long history, the earliest can be traced back to the Sanxingdui civilization, since the Eastern Jin Dynasty and Shu brocade and called "the treasure of Shu". Shu embroidery with soft satin, color silk as the main raw materials, stitching including 12 categories of 122 kinds. It has the characteristics of rigorous stitching, flat stitches, rich changes, vivid images and rich three-dimensional sense. The "embroidery" of Shu embroidery is to use velvet or silk thread to tattoo a pattern on cloth (Huang, 2022). The development of Shu embroidery is based on the richness of Shu, and the silk civilization of the ancient Shu land has given birth to developed silk weaving technology, which not only provides embroidery raw materials for Shu embroidery - silk and silk thread, so that the development of Shu embroidery has a strong material foundation, but also creates an industrial and cultural environment for the development and prosperity of Shu embroidery (Qu, 2010).



Figure 1 "Hibiscus Carp".

Source: Liu Ying (2024)

The unique natural conditions of the Chengdu Plain provide a material basis for the development of Shu embroidery. The climate here is warm and moist, suitable for mulberry planting, and it has the reputation of "the country of silkworms" since ancient times. In the Western Han Dynasty Yang xiong's "Shu Du Fu", the record of "Er is his

own person, making his own strange brocade" reflects the prosperity of the silk weaving industry in Shu. Shu embroidery is mainly made of local soft satin and colored silk, among which soft satin has become an ideal base for embroidery because of its soft texture and good gloss; The colored silk is dyed with plant dyes, which are bright and timeless. This high-quality supply of raw materials ensures the high-quality output of Shu embroidery works.

In terms of skill system, Shu embroidery has formed an extremely rich stitch system. After the practice and accumulation of embroidery girls in the past dynasties, 12 categories and 122 kinds of needles have been developed, including basic Qi needle, paving needle, characteristic halo needle, sand needle, as well as complex doping needle, cover needle, etc. Each of these stitches has its own characteristics: the stitches are flush and tightly arranged; The halo needle creates an ink painting-like rendering effect through the gradient transition of silk thread colors; The doping needle achieves a subtle blend of colors through the interweaving of threads of different colors. Song Ying xing, a scientist in the Ming Dynasty, specially recorded the technological characteristics of Shu embroidery in "Heavenly Creation", which is "full of ingenuity, each extremely wonderful". This rigorous and changeable stitch system makes the Shu embroidery works present vivid and three-dimensional artistic characteristics, which is unique in Chinese embroidery art.

As the core part of Shu embroidery art, the traditional pattern of Shu embroidery is the crystallization of people's collective wisdom for thousands of years, with a long history and profound cultural precipitation, which is a huge treasure left to us by our ancestors, and also integrates regional characteristics and cultural symbols (Wei, 2010). Traditional Chinese auspicious patterns are one of the most beautiful and splendid parts of this treasure. Over the long years, our ancestors created many patterns that yearn for a better life and symbolize auspiciousness (Wu, 2023). These patterns skillfully use people, animals, flowers and birds, sun, moon and stars, wind, rain, thunder and lightning, words, etc., with myths and legends, folk proverbs as the theme, through metaphors, analogies, puns, homophony, symbolism and other techniques, to create a perfect combination of graphics and auspicious meaning of the art form. We call this kind of pattern with historical origins, rich in folk characteristics, and containing auspicious expectations as traditional Chinese auspicious patterns. Traditional Chinese

auspicious patterns are an important part of the traditional culture of the Chinese nation, and a complete set of art forms that express the history of the nation. Through these intuitive and perfect forms, the ancestors expressed their eagerness and desire for a happy and contented life and wealth (Yi, 2010). Chengdu, Sichuan Province, China, as the birthplace of the largest Shu embroidery, the embroidery patterns in this region represent the highest level of Shu embroidery, and it is also shining in the world. Although modern society has increased its attention to Shu embroidery, it still faces the challenge of pattern protection and inheritance. How to systematically and standardize the research and sorting of Shu embroidery patterns is an urgent problem to be solved in the current academic and industrial circles.

The rapid development of digital technology has provided new possibilities for the protection and innovation of Shu embroidery. As the core knowledge representation method in the era of semantic web, knowledge graph technology is particularly suitable for solving the key problems in the knowledge management of Shu embroidery patterns. In terms of knowledge structuring, a unified classification system and technical standards can be established by constructing a sample model of Shu embroidery pattern. For example, the CIDOC-CRM cultural heritage description standard can standardize the metadata such as spatiotemporal attributes and technical characteristics of patterns. Using the OWL ontology language, the logical relationship between the stitch and the pattern can be accurately expressed. This kind of structured representation makes the scattered pattern knowledge form an organically connected knowledge network. In terms of cultural semantic coding, the knowledge graph supports multi-dimensional semantic annotation. In addition to the visual characteristics of the pattern, it can also be related to its historical origin, regional characteristics, symbolism and other cultural connotations. For example, the "hibiscus carp" pattern can establish a semantic association with background knowledge such as the nickname "Rongcheng" in Chengdu and fish culture worship, so as to realize the digital preservation of cultural genes.

In terms of intelligent innovation applications, combined with generative AI technology, a pattern innovation system based on knowledge graph can be developed. The system achieves innovation through the following paths: first, based on the constraint rules in the map, to ensure that the generated results meet the process

specifications; Secondly, the semantic reasoning ability of the graph is used to realize the organic combination of cultural elements. Finally, through human-machine collaborative design, the computing advantages of artificial intelligence and the aesthetic judgment of designers are brought into play. The MIT Media Lab has shown that this "generative heritage" approach can effectively promote the contemporary transformation of traditional elements.

In this context, effective methods should be adopted to inherit and protect Sichuan Chengdu Shu embroidery, enhance the sense of identity of Sichuan Chengdu Shu embroidery culture, and make it better develop in the era of digital technology. To this end, the main objectives of this study are threefold: (i) the history of Shu embroidery in Chengdu, Sichuan Province (ii) the inheritance and preservation status of Shu embroidery in Chengdu, Sichuan; (iii) The mode of development of traditional patterns of Shu embroidery. Through the application of knowledge graph technology to the study of Chinese Shu embroidery patterns, it can not only systematically sort out and analyze the data of traditional patterns, but also provide strong support for the protection and innovation of traditional crafts. This research not only has important academic value, but also has a wide range of practical application prospects, which is of great significance for promoting the inheritance and innovation of traditional culture and promoting the development of related industries.

1.2 Research Objectives

- 1.2.1 To study the history of traditional patterns of Shu embroidery
- 1.2.2 To study the current situation and problems of traditional patterns of Shu embroidery
- 1.2.3 To study the development mode of traditional patterns of Shu embroidery

1.3 Research Questions

- 1.3.1 What is the historical origin of the traditional patterns of Shu embroidery?
- 1.3.2 What is the current situation and problems of traditional patterns of Shu embroidery?
- 1.3.3 What is the model for the development of traditional pattern culture of Shu embroidery?

1.4 Importance of Research

1.4.1 The importance of this study is mainly reflected in the history of traditional Shu embroidery, the cultural connotation of the pattern, and the innovation of the pattern. Contribute to the promotion and development of the cultural value of Chengdu Shu embroidery traditional patterns.

1.4.2 This study will contribute to the inheritance and development of traditional patterns of Shu embroidery in Chengdu by analyzing the current situation and problem status of traditional patterns of Shu embroidery in Chengdu.

1.4.3 This study combines artificial intelligence technology with cultural heritage, firstly, by constructing a knowledge graph of Shu embroidery, it can systematically sort out the multi-dimensional information (such as theme, meaning, stitching, color, structure, etc.) of traditional patterns of Shu embroidery, and provide scientific technical support for the preservation and management of cultural heritage (Zhao, 2023). This not only helps to avoid the loss of traditional cultural resources, but also realizes the efficient dissemination and sharing of cultural information, and promotes the display and recognition of Shu embroidery culture on a global scale. Then, combined with generative artificial intelligence (AIGC) technology, the design of traditional patterns of Shu embroidery breaks through the limitations of traditional manual creation, and through the way of text generation of images, innovative designs can be quickly completed to meet the needs of the modern market for personalized and diversified designs. This innovative approach not only lowers the design threshold, but also opens up a broader commercialization path for Shu embroidery, promoting its revival and prosperity in modern society (Ding, 2023).

1.5 Definitions of Terms

1.5.1 Chinese Shu Embroidery

(i) Shu embroidery pattern refers to the pattern, image and its combination form used in the art of Shu embroidery, which is the core expression carrier of Shu embroidery culture and skills. (ii) Chinese Shu embroidery patterns are known for their bright red, green, blue, yellow and other colors, and the clever combination gives the pattern a three-dimensional sense and vividness. (iii) The main materials of Shu embroidery cover embroidery substrate, embroidery wire and auxiliary materials. (iv) The production process is produced by handmade traditional craft design, sketching,

stretching, wiring, embroidery, mounting, inspection and other technological procedures. (v) Equipment includes embroidery frame, embroidery bandage, embroidery needle, silk thread, etc. (vi) function, Shu embroidery is often used in the production of clothing, home accessories and artworks (vii) producers refer to the personnel engaged in the production and production of Shu embroidery skills.

1.5.2 patterns

The pattern refers to the category of Shu embroidery patterns divided into (i) plant patterns: peonies, plum blossoms, bamboo, orchids, etc., mainly flowers and plants in nature, symbolizing auspiciousness, elegance or prosperity (ii) animal patterns: dragons and phoenixes, magpies, carp, cranes, etc., often implying auspiciousness, longevity, and blessing. (iii) Geometric patterns: moire, back pattern, brocade pattern, etc., mostly arranged in regular patterns, with decorative and cultural symbolic significance.

1.5.3 Culture heritage development in Si Chuan

The development of Sichuan culture mainly refers to the concepts and theories of cultural phenomena, cultural products, and cultural heritage unique to Sichuan. In the development process of Sichuan culture, Shu embroidery, as an important part of traditional crafts, has played an irreplaceable role. First of all, the inheritance and innovation of Shu embroidery patterns show the unique national customs and aesthetic concepts in Sichuan, and promote the inheritance and development of local traditional culture. Secondly, through the carrier of Shu embroidery, Sichuan's folk art has been widely disseminated throughout the country and even the world, enhancing the influence and identity of Sichuan culture. The international spread of Shu embroidery has also enabled Sichuan culture to gain wider attention and recognition in the context of globalization.

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1.6 Conceptual Framework

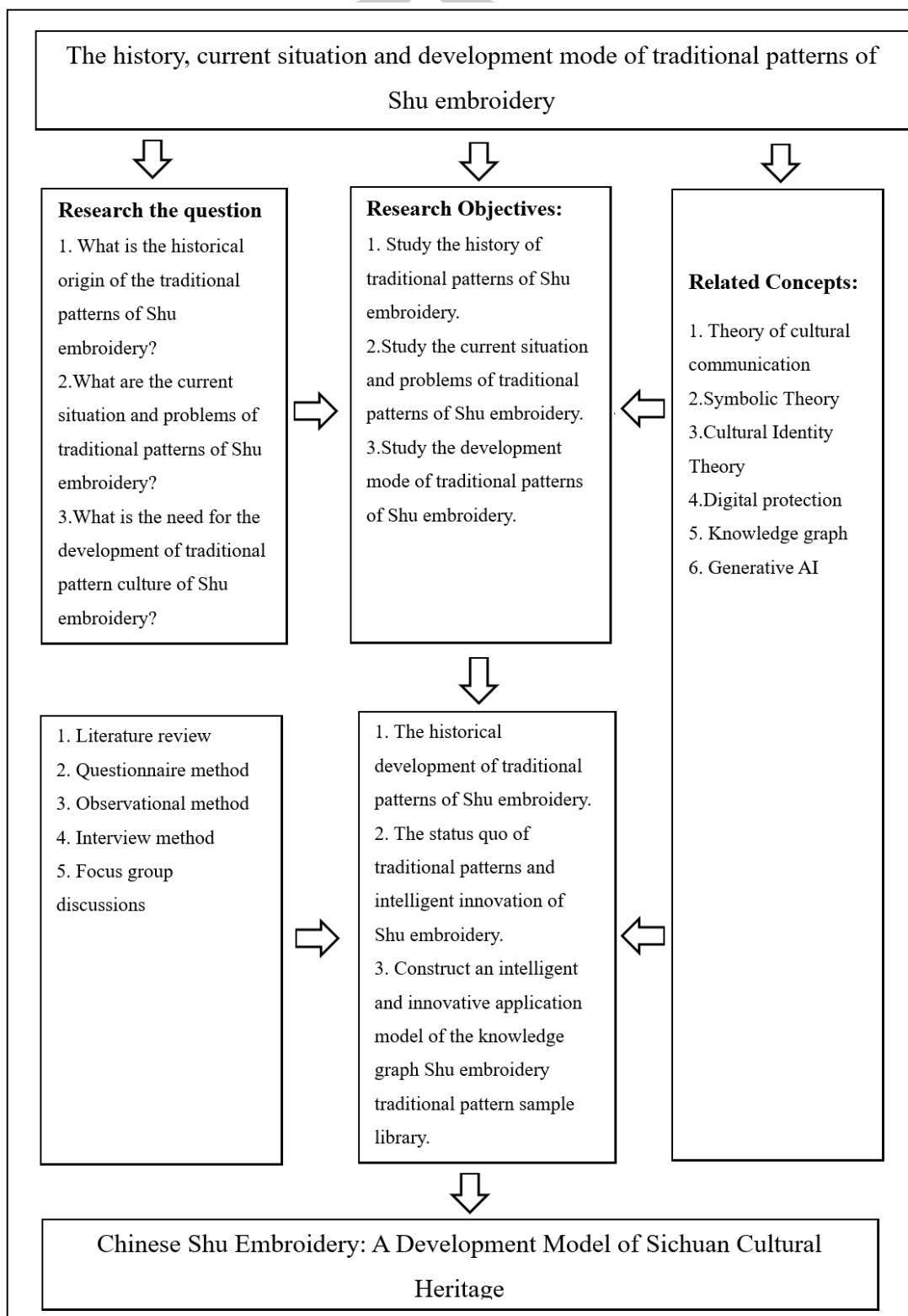


Figure 1 Conceptual framework

Source: Ying Liu(2024)

CHAPTER II

LITERATURE REVIEWS

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2.1 Knowledge of relevant cultural heritage

2.1.1 Knowledge of cultural heritage

Cultural heritage knowledge refers to the knowledge system about the relics of human history, traditional arts, cultural customs, etc. It includes tangible cultural

heritage, such as historical buildings, sites, artifacts, etc., as well as intangible cultural heritage, such as oral traditions, performing arts, social practices, festivals, handicraft skills, etc. This knowledge covers all aspects of human civilization and is the common cultural wealth of mankind, which is of great significance for the study of history, understanding the world, and promoting cultural exchanges (Peng, 2006).

On November 16, 1972, UNESCO adopted the Convention concerning the Protection of the World Cultural and Natural Heritage, which clarified the concepts of "public heritage of all mankind" and "collective protection", and also established a special department responsible for this work, the UNESCO World Heritage Committee.

At its 32nd session in Paris from 29 September to 17 October 2003, the United Nations Educational, Scientific and Cultural Organization (UNESCO) adopted the Convention for the Safeguarding of the Intangible Cultural Heritage. knowledge and skills and their related tools, objects, crafts and cultural sites" (Qian, 2013). According to the above definition, intangible cultural heritage encompasses five aspects: 1) oral traditions and expressions, including language as a medium of intangible cultural heritage; 2) Performing Arts; 3) social customs, etiquette, and festivals; 4) knowledge and practice about the natural world and the universe; 5) Traditional handicraft skills. Intangible cultural heritage is an important feature of a nation and a civilization to identify itself, and it is also an irreplaceable bridge for human beings to study their own development process, seek historical wisdom and exchange diverse values. The protection of intangible cultural heritage has attracted widespread attention at home and abroad. On May 20, 2006, the State Council issued the Notice of the State Council on Publishing the First Batch of National Intangible Cultural Heritage Lists, announcing the first batch of 518 national intangible cultural heritage lists, and the Ministry of Science and Technology has also given great support in terms of national funds and scientific research projects, indicating that China's intangible cultural heritage protection research has been officially launched.

2.1.2 Shu embroidery symbol characteristics

Cultural heritage is a historical witness to the development of human society, carrying rich historical memory, national identity and cultural value. Among them, intangible cultural heritage (ICH) has become an important part of global cultural diversity and human civilization with its unique skills, languages, performing arts,

folklore and traditional knowledge. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has made it clear in the Convention for the Safeguarding of the Intangible Cultural Heritage that intangible cultural heritage plays an irreplaceable role in enhancing social cohesion, promoting sustainable development and preserving cultural diversity (UNESCO, 2003).

Since the 16th National Congress of the Communist Party of China, the state has promulgated a series of policies and regulations, such as the "Opinions on Strengthening the Protection of China's Intangible Cultural Heritage" issued by the General Office of the State Council in 2005, which proposes to "give full play to the important role of intangible cultural heritage in carrying out traditional cultural education and patriotism education for the majority of minors". In 2017, the "Opinions on the Implementation of the Project for the Inheritance and Development of Excellent Traditional Chinese Culture" further improved the intangible cultural heritage protection system, emphasizing the core position of intangible cultural heritage in social and cultural development. Cultural heritage is not only a record of history, but also a key resource for sustainable economic, technological and social development (Wang, 2020).

As an important material cultural heritage of China, the rich and colorful patterns of Shu embroidery proposed in this paper contain extremely high artistic value and cultural research value. Shu embroidery not only shows unique regional cultural characteristics, but also is an important carrier of Chinese excellent traditional culture, with far-reaching academic research significance. Due to the non-renewable and extremely scarce nature of cultural heritage, its protection has become a global cultural consensus. Strengthening the protection and inheritance of Shu embroidery not only helps to promote the excellent traditional Chinese culture, but also plays an important role in cultivating the national spirit and enhancing cultural identity.

At present, although the protection of cultural heritage has been highly valued by the state, it still faces many challenges in practice. First of all, intangible cultural heritage is oral, mobile and alive, and it is difficult for traditional static safeguarding methods to fully adapt to its complexity (Li, 2021). Secondly, the problem of the aging of inheritors is becoming more and more serious, and the interest and willingness of the younger generation to learn traditional skills have declined, resulting in some skills on

the verge of being lost. At the same time, the acceleration of globalization and modernization has led to the gradual decline of some intangible cultural heritage under the impact of urbanization and market economy, which has further exacerbated the difficulties of intangible cultural heritage protection (Zhao, 2019).

In recent years, the rise of digital technology has provided new possibilities for the protection of intangible cultural heritage. For example, technologies such as artificial intelligence (AI), knowledge graphs, big data, blockchain, and virtual reality (VR) can accurately record, intelligently classify, and innovatively display intangible cultural heritage (Liu, 2022). As early as 2002, UNESCO drafted the Guidelines for the Safeguarding of Digital Cultural Heritage and the Framework for the Safeguarding of Digital Cultural Heritage, emphasizing the key role of digital technologies in the protection of cultural heritage (UNESCO, 2002).

2.2 Shu embroidery knowledge

2.2.1 Chinese pattern culture

Chinese pattern culture is an important part of Chinese civilization, carrying rich historical, artistic and social cultural information. Patterns are not only the embodiment of visual art, but also an important symbol of traditional values, religious beliefs, social customs and regional culture of the Chinese nation. This paper systematically reviews the historical origin, classification system, cultural connotation and application of Chinese pattern culture in modern design and digital preservation, and discusses the inheritance and innovation of pattern culture in combination with artificial intelligence, big data and other technologies (Brown, 2024).



Figure 2 Traditional Chinese patterns
Source: Liu Ying (2024)

Neolithic faience ornamentation is one of the earliest forms of pattern in China, such as the swirl pattern and geometric pattern of Yang shao culture, and the fish pattern and bird pattern of Majiayao culture. These patterns are not only used for decoration, but also carry primitive religious beliefs and tribal symbolism (Li, 2006).

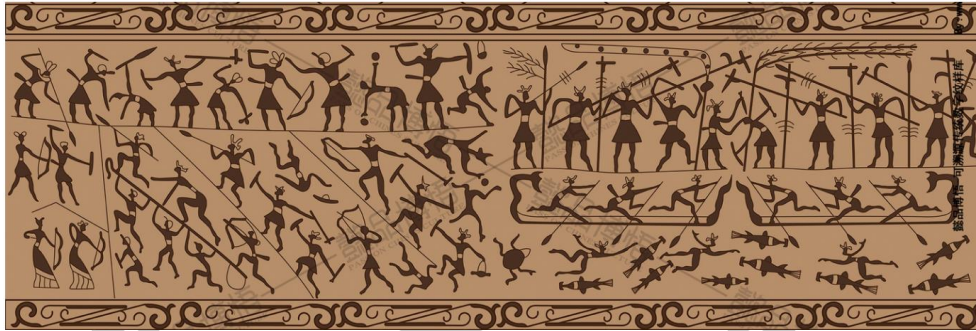


Figure 3 Traditional decorative patterns

Source: Liu Ying (2024)

The decorative patterns of Shang Dynasty bronzes are mostly imaginary animal patterns. During the Shang and Zhou dynasties, bronze patterns such as the Kui Dragon Pattern, the Tao Tao Pattern, and the Cloud and Thunder Pattern showed mystical and majestic religious and ruling symbols, reflecting the social class and ritual culture of the time (Gao, 2012). Its main pattern is a common gluttonous pattern, which is mostly decorated in the prominent parts of the utensils. The dragon pattern is one of the longest used decorative patterns in China, and it was first seen in bronzes. The patterns and patterns of Shang Dynasty bronzes are mainly individually suitable, and most of them are in a symmetrical format. The decoration yet to be decorated mostly adopts the combination of the main pattern and the ground pattern. In the later period, there were three layers of depiction, that is, in addition to the main pattern and the ground pattern, a thin line was engraved on the thicker pattern or the main pattern (Yan, 2019).

The pattern of the Zhou Dynasty broke the characteristics of the Shang Dynasty with a straight line, and also broke the symmetrical format, which generally formed a shape, but did not completely get rid of the rudimentary form of a straight line, so it formed the characteristics of a circle in the straight and a square in the circle, and the plagiarism pattern is a representative one (Pei, 2014).

During the Spring and Autumn Period and the Warring States Period, the most important decorative pattern was the pan pattern, and the later period was popular. In the late Warring States period, some patterns that reflected real-life themes appeared,

such as feasting, fishing, hunting, and attack patterns, and water and land attack battle patterns.

During the period of the Six Dynasties, the decorative patterns of celadon were very rich, including paving, vermilion bird, evil spirit, fairy Buddha, lotus, honeysuckle, bead pattern, reticulated pattern, rhombic pattern, wave pattern, etc. The appearance of the first pattern in the Six Dynasties is the inheritance of the decorative tradition of the Han Dynasty.

The patterns of the Song Dynasty tended to be realistic and literati, especially the entwined branch lotus and folded branch flower on the porcelain. The Yuan Dynasty was influenced by Mongolian culture, and a large number of cloud patterns, dragon patterns, etc. appeared. During the Ming and Qing dynasties, embroidery, porcelain, wood carving and other artistic fields were extremely complex and colorful, symbolizing auspicious meanings (Zhang, 2020).

In the Ming and Qing dynasties, arts and crafts reached their peak, bringing together the essence of a dynasty, whether it is modeling or patterning, the decoration is very strong, making people feel the beauty of the style, stylization, patterning (Tie, 2002).

China's traditional decorative patterns have a long history and are rich and colorful. After thousands of years of development, the decorative patterns are not only beautiful in shape but also different in style and variety, which has national characteristics and different styles of the times, which fully shows the wisdom of the creators and a variety of different customs and folk feelings, and has become a true portrayal of human evolution and development. For the inheritance and development of traditional art, for the study of the history of Chinese arts and crafts, the evolution of the development of traditional Chinese patterns plays a pivotal role.

The Chinese pattern has a profound cultural background, reflecting the constantly changing aesthetic interest of Chinese and the profundity of traditional Chinese culture.

As a "wordless history book and national totem", Chinese patterns are almost ubiquitous, and each era has its own unique characteristics and style. From the natural patterns such as mountains and clouds on the solemn and majestic deep clothes of the Han Dynasty, to the bird and beast patterns such as the Xiang feng pattern and the rui lion pattern on the rich and gorgeous skirt of the Tang Dynasty, to the floral patterns

such as peony and laurel on the simple and soft back of the Song Dynasty, and the auspicious patterns such as gourds and lanterns on the dignified and elegant skirts of the Ming Dynasty, these patterns not only show the changes in Chinese's aesthetic concepts over thousands of years, but also reflect the richness and continuity of traditional Chinese culture (Owen, 2021)。

The creation of Chinese patterns is inspired by life, reflecting people's yearning and pursuit of a better life (Owen,2021). For example, bamboo patterns, twig patterns and cloud patterns, these patterns are not only beautiful, but also contain rich cultural significance and auspicious meanings, such as "flowers and leaves", "endless life", "wealth and longevity", etc., reflecting the Chinese's wishes for harmony and a better life.

In addition, Chinese patterns also enjoy a good reputation in the world. The Chinese Patterns Collector's Edition, through a high level of printing technology, restores the texture of traditional crafts such as blue and white porcelain, cloisonné, cloisonné enamel and Qing pastel porcelain (Huang,2021) 。 This book not only provides a rich visual enjoyment for enthusiasts, but also provides valuable historical materials for researchers, and the spread and influence of Chinese patterns have also expanded overseas.

In summary, Chinese patterns are not only the embodiment of art, but also the carrier of history and culture, through which we can gain an in-depth understanding of the Chinese lifestyle, aesthetic concepts and the profound heritage of Chinese culture.

2.2.2 Shu embroidery knowledge

Shu embroidery, also known as "Sichuan embroidery", is a traditional Chinese craft that uses silk thread to embroider patterns on silk or other fabrics, mainly referring to the embroidery in the western Sichuan Plain centered on Chengdu, Sichuan.

Shu embroidery was first seen in the records of the Western Han Dynasty, when the craft was quite mature, and at the same time inherited the characteristics of bright patterns and common red and green colors. The Qing Dynasty established "Shu embroidery, Suzhou embroidery, Hunan embroidery, and Guangdong embroidery" as China's four famous embroideries. (Qi, 2014).

On May 20, 2006, Shu embroidery was approved by the State Council to be included in the first batch of China's national intangible cultural heritage list. In December 2012, Shu embroidery was officially approved by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China as a geographical indication protection product.

The history of Shu embroidery may be traced back to the ancient Shu Sanxingdui civilization at the same time as the Xia Dynasty civilization in the Central Plains. The earliest record of Shu embroidery can be found in Yang xiong's "Shu Du Fu" in the Western Han Dynasty: "The beautiful candle, if you wave the brocade cloth embroidery, there is no width." Later, Yang xiong made "Embroidery"; The record of Shu embroidery in the Han Dynasty can also be found in Liu Xin's Xi jing Miscellaneous Records (Liu, 2023) at the end of the Western Han Dynasty; These records show that in the Western Han Dynasty, brocade and embroidery are the most exquisite silk fabric products in people's minds, indicating that the weaving and embroidery process at that time should have developed to a considerable level, and at the same time conveying the colors of the brocade of Shu in the Han Dynasty are bright and dazzling, giving people a strong visual feeling. By the end of the Western Han Dynasty, "the industry of female workers covered the world" (Zhao, 2021).

The "Hua yang National Chronicles" written by Chang Xuan of the Western Jin Dynasty contains the products of Shu in detail, and the brocade and embroidery are listed with gold, silver, pearls and jade; During the Sui and Tang dynasties, brocade weaving and embroidery were highly popular and developed in Shu (Peng, 2023), and the Book of Sui Geography said that "adults are more skillful, and the wonder of silk brocade carving is lost in Shang guo" (Hua, 2019). In the Tang Dynasty, "the cocoon silk weaves the delicate and the beautiful is poor in the world", "Song History: Geographical Chronicles"; Weaving and embroidery is not only a production activity throughout Shu, embroidery and embroidery also frequently appear in the poetry of the literati, representing luxury, opulence and rarity, the wealthy families of Shu in the Tang Dynasty often wore splendid clothes, and the common people used the female red embroidered with thousands of needles and threads in the boudoir to convey their feelings (Guo, 2003).

The Song Dynasty's "Quan shu Art Chronicles" recorded: "The weaving pattern is splendid, and the poor work is extremely ingenious" (Liu, 2022). "Emperor Song Tong jian" contains: "Shu is rich, silk is produced, and the people make ice silk, Qi embroidery and other things, which are called the crown of the world." (Yang, 2016) In the Song Dynasty, under the influence of the Central Plains embroidery school, Shu embroidery shifted from practicality to decoration and artistry, chasing the fashion of using celebrity calligraphy and painting as embroidery powder; During the Shao xi period of the Song Dynasty (1191-1194), the "Double Crown Map" is the earliest existing Shu embroidery, the embroidery material is silk, embroidered with two cockscomb flowers and a rooster, although it lasted nearly a thousand years, it is still lifelike, showing the characteristics of the Song Dynasty Shu embroidery "painting and embroidery". The embroidery of the Song people, the needle and thread are fine, and the thread is used to stop one or two filaments, and the needle is used for it. The embroidery of flowers, plants, birds and birds is not so fine and can not be worked, and the natural freshness of the subject matter is more life-like than the popular patterns of dragons and phoenixes and Han and Tang dynasties. Later generations talk about the work of the embroiderer, they say that "the work imitates Song embroidery", and praises the "fine embroidery", that is, it "can eliminate the traces of needle and thread", and is called "the god of needles". This is the work of imitating Song Dynasty painting, and there is even a direct "painting and embroidery".

In the Song and Yuan dynasties, the needlework skills of Shu embroidery continued to develop, and gradually formed its own needlework characteristics and charm style; At the end of the Yuan Dynasty, Ming Yuzhen established herself as the king in Chongqing, and the dragon robe she enthroned was a Shu embroidery embroidery, and the dragon embroidered with silk thread on the chest used a variety of stitches such as lock needles, Qi needles, auxiliary needles, doping needles, needles, rolling needles, turning and twisting, etc., and its halo needle method has appeared in the prototype of two or two needles and all three needles, and the dragon scale embroidery piece is smooth and bright, and the color is evenly mixed, which fully demonstrates the bright style of Shu embroidery (Shao, 2023).

During the Hongwu period of the Ming Dynasty, the "Weaving and Dyeing Bureau" was set up in Sichuan, and the "Ming Hui dian" recorded that the Weaving and

Dyeing Bureau had embroiderers, weavers, carpet makers, felt makers, etc. (Shen, 1989) ; In addition to the python pattern, the chest and back are embroidered with double phoenixes, the skirt corner is embroidered with Shoushan Fuhai, the blank space is embroidered with colorful clouds, and the two sides are embroidered with treasure phase flowers, there are Qi needles, auxiliary needles, needles, needles, needles, needles and other stitches, showing the skill level and characteristics of Shu embroidery at that time. One is a blue satin and gold embroidered python robe, and the chest and back sleeves are embroidered with gold Ruyi, cloud pattern, treasure pattern, etc. Due to the large use of cotton fabrics in the Ming Dynasty, the flower picking and yarn drawing techniques of Shu embroidery were greatly developed.

In the tenth year of Dao guang of the Qing Dynasty (1830), the Chengdu embroidery industry established a special guild "Three Emperor God Society" composed of shop (shopkeeper), material (foreman) and division (worker), the establishment of this organizational form, indicating that Shu embroidery has gradually developed from family handicraft to market-oriented operation; According to the needs of the business, it is divided into three different categories: clothing (xia drape, sleeves and other practical products), line (drama costumes, robes), lanterns (red and white ceremonial occasions with screens, color tents, etc.); In the late Qing Dynasty, the Shu embroidery industry has formed a pattern of combining family individuals, small workshops and government operations. Initially, Shu embroidery was mainly popular among the people, and after the middle of the Qing Dynasty, it gradually formed an industry, especially the Shu embroidery in the area of Jiu long Lane and Ke jia Lane in Chengdu is famous. At that time, the "Persuasion Bureau" run by the county government also set up an embroidery department, which shows the wide range of its production. At that time, the main varieties of production were official uniforms, gifts, daily flowers, side flowers, dowries, color tents and strip screens.

At that time, there were eighty or ninety embroidery workshops in Chengdu in Jiu long Lane and Ke jia Lane, and the official persuasion bureau was established, and the Shu embroidery industry was more prosperous. For example, the embroidery of the Three Emperors will be divided into: the production of dresses, to the period of the Persuasion Bureau, the practical products are more enriched in the embroidery appreciation category, such as the strip screen, the middle hall, the bucket square, the

horizontal drape, etc., the subject matter is divided by the ancient famous paintings such as Su Dongpo's strange stone clusters, Zheng Banqiao's bamboo stone, Chen Lao lian's figures, etc., and invited the famous painter at that time to design the embroidery, and embroider popular patterns, both landscapes, flowers and birds, Bo gu, dragon and phoenix, Wawen, ancient money, etc., and folklore, such as the eight immortals across the sea, Magu offering longevity, to attract the phoenix, unicorn to send children, etc., There are also metaphors for festivity, auspiciousness, glory and wealth, magpies and plums, mandarin ducks playing in the water, gold and jade halls, phoenixes wearing peonies, etc., which are very rich.

In the 29th year of Guangxu (1903), the Qing government established the Sichuan Provincial General Bureau of Persuasion in Chengdu, which set up an embroidery department, hired famous artists to design embroidery drafts, and studied embroidery techniques at the same time; At that time, a number of distinctive painters' sketches, such as Liu Zijian's landscapes, Zhao He qin's flowers and birds, Yang Jian'an's lotus, Zhang Zhi'an's insects and fishes, etc., were embroidered, which improved the artistic appreciation of Shu embroidery; At this time, a number of embroidery masters were also produced, such as Zhang Hong xing, Wang Cao ting, Luo Wen sheng, Chen Wen sheng, etc.

With the development of the silk weaving industry in Shu, Shu embroidery has a strong foundation, so it is famous. The foundation of embroidery was among the people, but as a craft, it was still rare at the time, because it was a luxury and was controlled by the imperial government (Jiang, 2023).

The development of Shu embroidery is based on the richness of Shu, especially the quality and quantity of silk produced, and the famous Southern Silk Road began in Chengdu.

Ancient Shu embroidery is rarely handed down, as a specialized skill, embroidery in history is often controlled by the imperial court, such as the Song Dynasty began to set up the Institute of Embroidery, recruit embroiderers for the royal family to embroider royal clothes and ornaments, the Yuan Dynasty has embroidery bureaus throughout the country, the Ming Dynasty set up an inner court workshop to manage the production of various crafts, and the Qing Dynasty similar institutions are called the office. In addition to supervising the needs of the imperial government, these official

institutions also played a positive role in the formal establishment of the embroidery industry and the improvement of its social and economic status.

For example, in the 29th year of Guangxu (1903), the Qing government established the Sichuan Provincial General Bureau of Persuasion in Chengdu, which set up an embroidery department, and Zhang Hong xing and other famous artists embroidered animal quadruple screens and won the gold medal of the Panama Competition. Zhang Hong xing's embroidered lion rolling hydrangea hanging screen was awarded by the Qing Dynasty and awarded the five military merits, which won a great reputation for Shu embroidery.

Originally, Shu embroidery was mainly popular among the people, distributed in, and passed down from generation to generation. At that time, the "Persuasion Bureau" run by the county government also set up an embroidery department, which shows the wide range of its production. At that time, the main varieties of production were official uniforms, gifts, daily flowers, edge flowers, dowries, color tents and strip screens, etc.

After the middle of the Qing Dynasty (AD 1644~1911), Shu embroidery gradually formed an industry, and at that time, the county government set up a "persuasion bureau" to encourage the production of Shu embroidery. After the founding of the People's Republic of China, Chengdu Shu Embroidery Factory was set up in Sichuan, which made the development of Shu embroidery technology enter a new stage, and continuous innovation in technology.

At the beginning of the Qing Dynasty, the artists also absorbed the advantages of Gu embroidery (there were still several workshops in Chengdu with the name of Gu embroidery shops in the last Qing Dynasty), as well as the folk embroidery method of long needle embroidery and then needle. At that time, Chengdu was the center of Shu embroidery. Due to the selection of materials, the production is serious, the finished products are strong, the materials are real, and the price is cheap, and it has been sold in Shaanxi, Shanxi, Gansu, Qinghai and other provinces for a long time, and is quite popular. It produces practical clothing such as dresses, quilts, pillowcases, curtains, shoes and hats.

During the Qing Dao guang period, Chengdu developed many embroidery shops.

Shu embroidery comes from the folk, just as Shaanxi paper-cut and Mian zhu New Year paintings come from the folk, because the creativity of the people is endless.

In the courtyards and boudoirs of the city and countryside, women embroider elaborate patterns on dowry clothes and gifts, expressing their pursuit of beauty and yearning for a happy life. With the evolution of the times, many of the skills that have been passed down to the people will gradually form an industry and scale.

In 1831 (during the reign of Dao guang of the Qing Dynasty), with the establishment of the Shu Embroidery Guild, Chengdu's Shu embroidery craft ushered in a new period of development, with dozens of shops and workshops, and more than 1,000 embroiderers. During this period, embroidery products began to be designed by professional designers, and the products were gradually divided into three industries: clothing, costumes, and lanterns. With the endless growth of folk Shu embroidery, the Shu embroidery process presents a thriving situation. At the end of the Qing Dynasty, the government advocated the revitalization of industry, and opened the Persuasion Bureau in Chengdu, which set up an embroidery department to manage the production and sales of Shu embroidery. Many fine products in Shu embroidery have been designated as royal tribute, and outstanding artists have also been awarded the title of "five products with the title of knowledge", which greatly encourages the production and production of Shu embroidery.

After the Republic of China, although Shu embroidery no longer embroidered court clothes and tributes, the scope of embroidered daily necessities became wider and wider, including almost all aspects of people's daily life. From children's shawls, shoes and hats, to bedding, interior decorations and gifts for weddings. With the promotion of the scope and subject matter of embroidery, the decoration of Shu embroidery has also been further improved, and a large number of Shu embroidery works using the embroidery artwork of famous paintings of previous dynasties have also emerged. During the Anti-Japanese War, the cultural center moved south, and many painters and technicians came to Chengdu and made positive contributions to the development of Shu embroidery.

The development of Shu embroidery technology has also suffered a major setback, in the "Cultural Revolution", many outstanding national cultural heritage was criticized as "sealed, capitalized, repaired". Shu embroidery is no exception, and the artists engaged in embroidery were even falsely accused of "serving the emperor and generals, talented and beautiful women", resulting in the transformation of the

embroidery industry and the embroidery workers to find another way to make a living. The famous Chengdu Shu embroidery factory, at that time was also in a state of closure and shutdown, this professional production of Shu embroidery collective ownership enterprises was established in 1951, at that time called Shu guang embroidery factory and Qun li embroidery factory, professional staff reached more than 450 people. The main products are daily necessities and appreciation of two categories, daily necessities include cloaks, skirts, pillowcases, quilts, bed sheets, clothes, hand towels, curtains, color tents, etc., appreciation products are in the hall, bucket square, embroidered screen, etc.

After 1971, the Chengdu Shu embroidery factory began to resume production, and those embroidery workers who changed their careers to other industries also returned to the factory to pick up their beloved needles and embroidery frames again. After 1981, Shu embroidery has a great development, in addition to the embroidery factory specializing in embroidery workers, rural suburbs and embroidery personnel increased rapidly to seven or eight thousand people, Shu embroidery business ushered in a bright spring. In 1982, the second Hundred Flowers Award for Chinese arts and crafts, as well as the 1985 Paris Exposition, Shu embroidery won a high honor.

Shu embroidery all over the Sichuan folk, at the end of the 70s, the countryside of western Sichuan was almost "every woman red, every household needle worker", the number of people reached four or five thousand, equivalent to 15 times the number of in-service workers in the embroidery factory. In addition to dozens of varieties of embroidered quilts, pillowcases, headscarves, hand towels, shirts, tablecloths, etc., they also actively produce raw textile embroidery pieces and embroidery screens for foreign trade export. The embroidery still retains a strong local character. In the early years of the Republic of China, embroidery households specializing in embroidery began to appear in Anjing Town, Pixian County.

But the current situation of Shu embroidery is not optimistic. Sichuan has only one Chengdu Shu embroidery factory, the situation is not good, is facing the problem of restructuring, the number of embroidery workers is small, the age is also over 30 years old, it is difficult to have "fresh blood" injection. Some connoisseurs say that the development of the beautiful Shu embroidery has seriously lagged behind, and the Suzhou embroidery, which is known as the "million embroiderers", is far away. At the

end of 2005, Chengdu Shu embroidery factory was restructured, and the employees of the whole factory bought out their seniority. At the beginning of 2006, Chengdu Jin niu District funded Meng De zhi to establish the Shu embroidery master studio; In May, Shu embroidery was among the first batch of national intangible cultural heritage.

Table 1 Overview of the historical development of Shu embroidery



Time	dynasty	Important Events	Representative works
Warring States Period (475-221 BC)	Warring states	There is already an embroidery process in Shu, and archaeological discoveries show that the silk weaving process in Shu is prosperous	Shu silk fabrics
Han Dynasty (206 BC - 220 AD)	Western Han Dynasty, Eastern Han Dynasty	Shu brocade and Shu embroidery are famous all over the country and become court tribute	Mawangdui Han tomb unearthed embroidery, Shu brocade fragments
Three Kingdoms (220-280)	Shu Han	Zhuge Liang attaches great importance to the development of the Shu brocade industry and promotes the improvement of Shu embroidery skills	Zhuge Liang related Shu brocade pattern
Tang Dynasty (618-907)	Tang dynasty	Shu embroidery entered its heyday, and Suzhou embroidery, Hunan embroidery, etc., known as famous embroidery, for royal use	Tang Dynasty lady picture embroidery, religious embroidery

<p>Song dynasty (960-1279)</p>	<p>Northern Song Dynasty, Southern Song Dynasty</p>	<p>The development of Shu embroidery techniques is fine, the level of craftsmanship is improved, and the trade of Shu brocade is prosperous</p>	<p>Song Dynasty landscape figure embroidery, court costume embroidery</p>
<p>Yuan dynasty (1271-1368)</p>	<p>Yuan</p>	<p>The embroidery process of Shu has been further improved, and it is mostly used in Buddhism and Taoism</p>	<p>Religious Buddha statue embroidery, Yuan Dynasty cloud shoulder embroidery</p>
<p>Ming Dynasty (1368-1644)</p>	<p>Ming dynasty</p>	<p>Shu embroidery became an official tribute, the craftsmanship was refined, and the colors were richer</p>	<p>Ming Dynasty dragon robe embroidery, court costume embroidery</p>
<p>Qing Dynasty (1644-1912)</p>	<p>Qing Dynasty</p>	<p>Shu embroidery is known for its delicate craftsmanship and rich colors, forming a unique style, and Suzhou embroidery, Guangdong embroidery, Hunan embroidery and known as the four famous embroidery</p>	<p>"Hundred Butterflies" embroidery, dragon and phoenix auspicious embroidery</p>

Republic of China period (1912-1949)	republic	The Shu embroidery industry is in decline, but there are still some folk artists who inherit their skills	Embroidery of the ladies of the Republic of China
Contemporary (1949-present)	nowadays	The state attaches great importance to the protection of intangible cultural heritage, the Shu embroidery skills have been protected and innovated, and artificial intelligence and digital technology have helped to pass it on	Modern Shu embroidery cultural and creative products, digital Shu embroidery artworks

Source: Ying Liu(2023)

2.2.3 Knowledge of traditional patterns of Shu embroidery

2.2.3.1 Knowledge of traditional patterns of Shu embroidery

Shu embroidery, also known as "Sichuan embroidery", is a general term for embroidery products centered in Chengdu, Sichuan Province (Zhu, 2014). The production of Shu embroidery has a long history. Shu embroidery with soft satin and color silk as the main raw materials, stitching up to more than 100 kinds, give full play to the characteristics of hand embroidery, with a strong local style. In addition to embroidered screens, there are also quilts, pillowcases, cushions, tablecloths, headscarves, and so on (Corning, 2019). Ming-style furniture . As early as the Han Dynasty (206 B.C. ~ 220 A.D.), the name of Shu embroidery has been famous all over the world, and the Han Dynasty government also set up a "brocade official" in Chengdu to manage. After the Han Dynasty to the period of the Five Dynasties and Ten Kingdoms (907~960 AD), the relatively stable situation in Sichuan created favorable conditions for the development of Shu embroidery, and the continuous increase in social demand stimulated the rapid development of Shu embroidery industry. In the Song Dynasty (960~1279 AD), the development of Shu embroidery reached its heyday,

and embroidery products were unique in the world in terms of craftsmanship, production and sales, and exquisiteness. After the middle of the Qing Dynasty (AD 1644~1911), Shu embroidery gradually formed an industry, and at that time, the county government set up a "persuasion bureau" to encourage the production of Shu embroidery. After the founding of the People's Republic of China, Chengdu Shu Embroidery Factory was set up in Sichuan, which made the development of Shu embroidery technology enter a new stage, with continuous innovation in technology and increasing varieties. In addition, the government has also formulated the "Three-year Action Plan for the High-level Protection and High-quality Development of Shu Embroidery in Chengdu (2025-2027)", which aims to promote the high-quality development of the Shu embroidery industry through policy guidance and financial support.



Figure 4 The giant panda, the representative work of Shu embroidery
Source: Liu Ying (2024)



Figure 5 The representative work of Shu embroidery, hibiscus koi

Source: Liu Ying (2024)

2.2.3.2 Historical knowledge of traditional patterns of Shu embroidery

Shu embroidery originated from the folk of western Sichuan, and in the long-term development process, due to the influence of geographical environment, customs, culture and art, it has gradually formed a unique style of rigorous and delicate, bright and smooth, sparse composition, thick and round, and bright colors (Zhu, 2014). The selection of Shu embroidery works is rich, including flowers and trees, birds and animals, landscapes, fish and insects, portraits, etc. The traditional patterns of Shu embroidery are not only beautiful and generous, but also contain rich cultural connotations and historical stories (Kang, 2019).

Silkworm King developed silkworm mulberry: As early as 2700 BC to 2600 BC, the silkworm cong in the upper reaches of the Min River in Sichuan found that there were many silkworm cocoons on the mulberry trees, and began to lead the clansmen to plant mulberry trees, raise silkworms to gather cocoons, reel silk and weave silk, and use them for clothing. This discovery marks the earliest tribe in China to collect wild silkworm cocoons to make cotton and draw silk, and people call this place Shu (Fan, 2018). Silkworm Cong, also known as Silkworm Cong, is the silkworm god in ancient myths and legends, and also the first king of the ancient Shu Kingdom. He was an expert in sericulture, and it is rumored that silkworm cong first lived in the stone chamber of Minshan, and later led the tribe to move from Min shan to Chengdu for the cause of sericulture. This migration not only brought sericulture technology, but also promoted the development of the silk industry, thus laying the foundation for the rise of Shu embroidery. Shu embroidery, as one of the four famous embroideries in China, has a

long history and exquisite skills, and is inseparable from the contribution of the silkworm king.

The contribution of the silkworm king is not only reflected in sericulture and the silk industry, but also profoundly affects the culture and economy of Shu. In his time, mulberry trees were widely cultivated and silkworms were cultivated in Shu, and the silk produced became a precious commodity, often used in exchange for war horses or other supplies in the north. This silk is not only used to make clothing, but also for decoration, such as embroidery, thus promoting the development and popularization of Shu embroidery techniques (Zhao, 2021).

Both the Shu Du Fu and the Book of the Later Han Dynasty contain descriptions of silkworms and their contribution to the silk industry in Shu. These documents not only provide us with the historical background of the silkworm king and Shu embroidery, but also show the importance and love of silk and embroidery art in ancient Shu (Fan, 2018).

The heyday of Shu embroidery in the Song Dynasty: In the Song Dynasty, the development of Shu embroidery reached its heyday, and the embroidery was unique in terms of craftsmanship, production and sales and exquisiteness. The representative works of this period include the "Northern Song Dynasty Shu Embroidered Double Crown Picture", which depicts the scene of the rooster reporting the dawn and crowing at the rooster's comb flower, because the cockscomb flower is similar to the rooster's comb, so it is called "double crown", which is now hidden in Southwest Normal University.

The development of Shu embroidery in the Qing Dynasty: In 1831, Shu embroidery began to gradually develop into an industry. During the Dao guang period of the Qing Dynasty, the Shu Embroidery Guild was formally established, marking the beginning of the formalized management of the production of Shu embroidery. At the end of the Qing Dynasty, with the development of national capitalism, "Shu embroidery" also made great progress through industrial salvation, and won the gold medal in the International Panama Competition in 1915.

2.2.3.3 The theme of traditional pattern creation of Shu embroidery

Shu embroidery, also known as "Sichuan embroidery", originated in the surrounding areas centered on Pi xian County, especially in Anjing Town, Pi xian

County, as the birthplace, Chengdu as the center of the general name of embroidery products. Shu embroidery has a long history, and Suzhou embroidery, Hunan embroidery, Guangdong embroidery and called the "four major embroidery species". Shu embroidery with soft satin and color silk thread as the main raw material, the use of unique embroidery techniques, embroidery quilt, pillowcase, clothing, shoes and picture screen, etc., its stitch is diverse, including 12 categories of 130 kinds of stitches, such as "cloth brocade line" involves 70 processes, showing the exquisite skills and unique charm of Shu embroidery. The embroidery and stitching characteristics of Shu embroidery can be summarized as "neat stitches, bright thread art, tight and soft, and the car is screwed to the home", reflecting the fineness and beauty of its craftsmanship (Shao, 2018).

The creative subjects of Shu embroidery are wide-ranging, including the creation with reference to the characteristics of gong bi painting, as well as the realistic works that imitate oil painting. In the long-term development process, Shu embroidery has formed a unique style of rigorous and delicate, bright and flat, sparse composition, thick and round, and bright colors, which is deeply affected by factors such as geographical environment, customs and habits, local culture and art. The works of Shu embroidery are not only exquisite, but also a perfect work of art, fully demonstrating the charm of Chengdu's thousand-year-old civilization. In addition, Shu embroidery is also inherited through innovation, such as in the 31st Summer Universiade in Chengdu, so that more young people can see the beauty of traditional Shu embroidery, and also let Shu embroidery enter life and go to the world through the Universiade, showing the charm of China's excellent traditional culture and the exquisite skills of traditional craftsmanship.

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Figure 6 The grand opening of the 31st Summer Universiade in Chengdu
Source: Liu Ying (2024)

Figure 7 depicts the traditional Chinese craft patterns of paper patterns and ru yi patterns, implying auspiciousness and longevity.

This paper discusses the cultural connotation, types and expressions of traditional embroidery patterns of Chinese Shu thorn, and analyzes its development model. Through the knowledge graph technology, the research aims to systematically protect the Shu embroidery pattern and promote its inheritance and development (Wu , 2021). The use of this technology can effectively preserve and transmit the traditional art of Shu embroidery, and ensure its continuation and development in modern society.

2.2.4 Knowledge of digital technology protection

2.2.4.1 Knowledge of digital technologies

The history of digital technology is a process full of innovation and breakthroughs, which closely accompanies the development of electronic computers and gradually penetrates into all fields of society.

The theoretical basis of digital technology can be traced back to the 19th century, especially the Boolean algebra proposed by Giocha Boolean Q in 1854, and his proposed binary system (i.e., binary, using "0 and 1" to represent information) laid the mathematical foundation for the development of digital technology (Gao, 2023).

In the late 9th and early 20th centuries, attempts were made to implement

computing functions in mechanical and electronic ways, such as the differential and analytical machines designed by Charles Babbage and the punched card tabulator by Hermann Holeley, which did not fully realize programmable calculations, but provided inspiration for later computer development (Rachel, 2023).

In the 40s of the 20th century, with the invention and application of electron tubes (vacuum tubes), electronic computers began to develop gradually. Computers in this period were bulky, power-hungry, and unreliable, but their emergence marked a new phase in digital technology (Tang, 2024).

At the end of the 50s of the 20th century, the invention of the transistor greatly promoted the development of computer technology. Transistors are smaller, lighter, and more reliable than electron tubes, making computers more compact and efficient. During this period, computers began to be used in more fields, such as scientific computing, data processing, etc. (Chen, 2024).

In 1958, Jack Kilby invented the integrated circuit, which integrates multiple electronic components on a single chip, greatly improving the integration and reliability of the circuit. The emergence of integrated circuits marks the beginning of a new era in electronic technology (Jia, 2022).

With the continuous development of integrated circuit technology, microprocessors (CPUS) came into being. A microprocessor is the core component of a computer, responsible for executing program instructions and processing data. Its advent has made computers more miniaturized and intelligent.

In the mid-70s of the 20th century, with the maturity of microprocessor technology and the reduction of costs, personal computers began to gradually become popular. The advent of personal computers has dramatically changed the way people live and work, making digital technology more relevant to people's daily lives (Zheng, 2014).

With the continuous development of Internet technology, computers around the world began to connect to form a huge network. The popularization of the Internet has made information transmission faster and more convenient, and has also provided a broad space for the wide application of digital technology (Wu, 2019).

Since the mid-80s of the 20th century, multimedia technology has developed rapidly. Multimedia technology can integrate and process text, images, audio, video

and other forms of information, making the application of digital technology more colorful.

With the continuous development and popularization of digital technology, human society has entered the digital era. In this era, digital technology has penetrated into all areas of society, such as education, medical care, transportation, entertainment, etc., and has become an important force to promote social progress and development (Wu, 2020).

At present, digital technology is deeply integrated with other technologies such as artificial intelligence, big data, cloud computing, etc., forming a new technical system and application model.

In the future, with the continuous development of artificial intelligence technology, digital technology will be more intelligent and autonomous, able to better meet people's needs and provide more personalized services.

At the same time, with the widespread application of digital technology and the popularization of the Internet, cybersecurity and data protection have also become an important challenge. It is necessary to continuously strengthen the research and application of cyber security technology to ensure the safe and stable operation of digital technology.

The history of digital technology is a journey of innovation and breakthrough. From the early embryonic stage, to today's digital age, and then to the future intelligent trend, digital technology has been constantly developing and evolving, making great contributions to the progress and development of human society. The use of artificial intelligence technology to effectively preserve, display and disseminate cultural heritage is a work of far-reaching significance (Cai, 2024).

In the digital age, the success of intangible cultural heritage products, such as the documentary "National Treasure" and "China in Intangible Cultural Heritage", the popularity of horse-faced skirts and new Chinese costumes, and the popularity of Yue opera "New Dragon Gate Inn", All of them reflect the public's strong recognition of traditional culture and the infinite vitality of intangible cultural heritage in the digital age.

2.2.4.2 Artificial intelligence knowledge

John McCarthy (September 4, 1927 ~ October 24, 2011), who received the

Turing Award in 1971 for his contributions to the field of artificial intelligence. In fact, it was he who came up with the concept of "artificial intelligence" at the Dartmouth conference in 1956 and is known as the "father of artificial intelligence".

Artificial Intelligence (AI) in English. It is an important driving force for a new round of scientific and technological revolution and industrial transformation, and a new technical science for researching and developing theories, methods, technologies and application systems for simulating, extending and expanding human intelligence (Nick, 2021).

Artificial intelligence is an important part of the discipline of intelligence, which attempts to understand the essence of intelligence and produce a new kind of intelligent machine that can react in a similar way to human intelligence. Artificial intelligence is a very broad science, including robotics, language recognition, image recognition, natural language processing, expert systems, machine learning, computer vision, etc. (Luch, 2023).

The governance challenges posed by large AI models cannot be ignored. Musk pointed out that the essence under the mask of artificial intelligence machine learning is still statistics. To create a good innovation ecosystem, it is necessary to do a good job of forward-looking research, and establish and improve laws, regulations, institutional systems, and ethics to ensure the healthy development of artificial intelligence. Looking to the future, while attaching importance to risk prevention, we should also establish a fault-tolerant and error-correcting mechanism at the same time, and strive to achieve a dynamic balance between regulation and development (Wang, 2024).

Professor Nelson defines AI as follows: "AI is the discipline of knowledge – the science of how knowledge is represented and how knowledge is obtained and used. Another professor at the Massachusetts Institute of Technology in the United States, Winston, said: "Artificial intelligence is the study of how to make computers do intelligent work that only humans could do in the past." These statements reflect the basic ideas and basic content of the discipline of artificial intelligence. That is, artificial intelligence is the study of the laws of human intelligence activities, the construction of artificial systems with a certain intelligence, the study of how to make computers to complete the work that required human intelligence in the past, that is, the study of how to apply computer software and hardware to simulate some basic theories, methods and

technologies of human intelligent behavior.

Since the 70s of the 20th century, artificial intelligence has been called one of the world's three cutting-edge technologies (space technology, energy technology, artificial intelligence). It is also considered to be one of the three cutting-edge technologies of the 21st century (genetic engineering, nanoscience, artificial intelligence). This is because in the past three decades, it has developed rapidly, has been widely used in many disciplines, and has achieved fruitful results, artificial intelligence has gradually become an independent branch, both in theory and practice, has become a system of its own.

The development of digital technologies such as artificial intelligence has enabled the inheritance and protection of intangible cultural heritage to break through the limitations of traditional carriers and enter a new era of digital media. By integrating intelligent technology into all processes of intangible cultural heritage protection and reshaping the path of intangible cultural heritage revitalization, AI technology has been applied to all aspects of intangible cultural heritage protection, including precise communication, product design and production process optimization (Yu, 2024).

For example, in the case of Wuxi Huishan Niren, AI technology was used to analyze tourist data to achieve accurate communication, and at the same time, through big data analysis and user portrait technology, the preferences of young people were analyzed to design products that are more in line with market demand. In addition, artificial intelligence has also been applied to the transmission of the Dongba language, through the development of an intelligent translation system and the compilation of the Dongba Hieroglyphic Reader, to help the dissemination and teaching of the Dongba language, opening up a broad path for the future of this ancient culture (Zhao, 2011).

Fantuo Digital uses AI and 3D cutting-edge digital intelligence technology to create a knowledge graph of Song painting, integrates massive Song painting materials and data, and realizes the knowledge coverage in the field of Song painting, which can be expanded and updated at any time (Fantuo D C, 2024).

Lingnan intangible cultural heritage is an important national cultural heritage, and the construction of a knowledge graph-based question and answer system for it is conducive to the protection and dissemination of cultural heritage, and is an important measure to enhance cultural soft power in the era of artificial intelligence (Zheng, 2024).

A study of the Testaccio Historic Area in Rome, Italy: Through social media data and artificial intelligence technology, an image of the city's cultural heritage in the Testaccio Historic Area was mapped to inform cultural heritage management and local development planning (Bai, 2023).

Sichuan Provincial Silk Research Institute uses AI, big data algorithms and vectorized drawing technology to carry out super-resolution reconstruction, vectorization modeling and digital restoration of Shu embroidery patterns, so as to realize the functions of color supplementation, leakage filling and missing filling. For example, AI technology is used to convert the customer's photo pattern into a design draft, and generate a picture of the artist on the woven paper, and then the Shu embroiderer embroiders the main body of the picture on the brocade (Guo, 2024).

In summary, the application of artificial intelligence technology in the inheritance and protection of intangible cultural heritage has not only improved the visibility and accessibility of intangible cultural heritage, but also provided new possibilities for its innovative development and cross-border integration, from digital display to data analysis and management, which has greatly improved the efficiency of the protection, inheritance and dissemination of cultural heritage (Wan, 2012). In this way, the revitalization and inheritance of intangible cultural heritage have been promoted.

2.2.4.3 Knowledge graph knowledge

The AI Knowledge Graph was first proposed by Google in 2012. Knowledge Graph is an important sub-technology in the field of artificial intelligence, which aims to build a large-scale knowledge base to support search, natural language processing, intelligent assistants, e-commerce, and other fields. Google made a major breakthrough in search by proposing this concept in 2012 as a killer app for building knowledge at scale. Knowledge graph technology is a part of knowledge engineering, and its goal is to construct a vast semantic network graph by describing the various entities or concepts that exist in the real world and the relationships between them. The nodes in this network diagram represent entities or concepts, while edges represent attributes or relationships, enabling structured representation and efficient retrieval of knowledge (Wang, 2019).

The knowledge graph technology is used to construct a knowledge graph related

to cultural heritage, systematically organize cultural information, reveal the internal relationship of cultural heritage, provide a deep cultural understanding, and help scholars, cultural protectors and the public better understand Shu embroidery patterns (Wang, 2019).

The Henan Provincial Department of Culture and Tourism has built a digital asset library of intangible cultural heritage resources by using big data, artificial intelligence, knowledge graph and other technologies, realizing the protection, inheritance and dissemination of intangible cultural heritage resources. (Zhang, 2021).

In addition, the concept of knowledge graph was first proposed by computer scientist John F. Sowa in the 60s of the 20th century, who defined knowledge graph as a representation method used to structure representations of entities, concepts, and relationships in the real world to support computer reasoning and problem solving. With the passage of time, the concept and application of knowledge graph have continued to develop and become an important part of the field of artificial intelligence, which is of great significance for promoting the progress and application of artificial intelligence technology (Yu, 2023).

2.2.4.4 Knowledge graph and cultural heritage construction related knowledge

Knowledge graph is a kind of knowledge base with semantic processing capabilities and open interconnection capabilities, which can organize loosely structured, multi-source and heterogeneous digital resources to realize the interconnection of knowledge. At present, the knowledge graph has formed certain research results in the field of cultural heritage, and the representative work mainly includes: Zhao Xueqin et al. have realized the knowledge association and representation of resources by constructing the ontology of Wanli Tea Ceremony digital resources, and then constructing the knowledge graph of Wanli Tea Ceremony digital resources based on this ontology; Gao Jinsong et al. took movable cultural relics as the object to construct the knowledge ontology of movable cultural relics, and then mapped the instances of the ontology to the graph database based on the mapping rules to construct the knowledge graph of movable cultural relics, and finally released it in the form of associated data. In the field of intangible cultural heritage, representative work includes: Fan Qing et al. construct an intangible cultural heritage knowledge graph model, display the correlation between resources based on the model, realize data association,

and provide a new solution for the digitization of intangible cultural heritage knowledge; Zhao Xueqin et al. used the domain knowledge graph to realize the knowledge organization of intangible cultural heritage archive resources, and took the "Hua xian shadow puppet" intangible cultural heritage archive resources as an example to verify the feasibility of the application of knowledge graph in intangible cultural heritage archives (Feng, 2024). The "One Map of Henan Cultural Heritage" project uses knowledge graph technology to standardize the data of 1,030 representative intangible cultural heritage projects at the provincial level and above and 1,147 representative inheritors of intangible cultural heritage at the provincial level and above in Henan Province. Through the combination of Baidu's artificial intelligence, knowledge graph, big data and other technologies, the "digital asset library" of Henan's cultural heritage resources has been built, and the protection, inheritance and dissemination of intangible cultural heritage resources have been realized. This model of "intangible cultural heritage + digitalization" has opened up a new way for the protection and inheritance of intangible cultural heritage (Henan B P, 2024). These studies have verified the feasibility of combining knowledge graph and cultural heritage research, and provided methodological guidance for this study.

This paper studies the protection and inheritance of traditional Chinese Shu embroidery patterns through knowledge graph technology, and studies the development mode of traditional Shu embroidery patterns. Knowledge Graph, known as knowledge domain visualization or knowledge domain mapping map in the library and information industry, is a series of different graphs that show the relationship between knowledge development process and structure, and use visualization technology to describe knowledge resources and its carriers, mining, analyzing, constructing, mapping, and displaying knowledge and the interconnections between them (Zhang, 2023).

Knowledge graph is a combination of theories and methods in applied mathematics, graphics, information visualization technology, information science and other disciplines with quantitative citation analysis and co-occurrence analysis. It also uses a visual map to vividly display the core structure, development history, frontier fields and overall knowledge structure of the discipline to achieve the modern theory of multidisciplinary integration (Yi, 2023).

It displays complex knowledge fields through data mining, information

processing, knowledge measurement and graphic drawing, reveals the dynamic development law of knowledge fields, and provides practical and valuable references for discipline research.

So far, its practical application has been gradually expanded in developed countries and has achieved good results.

To sum up, the purpose of this study is to use the knowledge graph technology to construct a sample body of Shu embroidery pattern, and to carry out in-depth research and exploration around Shu embroidery, a treasure of traditional Chinese culture. Through the construction of knowledge graph, the historical development of Shu embroidery can be sorted out from a systematic perspective, and the style evolution and cultural influence of each historical stage can be clarified. At the same time, the research will also make a detailed summary and analysis of the classification of Shu embroidery patterns, and clarify the morphological characteristics, design elements and cultural connotations behind different patterns. Through this research framework, we can understand the art of Shu embroidery more comprehensively, especially the rich cultural and historical information behind its pattern design.

In addition, the application of knowledge graph technology is not only at the level of academic research, but also provides strong technical support for the digital protection of Shu embroidery. In the digital age, the dissemination and protection of cultural heritage face many challenges, and the introduction of knowledge graph helps to build an open and dynamic knowledge system of Shu embroidery art, so that more people can understand, learn and appreciate Shu embroidery art through digital platforms. Ultimately, this study is expected to provide innovative ideas for the protection and inheritance of Shu embroidery, an intangible cultural heritage, which will not only deepen the understanding of its artistic value in the academic community, but also open up new ways for its dissemination and promotion in popular culture, and help promote and inherit the excellent traditional Chinese culture (Wang, 2023).

2.3 Relevant Laws and Policies

2.3.1 Relevant national policies

In February 2018, when General Secretary Xi Jinping came to Sichuan to inspect the national intangible cultural heritage of Shu embroidery in Pidu District, he made an

important instruction on the national intangible cultural heritage Shu embroidery, "to develop and design more styles and patterns, and send Shu embroidery as a national gift, so that China's traditional intangible cultural heritage culture can go to the world", in fact, on March 25, 2013, Xi Jinping's wife Peng Liyuan gave a national gift list when she visited Tanzania's "Women and Development Foundation", which included a Shu embroidery "plum blossom double bear". "Shu embroidery can be made into gifts" is an important measure for Shu embroidery in the new era to "tell Chinese stories well", highlight cultural self-confidence, integrate culture and tourism, and realize rural revitalization, and there is also a long way to go.

2.3.1.1 Relevant policies of the General Office of the Central Committee of the Communist Party of China

The General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the "Opinions on Further Strengthening the Protection of Intangible Cultural Heritage", which mentioned the main objectives

By 2025, the representative items of intangible cultural heritage will be effectively protected, the work system will be scientifically standardized and effectively operated, the people's sense of participation, acquisition and identity of intangible cultural heritage will be significantly enhanced, and the role of intangible cultural heritage in serving the present generation and benefiting the people will be further developed.

By 2035, intangible cultural heritage will be fully and effectively protected, the vitality of inheritance will be significantly enhanced, the work system will be more perfect, the inheritance system will be more sound, the concept of protection will be further rooted in the hearts of the people, the international influence will be significantly enhanced, and the role of intangible cultural heritage in promoting sustainable economic and social development and serving major national strategies will be more prominent.

2.3.1.2 The Central People's Government of the People's Republic of China issued the "Digital Technology Promotes the Inheritance and Innovation of Excellent Traditional Chinese Culture"

Digital technology enriches the new carrier for the inheritance and protection of

excellent traditional culture: This year, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the "Opinions on Promoting the Implementation of the National Cultural Digitalization Strategy", which clearly proposes to make overall use of the achievements of digital projects and databases that have been built or are under construction in the cultural field to form a Chinese cultural database (Ren, 2024).

2.3.2 Relevant policies of local governments

The People's Government of Pi du District, Chengdu City issued the "Implementation Rules of Several Policies for Promoting the Innovation and Development of Shu Embroidery Industry in Pi du District, Chengdu" to support the construction of innovative and creative carriers. Put forward the support policy of Shu embroidery industry in Pidu District, and you can apply for funds and business sites.

2.4 Research Areas

2.4.1 General Conditions

Shu embroidery mainly refers to the embroidery in the western Sichuan Plain centered on Chengdu, Sichuan. From the perspective of modern science, the Chengdu Plain is rich in water and soil, pleasant climate, and suitable for planting mulberry and silkworms. This area in western Sichuan was called "Shu" in ancient times, and silk was abundant in the land of Bashu; The silk civilization of the ancient Shu land gave birth to a developed silk weaving technology, which not only provided embroidery raw materials for Shu embroidery - silk and silk thread, so that the development of Shu embroidery has a strong material foundation, but also created an industrial and cultural environment for the development and prosperity of Shu embroidery.

2.4.2 Geographical conditions

Anjing Town, Pi du District, Chengdu City, Sichuan Province is the birthplace of Shu embroidery, located in the upwind and water area of Chengdu City, is a first-class ventilation corridor control area and water source protection belt, and also belongs to the Chengdu Huan cheng Greenway Ecological Zone. Anjing Street, Pi du District, gives full play to the advantages of the traditional industry of "the hometown of Shu embroidery", implements the spirit of General Secretary Xi Jinping's instructions on February 12, 2018, "to develop and design more styles and patterns, Shu embroidery can be made into a national gift and sent out, so that China's traditional culture can go

to the world", focusing on promoting the integrated development of agriculture, commerce, culture, tourism and sports, talent cultivation and brand building, combined with rural revitalization and the construction of park city demonstration area, successfully created a set of "intangible cultural heritage, leisure life, cultural tourism, and industrial development" The four-in-one Shu embroidery industry cluster area (Wang, 2021).

Aggregate inheritance forces and promote common prosperity. It has successively established Chengdu Jing xiu Yuan Shu Embroidery Co., Ltd., Xiun iang Embroidery Professional Cooperative and other institutions, introduced 10 enterprises of Shu embroidery inheritors and masters of arts and crafts to settle in the park, and cooperated with colleges and universities to establish Anjing Shu Embroidery College; Research and development of Shu embroidery courses, has carried out 72 Shu embroidery skills training courses, trained more than 8,000 embroiderers, fully realized women's flexible employment at home.

Create consumer experience scenarios and promote the transformation of multiple values. Relying on the ecological resources of Shu xiu Park and Jinjiang Greenway, implanting scenes such as colorful embroidery workshops to create a number of new cultural landmarks such as "Xiu li", attracting nearly 500,000 tourists every year and achieving tourism income of 20 million yuan. Opened 5 flagship stores of Shu embroidery on the e-commerce platform, with cumulative online sales of more than 1 million yuan.

Innovate the research and development of intangible cultural heritage products and incubate cultural and creative brands. 4 design teams and 9 independent designers have been introduced, and more than 300 new cultural and creative products in 25 categories such as Shu embroidery jewelry, coats, and silk scarves have been developed, and 14 intellectual property rights declarations have been completed; Create literary products with the theme of Shu embroidery such as "A Hundred Years of Embroidery Dream"; Vigorously develop the "Shu embroidery +" project, cooperate with the Universiade, e-sports, sports, milk tea and other events and enterprises, incubate the "embroidered tea" brand, and open 223 stores across the country, with an industrial value of 200 million yuan.

As of the end of 2021, Pi du District has developed more than 30 Shu embroidery-

related enterprises, employing nearly 30,000 people, and the output value of the whole Shu embroidery industry chain in the district is nearly 500 million yuan. The brand value of Shu embroidery reached 4.445 billion yuan, ranking 73rd in the top 100 regional brand geographical indication products in the country.

On June 7, 2024, Anjing Shu Embroidery Cultural and Creative Park in Pi du District was successfully selected into the second batch of intangible cultural heritage life aesthetics scene list in Chengdu. It has become a creative base for the Shu embroidery industry integrating Shu embroidery creative center, Shu embroidery training college, offline experience store and online marketing platform. Shu Embroidery Park in Anjing Town not only shows the cultural connotation and fashion temperament of Shu embroidery, but also amazes Chinese and foreign audiences by holding the 7th China Chengdu International Intangible Cultural Heritage Festival Pidu District Venue, and further enhances the international influence of Shu embroidery. In addition, the park has also been rated as "Sichuan Province Women's Entrepreneurship and Employment Demonstration Base", "Chengdu Shu Embroidery Labor Brand Training Base", "Chengdu Intangible Culture Workshop" and "Sichuan Province Home Flexible Employment Demonstration Base". These honors prove the efforts and achievements of Anjing Town in inheriting and carrying forward the Shu embroidery culture. Through these measures, Anjing Town not only successfully dressed up the business card of "Pi xian Shu embroidery", but also promoted the vigorous development of the Shu embroidery industry and achieved a win-win situation for culture and industry.

2.4.3 Historical conditions

The development of Shu embroidery is based on the richness of Shu, especially the quality and quantity of silk produced. Western Han Dynasty writer Yang Xiong's "Shu Du Fu" cloud: "Brocade cloth embroidered Wang, Mang sun xi without a width", and described that "waving brocade" can be seen everywhere in Cheng du The scene of "exhibition silk embroidery" is accompanied by Yang xiong's poem "Embroidery Repair", which expresses the author's high praise for Shu embroidery skills (Fan, 2018). At the end of the Western Han Dynasty, Shu Di "The industry of female workers, covering the world" (Book of the Later Han Dynasty) (Zhao, 2021). According to the literature, the earliest king of Shu had already known how to breed silkworms. At the

end of the Han Dynasty, during the Three Kingdoms, Shu brocade and Shu embroidery were already well-known all over the world, and as a rare and expensive silk fabric, Shu often used it to exchange for war horses or other materials in the north. Jin Chang xuan's Hua yang National Chronicles contains the treasures of Shu in detail, and the splendid scenery is listed with gold, silver, pearls and jade (Peng, 2023).



Figure 7 Map of China
Source: Baidu Map (2023)

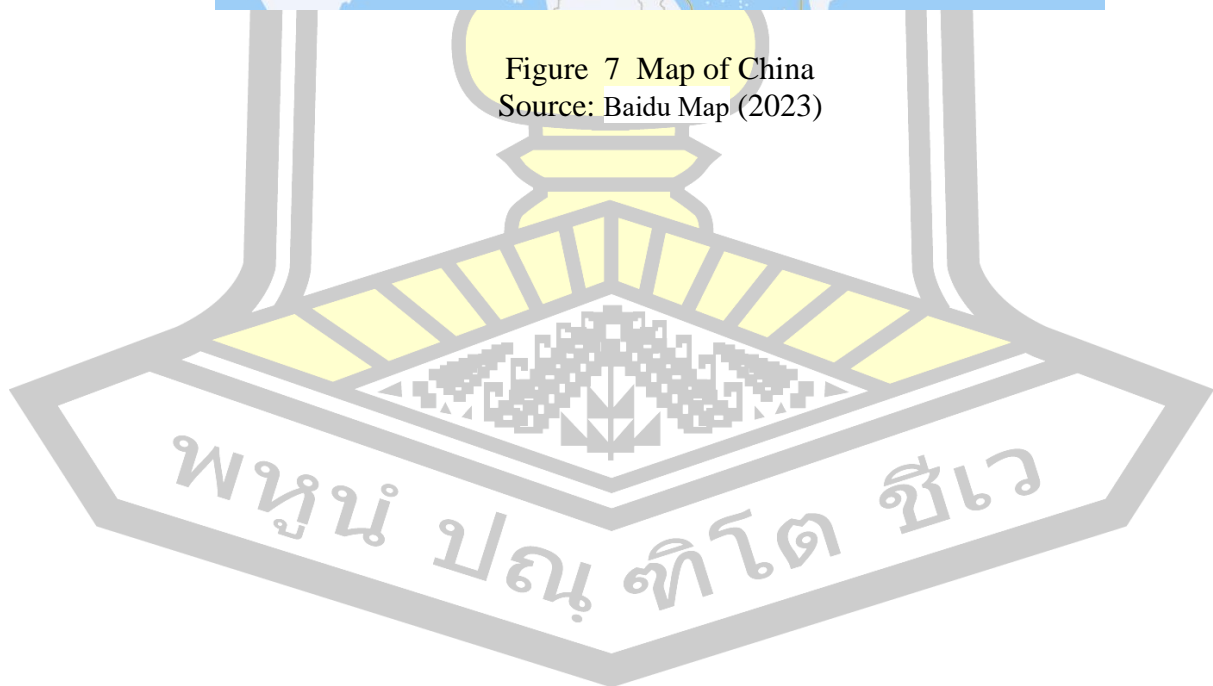




Figure 8 Map of Chengdu
Source: Baidu Map (2023)



Figure 9 Location of Anjing Town
Source: Baidu Map (2023)

To sum up, the development of Shu embroidery benefits from its unique geographical and historical and cultural background, the inheritance and development

of skills, the formation of industrial clusters, the support of the government and society, and the development of cultural and creative industries.

2.5 Relevant theoretical knowledge

2.5.1 Theories of Cultural Communication

Cultural heritage communication is further divided into narrow and broad cultural heritage communication. Cultural heritage dissemination in a broad sense refers to the flow process and activities of all information related to cultural heritage. The dissemination of cultural heritage in the narrow sense is based on the authenticity and integrity of cultural heritage, with the purpose of protecting and inheriting cultural heritage, with the participation of the government, mass media, markets, NGOs and other organizations, social forces, and the public (Wu, 2009).

Based on the dissemination of cultural heritage in a narrow sense, this study will present intangible cultural heritage to the world through the mainstream cultural communication method of the Internet. Let more people in Angola have a better understanding of intangible cultural heritage. Therefore, this study believes that the use of digital handicraft sections to maximize the protection of intangible cultural heritage, that is, to use the form of digital media, the traditional patterns of Shu embroidery to transform, from the text, pictures, video resources, etc., resource integration and preservation, and design and processing into an aesthetic form of digital media, in order to achieve the most reasonable and perfect "collection", the greatest "display" and the most extensive "dissemination" (Gao, 2023). It has a great necessity and significance.

2.5.2 Symbolic theory

From the existing translations of Western semiotic theories in China, it can be found that foreign semiotic research has a relatively complete system, and it can be seen from the current development trend that semiotics is being more and more applied to the research of other disciplines, and interdisciplinary research is carried out, such as the intersection of semiotics and anthropology, sociology, art and design, etc., and the principles and research methods of semiotics have also shown great penetration into the research of various disciplines, and various disciplines can be infiltrated and studied from a new perspective. Due to different origins, several major semiotic theories have emerged in modern semiotics, Saussure's linguistic semiotics, Peirce's logical semiotics, Cassirer's cultural semiotics, and Susan Lange's semiotics of art (Roland, B, 2008).

First, Saussure's theory of symbols from the point of view of linguistics, published by his students in his book "A Course in General Linguistics", compiled by his students from lecture notes, proposes that "language is a system of symbols for expressing ideas, and therefore can be compared to writing, the alphabet of the deaf and dumb, symbolic rituals, ceremonial forms, military signals, and so on." It is simply the most important of these systems. "So we conceive of a science that studies the life of symbols in social life, which will form part of social psychology, and therefore only part of general psychology, which we call semiotics." He decomposes the sign into two components, the signifier and the signified, that is, the referent and the referent. The category forms the fundamental concept of European semiotic research. It has also become a strong support for the semiotic research of this paper (Ferdinand, 1980).

Second, Peirce's semiotic theory from the perspective of logic, the American utilitarian philosopher C. On the basis of the study of logic, S. Peirce summarized the forms of expression of people's judgments into three categories, one of which concerns the quality of feeling, the second concerns human experience, and the third concerns thinking. In this way, Peirce proposes three elements of symbolic composition, namely, the medium, the object referent, and the interpretation. A symbol is something that is used to represent or represent other things, which can be understood or interpreted by people, so that it has a certain meaning for people. According to the association of symbol objects, the symbols are divided into three subordinate symbols, namely, image symbols, representation symbols, and symbolic symbols. Peirce did not have systematic semiotic works, and his semiotic discourse was scattered throughout his logical works, but the concept of signs he proposed was universal and could be applied to any field, so it was called "generalized semiotics". His Shangshu division of symbolic types was later widely used in linguistics, literary arts, aesthetics, and architecture (Peirce, 2014).

Third, Cassirer proposes the idea of semiotics from the perspective of cultural philosophy. He believed that symbols were subordinate to the human world of meaning. Human beings are symbolic animals, and all forms of human spiritual culture are the products of symbolic activities. Language and art are two distinct centers of all human activity. Language and art are both symbols of human cultural activity, but they have different qualities. Art is an intuitive symbol, and whoever does not understand this symbol cannot feel the patterns of color, shape, spatial form, harmony and melody. Art,

therefore, is the objectification of intuition and contemplative activity. Influenced by Cassirer and Whitehead's semiotic ideas, Susan Lange further developed the aesthetic idea of art semioticism. She believes that signs not only have the function of conveying concepts, referents and identification, but also have the function of configuration, which can formalize human experience so that it can be presented objectively. In view of the different nature of language and art, she distinguishes between inferential signs and representational signs. Inferential symbols are expressed in the form of concepts and are therefore operational in certainty and reasoning, used to describe and define the nature of things, to express the emotional connotations associated with feelings and emotions. In works such as "Problems of Art" and "Emotions and Forms", she pointed out that the form of human life is isomorphic to the form of art, and that art is the creation of the symbolic form of human emotion (Cassirer, 2020).

From the semiotic perspective of semiotics, this paper mainly uses Cassirer's cultural philosophy and semiotic thoughts. Shu embroidery culture and Shu embroidery pattern culture belong to the field of Shu embroidery research, that is, social culture, which corresponds to Cassirer's cultural philosophy and semiotic perspective. At the same time, he also borrowed Susan Lange's theory of art semiotics to conduct theoretical research on the relationship between art symbols and emotions of Shu embroidery patterns.

2.5.3 Cultural Identity Theory

Cultural identity is the deepest level of identity, the root of national unity and the soul of national harmony (Zhang, 2021). Intangible cultural heritage has been passed down for hundreds of years or even millennia, and to a large extent depends on the psychological identity of the national culture, which is related to the cultural consciousness, cultural self-confidence and cultural self-improvement of a nation, as well as the sustainable life of the national culture. Therefore, the internal continuation of intangible cultural heritage mainly comes from the strong vitality given to it by the national cultural psychological identity, which mainly relies on the cultural symbolic orientation of the carrier (Zhao, 2023).

Cultural identity is a sense of cultural identity of a group, a feeling that an individual is influenced by the culture of the group. Although there are similarities with political identity, it is not a tautological repetition. Cultural identity, especially the

recognition of foreign cultural values, is enough to dismantle a country's political system; On the contrary, the strong identification of the people with their own culture is the great spiritual strength of the country to stand on its own feet in the world (Zheng, 1992).

Huntington It has been pointed out that different people often answer with the things that are most meaningful to them “Who we are”, ready to use “Ancestors, religion, language, history, values, customs, and institutions to define the mselves”and use a symbol as a symbol to signify their cultural identity, such as a flag, a cross, a crescent, or even a skull. Huntington thinks “Cultural identity is the most meaningful thing for most people”。 in a word “Cultural identity” It's people in one National Community The core of the affirmative recognition of the most meaningful things of the nation formed by living together in the medium and long term is the recognition of the basic values of a nation; It is the spiritual bond that unites this national community and the spiritual foundation for the continuation of the life of this national community. Therefore, cultural identity is an important foundation of national identity and national identity, and it is the deepest foundation. In today's era of economic globalization, cultural identity and value identity, which are the important basis of national identity and national identity, have not only not lost their significance, but have also become the most important in the competition of comprehensive national strength “Soft power”。

This paper studies and studies the Shu embroidery that has been developed for thousands of years, which is not only a representative cultural symbol of Chengdu, but also a symbol of cultural exchanges between China and the West, on the occasion of the Chengdu Universiade. Chengdu once again showed the world this proud intangible cultural heritage business card. It comes from the depths of history, travels through the long river of time, and shines brightly. How to make it more vigorous and continue to shine on the world stage.

2.5.4 Knowledge related to digital technology knowledge

The Convention for the Safeguarding of the Intangible Cultural Heritage clearly stipulates that "the safeguarding of intangible cultural heritage is to clarify and emphasize the "vitality" of intangible cultural heritage. In other words, intangible cultural heritage is based on the spiritual inheritance in the context of a specific era, and

exists and develops in its own unique way with the characteristics of intergenerational, lively, situational and practical, so as to create favorable conditions for social development. On this basis, the derivation of digital technology is not only a change in the ecology and concept of intangible cultural heritage, but also an external way of storage or publicity, highlighting the possibility and legitimacy of intangible cultural heritage, which is not only an interpretation of the vitality of intangible cultural heritage, but also a necessary trend in the protection of intangible cultural heritage (Qian, 2013).

Digital technology protection refers to the use of modern technical means such as digital collection and storage, processing, display and dissemination, through transformation, reproduction and restoration, to evolve into a digital form, and through the interpretation and interpretation of new perspectives, with new ways of preservation as the benchmark, to achieve the purpose of intangible cultural heritage protection and inheritance from the source (Jiang, 2023).

Article 13 of the Law of the People's Republic of China on the Protection of Intangible Cultural Heritage (June,2011) clearly stipulates that: The competent departments of culture shall have a comprehensive understanding of the relevant situation of intangible cultural heritage, and establish archives and related databases of intangible cultural heritage. Except for those that shall be protected in accordance with law, intangible cultural heritage archives and related data and information shall be made public so that they can be easily consulted by the public. "The promulgation of this law emphasizes the importance and necessity of digital protection of intangible cultural heritage from a legal perspective. In addition, the launch of the digital protection project of intangible cultural heritage is based on digital technology to protect and inherit intangible cultural heritage in an all-round way. For example, the establishment of intangible cultural heritage databases in Shaanxi and other places has laid a favorable foundation for its digital protection and inheritance. With the prosperity and development of culture, the protection and inheritance of traditional Chinese culture is a key topic of public concern, especially in the context of digitalization, the digital inheritance of traditional Chinese patterns needs to find a focus and do a good job in corresponding innovative design. Focusing on the cultural and artistic characteristics of traditional Chinese patterns, gradually updating their art forms, and understanding the

difficulties faced in the process of innovation, we should not only summarize the best practice cases, but also formulate their development strategies in the process of innovation, in order to inject new elements of the times into the regeneration and development of traditional Chinese patterns, and enhance their dissemination and utilization value (Zhang, 2022).

This paper studies the use of artificial intelligence knowledge graph technology in digital technology to protect the traditional patterns of Shu embroidery, first of all, to conduct field investigations, do a good job of data collection, followed by the sorting of data, the content of traditional patterns of Shu embroidery is very complex, and the traditional patterns of Shu embroidery can be classified and sorted out by using artificial intelligence knowledge graph change technology. Then establish a library of traditional patterns of Shu embroidery for visual display. On the one hand, the traditional patterns of Shu embroidery can be displayed on the Internet, so that more people can understand and recognize the traditional patterns of Shu embroidery, which is conducive to people supplementing the missing traditional patterns of Shu embroidery. This paper studies the use of knowledge graph technology to protect the traditional patterns of Shu embroidery, first of all, to conduct field investigations, do a good job of data collection, followed by the sorting of data, the content of traditional patterns of Shu embroidery is very complex, and the traditional patterns of Shu embroidery can be classified and sorted out by using knowledge graph technology. Then, the knowledge map of traditional patterns of Shu embroidery was established, and the traditional patterns of Shu embroidery were visually displayed (Chen , 2014).

2.5.5 Knowledge Graph and Symbolism

2.5.5.1 Knowledge Graph and Symbolism

Knowledge graphs represent entities and their relationships through a diagram structure, similar to the analysis of symbols in semiotics. Combined with semiotic theory, knowledge graphs can be applied in the following aspects:

Symbol and entity mapping: In the knowledge graph, the entity can correspond to the signifier in semiotics, and the attributes or associations of the entity can correspond to the signified. Through this mapping, the multiple meanings of symbols can be analyzed and expressed at a deeper level.

Modeling of symbol system: The symbol system can be modeled through the knowledge graph, which shows the different manifestations of symbols, the cultural background behind them, and the historical evolution process in a structured manner. This helps to study complex symbol systems such as language, artistic symbols, cultural symbols, etc.

Semantic understanding and reasoning: Knowledge graphs, combined with symbolism, can provide richer contextual information in semantic understanding and reasoning. For example, in the protection of cultural heritage, the meaning of a certain symbol in different cultural contexts can be displayed through the knowledge graph to help users understand its deep cultural connotation (Li, 2018).

2.5.5.2 Application of semiotics in intangible cultural heritage knowledge graph

In the study of intangible cultural heritage, the combination of symbolism and knowledge graph has the following application scenarios:

Digital Expression of Cultural Symbols: From the perspective of semiotics, the cultural symbols in intangible cultural heritage (such as Shu embroidery patterns) are digitally expressed in the form of knowledge graphs to show their symbolic meaning, historical background and cultural value (Su, 2018).

The digitization of traditional patterns is not only a technology transplantation, but also a cognitive reconstruction of cultural heritage. Taking the digitization of blue calico patterns as an example, the team of the Nantong Academy of Sciences realized the standardized management of intangible cultural heritage resources through metadata technical regulations, which can provide a methodological reference for the classification and coding of Shu embroidery patterns (Jiang, 2023).

Analytic hierarchy of symbolic meaning: Using the knowledge graph, the hierarchical structure of symbolic meaning can be displayed, as the evolution and meaning change of a symbol in different historical periods and different cultural backgrounds.

Cross-cultural symbol comparison: The knowledge graph can compare and analyze similar symbols in different cultures, and understand the commonalities and differences of symbols in different cultures through semiotic methods (Wang, 2018).

The combination of symbolism and knowledge graph can understand and convey the complex meaning of symbols in a more systematic and structured way. This

approach is particularly applicable to the study and digital preservation of intangible cultural heritage, providing a new tool and perspective for the analysis, display and dissemination of cultural symbols.

2.5.6 AIGC (Artificial Intelligence Generated Content)

AIGC (Artificial Intelligence Generated Content) is a way to automatically generate text, images, audio, video, and other content by learning large amounts of data through artificial intelligence technology. It includes auto-generated content production methods in the narrow sense, such as automatic writing, automatic design, and AI technology with human creative capabilities in the broader sense. AIGC mainly uses algorithm models such as GAN (generative adversarial network), Transformer model, and Diffusion model, as well as technologies such as pre-trained model and CLIP (cross-modal learning model) (Ding, 2023).

In the process of creating Shu embroidery patterns, the introduction of AIGC (generative artificial intelligence) technology provides a new creative idea and practice method for Shu embroidery design. By inputting the ontological data of the Shu embroidery pattern into the AIGC tool, the system can automatically generate innovative designs that meet specific themes and emotional needs according to the existing patterns, meanings and cultural connotations. This process not only improves the design efficiency, but also breaks through the limitations of traditional creation and realizes the diversified innovation of Shu embroidery patterns. For example, designers can input text descriptions according to theme needs (such as blessings, auspiciousness, love, etc.), and the system will automatically generate corresponding pattern designs based on the traditional techniques and pattern styles of Shu embroidery. The application of this technology has greatly reduced the threshold for creation, so that the creation of Shu embroidery is no longer limited to skilled craftsmen, and more designers and artists can participate in the creation of Shu embroidery art with the help of intelligent tools, so as to promote the spread and development of Shu embroidery culture.

By constructing the knowledge graph of Shu embroidery patterns and combining AIGC technology to generate creative patterns, the traditional art of Shu embroidery has been rapidly disseminated and widely used. Especially in the Internet era, digital Shu embroidery patterns can not only be displayed and shared globally, but also provide

personalized design services for users with different needs (You, 2024). This innovative use has greatly enhanced the visibility of Shu embroidery art, making its cultural connotation and artistic value more deeply rooted in the hearts of the people. At the same time, AIGC technology can accurately generate creative patterns that meet the needs of designers or consumers based on the knowledge graph of Shu embroidery patterns. This convenience and creativity not only promote the cultural inheritance of Shu embroidery, but also bring a broad market for its artistic design, and promote the cultural revival and inheritance of Shu embroidery in contemporary society.

2.6. Related Studies

The research on Shu embroidery at home and abroad mainly covers the artistic value, cultural connotation, skill inheritance, protection and inheritance, and the construction of knowledge map of Shu embroidery. In recent years, with the advancement of the protection of intangible cultural heritage, the study of Shu embroidery has gradually entered the mainstream of academic and cultural discussions. The following are the key areas and representative studies of Shu embroidery in domestic and foreign research:

2.6.1 Domestic research

2.6.1.1 The historical and cultural value of Shu embroidery

As one of the representatives of traditional Chinese embroidery, domestic scholars have studied the cultural connotation of Shu embroidery and its connection with regional culture by combing historical documents and investigating the origin, development and artistic characteristics of Shu embroidery. From the geographical point of view, the production area of Shu embroidery is located in the Sichuan Basin in the west of China, and there is little communication with the outside world. This will inevitably cause Shu embroidery to be unable to combine with the market relatively loosely, can not get the latest market development and demand information in a timely manner, which can not make timely countermeasures, so that Shu embroidery lags behind other competitive industries. From the perspective of talent and market. The Shu embroidery industry lacks the inheritance and development of modern talents, and also lacks market information and the connection between the industry, which has caused the current situation of slow renewal and few types of Shu embroidery.

Scholar Shen Cong wen discussed the history of Shu embroidery in "Research

on Ancient Chinese Costumes", emphasizing the status of Shu embroidery as an important part of ancient Chinese clothing and art. Other researchers, such as Huang Wei bing, through the analysis of the historical documents and physical materials of Shu embroidery, investigated the evolution of Shu embroidery patterns and the cultural images they reflected, especially in the historical dynasties, how Shu embroidery reflects the characteristics of keeping pace with the times at the level of craftsmanship and culture (Shen, 2011).

Tong Yan ting's "Picture Must Be Intentional, Meaning Must Be Auspicious" provides a systematic and profound analysis of the culture, art and semiotics of traditional auspicious patterns, and has important academic value. Through the in-depth excavation of traditional patterns and the discussion of modern applications, this paper provides a new perspective for understanding and promoting traditional Chinese culture, and also provides a useful reference for the practice in the fields of design and arts and crafts. The paper also explores the inheritance and innovation of auspicious patterns in modern design (Wang, 2023). With the development of the times, traditional patterns still play an important role in contemporary design, especially in the fields of clothing, architecture, handicrafts, etc., through the integration of modern design concepts, these ancient patterns are rejuvenated (Tong, 2014).

According to the characteristics of the field of ethnic festivals, Wang Haining realized the construction of the knowledge graph of ethnic festivals, and built an intelligent question and answer system for ethnic festivals on this basis Provide users with Q&A services related to ethnic festivals. However, the system's Q&A effect is not very good, and once the user asks a question that is too complex or beyond the scope of the constructed knowledge graph, it is impossible to get the correct answer. Li Qiua constructed a knowledge graph in the field of information resources of ethnic minorities and realized the intelligent retrieval of information resources of ethnic minorities based on the knowledge graph, but because the graph involves many ethnic groups, it is impossible to achieve in-depth exploration of the resources of each ethnic group. Therefore, when the national information resources are intelligently retrieved, there may be a situation where they cannot be retrieved. According to the characteristics of the field of ethnic minority clothing, Cui Lin constructed the knowledge graph of ethnic minority clothing culture, and realized the intelligent retrieval based on the knowledge

graph of ethnic minority clothing culture. From the above, it can be seen that although some achievements have been made in the protection and inheritance of national culture in the digital form of knowledge graph, further in-depth research is still needed.

2.6.1.2 Shu embroidery skills and pattern research

"Shu Embroidery - The Legend of the Old Embroidery Museum" is Jiang Ke jun's work on Shu embroidery culture, mainly through the story-based narration, telling the historical origin and inheritance and development of the traditional skill of Shu embroidery. The book not only shows the unique style of Shu embroidery as a traditional Chinese embroidery art, but also describes in detail the rise and fall of the old embroidery hall of Shu embroidery, the skills and life stories of embroiderers. Through the description of the inheritance of Shu embroidery skills, Jiang Ke jun reveals the rich cultural connotation and historical memory behind Shu embroidery (Jiang, 2010).

The book emphasizes the importance of Shu embroidery as an intangible cultural heritage and explores how to preserve and pass on this ancient art form in modern society. At the same time, the book also touches on many details about the embroidery process, color matching and pattern design, so that readers can not only appreciate the artistic beauty of Shu embroidery, but also understand its cultural value more deeply.

Kang Ning's Shu Embroidery is a comprehensive introduction to the art of Shu embroidery, with an in-depth discussion of the history, skills, and cultural connotations of Shu embroidery, as well as its place in the art of embroidery in China. The book illustrates in detail the unique stitching, color application, and pattern design of Shu embroidery through a wealth of graphic materials, and analyzes the development and evolution of Shu embroidery in different historical periods (Corning, 2019).

2.6.1.3 Safeguarding and inheritance of intangible cultural heritage

As a national intangible cultural heritage project, domestic scholars also pay attention to its inheritance and protection. Li Xiaoqing pointed out in the "Research on the Protection of the Intangible Cultural Heritage of Shu Embroidery" that the impact of the modernization process and industrial production on the skills of Shu embroidery has made the inheritors and inheritance mechanisms face challenges. Researchers have explored ways to continue the vitality of Shu embroidery through technological innovation, digital protection and cultural dissemination.

The Shu embroidery that has been passed down from generation to generation embodies a long historical value, rich cultural value and high artistic value. Based on the perspective of "aesthetic education", combined with AIGC technology, innovative design is helpful for the inheritance and development of Shu embroidery. The design of artificial intelligence integrates the cultural characteristics of Shu embroidery to develop cultural and creative products and peripherals, so that aesthetic education can be integrated into the fashion life of modern young people and become an accessible life aesthetics. This not only injects new vitality into the innovation and development of traditional culture, but also protects the intangible cultural heritage of Shu embroidery in the inheritance and innovation (Li, 2024).

2.6.2 Foreign research

2.6.2.1 International academic dissemination of Shu embroidery

As one of the symbols of traditional Chinese culture, Shu embroidery has been relatively little studied abroad, but in recent years, with the "going out" strategy of Chinese culture, the attention of the international academic community to Shu embroidery has gradually increased. Foreign scholars usually combine Shu embroidery with the study of Chinese culture, handicrafts, and art history, especially from the perspective of comparative culture to explore its significance on a global scale.

In "The Visual Culture of the Silk Road", the American scholar Claire Roberts compares Shu embroidery with other cultural products on the Silk Road and analyzes its position in cross-cultural communication. She noted that Shu embroidery is not only representative of Chinese crafts, but also plays an important role in China's cultural exchange with the rest of the world (Jody, 2022).

2.6.2.2 Museums and Shu embroidery collections

Many foreign museums have collected Shu embroidery products, which provide important information for the study of Shu embroidery. Museums in Japan, the United States, France and other countries have collections of Shu embroidery, and researchers usually disseminate Shu embroidery culture through physical analysis and cultural exhibitions. For example, the Kyoto National Museum in Japan once held an exhibition "East Asian Embroidery Art", which exhibited Shu embroidery works and introduced them in the context of history.

In terms of collection research, the British Museum in the United Kingdom and

the Guimet Museum in France have conducted special studies on Shu embroidery, analyzing its craft characteristics and historical and cultural background. The French scholar Sylvie Caldelron conducted research on the collection and cultural dissemination of Shu embroidery, and proposed that Shu embroidery is an important way to understand Chinese handicraft culture.

2.6.2.3 Analysis from the perspective of semiotics and art

In the study of semiotics and art, foreign scholars try to understand the symbols and symbolic meanings in Shu embroidery from the perspectives of visual culture and semiotics. Especially under the framework of semiotician Umberto Eco and other semiotic scholars, how the symbols in Shu embroidery patterns construct cultural identity and convey cultural values has become a hot topic of research.

These studies usually combine traditional Chinese cultural symbols with Western semiotic theories to analyze how common patterns such as dragons, phoenixes, and flowers in Shu embroidery have been interpreted and reconstructed in different eras and cultural contexts.

To sum up, as an important carrier of Chinese culture and art, the research of Shu embroidery has shown a diversified development trend at home and abroad (Li, 2024). First of all, multidisciplinary research has become an important feature of Shu embroidery research. Scholars at home and abroad not only start from the perspective of craftsmanship and art, but also combine semiotics, cultural studies, communication and other multidisciplinary theories to expand the depth and breadth of Shu embroidery research. This interdisciplinary approach to research has promoted a comprehensive understanding of the history, cultural connotation and social function of Shu embroidery.

Secondly, digital protection and innovation have gradually become an important direction of Shu embroidery research. Domestic scholars are particularly concerned about how to use modern digital technology to protect and inherit the skills and patterns of Shu embroidery. Through the establishment of digital pattern databases, virtual museums and other methods, researchers have provided new technical means for the long-term protection of Shu embroidery, which not only promotes its cultural inheritance, but also provides valuable research materials for the international academic community.

Finally, with the acceleration of the globalization process, the global cultural communication and exchange of Shu embroidery as a symbol of Chinese culture has gradually received attention. The international academic community has begun to pay attention to the cross-cultural communication and identity of Shu embroidery in the context of globalization, and analyze its cultural symbolism and significance in the international arena (Xu, 2023).

On the basis of the existing research, the future research on Shu embroidery can be further combined with the theoretical framework of international semiotics and cultural studies to explore its role in global cultural communication and its impact on cultural identity. This will help deepen the understanding of Shu embroidery as a global cultural symbol, and promote its dissemination and promotion in international academic and cultural exchanges.

CHAPTER III

RESEARCH METHODOLOGY

In this chapter, the researchers selected Chengdu City and its surrounding areas in Sichuan Province as the research area. The region is an important birthplace of the representative Shu embroidery art in the intangible cultural heritage, and the Shu embroidery is unique in the traditional Chinese embroidery art with its exquisite skills and rich cultural connotation. The researchers selected the inheritors and craftsmen with key influence, took the Shu embroidery pattern as the core research clue, and conducted an in-depth analysis through the investigation of the Shu embroidery culture in the region. All the data collected in this study and the results of the study are elaborated in the following sections.

3.1 Scope of Research

3.1.1 Research Content

3.1.2 Research Method

3.1.3 Research Period

3.1.4 Research Area

3.1.5 Population and Sample

3.2 Research Administration

3.2.1 Research Tools

3.2.2 Data Collecting

3.2.3 Organizing and analyzing data

3.2.4 Display of research results

3.1 Scope of Research

3.1.1 Research content

Study the history of traditional patterns of Shu embroidery

Study the current situation and problems of traditional patterns of Shu embroidery

Study the development mode of traditional patterns of Shu embroidery

3.1.2 Research Method

This study adopts a mixed research approach to study Shu embroidery in China: a model for the development of cultural heritage in Sichuan. The researchers collected data from relevant literature and research papers. Use fieldwork methods to collect data and information through surveys, observations, interviews, and focus group discussions. The data were analysed using research concepts, theories, literature, and related studies, and descriptive analysis was used to analyze the data according to the research objectives.

3.1.3 Research Period

Table 2 Study period: June 2023 to December 2024

1	period	Time
1	Gather information from the study and determine the pattern protection plan	trimester
2	Pattern collection	Four months
3	Shu embroidery patterns are classified and stored	Four months
4	Construct the sample body of Shu embroidery pattern and visualize the display of the line	One month
5	Improve system design and planning	trimester
6	Conclusions and submission of results	trimester

Source: Liu Ying (2023)

3.1.4 Research Area

Anjing Town, the birthplace of Shu embroidery, is located in the hinterland of the Chengdu Plain, located in the humid subtropical monsoon climate zone, with a warm climate and moderate humidity, which provides excellent conditions for the development of the sericulture industry. In this land, high-quality silk production has laid the foundation for Shu embroidery raw materials, so that Shu embroidery skills can continue to develop. In addition, the abundant water resources of Anjing Town are also conducive to the production of dyes, ensuring the brightness and durability of the colors of Shu embroidery. The choice of Anjing Town in the study of Shu embroidery is helpful to understand the complete process of Shu embroidery from material collection to process production, and provides a detailed case for the localization research of Shu embroidery. Through the investigation of the Shu embroidery workshop in Anjing

Town, we can trace the evolution of Shu embroidery skills from the Han Dynasty to the present, and deeply analyze its artistic value and historical heritage. Through field interviews, fieldwork and other methods, we can more intuitively contact the old craftsmen of Shu embroidery, find the unique artistic style of Shu embroidery from their skills, and form a more empirical historical perspective.



Figure 10 Map of China
Source: Baidu Map (2023)

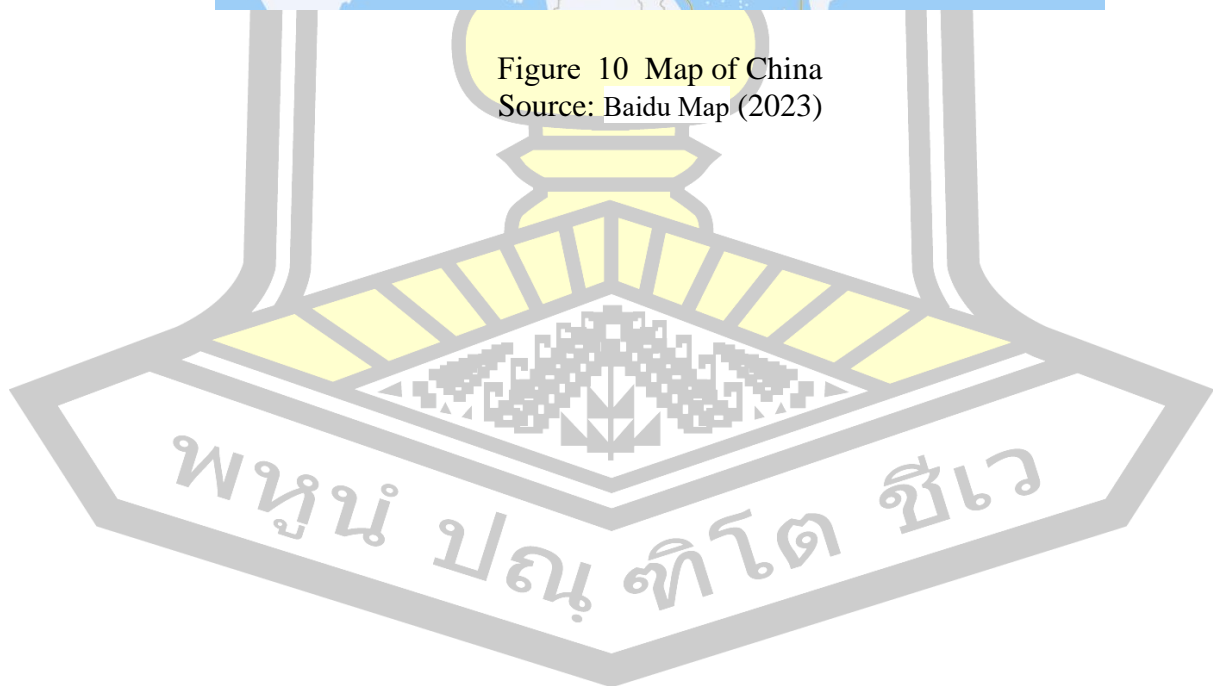




Figure 11 Map of Chengdu
Source: Baidu Map (2023)



Figure 12 Location of Anjing Town
Source: Baidu Map g (2023)

Anjing Town is not only an important base for the inheritance of Shu embroidery

skills, but also gradually becoming the source of innovative Shu embroidery technology. In Anjing Town, traditional handicrafts and modern fashion are gradually merging. Many Shu embroidery craftsmen and artists are committed to combining Shu embroidery with modern life, such as clothing, home decoration, etc., to promote Shu embroidery out of the traditional ceremonial scene and into modern life. Choosing Anjing Town to study Shu embroidery can study the inheritance and innovation of skills, combine modern design and diversified application paths, and provide academic basis and development direction for the sustainable development of Shu embroidery.



Figure 13 Shu Embroidery Creative Center
Source: Liu Ying (2024)

At present, the digital protection of traditional skills has gradually become an important means of cultural inheritance. The study of Shu embroidery in Anjing Town can provide an opportunity to protect and inherit traditional skills in the context of digitalization and intelligence. The use of computer technology to digitally preserve and restore the technical process, style and pattern, color matching, etc. of Shu embroidery can not only help us record the Shu embroidery process, but also present the three-dimensional effect of Shu embroidery works through 3D modeling, virtual reality and other technologies (Zhou, 2023).

With the commercialization and marketization of Shu embroidery, Anjing Town has become a typical area for the industrialization of Shu embroidery. A large number of Shu embroidery studios, art centers, and training institutions have gathered here, promoting the development of local economy and cultural tourism. The agglomeration

effect of this industrial chain provides a real case study for the study of Shu embroidery, exploring how the Shu embroidery industry transitions from tradition to modernity, and how to integrate art and commercial value. In addition, it can also study the driving role of the Shu embroidery industry on the local economy, and provide practical theoretical and data support for the commercialization model of Shu embroidery.

To sum up, the selection of Anjing Town as the location for the study of Shu embroidery can comprehensively reveal the cultural connotation, artistic value, inheritance and development of Shu embroidery and the path of modern innovation. Carrying out research on Shu embroidery culture here not only provides an opportunity to gain an in-depth understanding of the unique charm of Shu embroidery, but also provides innovative ideas for cultural inheritance and industrial development. In the future, we look forward to developing more achievements with social impact and academic value.

3.1.5 Population and Sample

According to the purpose of the study, three groups of people were selected as the respondents for the field study. They are key informants, temporary informants, and general informants. The following selected criteria and selected people will be introduced.

3.1.5.1 Key Information Providers

3 people who have an in-depth understanding of the intangible cultural heritage culture of Chengdu City, Sichuan City, and people who have long been committed to studying the Yi shu embroidery culture and Shu embroidery patterns. Cultural experts who have an in-depth understanding of Shu embroidery culture can provide theoretical knowledge, historical background and artistic value of Yi Shu embroidery culture. and other relevant information.

The national representative inheritor who has been engaged in Shu embroidery culture for a long time can provide relevant information such as the history and culture of Shu embroidery culture and pattern samples.

Scholars or researchers involved in the safeguarding of intangible cultural heritage in Chengdu, Sichuan Province, should learn about the relevant policies and regulations, work planning trends and other relevant information on the inheritance and protection of intangible cultural heritage.



Figure 14 National Shu embroidery inheritor: Hao Shuping
Source: Liu Ying (2024)

Hao Shuping: female, Han nationality, born in Chengdu, Sichuan Province in October 1945. She is the representative inheritor of the first batch of national intangible cultural heritage projects of Shu embroidery, a master of Chinese arts and crafts, and enjoys special government allowances from the State Council. Her representative works include "Hibiscus Carp", "Heterochromatic Cat", "Double-sided Hibiscus Carp", "Double-sided Bamboo Forest Horse and Chicken", "Shu Palace Night Banquet" and so on. Master Hao Shuping has performed in Europe, the United States, Southeast Asia and other countries and regions, and has achieved outstanding results in the world.



Figure 15 National Shu embroidery inheritor: Meng De zhi
Source: Liu Ying (2024)

Meng Dezhi: Born in March 1961, he is currently the general manager of Chengdu Mengyuan Shu Embroidery Arts and Crafts Co., Ltd., and the president of Chengdu Chanlin Shu Embroidery Research Institute. He has been engaged in the creation and research of Shu embroidery skills for more than 30 years. He has successively won the honorary titles of Chengdu Model Worker, Sichuan Arts and Crafts Master, National Arts and Crafts Industry Outstanding Technician, Sichuan Top Ten Outstanding Inheritors of Folk Skills, Representative Inheritors of Sichuan Intangible Cultural Heritage Projects, Chinese Folk Culture Brand Artists, Sichuan Province Moral and Art Shuangxin Workers, and Outstanding Experts with Outstanding Contributions in Chengdu.



Figure 16 Provincial Shu embroidery inheritor: Peng Shiping
Source: Liu Ying (2024)

Peng Shi ping, master of arts and crafts in Sichuan Province, was born in 1961 in a family of Shu embroidery, engaged in the study of Shu embroidery skills for more than 30 years, and embroidered hundreds of Shu embroidery products. At the age of 15, he began to learn the basic techniques of Shu embroidery at home with his father Peng Yongxing (a master of Chinese arts and crafts), and entered the Shu embroidery factory in 1980 to devote himself to the study of Shu embroidery skills and needlework.

3.1.5.2 Temporary Informants

15 interviews and focus group discussions with designers, technical teams and professionals working in digital media-related professions.

Informal interviews were conducted with relevant inheritors of Shu embroidery culture, designers and enthusiasts of Shu embroidery patterns in Chengdu, Sichuan Province.

Informal interviews were conducted with local culture-related practitioners in Chengdu, Sichuan Province.



Figure 17 Shu embroidery workers in Shu embroidery park, Anjing Town
Source: Liu Ying (2024)

3.1.5.3 General Informants

15 general informants who are interested in the Shu embroidery culture in Chengdu, Sichuan Province,. From different perspectives, they will have a certain understanding of the history, culture, and artistic value of Shu embroidery culture in Chengdu, Sichuan Province, as well as the current difficulties faced in inheritance and protection. This will ensure the representativeness and diversity of the data information of this group of members. They have different specializations. Background, cultural background, gender, age, etc., which can provide more comprehensive and richer data and information, so that the research can be more in-depth.



Figure 18 People who like Shu embroidery culture

Source: Liu Ying (2024)

At the same time, we will assess potential information providers to understand their professional judgment and credibility to ensure that the information provided is reliable and informative.

3.2 Research Administration

3.2.1 Research Tools

The research tools used in this dissertation are mainly interviews and observations based on data collection and factual observations, which focus on process and structural analysis, seek to obtain target field survey data, and conduct qualitative research and interpretation of research subjects. In order to obtain the research data, the researchers designed questionnaires and designed corresponding interview forms and observation forms according to different research subjects. The research tools and research process are as follows.

3.2.1.1 Research tools

Literature analysis: consult the literature and government documents related to Shu embroidery culture, Shu embroidery patterns and history, so as to construct a theoretical foundation. The main literature sources are: (i) CNKI, which was established in 1999 and is the largest literature database in China, CNKI The project is an informatization construction project aimed at the dissemination, sharing and value-added utilization of knowledge resources in the whole society. It was initiated by Tsinghua University and Tsinghua Tong fang. Behind the China Knowledge Network is a huge national project, which is simply to build a large platform and warehouse that can cover most of a country's knowledge resources (China Knowledge Resources Database), which we can intuitively understand as a bank or supermarket of knowledge, where people store their research results and then find what they want from others. (ii)

Sichuan University Library website, Sichuan University Library is the oldest and largest library in southwest China, consisting of a liberal arts library, an engineering library, a medical library, and a Jiang'an library. The library of Sichuan University is the library with the longest history and the largest literature scale in southwest China, which is composed of the library of arts and sciences, the library of engineering, the library of medicine and the library of Jiang'an. (iii) China Intangible Cultural Heritage Network - China Intangible Cultural Heritage Digital Museum is a public welfare website for the protection of intangible cultural heritage under the leadership of the Ministry of Culture of the People's Republic of China, under the leadership of the Ministry of Culture, sponsored by the Chinese Academy of Arts, led by the Inter-ministerial Joint Conference on the Protection of Intangible Cultural Heritage, and sponsored by the Chinese Academy of Arts. In accordance with the spirit of the Circular of the State Council on Strengthening the Protection of Cultural Heritage, we will promote the protection of China's intangible cultural heritage.

Observation method: refers to the research method of observing the natural state of the research object to obtain the corresponding data. In this study, the researchers delved into the specific social environment of Chengdu, Sichuan Province, including personally participating in the inheritance activities related to Shu embroidery, to understand the current status of the inheritance and protection of Shu embroidery.

Field investigations were conducted in Anjing Town, Sichuan, the birthplace of Shu embroidery, to collect first-hand information and observe the current situation of local craft inheritance. Collect Shu embroidery patterns and records in the Museum of Sichuan University. According to the degree of observer integration into the fieldwork, observation methods can be divided into participatory and non-participatory observations. Participatory observation refers to the in-depth study of the living conditions of the research subjects, weakening personal identity and willingness to participate, and conducting implicit observation in the actual participation process. In this study, the researcher participated in the observation of the current situation of the inheritance and protection of Shu embroidery in Chengdu, Sichuan, and made an implicit observation of its current situation and problems. Non-participant observation means that the observer needs to keep a certain distance from the study subject. In this study, the researchers observed the research subjects from a third-party perspective,

collected relevant information, and formed a wealth of data to provide reference for subsequent research

Questionnaire survey: The questionnaire design takes the cultural cognition, pattern characteristics and connotation, inheritance status and modern development needs of Shu embroidery as the core, to help analyze the understanding and support of different groups of people for Shu embroidery culture and its promotion prospects in modern society. Make a list of the people who participated in the questionnaire, identifying the date, location, and key information such as name, age, gender, occupation, etc. Ask questions based on the designed questionnaire and design the key themes around the theme of this interview.

Interview method: through interviews with Shu embroidery inheritors, local cultural scholars and related practitioners, to understand the pattern characteristics and development needs of Shu embroidery. The aim of this study is to collect the current situation of Shu embroidery in Chengdu, Sichuan Province and the role of artificial intelligence knowledge graph in the inheritance and protection of intangible cultural heritage. The relevant data of the application, as well as the opinions on the construction of the application practice model in the protection of Shu embroidery pattern, will summarize and analyze the discussion results, and adjust and optimize them in time.

3.2.1.2 Research Steps:

Preliminary preparation: through literature analysis, the historical development, pattern characteristics and cultural connotation of Shu embroidery, so as to lay a theoretical foundation for field investigation.

Data collection: The characteristics and connotations of Shu embroidery patterns were recorded in field investigations, and the inheritors' insights on pattern protection were deeply understood through interviews.

Data collation and analysis: classify, sort out and analyze the collected video data, interview records and historical documents, and summarize the cultural characteristics and pattern connotations of Shu embroidery.

Model construction: Based on the theory of protection of Shu embroidery culture and pattern connotation, combined with research data, a protection model for the inheritance and innovation of Shu embroidery culture was established.

Write a report: Finally, the research results will be systematically organized into a paper, and specific suggestions for the protection and inheritance of Shu embroidery culture will be put forward.

3.2.2 Data Collection

Through field work, we visited the inheritors of Shu embroidery, completed the collection of classic works of the inheritors of Shu embroidery, interviewed the inheritors and practitioners, and collected the cultural connotation of the patterns.

The collected research data is summarized through digital technology, classified according to the expected research objectives, and integrated into a summary table to check the integrity of the research data.

In response to the first research objective, the researchers conducted a detailed analysis and combing of the historical origin of the traditional patterns of Shu embroidery. This article will explain the historical origin of the traditional patterns of Shu embroidery.

In view of the second research objective, the researchers collected the relevant data on the current situation of traditional patterns of Shu embroidery in recent years, sorted out and analyzed the current situation and problems, and concluded that the inheritance and protection of traditional patterns of Shu embroidery are facing many problems.

For the third research objective, the researchers based on the relevant literature, the current situation and problems of the inheritance and protection of traditional patterns of Shu embroidery, and the suggestions put forward by the respondents. Using relevant concepts and theories, this paper studies the development model of Chinese Shu embroidery: Sichuan cultural heritage. It is a creative path that uses digital technology to collect patterns, analyze patterns, construct pattern bodies, visualize patterns display on knowledge graphs, and evaluate feedback.

3.2.3 Organize and analyze data

In this study, the researchers combined the knowledge graph and AIGC (generative artificial intelligence) Wen sheng graph technology to systematically organize and analyze the data related to Shu embroidery patterns, so as to realize the digital protection, innovation and dissemination of patterns. The process of data organization and analysis consists of the following steps:

3.2.3.1 Data collection and collation

Collection of physical data: Through field research, literature review and interviews with inheritors, the relevant data of Shu embroidery patterns are obtained, including the historical origin, cultural connotation, technical characteristics, color matching and moral interpretation of the patterns.

Integration of digital resources: Integrate the digital image data of Shu embroidery patterns, existing pattern databases and related literature to ensure the diversity and comprehensiveness of data sources.

Data classification: classify the collected data according to the type of pattern (such as geometric pattern, animal and plant pattern, character pattern, etc.), and summarize the cultural connotation and significance of the times behind it.

3.2.3.2 Knowledge graph construction

Ontology modeling: Based on the classification of Shu embroidery patterns, the ontology of the knowledge graph is constructed, including classes (such as pattern categories, cultural backgrounds, and technical forms), object attributes (such as the association between patterns and meanings, and the relationship between patterns and colors), and data attributes (such as pattern size, age, stitching), etc.

Semantic association: Through the semantic analysis of data, the Shu embroidery pattern is associated with related cultural events, historical figures and regional culture to ensure the logic and integrity of the knowledge graph.

Visualization design: The Protégé visualization tool is used to display the structured data of Shu embroidery patterns and their associated information, which is convenient for subsequent analysis and application.

3.2.3.3 Application of Wen sheng Diagram Technology

Positive prompt word design: According to the cultural connotation and aesthetic characteristics of Shu embroidery patterns, design positive prompt words related to the pattern (such as "rich flowers", "auspicious dragon playing with pearls", etc.) to ensure that the generated image conforms to the style of Shu embroidery.

Negative prompt word optimization: Negative prompt words are formulated for constraints on elements that may not conform to the traditional Shu embroidery style (such as overly modern design, overly bright tones, etc.) that may appear in the generated image.

AIGC tool generation: Combined with the pattern data provided by the knowledge graph, input prompt words in the AIGC tool to generate an image, and evaluate the style consistency and innovation of the generated pattern.

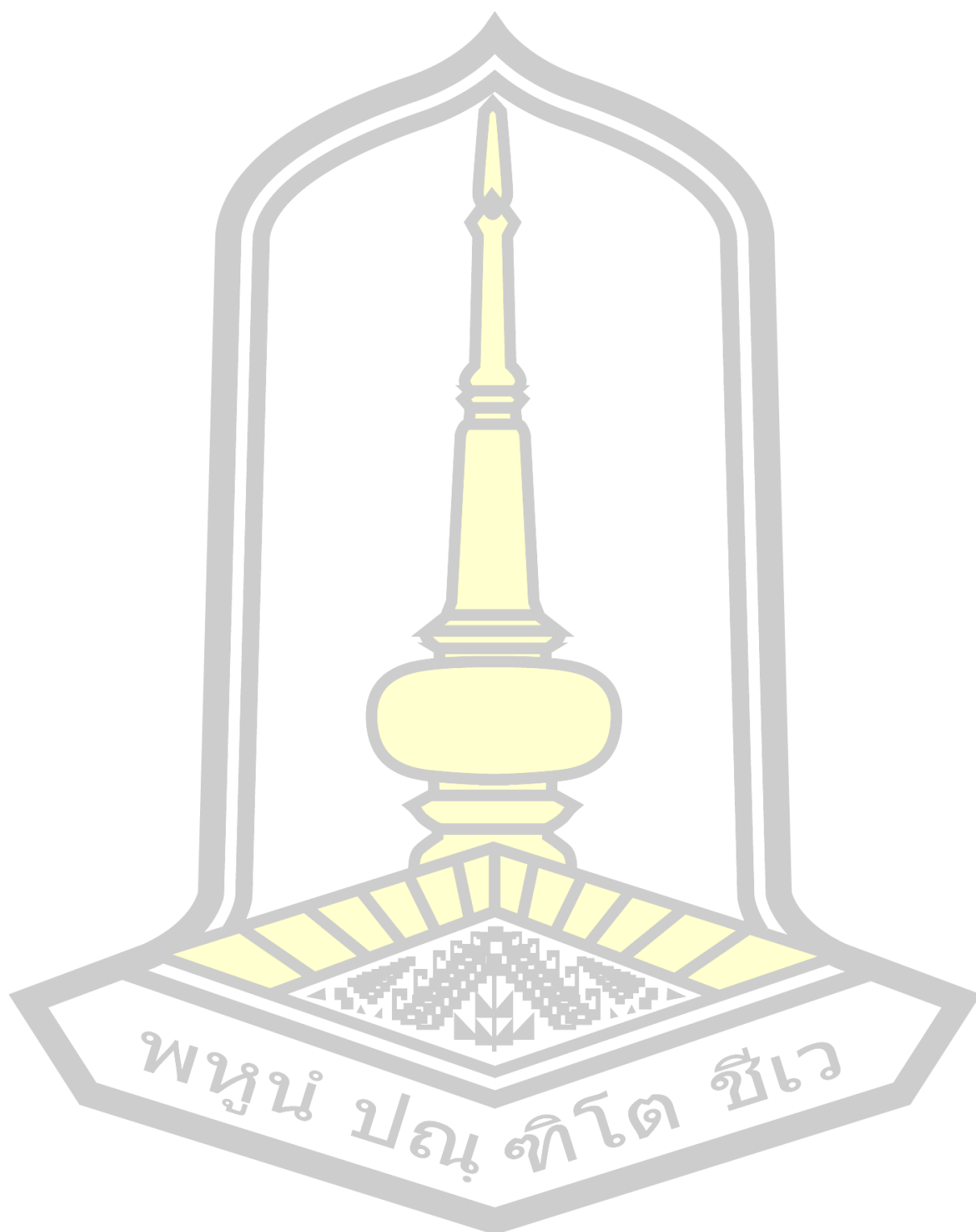
3.2.4 Display of research results

This study adopted a qualitative research method, collected first-hand data through fieldwork, in-depth interviews and focus group discussions, and systematically analyzed the protection and innovation of Shu embroidery culture in combination with existing literature resources. The research framework mainly includes the historical context of Shu embroidery culture, the application of digital protection technology, and the innovative practice of knowledge graph and generative artificial intelligence (AIGC) technology in Shu embroidery pattern design.

Through in-depth excavation of the cultural connotation of Shu embroidery, the key elements of its inheritance and development are sorted out. At the same time, with the construction of the knowledge graph of Shu embroidery as the core, the systematic and visual storage of cultural resources has been realized through the digital sorting of multi-dimensional information (such as subject matter, meaning, stitching, color and structure, etc.) of Shu embroidery patterns, for example, the research team at Nanjing University has constructed CICHMKG, which contains 1,774,005 triples to support visual perception and understanding (Fan, 2023) 。 Combined with AIGC technology at the technical level, the prompt words of Shu embroidery pattern innovation are generated through knowledge graph data, which further plays a role in the creative design of patterns, and can input prompt words for text-to-image generation according to cultural needs, so as to meet the diversified and personalized design needs of Shu embroidery patterns. For example, with the traditional theme of "hibiscus carp" as the theme, the relevant cultural symbols and connotations are extracted through the knowledge graph, and AIGC technology is used to generate innovative patterns with modern beauty and cultural significance.

In summary, through the combination of knowledge graph and AIGC technology, this study constructs a digital development model of Shu embroidery cultural heritage, which not only promotes the digital protection of Shu embroidery patterns, but also innovates the creative design and market application of Shu embroidery, and provides a practical example for cultural heritage protection. The results of the study will be

presented in the form of a research paper.



CHAPTER IV

RESEARCH RESULTS

This chapter will introduce the historical origin, cultural value and cultural identity of Shu embroidery patterns; Analyze the development mode of Shu embroidery pattern; Analyze the current situation of the development model of Shu embroidery pattern; This paper summarizes the theoretical model of the application of digital technology in the development of Shu embroidery patterns. Data were obtained from literature reviews, questionnaires, interviews, focus interviews. The theoretical model consists of 4 modules and 7 design steps. Four modules: pre-designed; mid-term design; After synthesis; Assessment and feedback. Eight design links: conceptual design; pattern collection; define concepts and classes; Shu embroidery pattern construction; reasoning and completion; visualization of Shu embroidery patterns; AIGC's Shu embroidery pattern innovation and evaluation feedback.

4.1 The history of traditional patterns in Shu embroidered

4.1.1 The history of traditional patterns in Shu embroidered

4.1.2 The development model of traditional patterns of Shu embroidery

4.1.3 Sichuan cultural development

4.1.4 Summary

4.2 The current situation and problems of Shu embroidery patterns

4.2.1 The inheritance and protection status of traditional patterns of Shu embroidery

4.2.2 The issues of inheriting and protecting traditional patterns of Shu embroidery

4.2.3 On the current situation and development model of Shu embroidery patterns

4.2.4 Summary

4.3 The mode of development of traditional patterns of Shu embroidery

4.3.1 Data collection and collation

4.3.2 Construct the knowledge graph ontology database of traditional patterns of Shu embroidery

4.3.3 Intelligent Shu embroidery traditional pattern innovation

4.4 Evaluation and feedback

4.4.1 Chinese Shu embroidery pattern

4.4.2 Shu embroidery pattern development model

4.4.3 Sichuan cultural development

4.1 The history of traditional patterns in Shu embroidered

Based on the materials of CNKI, Google Scholar, Sichuan Museum, Sichuan University Museum and related libraries, it has extensively collected relevant historical materials and books related to Chinese folk embroidery, Shu embroidery culture, and Shu embroidery pattern culture. At the same time, through field visits and exchanges with interviewees, inheritors of Shu embroidery and relevant folk culture experts, we will further understand the relevant information of Shu embroidery. The historical origins of Chinese Shu embroidery art have been elaborated in the literature review in Chapter 2 and will not be repeated here. This chapter will employ a qualitative research approach and focus on the modern history of Shu embroidery. It mainly discusses the following three aspects: first, the historical origin of Shu embroidery patterns, including its cultural connotation, the use of utensils and the context of inheritance; the second is the artistic characteristics of Shu embroidery patterns; The third is the cultural significance of Shu embroidery patterns.

4.1.1 The history of traditional patterns in Shu embroidered

Shu embroidery, mainly concentrated in Chengdu, Chongqing and other places, and Suzhou embroidery, Guangdong embroidery, Hunan embroidery. Shu embroidery has a long history, as early as the Jin Dynasty has been famous all over the world, and Shu brocade is called "the treasure of Shu" (Qi, 2014). During the Dao guang period of the Qing Dynasty, there was a professional embroidery workshop in Chengdu, which was sold after embroidery, and the embroidery of Shu was thus able to spread all over the world. After the middle of the Qing Dynasty, Shu embroidery was deeply influenced by Suzhou embroidery and Gu embroidery, combined with the essence of local embroidery techniques, forming a unique genre. Its main characteristics are that the composition is rigorous and concise, the colors are elegant and soft, the needles are neat, the stitches are neat and fine, the silk threads are bright and moist, and the edges of the patterns are as neat as knife cuts. The following is an overview of the

development history of Chinese Shu embroidery:

Han Dynasty: Initial development, 206 BC – 220 AD. Development characteristics: The Han Dynasty is an important period in the development of Shu embroidery. With the opening of the Silk Road, Shu embroidery skills have been widely spread. The embroidery patterns of the Han Dynasty were dominated by dragon and phoenix, moire and geometric patterns, and the craft gradually matured, and was widely used in aristocratic clothing and daily necessities. Shu embroidery began to show its delicate and delicate characteristics.

Tang Dynasty: Prosperity and Peak, 618-907. Development characteristics: The Tang Dynasty was the golden age of the development of Shu embroidery. The prosperity and openness of the Tang Dynasty provided a good environment for the development of Shu embroidery, and Shu embroidery became the favorite of the court and nobles. The Shu embroidery patterns of the Tang Dynasty were more rich and diverse, with a large number of flowers, animals and human patterns appearing, with bright colors and smooth lines. Shu embroidery reached a new peak during this period and became an important part of Chinese culture (Cheng, 2022).

Song and Yuan dynasties: delicate and elegant, time: 960-1368. Development characteristics: Song Dynasty Shu embroidery is known for its delicate and realistic style, and the patterns are mainly based on flowers and birds, landscapes, and the style is simple and elegant. The Yuan Dynasty was influenced by Mongolian culture, and some exotic elements such as Persian patterns were incorporated into Shu embroidery. The craftsmanship of Shu embroidery reached a new height during this period, further showing the unique artistic style of Shu embroidery.

Ming and Qing dynasties: mature and complex, time: 1368-1912. Development characteristics: The Ming and Qing dynasties were the stage of further maturity of Shu embroidery skills. The Shu embroidery patterns of the Ming Dynasty are more complex and diverse, the color matching is bold, and the patterns are mainly dragons and phoenixes, flowers, and landscapes. On the basis of inheriting the style of the Ming Dynasty, the Qing Dynasty Shu embroidery further developed the court themes and auspicious patterns, and the embroidery was more refined. During this period, the Shu embroidery technique reached its peak in history and became an important ornament for the royal family and nobles.

Modern Times: Inheritance and Innovation, Time: 20th Century to the Present.
 Development characteristics: After entering modern times, Shu embroidery is facing the challenges of industrialization and modernization. Despite the gradual decline in handicrafts, Shu embroidery still retains a place in the field of arts and crafts. The development of modern science and technology provides new possibilities for the protection and innovation of Shu embroidery skills. On the basis of maintaining tradition, Shu embroidery patterns incorporate modern design elements, which are not only used in traditional clothing, but also widely used in modern home decoration and artworks. As China's intangible cultural heritage, Shu embroidery continues to be inherited and carried forward at home and abroad.

Contemporary: Internationalization and Cultural Promotion, Time: 21st Century.
 Development characteristics: In the 21st century, Shu embroidery has gradually moved to the international stage and become one of the important symbols of Chinese culture. With the enhancement of cultural self-confidence and the importance of intangible cultural heritage protection, the skills of Shu embroidery have been more systematically protected and inherited. The multi-modal platform for the international dissemination of intangible cultural heritage in Henan Province realizes the three-dimensional scene of display, experience, interaction and education of intangible cultural heritage by integrating a multi-lingual translation and retrieval platform and a multi-modal interactive experience platform. This platform not only enhances the international dissemination of intangible cultural heritage, but also promotes cross-cultural understanding and exchange (Yang, 2023). At the same time, modern designers are also constantly integrating Shu embroidery elements into fashion design to promote the international dissemination of Shu embroidery (Zhu, 2021).

Table 3 The development of Shu embroidery in China

Historical period	Time frame	Development characteristics	Important events and cultural context
Pre-Qin period	11th century BC to 3rd century BC	The prototype of Shu embroidery is mainly geometric patterns, and the patterns are simple and simple.	Shu embroidery is used for religious sacrifices and aristocratic clothing, and the craft is in its infancy, reflecting the simplicity and primitiveness of ancient Shu culture.
Han dynasty	206 B.C.-220 A.D	Shu embroidery skills gradually matured, and the patterns included dragon and phoenix, moire and geometric patterns, which were widely used in daily life and aristocratic clothing.	The opening of the Silk Road promoted the spread of Shu embroidery, which became an important ornament in the life of the nobility.
tang dynasty	618-907	Shu embroidery has reached a new peak, the patterns are rich and diverse, the colors are bright, and the patterns include flowers, animals, people, etc.	The prosperity and openness of the Tang Dynasty made Shu embroidery a favorite of the court and nobles, showing a high

Historical period	Time frame	Development characteristics	Important events and cultural context
			degree of artistic achievement.
Song and Yuan dynasties	960-1368	The pattern is delicate and realistic, mainly flowers, birds, landscapes, and the style is simple and elegant, and the Yuan Dynasty has integrated exotic elements.	The Shu embroidery skills in the Song Dynasty were exquisite, and the Yuan Dynasty was influenced by Mongolian culture, and exotic elements such as Persian patterns appeared.
Ming and Qing dynasties	1368-1912	The skills are mature, the patterns are complex and diverse, and the colors are bold, which are widely used in court decoration, especially the dragon and phoenix and landscape patterns.	During the Ming and Qing dynasties, Shu embroidery reached its peak and became an important ornament for the royal family and nobles, and its skills reached the highest level in history.

Historical period	Time frame	Development characteristics	Important events and cultural context
Modern times	20th century to the present	Shu embroidery skills inheritance and innovation, integrated with modern design elements, widely used in artwork and home decoration.	Modern science and technology have promoted the protection and innovation of Shu embroidery, and Shu embroidery has been valued and promoted as an intangible cultural heritage.
Contemporary	21st century	Shu embroidery has become an important symbol of Chinese culture and continues to inherit and innovate.	Shu embroidery has been recognized on the international stage, and modern designers have integrated it into fashion design to promote cultural dissemination.

Source: Liu Ying (2024)

4.1.1.1 Shu embroidery mode and color

The embroidery themes of Shu embroidery are mostly flowers and birds, grass and insects, landscapes, animals, people, etc., among which carp, pandas and other themes are rich in strong local characteristics (Cha, 2023).

Figure 20 "Shou tian Bai xi" left "Fu She Shou xi" right, Shu embroidery is sometimes based on folk tales, mostly expressing the auspicious meaning of Fu lu.

These two Shu embroidery works are "Shou tian Bai lu" and "Fu lu Su xi" (also known as "Samsung Gao zhao"). It is on the yellow soft embroidery ground, embroidered with bright colored silk, the stitches are diverse, the stitches are neat, the thread pieces are bright, highlighting the characteristics of Shu embroidery tight and soft, the car is screwed to the home, it is a very precious ancient Shu embroidery painting.

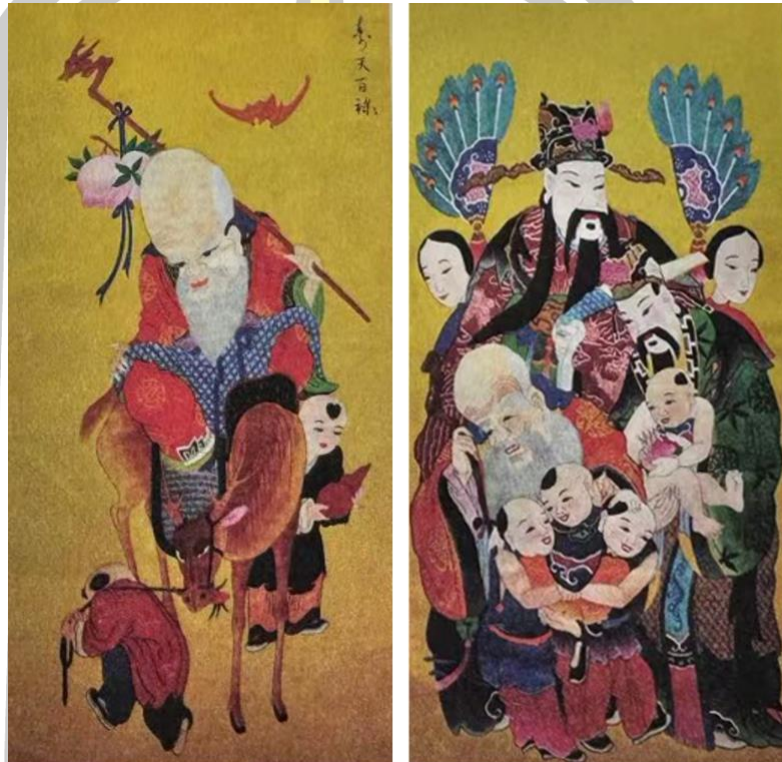


Figure 19 "Shou Tian Bai She" on the left and "Fu She Shouxi" on the right
Source: Liu Ying (2024)

Embroidery: The varieties of traditional Shu embroidery mainly include official clothes, gifts, daily clothing, dowry, color tents and strip screens. There are relatively few purely ornamental embroideries, and most of them are daily necessities.

Figure 21 Panjin character story map gasket Qing Dynasty Sichuan Museum collection, this embroidery composition is sparse and concise, the color is beautiful and elegant, and the white satin ground in the middle is embroidered with figures, small bridges and other patterns; The periphery is paved with gold, decorated with gourd, longevity peach, chrysanthemum, orchid, camellia and other patterns.



Figure 20 Panjin character story diagram gasket

Source: Liu Ying (2024)

Figure 22 Tong Bib Republic of China, this embroidery is embroidered by cutting and pasting, made of a variety of colored cloths, the color is rich and unified.



Figure 21 Tong Bizui Republic of China Republic of China

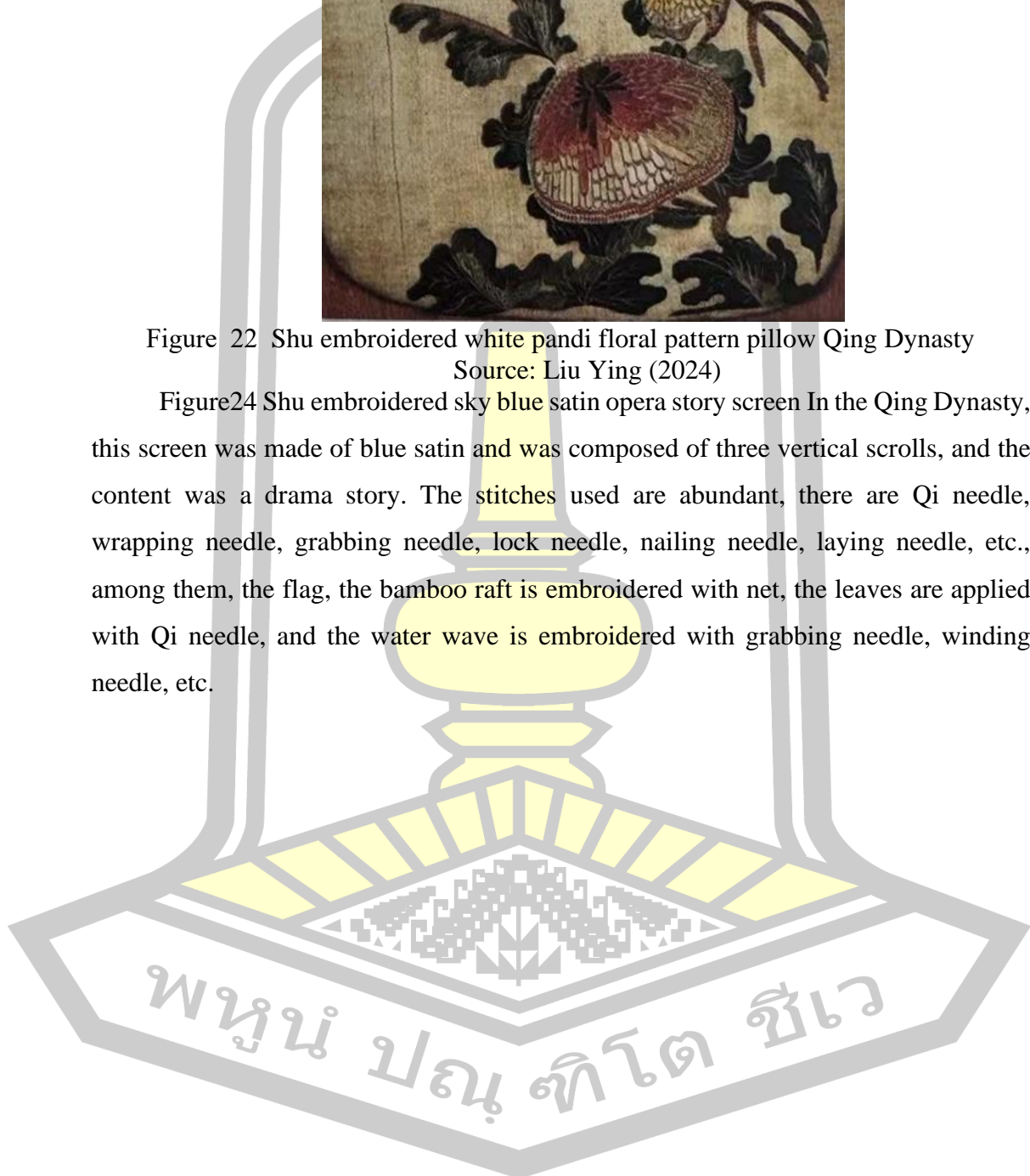
Source: Liu Ying (2024)

Figure 23 Shu embroidery white pandi flower pattern pillow Qing Dynasty, this pillow piece is white pandi, embroidered with orchid grass and chrysanthemum, the color is elegant, the image is simple, it is a typical folk style of Shu embroidery.



Figure 22 Shu embroidered white pandi floral pattern pillow Qing Dynasty
Source: Liu Ying (2024)

Figure 24 Shu embroidered sky blue satin opera story screen In the Qing Dynasty, this screen was made of blue satin and was composed of three vertical scrolls, and the content was a drama story. The stitches used are abundant, there are Qi needle, wrapping needle, grabbing needle, lock needle, nailing needle, laying needle, etc., among them, the flag, the bamboo raft is embroidered with net, the leaves are applied with Qi needle, and the water wave is embroidered with grabbing needle, winding needle, etc.



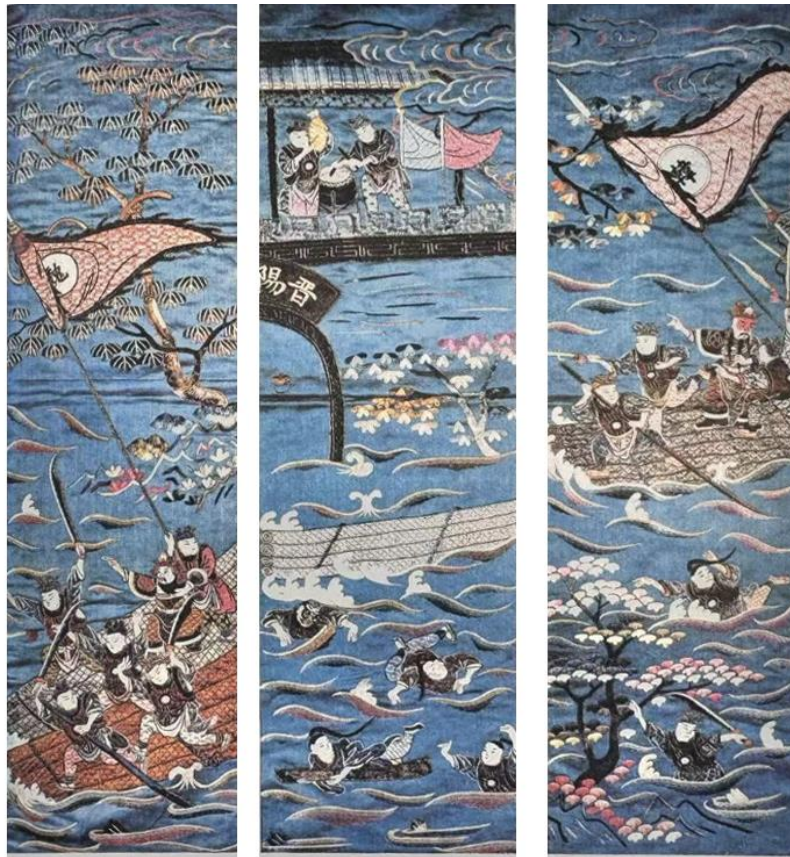


Figure 23 Shu embroidered sky blue satin opera story screen Qing Dynasty
Source: Liu Ying (2024)

Shu embroidery color: Shu embroidery uses elegant colors, and halo needles are often used to express the effect of color blending, and the atmosphere is vivid (Tracy, 2015).

Figure 25 Jiang shui Hague, each group of colors in Lishui from dark to light, Qianlong used to be deep in the middle, shallow on both sides, about Qianlong changed to the embroidery method from dark to shallow once arranged, the change of each group of color system is completed several times, the industry is called a few colors, the general court clothing with five layers, seven layers, nine layers of technology, the early color is more, to the middle and late period of many court dragon robes embroidered colorful or nine color. Most of the late civil embroidery is only embroidered with three layers, and some smaller patterns are even embroidered with only two layers, such as the horse face of the skirt and some small accessories. Moreover, most of the civil Shu embroidery in the late Qing Dynasty used the method of three blue embroidery, not color.





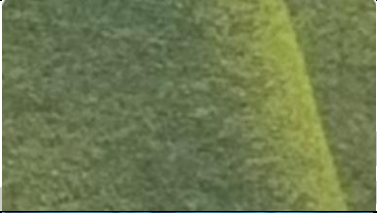




Figure 24 The Hague
Source: Liu Ying (2024)

4.1.1.2 Shu embroidery material

Fabric: Shu embroidery is mostly made of silk, pan, silk, yarn and crepe as fabrics, and the embroidered things have a smooth and transparent texture. Embroidery floor, the bottom of the remaining embroidery, that is, the embroidery fabric placed on the stretcher, also known as "ground" or "bottom". Embroidery is usually based on the subject matter and content of the sketch, to determine the type of embroidery, stitching method and the texture of the base material. Different textures of the base material have different requirements for embroidery needles, stitches and patterns. Embroiderers can only embroider well if they choose the right embroidery ground (Li, 2021).

Table 4 Common types of fabrics for Shu embroidery

name	Fabric material	introduce
cashmere		Slender and soft, elastic with a soft natural color. Cashmere embroidery is noble and elegant.
Soft satin		Varieties with smaller warp density are suitable for embroidering large patterns; The varieties with larger warp density are suitable for embroidering small scattered patterns. It has a glittering effect when the warp density is not large.

name	Fabric material	introduce
flannel		The surface is covered with soft and fine field hair, plain and generous, flat and comfortable, embroidered on it, highlighting the appearance in the plain elegance.
Animal fiber cloth		Smooth and soft, smooth and comfortable, it is a high-quality fabric. Embroidered on it, it looks delicate and luxurious.
Pure hemp		It is relatively coarse and hard, embroidered on it, the texture is clear, and the embroidery surface is smooth.
Pure cotton		It has strong moisture absorption, good air permeability, easy to clean, and is widely used in clothing. Embroidered to make it both practical and ornamental.
georgette		Light and transparent, elegant and hazy, elastic, easy to shrink, the shrinkage rate is generally 10%~12%. It is often used to make clothes, and embroidery on it is particularly feminine and beautiful.


Source: Liu Ying (2024)

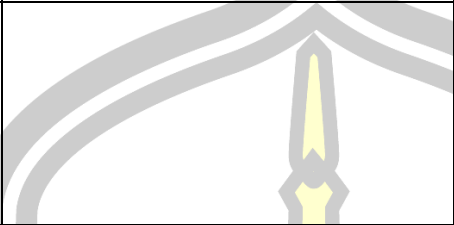


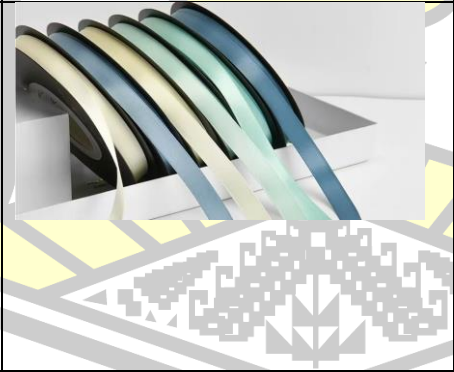

Embroidery thread: Embroidery thread is like the pigment in the painting, the more color gradations, the more realistic and colorful the picture. For example, the embroidery thread dyeing of Suzhou embroidery can reach more than 100 kinds, and each color level reaches more than 30 kinds. The choice of embroidery thread material and thickness should be determined according to the material of the embroidery ground and the design requirements of the pattern, such as the same embroidery pattern, the thread on the linen cloth should be thicker than the silk, and in the same embroidery, the thread of the hair is thinner than the thread of other parts.

Embroidery semicolon, embroidery thread is rich in color, and a variety of shades of color can also be divided into the same color. According to the different colors and

thicknesses of the embroidery thread, the embroidery thread is often divided into different models.

Table 5 Common embroidery threads for Shu embroidery

The name of the embroidery thread	Embroidery thread material	Introduction to embroidery threads
Embroidery thread		<p>The embroidery thread is rich in color, and a variety of shades of color can be divided into the same color. According to the different colors and thicknesses of the embroidery thread, the embroidery thread is often divided into different models.</p>
Pure cotton fine embroidery thread		<p>It is made of twisting strands of a single yarn. There are about 40 color series, and each color system has 6~9 color levels from light to dark. It can be used as a single root or as a strand. Because it has a faint luster, it can be embroidered on a variety of embroidery floors such as cotton, linen, silk, etc., and is also suitable for all kinds of stitches. When embroidering on the embroidery ground with rough material, it should be used together, otherwise the embroidered pattern is easy to expose the embroidery floor and uneven after foaming.</p>
Gold and silver thread		<p>Gold and silver thread is mostly used for flat gold or plate gold embroidery, because of its bright color, the embroidered things often appear rich and luxurious. As far as the material of gold and silver thread is concerned, it should be carefully distinguished, and it is dyed with cotton thread, which does not</p>

The name of the embroidery thread	Embroidery thread material	Introduction to embroidery threads
		<p>perform well and is not a real gold and silver thread. The gold thread of the real Shejin often has a golden effect. If it turns black, it means that it contains more copper.</p>
Cotton rental embroidery thread		<p>It is made of three yarns in strands, and there are fewer color systems, and there are 3~5 color levels for each color system. Generally, it is not used in shares, and there are two at most two together. It is suitable for embroidery on hemp base cloth and crumpled market.</p>
thread		<p>There are fine hair, medium and thick wire, thick twisted wire, and stranded wire. Generally, it is suitable for yarn embroidery. It should be noted that for embroidery on thick fabrics, thick twisted threads or ply threads should be used.</p>
ribbon		<p>A ribbon is a very fine, colored ribbon that is woven by a machine. It is suitable for use on thicker and thicker base fabrics, and can also be mixed with coarse embroidery threads. If it is paired with beads, sequins and other ornaments, the embroidery will be more gorgeous and rich.</p>
twine		<p>Most of them are imported embroidery threads, which are synthesized by 6 strands. The thread itself is glossy, the color is elegant, and each color contains "gray" components, such as gray-green, gray-pink, gray-blue, etc. It is most suitable for cross-stitch, nano-yarn embroidery, velvet embroidery,</p>







The name of the embroidery thread	Embroidery thread material	Introduction to embroidery threads
Silk thread		<p>etc.</p> <p>It is made of cocoon twisting and twisting, which is a kind of embroidery thread unique to southern China. Its color is bright, the luster is bright, the toughness is very good, suitable for embroidery on soft base cloth such as soft pan and silk, and can also be embroidered on glass silk yarn double-sided embroidery. When embroidering animals, the unique luster of silk threads is used to express the animal's fur, and the effect is excellent.</p>


Source: Liu Ying (2024)

Embroidered ornaments: When embroidering, according to the needs of the pattern, various ornaments are often embroidered. The range of materials for embroidery ornaments is very wide and eclectic. Common ornaments include glass beads, polyester beads, spherical beads, polygonal beads, tubular beads and other embroidered beads, as well as pearls, agate, coral, wood beads, glass and other treasures. In addition, all kinds of colored ribbons, cotton yarns of various colors, webbing, braided ropes, as well as sequins, buttons, etc., can be used to decorate embroidery.

Table 6 Commonly used embroidery ornaments in Shu embroidery

The name of the embroidered ornament	Embroidered ornament material	Introduction of embroidered ornaments
Bead embroidery		<p>Bead embroidery, that is, coral, glass beads, pearls and other beads are threaded and embroidered on the embroidery cloth to form a pattern.</p>

The name of the embroidered ornament	Embroidered ornament material	Introduction of embroidered ornaments
pearl		<p>Pearls are usually creamy yellow, flesh-colored, white, golden yellow, and have a beautiful luster that makes people fall in love with them. Pearls are precious ornaments, embroidered superior pearls, appear graceful and luxurious.</p>
Coral beads		<p>Coral beads are pure natural jewelry, the color is transparent, and it is often used in embroidery to have the finishing touch.</p>
Sequins		<p>Sequins are a material with a hard texture, a flat surface, and a high finish. Embroidery decorated with sequins shines.</p>
gold foil		<p>Gold leaf is a thin sheet hammered with gold, and after the ornament is decorated with it, it is brilliant and dazzling.</p>
Lace		<p>Lace is a hollowed-out gauze material, light as a thin wing, dreamlike, beautiful and delicate, used for embroidery decoration.</p>
Spikes		<p>If the tassel is too long, it is easy to mix, so you can tie it up and arrange it into a decoration of knots.</p>

The name of the embroidered ornament	Embroidered ornament material	Introduction of embroidered ornaments
tassel		<p>The tassel is in the shape of a vertical strip, which can be used to embroider the ground of the Ji yarn, and after the weft yarn is removed, it will be formed naturally. Tassels are used for embroidery edges. Elegant.</p>

Source: Liu Ying (2024)

4.1.1.3 Shu embroidery production process

Embroidery process, embroidery is a cumbersome skill, the completion of an embroidery work, roughly need to go through the selection of embroidery manuscript, preparation of embroidery tools, wiring and coloring, embroidery and embroidery after the completion of the embroidery mounting, maintenance and other processes. Only when all links are interlocking and orderly, can an embroidery be successfully completed. The traditional embroidery process mainly includes design, drafting, stretching, wiring, falling stretching, embroidery, mounting and other processes.



The drawing



Check draft



The color



Split wire



The guy



This needle



The embroidery



Framed

Figure 25 Embroidery process

Source: Liu Ying (2024)

4.1.1.4 Shu embroidery equipment

(i) Embroidery and curling

Stretching is to place the embroidery base cloth on the embroidery stretch or embroidery stand, which is a crucial step in the embroidery process. No matter how exquisite the embroidery is, if the embroidery is not good, most of the embroidery is

waste. There are two kinds of upper bandages: hand bandages and curly bandages, and their steps and methods are introduced below. Hand bandage, hand bandage is relatively simple. Square embroidery is the same as circular embroidery. Generally speaking, larger embroideries are banded in squares, and smaller embroideries are banded in circles. During the stretching process, the cloth grain cannot be tilted, and the warp and weft of the cloth must be kept vertical and horizontal.

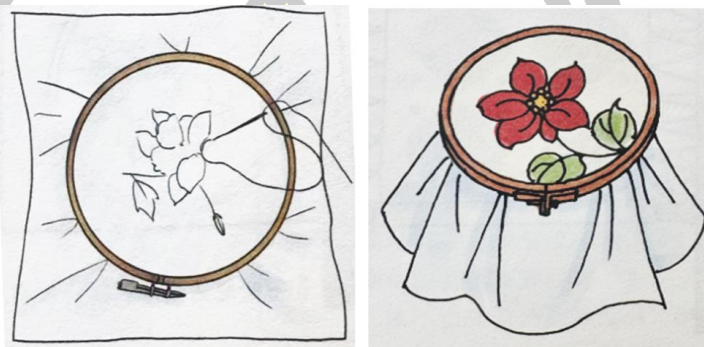


Figure 26 Hand bandage
Source: Liu Ying (2024)

Curling is the most conformable with a curling bandage, even if the base cloth is full of wrinkles, there is no need to iron. During the stretching process, the base cloth must be aligned with the curling to keep the embroidery bottom flat and compliant. The bottom cloth can be embroidered alternately with upper and lower hands, so that the effort is less and it is easier to achieve twice the result with half the effort.



Figure 27 Curling
Source: Liu Ying (2024)



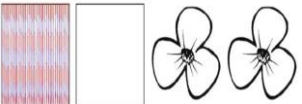




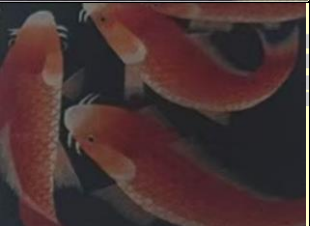
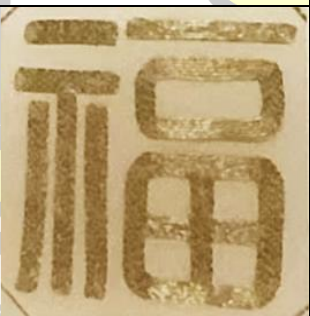
Figure 28 Shu embroidery on the curl of the embroidery panda work
Source: Chengdu Shu Brocade Embroidery Museum


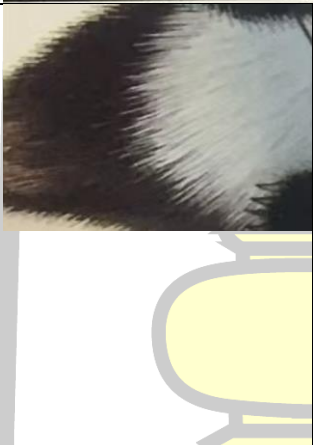

(ii) Shu needle method





There are 12 categories and 122 kinds of Shu needle methods, and various needle methods are used in a staggered manner and vary from variety to variety (Shao, 2018). Commonly used needle methods include halo needle, needle laying, needle rolling, needle truncation, needle doping, sand needle, cover needle, etc. The embroidery stitches are neat, the needle is rigorous, the color is soft, and the twisting (turning the needle, a kind of stitch of uneven length, embroidered from the inside to the outside or mixed from both sides to the middle when transporting the needle) freely.

Table 7 Common stitch methods for Shu embroidery

The name of the stitch	App works	Introduction to stitching
Qi needle	 	Qi needle is the most basic and simple embroidery method, which is a method of directly embroidering the pattern from one end of the pattern to the other end with a straight line, including straight embroidery and twill embroidery.
Faint needle method		The halo needle method is a regular long and short needle, all three needles are three needles of unequal length, two two needles

The name of the stitch	App works	Introduction to stitching
		are two long and two short needles, and two or three needles are two long and three short needles. The various pins are close to each other, and the length of each row varies, but the stitches are connected and staggered to form water ripples.
Hair needles		Hair needle is a needle method applied to the needle or other needle methods such as 22 needles, 23 needles, 33 needles, long and short needles, etc. This kind of stitching requires sparse but not dense, divergent but not combined, alive but not sluggish, uneven.
Turn the needle		The "car" is a type that gradually rotates from the center to the surrounding area, such as embroidering the eyes of an animal and distinguishing the flower of a flower.
Scaling needles		The head and abdomen of the object embroidered with feather scales, or butterflies, large birds, and fishes, should be embroidered in order according to the outline lines of the ink hook, and then at the outer edge, the needles should be pierced with thin threads to express the texture of the front end of the feathers.
Flat gold needle		Using gold and silver thread as embroidery thread, first use gold thread or silver thread to lay flat on the embroidery ground, while paving with silk thread with a short needle on the embroidery ground, the needle distance is 3-4mm, and the flat needle method is coiled and filled according to the pattern, which can be coiled into various patterns or images. The tie should be neat, and the gold or silver wire should be at a perpendicular angle to form a cross-shaped pair.

The name of the stitch	App works	Introduction to stitching
Disc gold needle		<p>The gold needle is also known as "nail gold embroidery", this technique has been popular as early as the Tang and Song dynasties, it is a needle method that coils the gold and silver thread into a thread or block according to the requirements of the pattern image, and then nails it on the fabric with embroidery thread. The nailing method is divided into bright line and dark line, the open line stitch is exposed, and the dark line stitch is hidden.</p>
Sand needles		<p>Sand needles, also known as "loose needles" and "sand needles", are flat needle marks that express incoherent lines and dotted lines. It is characterized by the fact that she is about to be about The thinner the needle, the thinner the thread, the lighter the color, and even the place where the embroidery is not embroidered is the same as the embroidery ground, which is the needle, for example, embroidering Chinese-style landscapes and ink paintings, you can also use this embroidery method.</p>
Prick the needle		<p>Embroider the straight needle first, and then add the horizontal needle on top of the straight needle, as if bandaging something, and the needle can create the effect of bird's foot pattern</p>

The name of the stitch	App works	Introduction to stitching
pine needles		<p>It is an embroidery method that expresses pine needles or grass. The pine needles are mainly fan-shaped and spherical, and are characterized by sharp and lush needles. Embroider with a combination of needles, rolling needles, straight needles, etc. Pine needles are mainly used to embroider pine leaves, and fan-shaped pine needles are also commonly used for embroidering grass and aquatic plants.</p>
Brocade embroidery		<p>Brocade embroidery is the traditional embroidery method of Shu embroidery, is the embroidery method of expressing fabric patterns, mostly used in the performance of the character's clothing and embroidered silk clothing, in the 80s of the 20th century, embroidered women processed hanbok, Japanese kimono more use this stitch.</p>
Loose stitches		<p>Loose needle is a mixed needle method that combines set needle, long and short needle, hair needle, needle receiving and sand needle. When embroidering, it is used according to actual needs. Such as embroidered clouds and smoke, the thick part is used to set the needle and fine thread, which is the whole needle; Needles, long and short needles and hair needles are used for light and curved places; Sand needles are used in very light places; With thinner and shorter threads, it is a loose needle.</p>
Needle laying		<p>Needlework is to use a long straight needle to follow the direction of the back, only embroider the front, or embroider together with the back, and embroider the back all over the back as if it were tiled, so it is called needle-laying.</p>

Source: Liu Ying (2024)

4.1.1.5 The role of Shu embroidery

As a traditional Chinese intangible cultural heritage, Shu embroidery is not only the artistic crystallization and cultural symbol of the ancient Shu civilization, but also covers many aspects such as cultural inheritance, artistic display, economic development, and cultural dissemination. It carries the historical memory with exquisite craftsmanship and profound cultural connotation, and highlights the unique charm of traditional Chinese aesthetics. At the same time, in the modern society, through the development of cultural and creative products, education and promotion, cultural tourism and brand building, Shu embroidery has become an important link connecting tradition and modernity, domestic and international, and has injected new vitality into cultural inheritance, innovation and development and regional economic prosperity.

(Liu,2024, Interview) said that the birthplace of Shu embroidery is located in the Chengdu area of Sichuan Province, where the geographical environment is superior and the history is long. As the birthplace of Shu embroidery, Chengdu's unique geographical location and historical background make Shu embroidery art integrate the national culture and traditional crafts in western Sichuan. For thousands of years, the people here have inherited and developed the traditional art of Shu embroidery in a unique social environment, and formed an embroidery style with local characteristics.

With the passage of time, Chengdu's Shu embroidery art has gradually formed a unique cultural identity, and Shu embroidery as a traditional craft has been continuously carried forward in this context. Shu embroidery not only carries a rich local culture, but also demonstrates regional folk customs and aesthetic orientations, making it an important part of traditional Sichuan culture (Wang, 2022).

(Wang,2024, Interview) said that Shu embroidery is a traditional art form created and inherited in Chengdu, Sichuan Province for hundreds of years. Shu embroidery works have a long history and are full of strong western Sichuan characteristics. The art of Shu embroidery in Chengdu is deeply influenced by multiculturalism, and it is not only rich in Bashu cultural heritage, but also influenced by the farming culture of the Central Plains. The Chengdu region, as an important node of the Silk Road, has accepted cultures from different regions and formed a unique Shu embroidery style. Sichuan Shu embroidery integrates local folk customs and foreign culture, and continues to innovate on the basis of traditional skills, forming a unique symbol of local

culture.

Through the collection and research of historical materials, as well as interviews with experts, Shu embroidery in Chengdu, Sichuan Province has been recognized as one of the representatives of China's intangible cultural heritage. Shu embroidery is mainly distributed in Sichuan Province, especially in Chengdu and its surrounding areas. Shu embroidery has a profound historical heritage and traditional craftsmanship in Sichuan culture. Traditional Shu embroidery works usually have flowers, birds, landscapes, people, etc. as the theme, reflecting the Sichuan people's love for nature, life and the inheritance of traditional culture. Although Shu embroidery and Sichuan's Bashu culture have different historical backgrounds and cultural connotations, they both reflect the rich and diverse cultural traditions and aesthetic tastes of southwest China. Although there is no direct evidence that Shu embroidery has a direct historical connection with other ancient cultures, Shu embroidery is closely related to the traditional art and folk activities in Sichuan, and together represents the long and rich cultural heritage of Sichuan.

With the changes of history, the art of Shu embroidery has undergone multiple stages of development in the Chengdu area of Sichuan Province (Hu, 2024).。 Initially, the formation of Shu embroidery was profoundly influenced by the local natural environment, traditional customs and social changes. Evolved from the practical handicrafts of ancient times, Shu embroidery gradually integrated the cultural elements and aesthetic concepts of different historical periods, forming a unique artistic style. Shu embroidery in the technique and pattern, deeply influenced by natural scenery and national traditions, these patterns include landscapes, flowers and birds and traditional stories, etc., reflecting the worship of nature and good wishes for life.

In short, the development of Shu embroidery has a long history, and it has gone through a long process from the original prototype to a high degree of maturity. The embroidery patterns of each historical stage have a unique style, showing the cultural background and artistic pursuit of the time. Today, Shu embroidery not only continues to be inherited in China as a representative of traditional Chinese handicrafts, but also gradually gains wider recognition and praise in the world.

4.1.1.6 Producers of Shu embroidery

The producers of Shu embroidery include traditional handicraft craftsmen,

modern designers, embroidery enterprises and cooperatives, art universities and research institutions, as well as technology developers and other subjects. They work together to promote the development of Shu embroidery through inheritance and innovation: traditional craftsmen focus on craftsmanship inheritance, modern designers integrate contemporary creativity, enterprises and cooperatives achieve large-scale production, academic institutions provide research support, and technology developers empower Shu embroidery through digitalization and artificial intelligence technology to broaden its application scenarios and market space. Together, these producers have built an ecosystem that integrates tradition and modernity for the inheritance and development of Shu embroidery. It mainly includes the following categories

Traditional inheritors: Most of these inheritors are handicraft craftsmen in families or local workshops, who pass on the skills of Shu embroidery from generation to generation through oral transmission. They are not only the masters of skills, but also the disseminators of culture, concentrated in Sichuan, Chengdu, Pidu and other birthplaces of Shu embroidery.

Modern craftsmen: Driven by the policy of intangible cultural heritage protection and development, a group of new generation craftsmen combine traditional Shu embroidery techniques with modern design concepts to promote the innovation of Shu embroidery in the fields of fashion design and cultural and creative products (Ren, 2022).

Embroidery enterprises and cooperatives: Many local embroidery enterprises and professional cooperatives build Shu embroidery brands through large-scale production, while providing local employment opportunities and promoting regional economic development.

Universities and research institutions: Teachers and students of art colleges and universities, and scholars from intangible cultural heritage research institutions also participate in the production and innovation of Shu embroidery, and promote the development and dissemination of Shu embroidery skills through design, teaching, scientific research projects and other forms.

Artificial intelligence and technology developers: With the advancement of technology, artificial intelligence and knowledge graph technology developers have also become important participants in Shu embroidery producers, and through digital

means to build a Shu embroidery pattern database and generate innovative designs, which has broadened the application scenarios and development space of Shu embroidery.

These producers together constitute the ecological system of the inheritance and development of Shu embroidery, which not only continues the traditional craftsmanship, but also promotes the modernization and international development of Shu embroidery.

4.1.2 The development model of traditional patterns of Shu embroidery

4.1.2.1 The pattern history of traditional patterns of Shu embroidery

Shu embroidery is one of the four famous embroideries in China, originating in Sichuan, especially in the Chengdu area. The development of its patterns reflects the changes in Chinese history and culture and the inheritance of handicrafts. The development of traditional patterns of Shu embroidery has undergone the evolution from simple geometric patterns to complex and delicate patterns, and gradually formed a unique style. The following is the development process of traditional patterns of Shu embroidery:

The development of Shu embroidery is based on the richness of Shu, especially the quality and quantity of silk produced. (Sima, 2014), in the Spring and Autumn Period, silk fabrics and linen fabrics were transported to Yong, the capital of Qin, for trade. By the time of the two Jin Dynasty, embroidery has become a special product of Shu. Shu embroidery developed with the development of the silk weaving industry in Shu.

At the end of the Western Han Dynasty, Shu was "the industry of female workers, covering the world" (Chen, 2016). According to the literature, the earliest king of Shu had already known how to breed silkworms. During the Three Kingdoms period at the end of the Han Dynasty, Shu brocade and Shu embroidery was already famous all over the world, as a rare and expensive silk fabric, Shu often used it to exchange for war horses or other materials in the north.

At the end of the Tang Dynasty, Nanzhao attacked Chengdu, and in addition to gold and silver, Shu brocade, and Shu embroidery, the objects of plundering also plundered a large number of Shu brocade and Shu embroidery craftsmen, which were regarded as rare and exotic objects. According to the records of Yuanhe County and County, in the Tang Dynasty, Anjing embroidery entered the court as a tribute and

became the main item for the emperor to reward meritorious officials.

During the period of five dynasties and ten kingdoms, the relatively stable situation in Sichuan created favorable conditions for the development of Shu embroidery, and the increasing social demand stimulated the rapid development of Shu embroidery industry.

In the Song Dynasty, the name of Shu embroidery has spread all over China, the literature said that the Shu embroidery technique is "extremely ingenious", the development of Shu embroidery has reached its peak, and the embroidery products are unique in the world in terms of craftsmanship, production and sales and exquisiteness.

After the middle of the Qing Dynasty, Shu embroidery gradually formed an industry. During the Daoguang period, the Three Emperor Gods Society, a non-governmental organization, was established. This is a special guild of the embroidery industry composed of shops, materials and teachers, indicating that Shu embroidery has gradually entered the market from the family, forming a large-scale production that is widely needed by the society. In order to promote the revitalization of the industry, the government of each county at that time set up a "persuasion bureau" to encourage the production of Shu embroidery. The Embroidery Department is set up under the Persuasion Bureau, which specializes in managing the production and sales of Shu embroidery. Many fine products in Shu embroidery have been designated as royal tribute, and outstanding artists have also been awarded the title of "five products with the title of knowledge", which greatly encourages the production and production of Shu embroidery. With the establishment of the Shu embroidery guild, there are dozens of Shu embroidery shops and workshops in Chengdu, and there are more than 1,000 embroiderers. During this period, embroidery products began to be designed by professional designers, and the products were gradually divided into three industries: clothing, costumes, and lanterns.

Fig.30 "Joy of the Child" Qing Dynasty, this embroidery is very rich in content, the scene is complete, the characters are full, and the most important thing is that the theme of "joy" is perfectly presented through a long banner.



Figure 29 "Picture of Joy of Boys", Qing Dynasty
Source: Liu Ying (2024)

Figure 31 "Jiaguan Wealth" strip screen In the Qing Dynasty, this embroidery piece is an embroidery strip screen, which is a popular way of dressing Chinese calligraphy and painting, which can be hung in the living room and bedroom, and flowers and birds are its commonly used subjects. There are generally two strip screens, which are hung on the left and right. In the two strip screens above, the images of bamboo fences, ears of grain, etc. are embroidered respectively, due to the sense of extension up and down, the flower branches in the picture give people a feeling of being unusually tall and straight, the atmosphere is quiet and elegant, and the taste is elegant.

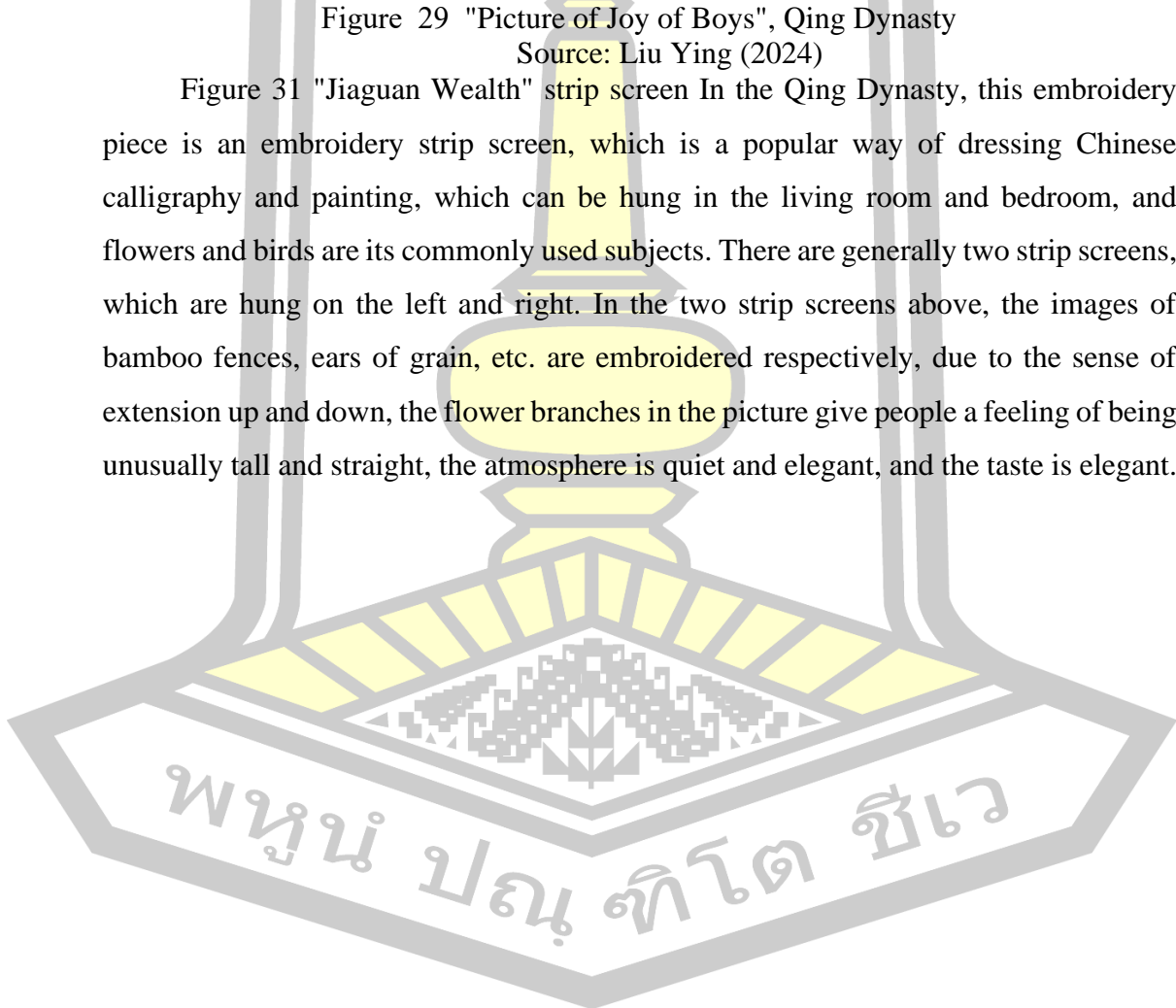




Figure 30 "Adding Officials and Wealth" strip screen Qing Dynasty
Source: Liu Ying (2024)

Figure32 "Green Pine Crane" Qing Dynasty, in this picture, the white crane stands on top of the green pine, leading to a trial cry, which makes people think boundlessly. The vertical banner is used to express the scene of cranes and pines, creating a sense of independence and charm. The three-dimensional sense of vertical embroidery is relatively strong, and its lofty artistic conception often makes people unable to bear to move their eyes.



Figure 31 "Green Pine Crane" Qing Dynasty
Source: Liu Ying (2024)

From the end of the Qing Dynasty to the early years of the Republic of China, Shu embroidery has enjoyed a high reputation in the world, and won the gold medal in the International Panama Competition in the fourth year of the Republic of China (1915). After the Republic of China, although Shu embroidery no longer embroidered court clothes and tributes, the scope of embroidered daily necessities became wider and wider, including almost all aspects of people's daily life. From children's shawls, shoes and hats, to bedding, interior decorations and gifts for weddings. This is the prominent

aspect of Shu embroidery folk, urban and rural women embroider shoes, hats, pillowcases, headscarves and even tents and quilts in their spare time, and those who practice extremely fine will become masters.

During the Anti-Japanese War, the cultural center moved south, and many painters and technicians came to Chengdu and made positive contributions to the development of Shu embroidery.

After the founding of the People's Republic of China, Chengdu Shu Embroidery Factory was set up in Sichuan, which made the development of Shu embroidery technology enter a new stage, and continuous innovation in technology. For example, the "cross needle" that expresses the texture of animal fur has been produced, which greatly enriches the expression and artistic style of Shu embroidery. In the "Cultural Revolution", Shu embroidery and many excellent national cultural heritage were criticized as "sealed, capitalized, and repaired" and artists engaged in embroidery, resulting in the transformation of the embroidery industry and the embroidery workers to find another way to make a living.

In 1972, China's four major embroideries, Guangdong embroidery, Suzhou embroidery, and Hunan embroidery, all participated in the Canton Fair, but Shu embroidery was missing. U.S. President Richard Nixon, who came here to visit, also specially asked Premier Zhou Enlai about the situation of Shu embroidery, and then government leaders began to pay attention to it.

At the end of the 70s of the 20th century, the rural areas of western Sichuan were almost "every girl is red, and every household is a needleworker", with as many as four or five thousand people. In addition to dozens of varieties of embroidered quilts, pillowcases, headscarves, hand towels, etc., it also actively produces raw textile embroidery pieces and embroidery screens for foreign trade exports. After 1981, Shu embroidery has a great development, in addition to the Shu embroidery factory specializing in embroidery workers, rural suburbs and counties processing embroidery personnel quickly increased to seven or eight thousand people.

Modern and contemporary: After entering the modern era, the Shu embroidery pattern has gradually integrated modern design elements on the basis of inheriting the tradition. Modern Shu embroidery is not only used in traditional clothing and decorations, but also widely used in modern art and home decoration. The Shu

embroidery process has also been supported by modern science and technology, so that the traditional patterns can be inherited and innovated.

Figure 33 "Panda" This embroidery uses a variety of stitches unique to Shu embroidery, which vividly expresses the image of the panda in a cute and cute manner. The tone of the picture is soft, the lines are smooth, and the light is smooth.

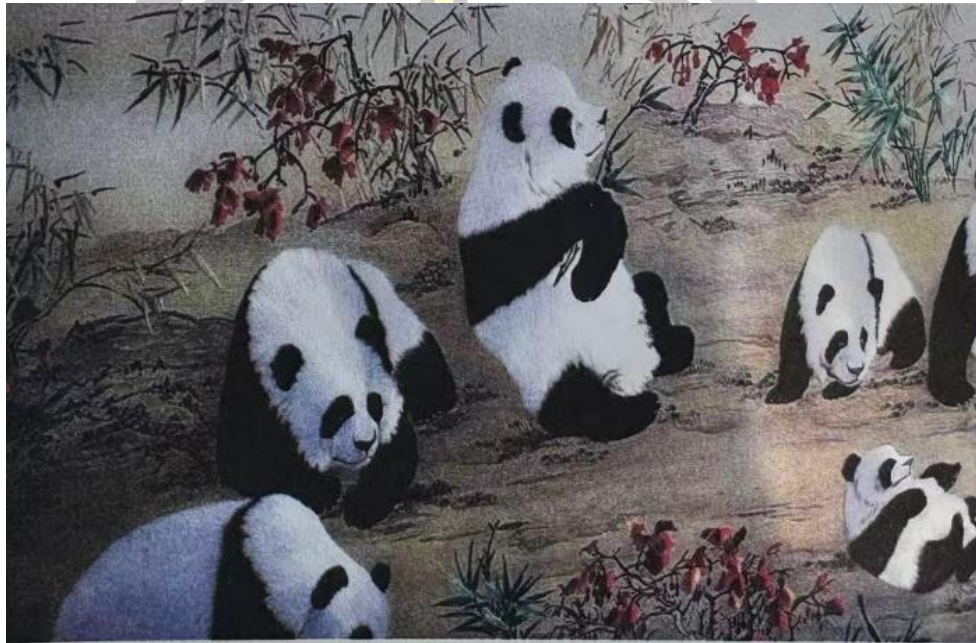


Figure 32 "Panda"
Source: Liu Ying (2024)

Table 8 Development of Shu embroidery patterns in China

Historical period	Pattern features	Cultural Background and Influence
Pre-Qin period	Geometric patterns, such as lines, ripples, etc., are simple and concise.	The ancient Shu culture is simple and primitive beauty, and the Shu embroidery process is in its infancy.
Han dynasty	Moire, dragon and phoenix, geometric patterns, began to express the natural landscape.	Shu embroidery is widely used in daily necessities, the level of skill is improved, and it symbolizes auspiciousness.

Historical period	Pattern features	Cultural Background and Influence
tang dynasty	Floral, animal, human motifs, bright colors, smooth lines.	The Tang Dynasty was prosperous and open, favored by the court nobles, and the development of Shu embroidery reached a new peak.
Song and Yuan dynasties	Flowers, birds, landscapes, the style is simple and elegant, and exotic elements appear.	The Song Dynasty focused on delicate realism, while the Yuan Dynasty was influenced by Mongolian culture and diversified patterns.
Ming and Qing dynasties	Flowers, dragons and phoenixes, landscapes, etc., the colors are bold and the skills are fine.	Shu embroidery reached the peak of skill, the patterns were more complex and diverse, and the court themes increased.
Modern vs. Contemporary	Traditional patterns are combined with modern design elements for diversified applications.	With the support of modern science and technology, Shu embroidery has developed in tradition and innovation, and its application fields have been broadened.

Source: Liu Ying (2024)

4.1.2.2 Classification of traditional pattern patterns of Shu embroidery

The classification of traditional patterns of Shu embroidery is based on the classification of the collected data, and the classification needs to comply with the theme, structure and color of the Shu embroidery patterns, as well as the relevant development of the classification (Jiang, 2011). The information collected is categorized as follows:

(i) Shu embroidery is rich in animal motifs, including dragons, phoenixes, deer, cranes, etc., which reflect the Bashu people's pursuit of a better life (Huang, 2022).

The animal motifs of Shu embroidery are not limited to the traditional auspicious ruyi patterns, such as dragons, phoenixes, deer, cranes, etc., these patterns symbolize wealth, longevity, wealth, blessings, etc. in traditional culture, reflecting people's yearning and blessings for a better life. In addition, Shu embroidery also uses a large number of folk auspicious patterns, such as dragons and phoenixes, deer and cranes, etc., some of them are similar to the sound, and some are similar to the shape, which are the patterns that symbolize auspiciousness in traditional culture. The use of these materials reflects the pursuit of a better life by the people of Bashu.

The animal motifs of Shu embroidery also include some specific animals, such as koi fish and pandas. Koi fish symbolize good luck and wealth in Chinese culture, and the panda, as a national treasure of China, is also a common motif in Shu embroidery. For example, the well-known hibiscus carp and the plum blossom bear as a national gift to witness the friendship between China and Africa are all fine products in Shu embroidery.

In general, the animal motifs of Shu embroidery not only show rich cultural connotation and artistic value, but also reflect the innovation of Shu embroidery artists and the inheritance and development of traditional skills.

The development mode of animal patterns has gone through the process from primitive simplicity to delicate and delicate, and then to formalization and stereotyping.

Primitive and simple stage: In the early period, animal patterns were more primitive and austere, reflecting the primitive characteristics of the culture and history of the time. For example, during the Shang and Zhou dynasties, the animal pattern style was more primitive and simple, which reflected the primitive and simple characteristics of the culture of the Central Plains and northern regions at that time.

Delicate and delicate stage: With the development of time and culture, animal patterns gradually become delicate and delicate, reflecting the prosperity and development of culture. For example, in the Shang Dynasty during the Western Zhou Dynasty, most of the animal patterns on its artifacts came from the northern region, indicating that the cultural exchanges between the Central Plains and the northern region were very frequent at that time.

(ii) As an important part of it, the botanical theme shows the unique charm of Shu embroidery art. These plant patterns are not only beautiful and elegant, but also have profound meanings, and are often used to symbolize auspiciousness, wealth and beauty (Huang, 2022). For example, patterns such as magpies making plum blossoms, mandarin ducks playing in the water, gold and jade full of halls, and phoenixes wearing peonies are all classics that metaphorize festivity, auspiciousness, glory and wealth. Most of these patterns have the beautiful meaning of auspiciousness, happiness and peace, reflecting the creator's pursuit and yearning for a better life.

To sum up, the botanical motifs in Shu embroidery are not only beautiful and generous, but also have profound meanings, showing the creator's pursuit of a better life and the inheritance and innovation of traditional culture.

The development model of botanical themes is undergoing diversified changes and innovations.

First of all, in the field of botanical research, the tassel aristolochia is considered to have the potential to become a magnolia model plant. This discovery is of great significance for the study of flower development, developmental genetics and synthesis of secondary metabolites. The selection of model plants plays a key role in finding out the status of the "whole class" in the plant kingdom, and the current botanical research is mainly focused on monocots and true dicots, and there is a lack of available model plants in the basal taxa of magnolia and ANA angiosperms.

In terms of the flower industry, scientific and technological innovation is supporting the development of the industry, forming the so-called "Yunnan model". This model promotes innovation and entrepreneurship by innovating the platform management model and establishing an open and integrated R&D and service platform. Through the implementation of industry-oriented collaborative innovation between science and technology, the extension of scientific and technological innovation has been expanded, and the supply-side structural change of the flower industry has been promoted.

To sum up, the development model of plant themes is undergoing a comprehensive change from scientific research to industrial application, including finding new model plants in the field of scientific research, and promoting the development of the industry and the change of the market through scientific and technological innovation and policy influence in the industrial field.

(iii) The development mode of geometric patterns has gone through the process from perceptual to rational, from practical to aesthetic, and from concrete to abstract. The development of geometric patterns can be broadly divided into several stages:

Primitive stage: the geometric ornamentation that appears on the primitive faience, the ornamentation of this stage is mainly based on simple geometric shapes, such as bead pattern, string pattern, straight stripe, horizontal stripe, oblique stripe, etc., most of these ornaments appear as foil patterns.

Spring and Autumn Period and Warring States Period: Geometric ornamentation was used as the main pattern, in a variety of forms, including cloud thunder pattern, hundred breast thunder pattern, zigzag thunder pattern, triangular thunder pattern, diamond thunder pattern, net pattern, etc., these patterns occupy an important position in the design, showing a rich visual effect.

Qin and Han dynasties: Geometric ornamentation was further developed, forming a four-square, eight-positioned, protruding center structure, which was stable and balanced, and became the mainstream ornamentation at that time.

Ming and Qing dynasties: geometric patterns were widely popular in the Ming and Qing dynasties, especially in brocade, and the back pattern was very common, which appeared in the form of a continuous combination of four directions, known as "Hui Hui brocade". In addition, geometric patterns are also widely used in porcelain decoration, such as the same origin and synonym of the back pattern and the thunder pattern, there are single intermittent arrangement, and there are also pairs that are connected by a positive and a negative connection, commonly known as "pair of back lines", and the continuous ribbon shape is also common in the decorative mouth or neck.

Modern stage: Geometric patterns have been innovated and developed in modern design, and more geometric decorative patterns in line with modern aesthetic tendencies have been created through exaggerated deformation, decomposition, disassembly, reorganization and reconstruction. This kind of innovation not only digs deep into the cultural connotation of traditional Chinese elements, but also absorbs and integrates foreign cultures, making traditional Chinese geometric patterns show more vigorous vitality.

To sum up, the development mode of geometric patterns has undergone an evolution process from simple to complex, from concrete to abstract, and each stage

has its own unique characteristics and styles, showing the pursuit of beauty and the innovation of art forms by human beings.

Table 9 Classification of the meanings and meanings of some patterns

category	Pattern theme	original idea	implied meaning	Traditional use	Typical cases
Animals	dragon	The image is majestic, usually combined with elements such as auspicious clouds and flames, showing a sense of dynamism	Authority, dignity, power	Royal costumes, court decorations, ceremonial items	The emperor's dragon robe and dragon pattern jade pendant
	Phoenix	Graceful, ornate, with delicate plumage, it is often paired with flowers such as peonies	Auspicious, auspicious, regeneration, symbolizing the queen	Wedding costumes, court decorations, festive occasions	Phoenix peony pattern
	Kirin	Mysterious, majestic, the image is covered with dragon heads, deer bodies, scales, and often accompanied by auspicious clouds	auspicious, peaceful, benevolent	Court decorations, items for the powerful	Unicorn send-off pattern
	hawk	The form is vivid, showing strength and keen gaze	Bravery, freedom, victory	Military supplies, hunting decorations	Eagle strike in the sky
Plants	peony	The petals are rich in layers and beautiful in shape, often	Wealth, glory, prosperity	Aristocratic costumes, wedding decorations, festive	Peony splendid pattern

category	Pattern theme	original idea	implied meaning	Traditional use	Typical cases
		combined with phoenixes and butterflies		supplies	
	plum blossom	The flowers are delicate and show tenacity and independence in the cold winter	Noble, tenacious, indomitable	Literati supplies, winter decorations	Plum blossom three friends pattern
	pine tree	The trunk of the tree is strong and straight, and it is often combined with cranes or deer to express the meaning of longevity	Longevity, tenacity, strength	Birthday feast for the elderly, courtyard decoration	Pine crane longevity pattern
	bamboo	The bamboo has distinct knots and slender leaves, showing the characteristics of both rigidity and softness	Integrity, integrity, modesty	The decoration of the four treasures of the study and the design of the courtyard	Bamboo newspaper peace pattern
Geometry classes	Anagram	The lines are square and continuous, with a recurring visual effect	Eternal, endless, cyclical	Decoration of clothing edges and utensils	Hollow pattern brocade ribbon
	Chain	Circles are intertwined, showing continuity and harmony	Reunion, harmony, endless	Window decoration, architectural decoration	Circular pattern

category	Pattern theme	original idea	implied meaning	Traditional use	Typical cases
	Zigzag	The shape is jagged, expressing a sense of power and movement	Strength, fighting spirit	Weapon decorations, shield motifs	Jagged edges
	Swastika pattern	The lines are simple and varied, often in a continuous or staggered arrangement	Auspicious, happy and peaceful	Religious decorations, Buddhist utensils	Swastika brocade pattern

Source: Liu Ying (2024)

4.1.2.3 The cultural connotation of the traditional pattern mode of Shu embroidery

The cultural connotation of Shu embroidery pattern auspiciousness is to imply auspiciousness and longevity. As an important part of traditional Chinese culture, the pattern design of Shu embroidery reflects profound cultural connotations and meanings (Zhu , 2021). Paperclips and ruyi patterns are common patterns in Shu embroidery, which not only have a beautiful appearance, but also contain rich cultural significance. Derived from ancient pottery and bronze ware, the paper pattern symbolizes continuous auspiciousness and good wishes; Ruyi pattern is a kind of traditional utensils, the handle end is finger-shaped, used to tickle, can be as expected, hence the name, meaning everything is as expected, all wishes come true. The application of these two patterns in Shu embroidery not only demonstrates the exquisite skills of Shu embroidery art, but also conveys people's wishes and pursuit of a better life (Huang, 2024).

In addition, the creation of Shu embroidery has a wide range of themes, including hibiscus koi, dragon and phoenix, giant panda, golden monkey, etc., these themes not only reflect the natural scenery and folk culture of the Bashu region, but also reflect people's pursuit of wealth, longevity, wealth and blessing. Through innovation and inheritance, Shu embroidery retains traditional elements while meeting the diversified needs of the modern market, demonstrating its important role as Chengdu's business card and window for foreign exchange (Wang, 2022).

(i) The development model of auspicious ruyi patterns originated from the awe and primitive worship of natural phenomena by the Chinese ancestors, who prayed for the protection of the gods by treating natural objects such as auspicious birds, animals, flowers, birds, fish, and insects as gods. This cultural phenomenon has been continuously derived and developed along with the exchanges, exchanges and blending of various ethnic groups, constituting the world view of the harmonious coexistence of man and nature of the Chinese nation. As an auspicious pattern in traditional Chinese clothing, the dragon and phoenix pattern is deeply loved by people of all ethnic groups. Each ethnic group processes and utilizes according to its cultural traditions and aesthetic tastes, and combines it with a variety of natural objects to create new variant patterns. For example, the Qing Dynasty Manchu blue silk golden dragon cloud pattern jacket collection of the National Costume Museum of Beijing Institute of Fashion Technology, the fabric is woven using silk technology, and the golden dragon is woven with eight auspicious patterns, such as ru yi clouds, bats, longevity peaches, and eight auspicious patterns, and the weaving technology is exquisite, and the patterns are vivid. The hem of the dragon robe is decorated with mountain stone treasures, standing on the rolling waves, implying that the rivers and mountains in the four seas are eternal and the eternal level is eternal. In contrast to the majestic and solemn image of the Manchu dragon robe, the dragon and phoenix patterns on the wedding dresses of the Han people from the Qing Dynasty to the Republic of China present a festive and peaceful scene (Li, 2022).

In addition, the traditional Chinese auspicious patterns concentrate on people's pursuit of good luck, blessing and longevity, and driving away disasters and avoiding disasters, reflecting people's general yearning for a better life. In the process of evolution and development, these patterns have become unique symbols of Chinese folk art, reflecting the rich imagination and superb artistic level of the Chinese people, and have the aesthetic value that is deeply rooted in the hearts of the people.

(ii) The basic themes of the decorative patterns of Rong hua Fugui Shu embroidery include animals, plants, landscapes and people, etc., and the popular patterns cover landscapes, flowers and birds, Bo gu, dragons and phoenixes, Wawen, ancient money, etc., as well as folk legends such as the Eight Immortals Crossing the Sea, Lin Can Ju shou, etc. In addition, there are metaphors for festivity, auspiciousness,

glory and wealth of magpies and plums, mandarin ducks playing in the water, gold and jade full of halls, phoenixes wearing peonies and other patterns. These patterns not only demonstrate the exquisite skills of Shu embroidery, but also contain the yearning and wishes for a better life in traditional Chinese culture (every fifteenth, 2024).

The magpie and plum symbolize auspiciousness and festivity, the mandarin duck playing in the water symbolizes the harmony and love of husband and wife, the golden jade hall represents wealth and harvest, and the phoenix wearing peony embodies dignity and elegance. Through exquisite stitching and delicate lines, these patterns integrate the essence of traditional culture into each Shu embroidery work, making it not only a work of art, but also a witness of cultural inheritance and history. The development model of Rong hua Fugui pattern reflects the inheritance and development of traditional Chinese patterns.

(iii) As an important cultural and artistic element, traditional Chinese patterns have always been regarded as valuable assets worthy of inheritance and development (Chen, 2023). These patterns not only have aesthetic value, but also contain rich cultural significance and auspicious meanings. As one of them, the development model of Rong hua and Fugui pattern can be summarized into the following stages:

Development of the Tang Dynasty: In the Tang Dynasty, craftsmen made bold innovations and integrated different kinds of flowers, branches and leaves, and fruits into the wave-like structure, forming various forms such as honeysuckle curly grass, grape curly grass, lotus curly grass, and peony curly grass. This ever-changing combination not only gives people endless space for imagination, but also became a popular pattern in the Tang Dynasty. During this period, plant patterns completely replaced the pattern style with clouds and animals as the main body, reflecting the new interest of facing nature and attaching importance to human nature, which had a significant impact on the development of Chinese pattern art and the overall aesthetic intention in later generations.

Localized new style: The foreign art style of curly grass pattern has taken root on the soil of China, and local craftsmen have taken the initiative to pursue the richness of artistic expression, flexibly adjust and change, and form a new style of localization. This new style creates a sense of rhythmic flow through the stretching and rotating

curves, and its undulating, vibrant visual image is endowed with the auspicious meaning of many blessings and longevity.

Application in modern architecture: Traditional patterns play an irreplaceable role in the shaping of China's important architectural image. For example, on the lintels and columns of the façade of the Great Hall of the People, you can see the simple, bright, simple and generous style of the lotus roll grass pattern, showing the connotation of a new era and exuding the enduring artistic charm of traditional Chinese patterns.

The diversity and symbolism of ornamentation: In furniture decoration, curly grass pattern and moire pattern are freely extended, and there are many places for decoration. Because of its multiple symbolic meanings, such as harmony and cooperation, incorruptibility, love and marriage, and many children and blessings, the lotus pattern is combined with other elements alone or with other elements to form different patterns, such as the entwined lotus pattern, etc., showing a graceful and gorgeous effect. To sum up, the development model of Rong hua Fugui pattern not only reflects the profound heritage of traditional Chinese culture, but also demonstrates its innovation and development in different historical periods, as well as its application and inheritance in modern society (Huang, 2022).

Table 10 Pattern connotation and development mode

kind	Pattern type	Cultural connotation	Representative works	Development model
Animals	Dragons and phoenixes, unicorns, carps	It represents power, auspiciousness, wealth, etc	The dragon and phoenix are auspicious, and the carp jumps the dragon gate	Preservation of traditional themes, combined with modern design innovation
Plants	Plum orchid, bamboo chrysanthemum, peony, lotus	It symbolizes nobility, wealth, incorruptibility	Meilan bamboo chrysanthemum picture, rich peony	Excavate cultural heritage and develop cultural and

		y, etc		creative products
Geometrical classes	Echo pattern, moire, diamond pattern	It represents auspiciousness and continuity	Hollow lines, 10,000 characters constantly	Digital inheritance, expand modern application scenarios

Source: Liu Ying (2024)

4.1.2.4 The structure, color and development of the traditional pattern pattern of Shu embroidery

(i) The structure of traditional patterns of Shu embroidery mainly includes individual patterns, continuous patterns and suitable patterns.

A single pattern is the basic pattern unit that makes up a pattern, which has relative integrity and independence. It can be divided into symmetrical and asymmetrical according to the form of the tissue arrangement. Symmetrical patterns have the characteristics of balance and stability, while asymmetrical patterns appear more lively and dynamic.

Continuous patterns include bipartite continuous and quadripartite continuous. Bipartite continuous refers to the continuous arrangement of a unit pattern left and right (horizontal), up and down (vertical), oblique (oblique), and end to end (ring), such as scattered, vertical, waveline, polyline, etc. The quadripartite continuous refers to the pattern of a unit pattern being repeatedly arranged on the upper and lower sides, left and right.

The suitable pattern is that the pattern and the contour of the shape are completely adapted, and there is no continuous effect. It can use a single pattern of units, or several units to decorate and configure in different shapes, and the form of expression can be divided into two types: symmetrical and balanced. In particular, the corner pattern is a suitable pattern within a right triangle, and can also be divided into two forms of expression: symmetrical and balanced. These structural forms not only enrich the expression of patterns, but also provide designers with a variety of choices, and can choose the appropriate pattern structure for design according to different needs and scenes.

The development mode of the traditional pattern structure of Shu embroidery is mainly reflected in the extensiveness of its subject matter and the promotion of artistry. The patterns of Shu embroidery are widely used, including myths and legends, historical stories, auspicious inscriptions, landscape figures, flowers, birds, birds and beasts, etc., these patterns have experienced more than 2,000 years of development and change, and different historical periods have different characteristics of the times. Shu embroidery artists are good at skillfully selecting a variety of themes, through the form of allegorical patterns, with its shape, choose its meaning, take its sound to combine into a pattern pattern containing a certain meaning or symbolic meaning, these allegorical patterns not only become an important feature of the national brocade pattern, but also often contain auspicious wishes, smooth, festive, congratulations, longevity, blessings, wealth, prosperity and other beautiful and auspicious meanings. This development model of Shu embroidery not only shows its important position in the traditional craft of national dyeing and weaving, but also has a huge and profound impact on the development of brocade dyeing and weaving patterns in later generations.

(ii) the traditional pattern color of Shu embroidery, which is characterized by bright colors, vivid images and three-dimensional sense (Tracy, 2015). This use of color is not only reflected in the pattern design of Shu embroidery, but also runs through the entire embroidery process, making the Shu embroidery works visually present a strong local color and unique artistic effect. Specifically, the color use of Shu embroidery has the following significant characteristics:

Bright color: Shu embroidery tends to use bright and highly saturated colors in color selection, which makes the overall tone of the work bright and lively, which can attract the attention of the audience.

Red flowers and green leaves, inlaid with poles: In Shu embroidery, you can often see red as the theme, with green leaves, forming a strong visual contrast, this color matching method not only increases the visual impact of the work, but also makes the work more vivid and realistic.

The development model of color has undergone an evolution from the ancient traditional color system to the modern color management system (Li, 2018).

Ancient traditional color systems, such as the Chinese Five Elements and Five Colors, as well as the color theories of ancient Greece and Rome, were based on natural

observation and an intuitive perception of color. Although these theories lacked a scientific basis, they laid the foundation for later color development.

With the development of science, the management and application of color are gradually becoming scientific and systematic. In 1905, Albert H. Munsell developed the Munsell Color System, a widely accepted system of color order, which provided an accurate description of color and became the basis of modern colorimetry (Guo, 2020).

In 1931, the International Commission on Illumination (CIE) defined a standard color system, stipulating that all excitation values should be positive and using two color coordinates, x and y , to represent all visible colors, laying the foundation for quantitative color measurement methods (CBCC, 2022). In addition, the application of color has also expanded to many fields, such as clothing, makeup, home decoration, etc., forming the so-called "Four Seasons Color Theory", which recommends suitable color matching according to the individual's skin color attributes, aiming to achieve the harmony and unity of man and nature.

Table 11 Pattern structure and color

Pattern category	Structural features	The main color	Accents	Color meaning	Typical patterns	Application scenarios
Animal patterns	Symmetrical layout, vivid image	Red, gold	Blue, green	Red symbolizes festivity, and gold symbolizes wealth	The dragon and phoenix are auspicious, and the figure of Pisces	Wedding and festive costumes
Botanical pattern	Arranged vertically or horizontally, with clear hierarchies	Pink, green	Red, yellow	Pink symbolizes femininity, and green	Plum orchid bamboo chrysanthemum picture, peony flower	Interior decoration, traditional costumes

				symbolizes vitality		
Geometric patterns	Regular arrangement, repeating patterns	Blue, white	Red, yellow	Blue symbolizes nobility and white symbolizes purity	Hollow pattern, diamond pattern	Home décor, embroidered fabrics

Source: Liu Ying (2024)

In general, the development mode of color has experienced the application from theory to practice from the traditional observation and feeling of modern scientific quantitative management in ancient times, and has been continuously developed and improved to meet people's needs for the pursuit and practical application of color aesthetics.

To sum up, the data classification of the display platform is mainly based on the subject matter, and the cultural connotation of the pattern is classified and stored, as well as the relationship between the Shu embroidery patterns and the historical relationship are displayed.

4.1.2.5 The role of the traditional pattern mode of Shu embroidery

(i) The role of traditional patterns in Shu embroidery is well-known at home and abroad for its exquisite embroidery skills, rich cultural connotation and unique artistic expression (Chen, 2018). The pattern of Shu embroidery is not only the embodiment of decorative art, but also carries the traditional Chinese culture, social values and historical memory. From the perspective of categories, the patterns of Shu embroidery are mainly divided into animals, plants, geometry and figures, and the patterns of different categories play a unique role in different social and cultural scenes, which not only have aesthetic value, but also reflect the national spirit (Li, 2020). Starting from the above four categories, this paper will analyze the role of Shu embroidery patterns and their application and development in modern society.

The classic pattern of Shu embroidery includes many elements of traditional Chinese culture, and each type of pattern has its own unique symbolic meaning and artistic style. Here are a few common classic patterns of Shu embroidery:

The role of animal patterns: Animal patterns occupy an important position in Shu embroidery, and are often used to express auspicious meanings, enhance decorative effects, and carry specific cultural symbols in different social contexts (Wu, 2020). Since ancient times, the Chinese have combined animals with myths and legends, religious beliefs, feng shui, etc., making them part of cultural symbolism. The animal patterns in Shu embroidery not only show the superb skills of the embroiderers, but also have profound symbolic meanings.

The role of botanical patterns: Botanical patterns are one of the most common types of Shu embroidery, and are often used in clothing, home decoration and ceremonial items to express blessings, beautiful meanings or symbolize the change of seasons (Liu, 2017). Plants have a specific symbolic meaning in traditional Chinese culture, and the plant patterns of Shu embroidery not only show the beauty of nature, but also contain moral concepts, life philosophy and social values.

The role of geometric patterns: The application of geometric patterns in Shu embroidery covers clothing, architectural decoration, cultural and creative products and other fields, mainly emphasizing the sense of structural beauty and order (Li, 2020).

The role of character patterns: Character patterns are mainly used to express historical stories, myths and legends, or opera culture, and have strong narrative and cultural value (Chen, 2018).

Table 12 The role of Shu embroidery patterns

Pattern category	description	function	peculiarity
Animal patterns	It is dominated by animal images such as dragons, phoenixes, tigers, cranes, and fish, implying auspiciousness, authority, or	It embodies cultural symbolism, such as the dragon and phoenix symbolizing a happy marriage, the crane representing	It has vivid and realistic shapes, rich colors and strong contrasts, and mostly adopts symmetrical or dynamic layouts.

Pattern category	description	function	peculiarity
	longevity.	longevity, and the tiger symbolizing majesty and strength.	
Plant-based patterns	Including peonies, plum blossoms, bamboo, lotuses, etc., reflecting the changes of the four seasons and natural beauty.	Peony means wealth and auspiciousness, plum orchid bamboo chrysanthemum represents noble character, and lotus symbolizes purity.	The lines are smooth, the layers are clear, the color rendering and the change of light and shadow are emphasized, and the beauty is presented with the combination of freehand and fine brushwork.
Geometric patterns	Abstract geometric patterns such as moire, back pattern, and thunder pattern are used to emphasize symmetry and regular beauty.	It symbolizes stability, eternity and order, such as the echo pattern symbolizes endlessness, and the cloud pattern symbolizes auspiciousness.	The structure is rigorous, the sense of rhythm is strong, and it is often combined with other patterns to form a composite pattern to enhance the sense of layering.
Character patterns	Mythology, historical figures, or folklore stories, such as ladies, fairies, opera characters, etc.	Tell cultural stories and carry historical memories, such as "Eight Immortals Crossing the Sea" implies happiness and longevity, and the picture of ladies shows classical aesthetics.	The details are delicately depicted, the expressions of the characters are vivid, and the cultural atmosphere is often enhanced by costumes and background elements.

Source: Liu Ying (2024)

Shu embroidery patterns are not only decorative, but also a symbol of culture, and different types of patterns play a unique role in different application scenarios. In the future, it is necessary to combine artificial intelligence, knowledge graph and other

technologies to promote the digital inheritance of Shu embroidery patterns and make them glow with new vitality in modern society.

(ii) The role of the structure of the pattern, the structure of the pattern is the composition of the embroidery, not to master the basic techniques of embroidery, you can embroider a good embroidery work. There is a good idea, a good subject matter, and it must be able to be redundant into a good composition and theme. If the embroiderer does not understand the theory of painting, it will be very difficult to achieve a high degree of artistic achievement. Therefore, mastering the basic skills of painting composition is very important for embroiderers. The so-called composition is to organize and arrange the position of objects in the picture.

The basic rule of pictorial composition, composition, although it is a very active process of artistic creation, is not unorganized. How to express rich content in a limited format, and how to present elements such as shape, line, light and shade, and space in the organization of the structural relationship between the surface and the surface, all have composition rules that meet certain aesthetic requirements.

Subject and object: When composing a picture, the object and host should be determined first according to the needs of the content. Lord, i.e., the image that plays a leading role in the presentation of the subject content; Bin, in a secondary position, sets off the image of the prominent subject. The subject is the center of the structure of the picture (not the center of the frame) and should be prominent; The object is mainly to create an event and environmental atmosphere, play an auxiliary role, and should be arranged around the subject. If there is no distinction between the subject and the guest in the composition, it will not accurately reflect the content of the author.

Change and unity: Change and unity are two sides of a contradiction. The characteristics of change are dynamic, lively and diverse; Unity is characterized by order, solemnity. variety, but it must be unified, otherwise it invites chaos; Unified and solemn, but there must be change, otherwise it will appear monotonous and rigid. This requires that the composition should seek unity in the change, and seek change in the unity, so that there is both change and order, and the overall harmonious beauty is formed.

Figure 34 Change and Unification "Hundred Sons of Labor", this embroidery has many figures, the composition is rich but not scattered, and it is orderly in chaos. The

peripheral "Xi" character pattern border is evenly arranged, harmonious and complete; Inside, a group of playful children, despite the large number of figures and different postures, the whole picture is composed of multiple local centers, which is complex but not chaotic. In addition, the huge trees, rocks, water tanks, pavilions and pavilions and other static scenes also frame a stable order for the complex picture.



Figure 33 Change and Unification
Source: Liu Ying (2024)

Symmetry and Balance: Symmetrical composition is based on the midline as the axis, or divided up and down or left and right equally. The image is the same or slightly changed. Balance the picture. The symmetrical composition gives people a sense of harmony such as stability, calmness, solemnity, and stability, but it is more rigid and monotonous. The management of symmetrical composition is often to seek change without destroying the symmetrical pattern, and to add vitality to the picture with local dynamics or changes. Balanced composition is to break the symmetrical pattern and create a balanced trend in the imbalance, in order to achieve a sense of stability in the picture, and its advantage is that it is not rigid and flexible. Achieving "different shapes and quantities" is the key to the success of this composition.

Figure35 Symmetrical composition "Deer Hui", in which the sika deer sits firmly in the center of the picture, and the flowers and plants at the four corners are arranged

in a symmetrical form to form a symmetrical composition. Without destroying the symmetrical pattern, the flowers and plants have different shapes and colors, adding a bit of life to the monotonous composition. The sika deer in the center of the picture, looking back with its hooves, is light and agile, full of interest, and integrates with the rigorous composition.



Figure 34 Symmetrical composition "Deer Hui"

Source: Liu Ying (2024)

Figure 36 Balanced composition: red satin embroidery with the word "longevity" for wealth. Although the upper and lower left and right sides of the central axis are not symmetrical, the distribution of flowers and birds is relatively even, forming a balanced trend, making the picture have the beauty of harmony, festivity, and wealth.

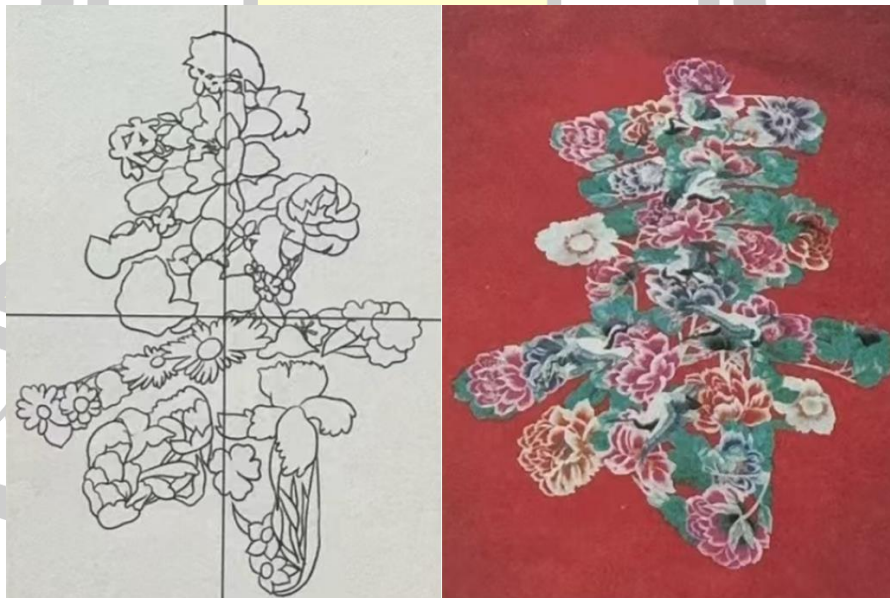


Figure 35 Balanced composition, red satin embroidery with the word "longevity" in wealth

Source: Liu Ying (2024)

Contrast and harmony: In composition, in order to make the image in the picture clear and prominent, contrasting techniques are often used. There are many contrasting

factors, such as the length and straightness of the line; the size and square circle of the shape; The quality is hard, soft, rough and smooth; the weight and quantity of the weight; the intensity, brightness and darkness of light; the warmth and depth of color; the front and back, up and down of the space; The contrast between the virtual and the real and the dry and moist of the technique forms a visual tension and enhances the intensity of the stimulus, which refers to the identity and unity of things. Contrast is a contrast that contains harmony, and contrast must not be disorderly, but must be organized in a certain internal connection according to certain norms, otherwise it will be chaotic, lose its beauty, and make people feel bored. Contrast and harmony can play against each other, so as to give full play to the appeal of composition.

Complex and simple and virtual and real: complex and simple refers to the relationship between points, lines and shapes on the composition, more and more complex is complex, less and simple is simple, and the two complement each other to highlight the main image. The correspondence between the virtual and the real is very important for any painting, and the combination of the virtual and the real can form a sense of rhythm in the painting, so that the main and secondary aspects of the picture are clear.

Rhythm and rhyme: Rhythm, also known as rhythm, refers to the continuous alternation of strength and weakness, length and shortness in a regular manner, and is widely used in music, architecture, sculpture, painting, poetry and other art and wood fields. In the composition of the painting, the dots, lines, colors and other elements are continuously and alternately presented to form the rhythm of the picture, such as the flying geese, the terraced fields, the undulating mountains and rivers, and the ripples of water lines. Rhythm is the effect of alternating rhythms, which has the beauty of harmony.

To sum up, the traditional patterns of Shu embroidery not only have a long historical origin, but also contain rich cultural significance and artistic value, and are an important part of Chinese culture. Chengdu, Sichuan Province is the core inheritance of Shu embroidery, with rich Shu embroidery craft resources and a large number of Shu embroidery artists. The Shu embroidery here is known for its exquisite craftsmanship and diverse patterns. In order to better protect and inherit the intangible cultural heritage of Shu embroidery, many schools, arts and crafts research institutions and cultural

organizations in Sichuan Province are actively carrying out inheritance education and innovative research on Shu embroidery skills. Through the interviews of experts and the collection of historical materials, the historical context of Shu embroidery has been further sorted out, and its cultural value and artistic characteristics have also been widely recognized.

(iii) Chengdu is the birthplace and main inheritance of Shu embroidery culture, which not only retains the traditional embroidery method, but also continuously integrates modern design elements, so that Shu embroidery glows with new vitality in the new era. The origin and characteristics of Shu embroidery are not simple artistic creation, but a unique way of artistic expression gradually formed by the people of Chengdu in dealing with the natural environment and absorbing foreign culture. This art form not only showcases the aesthetic aspirations of the local area, but also reflects the spirit of the people of Chengdu who have faced pressure and continued to innovate in the long course of history. This historical and cultural background gives Shu embroidery a unique social significance and artistic value.

Table 13 The development, regional characteristics, cultural symbols and cultural status of Shu embroidery

aspect	Content Description:
Historical changes and developments	Shu embroidery has gradually evolved from a practical handicraft in ancient times to a highly artistic and culturally symbolic intangible cultural heritage, showing rich historical and cultural connotations.
Manifestation of regional characteristics	Shu embroidery is deeply influenced by the natural environment and cultural background of Sichuan, combining local characteristics of animals and plants, landscapes and folklore, forming a unique artistic style.
Expression of local themes	The characteristic landscapes and creatures of Sichuan, such as koi carp, bamboo forest, Sichuan opera masks, etc., are used as the creative themes, showing strong regional cultural characteristics.
Systematic cultural	Shu embroidery carries rich cultural connotations, such as auspiciousness, peace and wealth, etc., and has become an


symbols	important cultural symbol.
Diversity of creative techniques	Combining fine stitching and complex craftsmanship, Shu embroidery incorporates different embroidery techniques, showing a combination of technological innovation and cultural expression.
Representation of intangible cultural heritage	As one of the four famous embroideries in China, Shu embroidery has been included in the national intangible cultural heritage, representing the highest level of traditional Chinese embroidery and becoming an important symbol of Sichuan culture.
The fusion of art and culture	Through artistic expression, Shu embroidery integrates local culture with traditional Chinese culture, becoming an important part of Chinese culture and enjoying a high reputation at home and abroad.





Source: Liu Ying (2024)



The focus of this study will be on the part of the patterns with Shu embroidery culture, which is the core part of Shu embroidery art, and each pattern carries profound cultural connotation and aesthetic significance. Through the Shu embroidery pattern, it conveys the rich cultural connotation and spiritual pursuit, expresses people's desire and belief in happiness, beauty, harmony, longevity and spiritual pursuit, and has become an indispensable part of Shu embroidery culture.

Table 13 Emotions and wishes of Shu embroidery patterns

Table 14 Emotions and wishes of Shu embroidery patterns

Shu embroidery pattern	Pattern drawing	Emotions and desires expressed
Floral pattern		The yearning for wealth, prosperity and happiness symbolizes the beauty and prosperity of life.

Shu embroidery pattern	Pattern drawing	Emotions and desires expressed
Auspicious pattern		The pursuit of longevity, health and happiness is a blessing for the health and safety of the family.
Dragon and phoenix pattern		The beautiful expectation of marital happiness and family harmony symbolizes the harmony of yin and yang and the harmony of husband and wife.
Landscape pattern		The love of nature and the yearning for a quiet life, praise the beauty of harmonious and beautiful nature.
Character print		The emphasis on the inheritance and moral education of Chinese culture reflects the cultural significance of historical stories and myths and legends.

Shu embroidery pattern	Pattern drawing	Emotions and desires expressed
Rui beast pattern		The desire for a peaceful and tranquil life symbolizes auspiciousness and peace, and reflects the hope for a better future.
Geometric pattern		The understanding and reverence for order, balance, and the laws of the universe reflect people's pursuit of a higher spiritual realm.

Source: Liu Ying (2024)

(Interview with Liu in 2024) said that Shu embroidery is a traditional art form created and inherited by the people of Chengdu, Sichuan Province for thousands of years, with a long history and strong local characteristics. The multi-ethnic coexistence in Sichuan, especially the blending of Han and indigenous peoples, has endowed Shu embroidery with rich cultural connotations. In the course of thousands of years of evolution, Shu embroidery has gradually integrated regional culture, religious beliefs and social customs, forming a unique artistic style. The art of Shu embroidery was profoundly influenced by the ancient Bashu culture and traditional skills, and gradually transformed from the original practical handicraft to elegant art. It not only shows the natural scenery and cultural features of Sichuan, but also integrates foreign cultural elements and enriches the form of expression. While absorbing the culture of the Central Plains, Shu embroidery has maintained its own uniqueness and has become an important part of traditional Chinese embroidery. Through the integration and development of this culture, Shu embroidery shows the profound artistic heritage and diverse cultural characteristics of Sichuan.

Through the collection and research of historical materials, as well as interviews with experts, Shu embroidery in Chengdu, Sichuan Province has been recognized as one of the important representatives of China's intangible cultural heritage. Shu embroidery is mainly distributed in Sichuan, especially in Chengdu and surrounding areas. Shu embroidery has a profound historical and cultural heritage in Sichuan culture. Traditional Shu embroidery works usually focus on themes such as flowers and birds, landscapes, and people, showing the unique expressions and good wishes of the Sichuan people for nature, life, and traditional culture (Liu, 2014).

Although Shu embroidery and Bashu culture have different historical backgrounds and cultural connotations, they both reflect the rich and diverse cultural traditions and regional characteristics of southwest China. Although there is no direct evidence that Shu embroidery has a direct historical connection with other ancient cultures, Shu embroidery, as a representative of Sichuan's traditional arts, carries rich local culture and traditional skills, and jointly embodies Sichuan's long and rich cultural heritage. The patterns and motifs in the art of Shu embroidery reflect the diverse natural landscapes and cultural traditions of the Sichuan region. His works often show respect for natural landscapes, flora and fauna, as well as the inheritance of traditional customs and cultural symbols. The artistic style of Shu embroidery not only retains the traditional embroidery skills, but also integrates the modern aesthetic needs, showing the rich cultural accumulation and regional characteristics of Sichuan. The art of Shu embroidery occupies an important position in traditional Chinese embroidery, and its unique regional style and diverse artistic expressions reflect profound historical and cultural and national characteristics (Chen, 2023).

The focus of this research will be on the art part of Shu embroidery with local characteristics in Chengdu, Sichuan. The symbolic meaning of the Shu embroidery pattern expresses people's prayers, aesthetic tastes and wishes. It combines all kinds of patterns with Sichuan's local language and culture, natural environment and folk customs, and has strong local characteristics. Character stories often use Sichuan opera characters and storylines, and are used in practical quilts, bed sheets, and sedan chairs to directly express a joyful and joyful atmosphere. These patterns not only convey the beauty of nature, but also reflect the symbolic meaning of traditional culture, and fully demonstrate the artistic value and local characteristics of Shu embroidery. Through

interviews with folklore experts and inheritors of Shu embroidery, the following will show samples of Shu embroidery patterns with the theme of Najib's blessing.

4.1.3 Sichuan cultural development

The purpose of this study is to deeply sort out and write representative works of traditional Shu embroidery patterns. As an important branch of traditional Chinese embroidery art, Shu embroidery is known for its unique craftsmanship and rich cultural connotation. In the course of our research, through extensive surveys and interviews, we obtained a large amount of information about the patterns of Shu embroidery, which provides a valuable basis for us to deeply understand the core themes and artistic characteristics of Shu embroidery (Xiang, 2022).

Among the many patterns of Shu embroidery, we find that the two themes of auspiciousness and peace and joy occupy an extremely important position. These themes are not only the core of Shu embroidery's artistic creation, but also the key to its cultural expression. The selection and use of these representative patterns reflect the good wishes and cultural values conveyed by Shu embroidery in the process of historical evolution (Huang, 2024).

First of all, the theme of auspiciousness is particularly prominent in Shu embroidery. Auspicious ruyi patterns are commonly found in various Shu embroidery works, which combine the shape of Ruyi and auspicious symbols through delicate embroidery techniques, showing a yearning and wishes for a better life. For example, the Ruyi flower pattern in Shu embroidery not only reflects the exquisite skills of the embroiderer, but also implies the prosperity and happiness of life. Auspicious ruyi patterns are often used as decorations for auspicious occasions such as festivals and weddings, expressing good wishes for the future (Guo, 2022).

Secondly, peace and joy is another theme that often appears in Shu embroidery. With its fresh and refined design, the peace and joy pattern conveys people's desire for a peaceful and happy life. In Shu embroidery works, the use of elements such as peace symbols, magpies, and lotus flowers all convey prayers for peace and joy. For example, the Ping'an pine crane pattern in Shu embroidery, through the combination of pine trees and cranes, symbolizes longevity and tranquility, and expresses the expectation of family and personal happiness (Xin, 2022).

Through the analysis and study of these representative patterns, we can conclude that the auspiciousness and peace and joy in Shu embroidery are not only the core themes of its traditional art, but also the concentrated embodiment of its cultural value. These patterns not only show the exquisiteness and complexity of the Shu embroidery process, but also carry rich cultural symbols and emotional expressions. In modern society, despite the ever-changing lifestyles and aesthetic concepts, the themes of auspiciousness and peace and joy still occupy an important position in Shu embroidery, reflecting the deep integration of traditional art and contemporary life.

Overall, this study systematically combed the traditional patterns of Shu embroidery, revealing the important position of the two themes of auspiciousness and peace and joy in the art of Shu embroidery. This not only provides a strong support for us to understand the artistic characteristics of Shu embroidery, but also provides a valuable reference for further exploration and protection of this traditional cultural heritage.

4.1.3.1. The value of cultural inheritance

As an important genre of traditional Chinese embroidery art, Shu embroidery originated in Sichuan Province, especially the Shu embroidery in Chengdu is the most famous. The traditional patterns of Shu embroidery not only show exquisite craftsmanship, but also deeply reflect the rich cultural connotation. The value of its cultural inheritance is reflected in many aspects, including historical inheritance, artistic value, social function, educational significance and innovative development. This article will discuss the cultural inheritance value of traditional patterns of Shu embroidery from these aspects.

(i) The value of historical heritage

The history of Shu embroidery can be traced back thousands of years and is a precious heritage of traditional Chinese embroidery art. The traditional patterns of Shu embroidery not only reflect the artistic level of ancient craftsmen, but also carry rich historical information and cultural memory. These patterns are often closely related to ancient social styles, customs and religious beliefs, and through them, we can get a glimpse of the historical style and changes.

For example, the "auspicious Ru yi" pattern in Shu embroidery, with its exquisite embroidery skills and profound design, conveys the ancient people's yearning

and wishes for a better life. Similar patterns not only retain the cultural characteristics of the historical period, but also provide valuable information for future generations to understand ancient society and folklore. Through the study and protection of these traditional patterns, we are able to better understand and inherit the essence of traditional Chinese culture.

(ii) the value of artistic heritage

The traditional patterns of Shu embroidery are known for their unique artistic style and exquisite skills. The Shu embroidery process involves a variety of stitches, such as flat embroidery, three-dimensional embroidery, etc., each technique shows the superb skills of the craftsman. The traditional patterns of Shu embroidery not only have high artistic value, but also reflect the craftsmen's understanding and expression of art.

Traditional patterns such as "Phoenix Flying" and "Double Dragon Playing with Pearls" not only have a high artistic aesthetic in vision, but also contain rich cultural symbols. Through delicate embroidery techniques, these patterns present a unique artistic effect and demonstrate the unique charm of traditional Chinese crafts. In modern society, these traditional patterns are still an important source of artistic creation, providing rich creative inspiration for modern artists and designers.

(iii) the value of social functions

Shu embroidery is not only a beautiful handicraft, but also plays an important role in social functions. As a representative of local characteristics, the traditional patterns of Shu embroidery have a positive role in promoting the local economy, enhancing cultural identity, and promoting social development.

In terms of economy, the production and sales of Shu embroidery not only provide employment opportunities for craftsmen, but also promote the development of related industries. As a cultural product with local characteristics, Shu embroidery is favored by domestic and foreign markets. Through exhibitions, sales and promotion, Shu embroidery not only enhances the local economy, but also promotes the development of the cultural industry.

In terms of cultural identity, Shu embroidery, as an important symbol of Sichuan culture, enhances the cultural pride and sense of belonging of local residents. Traditional patterns such as "peace and joy" are often used on auspicious occasions such as festivals and weddings to express people's yearning for a better life. These

patterns not only occupy an important position in local culture, but also become an important carrier to display the characteristics of local culture (Zheng, 1992).

(iv) the value of educational significance

The cultural inheritance of Shu embroidery is also of great significance in the field of education. Through the study of Shu embroidery skills and traditional patterns, young people can get in touch with and understand traditional Chinese culture, and enhance their awareness and respect for their country's cultural heritage.

Many schools and training institutions have developed courses related to Shu embroidery, aiming to cultivate students' interest and skills in traditional crafts. These courses not only help students master the basic techniques of Shu embroidery, but also improve their creativity and artistic perception through practical activities. Through these educational activities, the traditional skills of Shu embroidery have been inherited and developed, and at the same time, students' love for traditional arts has also been stimulated.

In addition, the educational significance of Shu embroidery is also reflected in the popularization and promotion of traditional culture. Through exhibitions, lectures and workshops, the traditional patterns of Shu embroidery have been disseminated among a wider range of groups, raising the public's awareness and appreciation of traditional crafts. This popularization campaign not only contributes to the transmission of traditional culture, but also promotes respect and protection of traditional art in society.

(v) the value of innovation and development

Innovation and development are indispensable in the inheritance of traditional crafts. The traditional patterns of Shu embroidery also need to adapt to the needs and changes of modern society while maintaining traditional skills. In recent years, many Shu embroidery craftsmen and designers have innovated on the basis of traditional patterns, integrating modern design elements and materials to create works that meet contemporary aesthetics and market demand.

This innovation not only allows Shu embroidery to remain dynamic and competitive, but also expands its range of applications in modern life. For example, the application of Shu embroidery elements to modern home decoration, fashion clothing and cultural and creative products not only retains the essence of traditional

craftsmanship, but also combines with modern design concepts to show the modern charm of traditional art. This innovative development not only promotes the market development of Shu embroidery, but also provides a new development direction for the future of traditional crafts.

In general, the cultural inheritance of traditional patterns of Shu embroidery has multiple values, including historical inheritance, artistic value, social function, educational significance and innovative development. Through the research and protection of traditional patterns of Shu embroidery, we can not only preserve and promote traditional Chinese crafts, but also promote the protection and development of local culture, and enhance the society's sense of identity and respect for traditional culture. In the future, the inheritance of Shu embroidery needs to continue to maintain respect for traditional skills, while actively innovating and integrating to meet the needs and challenges of modern society. This combination of inheritance and innovation will make Shu embroidery continue to shine on the global cultural stage and be appreciated and loved by more people.

4.1.3.2 The value of cultural symbols

Cultural semiotics provides us with a theoretical framework for understanding and analyzing cultural symbols, enabling us to deeply explore the cultural symbolic value of traditional patterns of Shu embroidery. The traditional patterns of Shu embroidery not only show exquisite craftsmanship and artistic style, but also carry rich cultural connotations and social significance. Through the analysis of these patterns, we can better understand the cultural value of traditional art and explore its function and influence in society. In the future, the cultural symbols of Shu embroidery will continue to play an important role in the interaction between tradition and modernity, local and global, providing new opportunities and challenges for cultural inheritance and innovation (Zhao, 2023).

Structuralist semiotics: Structuralist semiotics was largely laid by Ferdinand de Saussure. He believed that symbols consisted of a signifier and a signified. The signifier is the material representation of the sign (such as the sound of a word or the form in which it is written), while the signified is the concept or meaning that the sign represents. Structuralist semiotics emphasizes how structures and rules in a symbol system affect the generation of meaning.

Symbolic interactionism: Symbolic interactionism, developed by George Herbert Mead and Herbert Blumer, emphasizes the role of symbols in social interaction. Symbolic interactionism is concerned with how people interact socially through symbols, and how they construct and adjust their understanding of social reality through their interactions.

Poststructuralist semiotics: Poststructuralist semiotics, developed by Jacques Derrida, emphasizes that the meaning of signs is fluid and uncertain. Derrida proposed the concept of "deconstruction", arguing that the meaning of a text is not fixed, but is produced through continuous interpretation and reconstruction.

Semiotic analysis of traditional art: In traditional art, semiotic analysis can reveal the cultural information and social significance contained in a work of art. For example, in the traditional patterns of Shu embroidery, semiotics can help us understand how these patterns express cultural values, social concepts, and historical backgrounds. By analyzing the patterns in Shu embroidery, such as "auspicious ruyi" and "double dragon playing with pearls", we can explore how these symbols reflect the good wishes and social structure of traditional Chinese culture.

Cultural symbols of traditional patterns: As cultural symbols, the traditional patterns of Shu embroidery carry rich symbolic meanings. The following is an analysis of the cultural symbols of several typical patterns:

Auspicious Ruyi: The auspicious Ruyi pattern is one of the most common patterns in Shu embroidery. This pattern is often used in the decoration of various festivals and auspicious occasions, implying the yearning and wish for a better life. Auspicious patterns usually include elements such as ruyi and flowers, such as "ruyi flowers blooming" and "ruyi double dragons", which not only symbolize wealth and prosperity, but also convey good expectations for the future.

Double Dragon Playing Beads: Double Dragon Playing Beads is one of the classic patterns in Shu embroidery, the dragon symbolizes power and dignity in traditional Chinese culture, and the beads represent auspiciousness and beauty. Commonly found in the decorations of royalty and nobility, the twin dragons depict the majesty and mystery of the dragon, as well as double the luck and power. This pattern embodies the worship of dragons and the pursuit of power in ancient Chinese society.

Phoenix in Flight: The phoenix is a sacred bird in traditional Chinese culture, symbolizing auspiciousness, beauty and nobility. The phoenix pattern in Shu embroidery is often presented with bright colors and delicate craftsmanship, showing the elegance and mystery of the phoenix. The combination of a phoenix and a dragon also has a special meaning in traditional culture, often symbolizing harmony and happiness, especially in weddings and other occasions.

Landscape painting: The landscape painting patterns in Shu embroidery are known for their delicate expression and unique artistic style, showing the magnificence and tranquility of nature. Landscape painting patterns usually include elements such as mountain peaks, flowing water, and trees, expressing the appreciation of natural scenery and the pursuit of natural harmony. This pattern not only reflects the artistic characteristics of traditional Chinese landscape painting, but also conveys the Chinese's awe and love for nature.

Fu Shou Shuang quan: Fu Shou Shuang quan patterns usually contain the word "Fu" and longevity motifs, such as pine trees, cranes, etc., symbolizing happiness and longevity. This pattern is often used on occasions such as festivals and birthday feasts to express wishes for health and longevity. The pattern of Fu Shou Shuang quan shows the Chinese pursuit of a better life and long-term happiness.

4.1.3.3. The cultural identity of traditional patterns of Shu embroidery

The traditional patterns of Shu embroidery contain rich cultural identity. Shu embroidery, as one of the four famous embroideries in China (Qi, 2014), is not only famous for its exquisite skills and unique artistic style, but also carries profound cultural connotation and historical value. The traditional pattern design of Shu embroidery is deeply influenced by factors such as geographical environment, customs, local culture and art, and reflects the cultural characteristics and aesthetic concepts of the Bashu region. Its pattern design is not limited to delicate and vivid images such as flowers, birds, insects, fish, etc., but also is good at expressing the majestic momentum of mountains and rivers, showing a high degree of integration of natural beauty and humanistic beauty. This art form is not only a handicraft skill, but also a way of cultural expression and inheritance, passing on thousands of years of China's excellent cultural heritage through a stitch and a thread.

The history of Shu embroidery can be traced back to the Sanxingdui civilization period, and since the Han Dynasty, Shu embroidery has been famous for its exquisite skills and rich cultural connotations. In the long historical process, Shu embroidery has not only become a cultural symbol of Shu, but also an important part of traditional Chinese culture. Its many stitches, rich changes, as well as vivid images and bright colors, make it unique in traditional Chinese arts and crafts. The skills and pattern design of Shu embroidery reflect the awe of nature and the love of life, and convey people's yearning for a better life and praise for nature through specific pattern design.



Figure 36 R&D report and cost of restoring Sanxingdui bronze Liren dragon pattern dress

Source: Chengdu Shu Brocade Embroidery Museum (2024)

In addition, the inheritance and development of Shu embroidery has also been highly valued by the government and cultural institutions. Through various measures, such as the establishment of technical personnel title evaluation standards, the establishment of talent evaluation mechanism, the establishment of industrial development of special financial guidance funds, etc., to promote the inheritance and development of Shu embroidery art. These measures not only help to protect and inherit the intangible cultural heritage of Shu embroidery, but also promote the development of related industries, so that more people can understand and participate in the inheritance of Shu embroidery, so as to enhance people's sense of cultural identity with the traditional patterns of Shu embroidery.

As a part of traditional Chinese embroidery art, Shu embroidery's cultural symbols play an important role in social identity and cultural inheritance. The identity of Shu embroidery cultural symbols is reflected in the understanding and acceptance of the cultural significance of these symbols by individuals and groups, as well as the role

of these symbols in social and cultural activities. The following are three descriptions of the symbolic identity of Shu embroidery culture:

(i) Embodiment of cultural identity

Through its unique art form and rich symbolic meaning, the cultural symbols of Shu embroidery profoundly reflect the cultural identity. Each Shu embroidery pattern not only shows exquisite embroidery skills, but also carries a profound cultural background and social value. For example, the "dragon and phoenix are auspicious" pattern is not just a decorative pattern, it represents the imperial power and dignity in traditional Chinese culture, and embodies the pursuit of happiness and prosperity. These symbols help individuals and groups establish and maintain a sense of identity with traditional culture, so that people can feel cultural continuity and stability in their daily lives and festivals (Jiang, 2011).

In addition, the traditional patterns of Shu embroidery also play an important role in the local cultural identity. As a traditional craft in Sichuan, Shu embroidery is not only a symbol of local culture, but also enhances the cultural pride and sense of belonging of local residents. Through the appreciation and inheritance of Shu embroidery, local communities can better maintain and disseminate their unique cultural identity and strengthen the identity of regional culture.

(ii) the role of social functioning

The cultural symbols of Shu embroidery also show a significant role in identifying with social functions. These symbols are not only used for artistic decoration, but also play an important role in social activities. For example, Shu embroidery is often used in festival decorations, wedding celebrations and birthday banquets, through its beautiful patterns, such as "good luck", "good fortune", "good luck and longevity", etc., to express wishes for happiness, peace and longevity. Through their widespread use in social life, these symbols help to strengthen society's shared identity with these cultural values as part of social interactions and cultural practices.

The social function of Shu embroidery cultural symbols is also reflected in cultural inheritance and education. Through the study and research of Shu embroidery skills and patterns, we can not only inherit this traditional craft, but also promote the understanding and respect for traditional culture. In the process of cultural education and dissemination, the symbols of Shu embroidery are used as a medium to display

traditional art and culture, helping the new generation to understand and identify with the essence of traditional culture.

(iii) modern transformation and global identity

With the advancement of globalization, the recognition of Shu embroidery cultural symbols in modern society has also undergone transformation. Modern designers and craftsmen integrate traditional Shu embroidery elements into modern products and fashion designs, creating works that have both traditional charm and contemporary aesthetics. This innovation not only retains the cultural essence of Shu embroidery, but also makes it regain its identity in the context of globalization. For example, the integration of Shu embroidery elements into modern home decoration, fashion clothing and cultural and creative products not only shows the unique charm of traditional Chinese art, but also enhances the international community's understanding and appreciation of Chinese culture.

This process of modern transformation and global identity not only promotes the international dissemination of Shu embroidery cultural symbols, but also makes traditional culture gain new vitality in the context of globalization. Through international exhibitions and cultural exchange activities, the traditional symbols of Shu embroidery not only show the unique charm of Chinese culture, but also promote exchanges and understanding between different cultures, and enhance the global sense of identity with traditional Chinese art and culture.

In short, the identity of Shu embroidery cultural symbols is reflected in three aspects: cultural identity, social function and modern transformation. They not only play an important role in traditional culture and social activities, but also continue to develop and evolve in the context of globalization, providing rich resources and opportunities for cultural inheritance and cross-cultural communication.

4.1.3.4 The development model of the digitization of Shu embroidery patterns

Early digitization stage (early 2000s): In the early 2000s, the digitization of Shu embroidery patterns mainly focused on the basic digitization of traditional patterns. The focus of this phase is to extract digital images of the Shu embroidery patterns from the physical objects, mainly using scanners and digital cameras to take high-resolution photographs of the Shu embroidery samples. Image processing software such as Adobe Photoshop is used to sharpen, restore, and standardize images. During this period,

digitization was mainly used to create electronic archives of patterns and lay the foundation for subsequent digital applications, but the excavation of the details and cultural connotations of patterns was still relatively shallow (Yang Hong, 2024).

Expansion application stage (early 2010s): In the 2010s, the digitization of Shu embroidery patterns began to expand to a deeper application. The focus of this stage is on the use of digital technology to systematically organize and classify Shu embroidery patterns. The establishment of a data management system and a digital library makes the storage, retrieval and sharing of patterns more efficient. In addition, the application of digital technology is not only limited to image processing, but also begins to involve 3D modeling of patterns and virtual reality display. By using computer-aided design (CAD) software and virtual reality (VR) technology, designers can better simulate and display Shu embroidery patterns in a digital environment. This phase also includes the digital innovation of traditional patterns, such as the generation of new pattern combinations and artistic expressions.

Intelligent and interactive stage (2020s to present): At the current stage, the digitization of Shu embroidery patterns has entered a new stage of intelligence and interactivity. Using artificial intelligence (AI) and machine learning technology, in-depth analysis and automated design of Shu embroidery patterns can be carried out. For example, AI algorithms are able to identify patterns in patterns and generate new designs. Intelligent data analysis also helps researchers better understand the cultural connotation and development trend of Shu embroidery patterns. The construction of an interactive platform and an online virtual museum enables the public to more conveniently access and experience the digital display of Shu embroidery patterns. In addition, the introduction of blockchain technology helps to protect the copyright of digital Shu embroidery patterns and ensure the uniqueness and integrity of the original design.

This paper mainly uses the knowledge graph technology in artificial intelligence (AI) to systematize and digitize the traditional patterns, skills and cultural connotations of Shu embroidery, and associate them with the inheritors and their works. This enables people to have a deeper understanding of the cultural background and historical context of Shu embroidery, facilitates knowledge retrieval, education and inheritance, and at the same time intuitively displays the rich content of Shu embroidery through visual

tools, so as to promote the protection and dissemination of Shu embroidery in the digital age (Lu, 2016).

A Knowledge Graph is a graph structure built from nodes and edges that represents entities and their relationships and attributes. It can systematize and structure complex information for easy retrieval, understanding and analysis. Knowledge graphs are widely used in semantic search, intelligent recommendation, natural language processing, and other fields, especially when processing and connecting large-scale data (Wang, 2019).

In the application of intangible cultural heritage (ICH), knowledge graph technology can effectively organize and manage the huge and complex information related to intangible cultural heritage. Specific applications include:

Digitization of cultural heritage: By constructing a knowledge graph, information such as intangible cultural heritage items, inheritors, historical backgrounds, and cultural connotations can be systematized and digitized to form a comprehensive intangible cultural heritage database (Wang, 2019).

Relationship display and mining: The knowledge graph can show the relationship between intangible cultural heritage items, such as the inheritance relationship between different crafts and the interaction of cultural elements, and help researchers and the public better understand the multi-dimensional relationship of intangible cultural heritage.

Intelligent intangible cultural heritage protection: Through the reasoning and analysis capabilities of the knowledge graph, the weak links in the protection of intangible cultural heritage can be automatically identified, the potential problems of intangible cultural heritage inheritance can be predicted, and a scientific basis for formulating protection strategies can be provided.

Education and dissemination: Knowledge graphs can provide visual tools for intangible cultural heritage education and dissemination, make complex intangible cultural heritage knowledge more intuitive and easy to understand, enhance the learning experience, and promote the wide dissemination of intangible cultural heritage.

In the past, we generally used data tables to store information, such as Excel spreadsheets and relational databases. However, this storage method often makes the data develop in a chimney-like manner, and it is difficult to form structured knowledge.

The knowledge graph not only realizes the bridging between various types of professional data, but also forms a huge and comprehensive knowledge base; At the same time, it also provides a new visualization method to show the relationship between things in the real world more intuitively.

To sum up, the digital development of Shu embroidery patterns has undergone an evolution from basic digitization to application expansion, and then to intelligence and interactivity. The technological progress at each stage has promoted the preservation, inheritance and innovation of Shu embroidery art, and our choice to use the knowledge graph can not only improve the efficiency and accuracy of intangible cultural heritage protection, but also provide new ideas and technical support for the inheritance and innovation of intangible cultural heritage.

4.1.3.5 Summary

As an important representative of China's intangible cultural heritage, Sichuan Chengdu Shu embroidery faces multiple challenges in its inheritance and protection. The current situation of inheritors shows that most of the main inheritors of Shu embroidery skills are elderly, and there are problems of aging and skill faults. As a traditional Chinese embroidery art, Shu embroidery has a certain inheritance and protection of its patterns including animals, plants and geometry. At present, the Shu embroidery of animal patterns still maintains the traditional characteristics while integrating modern elements; Botanical patterns are faced with the problem of how to innovate and maintain the traditional charm; Geometric patterns remain unique in their blending with modern design. However, Shu embroidery is now also facing problems such as the lack of inheritors and the need to improve market recognition. To this end, the government has introduced policies such as financial subsidies and technical training, and at the same time established the Shu Embroidery Museum and Exhibition Center to promote traditional skills through the display of classic works and on-site teaching. In addition, the lack of cultural connotation and the low participation of the younger generation limit the sustainable development of Shu embroidery. In the future, it is necessary to widely apply digital technology, create digital platforms and interactive experiences, enrich the forms and communication channels of Shu

embroidery, realize the organic combination of cultural inheritance and modern innovation, and promote the rejuvenation of Shu embroidery in the era of globalization(Huang, 2022).

Secondly, this chapter deeply explores the cultural symbols of Shu embroidery patterns and their innovative development in modern society. As a cultural symbol, the Shu embroidery pattern carries a wealth of symbolic meaning and cultural value. These patterns not only play an important role in artistic creation, but also have a profound impact on social life and cultural inheritance. Modern Shu embroidery combines traditional patterns with modern design concepts to achieve the renewal of artistic style and the satisfaction of market demand. The innovative development of Shu embroidery not only enables Shu embroidery to gain new understanding in the context of globalization, but also promotes cross-cultural communication and the global dissemination of traditional crafts.

Finally, the chapter summarizes the role of Shu embroidery in education and inheritance, emphasizing the importance of the education system in passing on traditional skills and training a new generation of craftsmen. At the same time, in the face of the challenges and opportunities of modern society, Shu embroidery actively explores innovative paths while protecting traditional crafts to meet the needs of market changes and cultural inheritance. The innovative development of Shu embroidery embodies the multiple integration of tradition and modernity, local and global, and provides a solid foundation for the sustainable development of traditional crafts and the establishment of cultural self-confidence.

In general, through an in-depth study of the historical origins, cultural symbols and innovative development of Shu embroidery patterns, this chapter shows the unique value of Shu embroidery as a traditional craft and its new identity in modern society. This process not only promotes the preservation and inheritance of traditional crafts, but also promotes their recognition and development on the global cultural stage.

4.1.4 Summary

Through the combing and summarizing of this chapter, the historical origin of Shu embroidery patterns is first studied. As a part of traditional Chinese embroidery art, Shu embroidery has a long history and rich cultural background. Its development process reflects the artistic style and cultural customs of ancient Chinese society, from

the early court decoration to the folk inheritance, the Shu embroidery pattern has gradually formed a unique artistic style and cultural symbol. Research shows that Shu embroidery not only inherits ancient embroidery skills, but also integrates local characteristics and ethnic customs, and has become an important representative of traditional Chinese crafts (Huang, 2022).

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4.2 The current situation and problems of Shu embroidery patterns

This chapter collects and analyzes data through fieldwork, literature reviews,

expert interviews, and group discussions. Through interviews with relevant experts, government managers, and digital media experts, the corresponding data and information were obtained. Through analysis and collation, the current situation of the inheritance and protection of Shu embroidery in Chengdu, China is obtained. Through the analysis, collation and summary of data information, the following data are obtained:

4.2.1 The inheritance and protection status of traditional patterns of Shu embroidery



4.2.1.1 About heirs


This part mainly introduces the Sichuan embroidery in China through the Chengdu Municipal Government and relevant departments from the aspects of inheritor distribution, development and relevant national policies.

The overall distribution of Shu embroidery inheritors is wide, roughly distributed in Chengdu, Mianyang, Deyang, Leshan, Ziyue, Nanchong, Luzhou, etc. The inheritance and development of Shu embroidery has been developed for many years. The inheritors are represented by national inheritors, such as Hao Shuping, Meng Dezhi, Huang Min and Kang Ning and other national and provincial intangible cultural heritage inheritors and their disciples. It also includes non-representative successors, such as government administrative department personnel, university teachers, primary and secondary school art teachers, community cadres, Shu embroidery enthusiasts and enthusiasts.

Table 15 Representatives of Shu embroidery inheritors



Number	Name	Photo	Content
1	National-level Shu embroidery inheritor: Hao Shuping		The first batch of representative inheritors of the national-level intangible cultural heritage project Shu embroidery, a Chinese arts and crafts master, enjoying special government allowances from the State Council.
2	National-level Shu embroidery inheritor: Meng Dezhi		The general manager of Chengdu Mengyuan Shu Embroidery Crafts Co., Ltd., and the director of Chengdu Chanlin Shu Embroidery Research Institute, has been engaged in the creation and research of Shu embroidery techniques for over 30 years.

Number	Name	Photo	Content
3	Provincial-level inheritor of Shu embroidery: Peng Shiping		Master of Arts and Crafts in Sichuan Province, born in 1961 into a family of Shu embroidery, has been engaged in the study of Shu embroidery techniques for over thirty years, and has created hundreds of exquisite pieces of Shu embroidery.

Source: Liu Ying (2024)

The representative inheritance of Shu embroidery in Chengdu, Sichuan Province is divided into five major inheritance factions. Chengdu School: Pay attention to tradition, pay attention to fineness, and be magnificent (Yang Huazhen, Huang Chenghui). Western Sichuan School: natural realism, simple style, pay attention to artistic conception (Wu Shaozu). Southern Sichuan School: Folk customs, strong colors, warm and unrestrained (Liu Xiaohong). Northern Sichuan School: Profound cultural heritage, expression of history and mythology, solemn and rigorous (Li Guifen). Leshan School: Deeply influenced by Buddhist culture, his works are elegant and exquisite (Chen Lihua).

In order to protect and inherit the intangible cultural heritage of Shu embroidery, the Ministry of Culture and relevant departments of governments at all levels have adopted a series of support and protection measures, and introduced relevant policies to ensure the continuation and development of Shu embroidery skills. The Law of the People's Republic of China on Intangible Cultural Heritage (Law Press, 2011) promulgated by the State Council provides a legal guarantee for the protection of intangible cultural heritage such as Shu embroidery. The law clearly stipulates the basic principles and measures for the identification, recording, preservation, inheritance,

dissemination and revitalization of the national intangible cultural heritage. This law provides a legal basis for the protection and inheritance of Shu embroidery, so that the relevant departments have laws to follow when protecting Shu embroidery culture.

The Sichuan Provincial Government and the Chengdu Municipal Government have issued a series of local regulations and regulations specifically for the protection of local intangible cultural heritage such as Shu embroidery. These include the Regulations on the Protection of Intangible Cultural Heritage of Sichuan Province (Yang Hong, 2024), which clarifies the responsibilities of local governments in protecting, inheriting, and disseminating intangible cultural heritage. The protection measures of the local government have effectively promoted the inheritance and development of Shu embroidery, and provided policy support and necessary resources for the inheritors.

The Sichuan Provincial Government and the Chengdu Municipal Government have established a system for identifying inheritors of intangible cultural heritage. By identifying the inheritors of Shu embroidery, the government provides corresponding economic subsidies and social security to support them to concentrate on inheriting and disseminating Shu embroidery skills. This system ensures that the Shu embroidery skills are passed on from generation to generation, guarantees the basic livelihood of the inheritors, and motivates them to continue to engage in the protection and inheritance of Shu embroidery skills.

The government encourages and supports the inheritors of Shu embroidery to cooperate with modern designers to apply Shu embroidery skills to modern fashion and daily necessities, and promote the market-oriented development of Shu embroidery. Through the intervention of modern design, Shu embroidery has gradually expanded from the traditional decorative arts to fashion, home furnishing and other fields, attracting more young consumers and enhancing the market competitiveness of Shu embroidery.

The government subsidizes Shu embroidery works to participate in cultural exhibitions and exchange activities at home and abroad to enhance the international influence of Shu embroidery. Through these exhibitions and exchange activities, Shu embroidery has not only been more widely recognized in China, but also gradually moved towards the international market, enhancing its cultural influence and

commercial value.

4.2.1.2 Publication of documents and works

This part mainly introduces the inheritance and protection of Shu embroidery patterns through the Chengdu Municipal Government of Sichuan and relevant departments in terms of literature publication and construction of related cultural and historical materials:

There are many documents on Shu embroidery. For example, the monograph of Shu embroidery has, "Shu embroidery" editor: Zhu Li in this book is a special introduction to the handicraft of Shu embroidery, from the historical evolution to the craft skills, there are detailed introductions. The book displays a large number of Shu embroidery works, and also contains relevant historical and cultural background interpretations, which is a good reference book for understanding the artistic charm of Shu embroidery (Zhu, 2014). "The Beauty of Chinese Patterns: Animals" Author: Huang Qingsui, this book focuses on the theme of flowers and birds in Shu embroidery, and shows many exquisite Shu embroidery works. The book introduces different kinds of flower and bird patterns and embroidery techniques, and also explains the development history and cultural connotation of Shu embroidery. The illustrations in the book are beautiful and exquisite, suitable for those who like Shu embroidery flowers and birds to read and appreciate (Huang, 2022). "Bashu Creation: "Embroidery" Wai Huizhong" Author: Hu Shaozhong, this book includes some classic Shu embroidery works, including flowers and birds, people, landscapes and other works with different themes. Each work has a detailed interpretation and deconstruction, and there is an in-depth discussion on the craftsmanship and artistic characteristics of Shu embroidery. The illustrations in the book are rich and varied, which can help readers better appreciate and understand the charm of Shu embroidery (Hu, 2024). "Embroidery Techniques from Beginner to Mastery" Author: Li Jing, this book mainly introduces the Shu embroidery in Sichuan, China, and discusses the development and changes of Shu embroidery in the Chengdu area. From traditional techniques to modern design, the book details the history, cultural background and artistic characteristics of Shu embroidery in Chengdu, Sichuan. At the same time, the book also displays a large number of Shu embroidery works in Chengdu, Sichuan, which is suitable for readers who are interested in diverse embroidery (Li, 2021). These books give a detailed

introduction to the history, artistic characteristics, techniques and cultural connotations of Shu embroidery from different perspectives, which are of great significance to the inheritance and research of Shu embroidery

4.2.1.3 Construction of heritage venues and facilities

This part mainly introduces the inheritance and protection of Shu embroidery, and the situation of the construction of inheritance venues and related folk culture venues through the Chengdu government and relevant departments in Sichuan is as follows:

At the end of 2008, the Chengdu Women's Federation and the Pixian County Party Committee and County Government established the "Chengdu Home Flexible Employment Demonstration Base" with the theme of Shu embroidery in Anjing Town, Pixian County. Before 2019, the government created Area A of Shuxiu Park. Area A of Shu Embroidery Park is mainly based on the master work cluster, with the production and sales of Shu embroidery as one of the industrial chain, to create a Shu embroidery industrial block, but the industry is relatively single. Shu embroidery cultural and creative park was opened in October 2019, covering an area of 500 acres, in addition to the park greenway, but also includes the Shu embroidery creative center, Shu embroidery college, colorful embroidery workshop, embroidery tea sales experience store, etc., so that people can feel the charm of Shu embroidery at zero distance. You can watch the embroidery girls fly needles and threads here, and feel the vitality of traditional culture.



Figure 37 Shu Embroidery Museum - Inheritors and Shu Embroidery Works
Source: Liu Ying (2024)

In recent years, Anjing Town, Pixian County, will speed up the construction of Tianfu Shu Embroidery Cultural and Creative Industrial Park, and build the project into a comprehensive development core park, multi-functional high-end service base and national 4A-level scenic spot integrating Shu embroidery works exhibition, product research and development, creative design, production and production, cultural exchanges, market transactions, commercial finance, tourist experience, silkworm breeding and ecological protection; To build a demonstration area for the development of Shu embroidery cultural industry, upgrade the existing Shu embroidery museum, master studio, Shu embroidery exhibition hall, embroidery workshop, etc. along the Fu River, build more than 4 new exhibition halls and master studios along the line, introduce masters and powerful enterprises to settle in, and strengthen the development function of Shu embroidery industry.

The Shu Embroidery Pavilion of the Sichuan University Museum displays exquisite embroidery from the Qing Dynasty and the Republic of China, covering men's and women's daily clothing, official uniforms, boudoir items and women's accessories. These embroidery products are mainly the fine products of Shu embroidery and Hunan embroidery. As one of the four famous embroideries in China, Shu embroidery has a long history and profound cultural connotation, and is famous for its exquisite skills and unique artistic style. In the exhibition hall, the audience can enjoy these exquisite Shu embroidery works and learn about their production technology and cultural connotation.

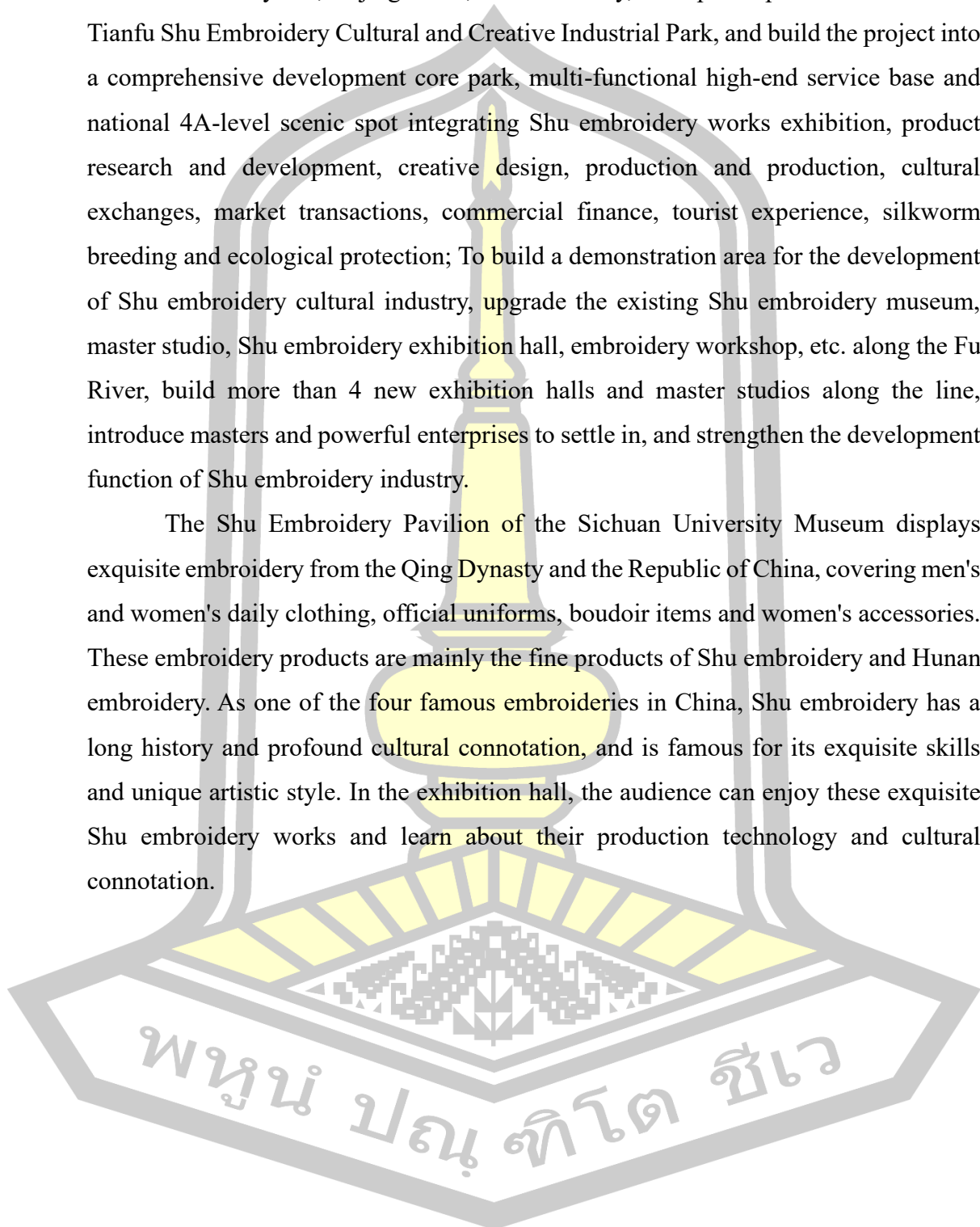




Figure 38 Sichuan University Museum - Qing Dynasty Shu embroidery lady landscape blue gauze sleeves
Source: Liu Ying (2024)

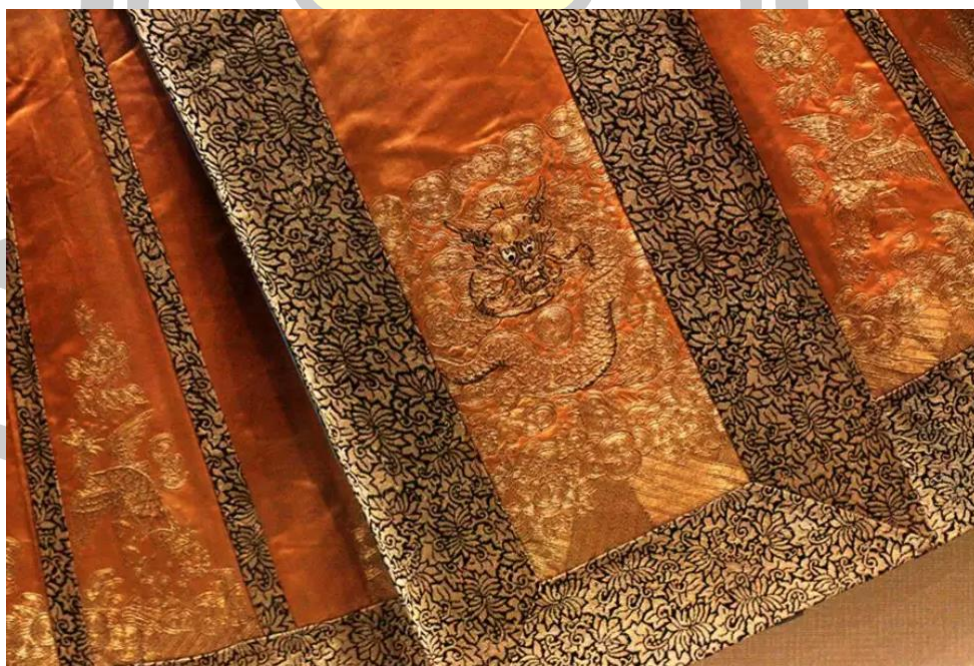


Figure 39 Sichuan University Museum - Qing Dynasty Shu embroidered 498 phoenix orange and yellow satin skirt

Source: Liu Ying (2024)

4.2.1.4 Education, training and exhibitions

This part mainly introduces the inheritance and protection of Sichuan Chengdu Shu embroidery patterns, and introduces the following aspects through the Sichuan Chengdu Municipal Government and relevant departments in terms of education, training, and holding relevant exhibitions and publicity:

(i) Activities carried out in the community of Shu xiu Park. The Shu embroidery exhibition displays the classic works and modern creations of Shu embroidery, and shows the artistic charm and technical essence of Shu embroidery through exhibition, explanation and interaction.



Figure 40 Yang Min, Director of the Community Coordination Office of Anjing Street

Source: Liu Ying (2024)



Figure 41 Shu embroidery activities in Anjing Town
Source: Liu Ying (2024)

The 2024 Chengdu Splendid Skills Competition Shu Embroidery Skills Track jointly sponsored by the Chengdu Federation of Trade Unions officially kicked off in the Xiuli Shu Embroidery Integration Innovation Industrial Park, Anjing Street, Pidu District.



Figure 42 2024 Chengdu Splendid Skills Competition Shu embroidery skills track activities
Source: Liu Ying (2024)

On April 29, 2024, the launching ceremony of the Chengdu 2024 Copyright Publicity Activity and Folklore (Shu Jin shu Embroidery) Copyright Protection and Promotion Project with the theme of "Copyright Empowerment and Lighting up the Beauty of Tradition" was held in Chengdu Shu Embroidery Cultural and Creative Park - Shu Embroidery Creative Center. The event was hosted by the Propaganda Department of the Chengdu Municipal Party Committee and the Chengdu Municipal Copyright Bureau, and undertaken by the Propaganda Department of the Pi du District Party Committee, the Pi du District Copyright Bureau and the Chengdu Copyright Society.

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Figure 43 Launching ceremony of the (Shu Jin shu Xiu) Copyright Protection and Promotion Project

Source: Liu Ying (2024)

On October 18, 2024, the "Splendid China - Embroidery Public Education Exhibition" opened at the China Arts and Crafts Museum (China Intangible Cultural Heritage Museum). The exhibition is hosted by the China Arts and Crafts Museum (China Intangible Cultural Heritage Museum) and undertaken by Tang Fengyun (Beijing) Film and Television Co., Ltd. and Beijing Xing tian Cultural Development Co., Ltd. Li Qun, Vice Minister of the Ministry of Culture and Tourism and Director of the State Administration of Cultural Heritage, attended the opening ceremony.



Figure 44 2024 Chengdu Splendid Skills Competition Shu embroidery skills track activities

Source: Liu Ying (2024)

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Department of the Chengdu Municipal Party Committee and the Chengdu Municipal Copyright Bureau, and undertaken by the Propaganda Department of the Pi du District Party Committee, the Pi du District Copyright Bureau and the Chengdu Copyright Society.



Figure 45 Launching ceremony of the (Shu Jin shu Xiu) Copyright Protection and Promotion Project

Source: Liu Ying (2024)

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Figure 46 "Splendid China - Embroidery Public Education Exhibition" China Intangible Cultural Heritage Museum opened

Source: Liu Ying (2024)

Exploring cross-border integration and AI empowerment, this intangible cultural heritage promotion conference focused on the high-quality development of Shu brocade and Shu embroidery. Shu Embroidery Performing Arts Center, Shu Embroidery Theme Hotel, "Shu Embroidery" Gaoding, AI New SplendidOn June 21, 2024, at the Chengdu Intangible Cultural Heritage Promotion Conference (Splendid Session), a number of projects appeared in the roadshow. The Red Star News reporter learned from the scene that the "Five-Year Action Plan for the High-level Protection and High-quality Development of Chengdu Shu Jinshu Embroidery (2024-2028)" and "Several Policies and Measures for Chengdu to Promote the High-level Protection and High-quality Development of Shu Jinshu Embroidery" will be introduced soon.

Since 2016, Zhong Ming has tried to use AI to assist in the design of Shu brocade embroidery, "At present, there are new AI splendid works. In addition, a large number of the company's copyrighted works can be converted into copyright authorization.

At the scene, Wu Jinliang, vice president of the China Silk Association, president of the Sichuan Silk Association, and chairman of the Jinmen Silk Culture Town, proposed that the Shu Jinshu embroidery industry needs industrialized thinking, market-oriented platform, product life, development model innovation, and development concept update. ”



Figure 47 Exploring cross-border integration and AI empowerment
Source: Liu Ying (2024)

On August 16, 2024, the 2nd Shu embroidery primary training course of Anjing Shu Embroidery College in 2024 officially kicked off. At 10 o'clock in the morning of

the same day, 25 new students gathered in Anjing Shu Embroidery Cultural and Creative Park and held the opening ceremony at Shu Embroidery College.

The training aims to deeply excavate and carry forward the long-standing and profound cultural connotation of Shu embroidery, and carry forward this traditional skill. By strengthening the students' accurate grasp of the cultural and historical connotation of Shu embroidery and the accurate grasp of needlework skills, we strive to let the students feel their own significant progress while mastering the basic skills of Shu embroidery. It is hoped that with this traditional handicraft, students will be self-reliant, effectively solve more employment problems, and contribute to local economic development and cultural inheritance.



Figure 48 Wu Xiaohong, teacher of Shu Embroidery College
Source: Liu Ying (2024)

Teacher of Shu Embroidery College, Wu Xiaohong. The main thing is to teach the technology, and secondly, tourists can also experience it. We have a lot of school students and elementary school students who come to experience it in groups.

(ii) Entering schools to carry out intangible cultural heritage activities. In Chengdu and its surrounding areas in Sichuan Province, some primary schools have begun to carry out educational activities related to Shu embroidery to promote students' awareness and interest in traditional culture. Including Chengdu Experimental Primary School, Chengdu Jinjiang District First Primary School, Chengdu Qingyang District Experimental Primary School, Chengdu Shuangliu District People's Primary School, Chengdu Wuhou District Experimental Primary School, Chengdu Pi du District Second Primary School, Chengdu High-tech Zone Tianfu Primary School, Chengdu Qing bai jiang District Experimental Primary School, etc., these primary schools actively carry out Shu embroidery-related educational activities by opening courses, organizing experience activities and lectures. These activities not only help students learn

traditional skills, but also enhance their understanding and interest in local culture, laying the foundation for the inheritance and promotion of Shu embroidery. These practices also help develop students' artistic perception and hands-on skills.

As shown in Figure 48, the Monument Community of Anjing Street and Master Wu's Studio carried out the "Yilin Shimmer Camp" in Huimin School: "Start with a dream and land with embroidery" Shu embroidery cultural experience into the campus. Let the teenagers realize the realization of the production materials and finally make a complete Shu embroidery small works, close contact with the Shu embroidery masters, in the process of learning while doing, but also improve the cultural and artistic accomplishment, Chinese culture self-confidence and sense of identity, pride. (Liu, 2024)



Figure 49 Photos of Shu embroidery activities
Source: Liu Ying (2024)

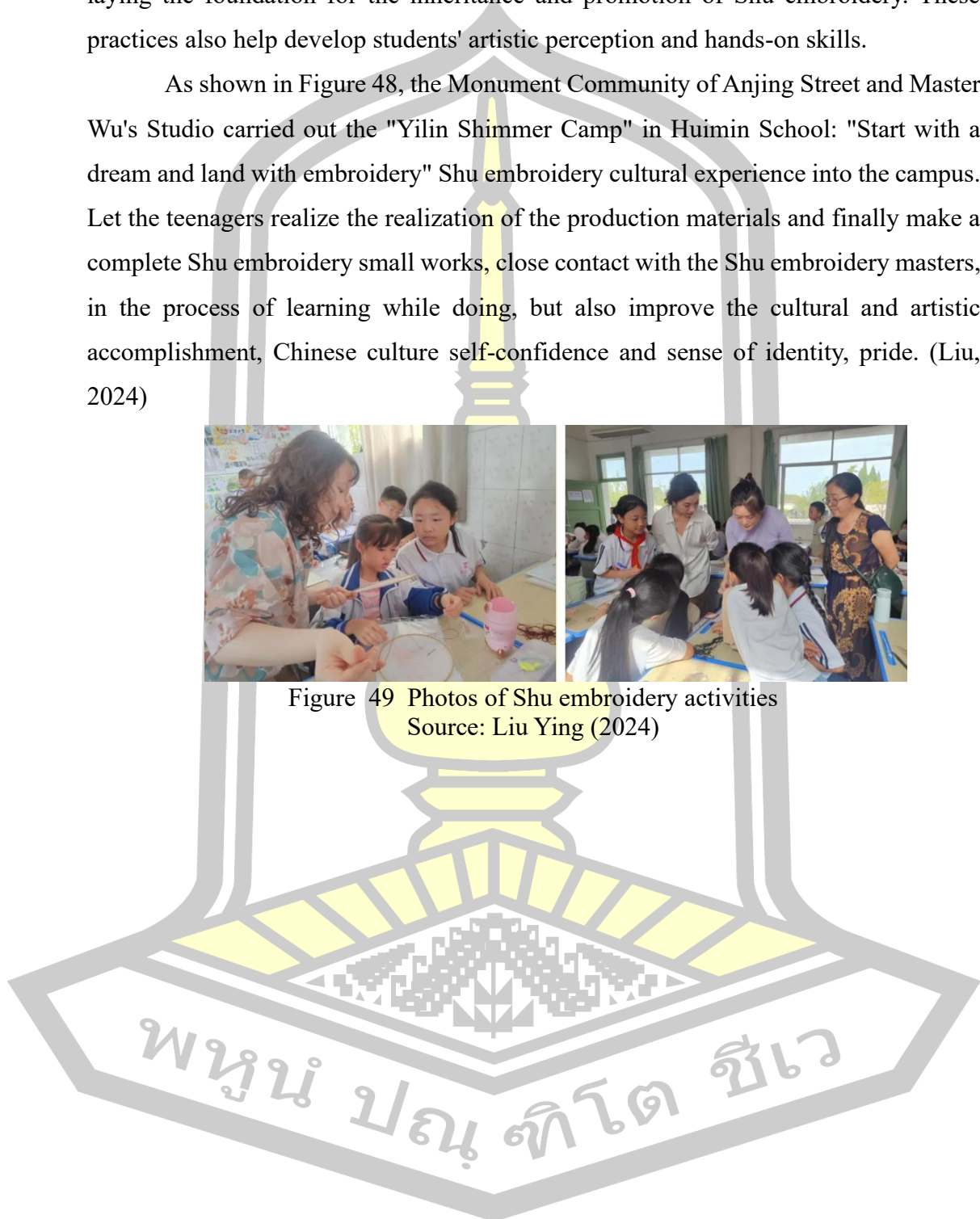




Figure 50 Yang Li, deputy secretary of the community party committee, introduced the historical origin of Shu embroidery to the children

Source: Liu Ying (2024)

Teacher Zhang, the inheritor of Shu embroidery, showed the children the production process of Shu embroidery, and patiently explained the stitches and skills of Shu embroidery.

Let the teenagers realize the realization of the production materials and finally make a complete Shu embroidery small works, close contact with the Shu embroidery masters, in the process of learning while doing, but also improve the cultural and artistic accomplishment, Chinese culture self-confidence and sense of identity, pride.

Sichuan Polytechnic University of Engineering held a cultural experience activity of "The Beauty of Shu Embroidery" for intangible cultural heritage culture to enter the campus. In order to further inherit the intangible cultural heritage and explore the integration of Shu embroidery culture and higher vocational education, on the afternoon of May 14, 2024, sponsored by the Intangible Cultural Heritage Inheritance

and Innovation Center, the Mianzhu New Year Painting Art Practice Workshop and the Mianzhu New Year Painting Research Society hosted the "Inheritance of Shu Embroidery Culture, Coloring the Picture Scroll of the Times" - the "Beauty of Shu Embroidery" cultural experience activity of intangible cultural heritage entering the campus was held in Sichuan Engineering Vocational and Technical University, with the in-depth participation of many teachers and students.

The event specially invited Liu Tiantian, the representative inheritor of Shu embroidery and the president of the Shu Embroidery Industry Chamber of Commerce in Guanghan City, as an intangible cultural heritage mentor. Mr. Liu has been engaged in the inheritance of Shu embroidery for more than 20 years, and has been committed to promoting, inheriting and innovating Shu embroidery culture. She vividly explained the history and characteristics of Shu embroidery to the students, introduced the basic stitching methods of Shu embroidery in detail, and demonstrated the skills of needle movement and thread routing on the spot.



Figure 51 "The Beauty of Shu Embroidery" cultural experience activity of intangible cultural heritage culture entering the campus
Source: Liu Ying (2024)

(iii) Chengdu Shu Brocade Embroidery Museum, which provides basic tutorials on Shu embroidery making, allows participants to make Shu embroidery works by themselves, sets up embroidery production areas, provides basic tools and materials, and is guided by Shu embroidery craftsmen or experts. The specific process and arrangement usually include the following aspects:

Basic tutorial explanation: The museum will provide explanations about the history, cultural background and basic techniques of Shu embroidery, helping participants understand the artistic value and production process of Shu embroidery.

On-site demonstration: Shu embroidery craftsmen or experts will demonstrate the basic techniques of Shu embroidery, including stitching, selection of threads and

color matching, etc., and participants can intuitively observe the production process.

Hands-on practice: Participants can make their own Shu embroidery works using the basic tools and materials provided in the embroidery making area. In practice, participants can exercise their hands-on skills and familiarize themselves with the embroidery process.

Individual guidance: Shu embroidery craftsmen will visit each participant during the production process, provide them with personalized guidance, answer questions, and ensure that everyone can get help in their learning.

Exhibition and sharing of works: After the embroidery is completed, the museum may set up a display platform where participants can share their works and communicate and learn from each other.

Through this comprehensive teaching and experience method, the Chengdu Shu Brocade Embroidery Museum not only allows participants to understand the traditional craftsmanship of Shu embroidery, but also stimulates their creative enthusiasm and interest in traditional culture.

Peng Shi ping, the provincial inheritor, introduced the history of Shu embroidery and on-site teaching.



Figure 52 Lecture: Provincial inheritor Peng Shi ping
Source: Liu Ying (2024)



Figure 53 Provincial inheritor Peng Shi ping Shu embroidery production guidance
Source: Liu Ying (2024)

4.2.1.5 Establishment of digital communications

With the rapid development of computer technology, Internet technology, communication technology and interactive technology, Shu embroidery is developing in the direction of digitalization. For example, some artists have converted Shu embroidery works into digital assets for launch, actively responding to the national cultural digitalization strategy (Diao, 2024). This shows that the Shu embroidery culture is gradually integrating into the digital era and spreading through the Internet, mobile Internet and other platforms.

As shown in the picture, the embroiderer embroidered with reference to the photos processed by digital technology, taken by Lu Yang. A photo is entered into the software system, and a pattern design suitable for Shu embroidery is generated in a few minutes, and the embroiderer then begins to embroider. At the same time, hundreds of kilometers away, customers can keep track of the embroidery progress of the embroidery girl on their mobile phones.



Figure 54 Embroidery by the embroiderer with reference to the photos processed by digital technology Photo by Lu Yang
Source: Liu Ying (2024)

(Zhong,2024,Interview) said that he has been engaged in traditional handicrafts for 17 years, and in 2016 began to study the combination of picture processing technology and Shu embroidery. He said that the reason for this shift is to respond to market changes on the one hand, and to broaden the possibilities of traditional handicraft expression on the other. "The traditional Shu embroidery aesthetics and modern home decoration style are quite different, and the sales are not good. In Zhong Ming's view, this technology can turn everyone's favorite photos into Shu embroidery, so that Shu embroidery can enter thousands of households, and traditional intangible cultural heritage can also be reborn.

We carried out fieldwork, went to the Sichuan University Museum and Chengdu Shu Brocade Embroidery Museum to collect Shu embroidery works, and collected information on national and provincial Shu embroidery inheritors. We also went to the museum and workshop in the Shu Embroidery Park in Anjing Town, and collected the Shu embroidery works from the museum and workshop. The works were filmed and interviews were conducted. At the same time, we will digitize and preserve the collected information to supplement the archival resources of Shu embroidery. At present, it has collected more than 2,600 exquisite Shu embroidery works, recorded more than 1,000 photos of Shu embroidery culture and ecological environment, produced 20 CD-ROMs,

and more than 200,000 words of text, and established personal files for 56 Shu embroidery workers. Archive database system for the subsequent data construction of Shu embroidery pattern platform.

4.2.2 The issues of inheriting and protecting traditional patterns of Shu embroidery

4.2.2.1 Regarding the successor level

The aging of heirs and the reluctance of young people to participate have led to a decrease in the number of heirs. Through field investigation, it was concluded that the phenomenon of declining eyesight and disease of Shu embroidery artists in Chengdu, Sichuan, and the number is still decreasing. This has had a negative impact on the living transmission and protection of Sichuan Chengdu Shu embroidery, and the transmission power of Sichuan Chengdu Shu embroidery has also been reduced. Gradually decrease.

(Peng,2024, Interview) said that the interviewee Peng Ling is the third generation of Shu embroidery, Sichuan Province Arts and Crafts Master Peng Shiping Shu Embroidery Master Studio manager, however, with the passage of time, she faces physical limitations, her father said that the Shu embroidery industry is now very lonely, the number is scarce, unlike those emerging industries thriving. I didn't understand this at the time, so I wanted to pass on the skills of my grandfather and father. Although I have some experience now, I still think differently from him, and I think that Shu embroidery still has great prospects for development in the future. But I agree with one of his statements, "Shu embroidery needs a large number of people, not one or two people, and everyone works together to develop." It is said that the impetuous society, but the real impetuosity is the group, is the people, the inheritance and development of traditional skills need a group of steady craftsmen. Guarding against arrogance and rashness and polishing works is "lonely", being good at ingenuity and not following the crowd is "brave", being a walker of heaven and earth, with the determination that the sunset does not set, in order to pass on the fine products to the world, and the spirit will last forever. The research in this paper uses digital media to record her experience and skills, and makes a contemporary translation of the artistic symbols of her Shu embroidery works, so that a wider audience can learn from them and disseminate them to promote Shu embroidery.



Figure 55 Peng Shiping and Peng Ling, the inheritors of Shu embroidery, father-daughter relationship

Source: Liu Ying (2024)

In addition to improving the stitch method of Shu embroidery, in the innovation of patterns, we have joined hands with Jiang Bo jiu and Liao Gao qiu national art masters to provide more innovative patterns for this ancient and exquisite art form through innovative communication methods, so that Shu embroidery works can be reborn. The Shu embroidery pattern platform can have more innovative patterns in the original data collection, which further promotes the spread and popularization of Shu embroidery culture.

With the attention of the country and all walks of life to the inheritance of intangible cultural heritage, various departments and inheritors publicize Shu embroidery, and more and more people are learning Shu embroidery. However, at present, most of the main inheritors of Shu embroidery skills are older generation artists, who are generally older and face the risk of losing their skills. However, the number of inheritors of the younger generation who truly grasp the essence of traditional skills is limited. With the gradual withdrawal of the older generation of inheritors, there may be a fault in the Shu embroidery skills, especially some complex techniques and processes may not be completely passed on to the next generation. The number of inheritors has decreased, and with the process of social modernization, there are fewer and fewer young people who are willing to devote themselves to the learning and inheritance of Shu embroidery skills. Many young people think that the work of Shu embroidery is

tedious, time-consuming, and the income is not high, and they are reluctant to pursue this profession. The decrease in the number of inheritors has directly affected the inheritance of Shu embroidery skills, and many exquisite skills may be lost with the death of the older generation of inheritors. The weakening of cultural identity, in the context of modernization and globalization, the sense of identity of traditional culture among the younger generation has weakened. Many people lack an in-depth understanding of the history and cultural connotation of Shu embroidery, and they do not pay enough attention to Shu embroidery skills. The weakening of cultural identity may lead to the gradual decline of the status of Shu embroidery in modern society, and it is difficult for traditional skills to be respected and protected.

To sum up, the number of representative inheritors has decreased, traditional patterns have been neglected, the impact of modernization, and the inheritance mechanism is not perfect. By establishing a systematic record of Shu embroidery patterns, strengthening the cultivation of inheritors, promoting the combination of tradition and modernity, improving public awareness and improving policy support, these challenges can be effectively addressed, and the protection and inheritance of Shu embroidery patterns can be ensured, so that this traditional art can develop sustainably.

4.2.2.2 On cultural connotations and levels of identity

At present, there is a lack of cultural connotation and conceptual identity in the creation of Shu embroidery patterns, resulting in the loss of the expression of cultural connotation in most Shu embroidery works (Chen, 2021).

(Peng Ling interview 2024) said that of course, it is still necessary to explore on the basis of retaining skills. Now many works on the market are flower shelves, just the pattern is good-looking, the traditional stitching method of Shu embroidery has been lost, and it cannot stand the test of time, so the phenomenon of shoddy production is not uncommon. As a result, intangible cultural heritage loses the overall significance of local culture in the process of inheritance, which inevitably leads to the problem of lack of cultural connotation and identity.

In some current inheritance studies, most of the researchers have sorted out some text clues about the Shu embroidery patterns in Chengdu, Sichuan from written documents and historical materials, but rarely through long-term field observations and interviews, they can truly understand the history of Shu embroidery patterns in Chengdu,

Sichuan from the perspective of local people. and cultural connotations, leading to a lack of awareness of their cultural connotations and cultural identity. The lack of exploration of new forms of expression based on cultural connotations has led to the dilemma of solidification and simplification of their inheritance.

The existence of multiculturalism in modern society has caused collisions and conflicts between different cultures. In this multicultural society, the Shu embroidery culture in Chengdu, Sichuan Province may feel competition and substitution from other cultures, thus affecting the stability of cultural identity.

4.2.2.3 About the level of inherited media

The "Opinions on Promoting the Implementation of the National Cultural Digitization Strategy" issued by the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council clearly put forward the goal of "presenting a panoramic view of Chinese culture and allowing the whole people to share the digital achievements of Chinese culture", and required strengthening the data entry standards of the Chinese cultural database. The 14th Five-Year Plan for the Safeguarding of Intangible Cultural Heritage issued by the Ministry of Culture and Tourism of the People's Republic of China lists key tasks such as intangible cultural heritage recording projects and new media dissemination plans for intangible cultural heritage. Intangible cultural heritage contains the humanistic spirit and moral norms inherited by the Chinese nation, which is full of eternal charm and has deep value of the times. General Secretary Xi Jinping stressed that "it is necessary to do a solid job in the systematic protection of intangible cultural heritage, better meet the growing spiritual and cultural needs of the people, and promote cultural self-confidence and self-reliance." "The protection, inheritance and promotion of intangible cultural heritage must closely follow the national cultural digitization strategy, integrate into the pulse of the times of national rejuvenation and social development, promote the creative transformation and innovative development of intangible cultural heritage, and make digitalization a new driving force for the protection, inheritance and activation of intangible cultural heritage.

Driven by national policies, the digital model of intangible cultural heritage has changed through continuous practice and exploration. It began as an aid to preservation, documentation and display, and has gradually become an important tool and scientific

motivation for the innovative development of intangible cultural heritage (Chan, 2022).

According to the national policy on the digital protection of intangible cultural heritage, it can be concluded that there are the following problems in the inheritance and protection of Shu embroidery patterns in Chengdu, Sichuan Province:

The limitations of the spread of Shu embroidery are mainly reflected in the following aspects: First, the traditional inheritance and production of Shu embroidery are mainly concentrated in Chengdu City, Sichuan Province and its surrounding areas, resulting in its influence being geographically limited. Secondly, due to the strong local cultural characteristics of Shu embroidery, residents from other places have insufficient understanding of its artistic value and process complexity, resulting in cultural cognitive estrangement. In addition, the communication channels of Shu embroidery mainly rely on traditional exhibitions and market activities, and the use of digital applications and online platforms is not sufficient, limiting its nationwide dissemination. Low market awareness and imperfect brand building have also failed to effectively expand the influence of Shu embroidery. In order to solve these problems, it is necessary to strengthen publicity and promotion, optimize market strategies, combine modern design elements, and expand education and training to enhance the national and even international popularity of Shu embroidery. The fast-paced pace and diversity of modern society have made people more inclined to pursue new and practical skills and ways of entertainment. As a result, the transmission of traditional handicrafts faces competition from modern lifestyles. The demand for Shu embroidery in society has decreased, limiting the scope of inheritance. (Peng, 2024, Interview).

In order to expand the scope of inheritance of Shu embroidery, comprehensive measures were taken. Establish a wider range of communication media and heritage institutions, provide digital training and educational resources, and attract more young people to participate in the learning of traditional crafts. Through the cooperation between universities and enterprises, we will cultivate professional talents and improve the level of design and production (Yang, 2015). At the same time, cultural promotion and publicity activities are carried out through digital media to improve the society's understanding of Shu embroidery, promote wider social participation, and help broaden the media and scope of inheritance.

Lack of digital transformation: Lack of effective digital communication means

makes it difficult to fully display Shu embroidery in the Internet era.

(Huang,2024, Interview) said that in the current context of rapid digital development, the inheritance and protection of Shu embroidery has not made full use of digital technology, which has restricted its sustainable development in modern society. First of all, digital platforms are difficult to build. At present, the construction of Shu xiu's digital platform faces many challenges, including the difficulty of attracting talents and the relative lack of digital resources. These problems limit the display and dissemination of Shu embroidery on the Internet, making the innovative display of Shu embroidery insufficient, and failing to effectively use digital tools to promote its global dissemination. This limitation restricts the digital inheritance and innovation of Shu embroidery, and it is impossible to fully display its artistic value and cultural connotation. Secondly, the digital support for Shu embroidery education and training is also insufficient. In the context of digital transformation, it is difficult for the education and training of Shu embroidery to give full play to the advantages of digital technology, and the lack of online education platforms and virtual training resources limits the popularization and inheritance of Shu embroidery skills. The inheritors of Shu embroidery encountered difficulties in spreading traditional skills to farther places, which limited the in-depth excavation of cultural connotations and the wide dissemination of traditional skills. In addition, the lack of interactivity of digital media is also a major problem. Interactivity is an important means of inheriting and promoting traditional culture, which can allow the audience to participate in the cultural experience more deeply. However, due to the lack of rich and diverse digital media interactions, Shu embroidery does not perform well on social media and other platforms, which leads to a lower level of attention on Shu embroidery among the younger generation. In the modern digital environment, Shu embroidery needs to attract the interest of more audiences through innovative interactive ways to improve its communication effect in the digital age. Therefore, in order to improve the inheritance and protection effect of Shu embroidery in the digital age, it is necessary to solve the problem of digital platform construction, strengthen the digital support of education and training, and innovate the way of digital media interaction. These measures will help to expand the spread of Shu embroidery, enhance its influence on a global scale, and also enable Shu embroidery to better integrate into the cultural ecology of modern society.

The traditional inheritance of Shu embroidery mainly relies on oral teaching and physical demonstration, although this method effectively retains the classic charm of Shu embroidery, it is relatively insufficient in the digital age. Traditional methods that rely on human interaction and on-site instruction, while playing an important role in preserving the authenticity of traditional crafts, have failed to take full advantage of digital technology to expand communication channels and methods. With the gradual passing away of the older generation of inheritors, this traditional way of inheritance faces the risk of the extinction of cultural connotations. The application of digital media technology is still limited in the dissemination and inheritance of Shu embroidery, which leads to the hindrance of the communication and innovation of Shu embroidery. Modern audiences are less interested in solidified forms of traditional inheritance, and are more inclined to cultural experiences that are modern and interactive. Therefore, a single traditional inheritance model cannot meet the aesthetic and cultural needs of contemporary audiences. In order to realize the effective inheritance and emotional identity of Shu embroidery in the digital era, more digital innovation attempts are needed. This includes the use of digital media technology for virtual displays, interactive experiences, online education, etc., to broaden the breadth and depth of the heritage. At the same time, the efforts of digitalization should be in line with the cultural value orientation of modern audiences, so that Shu embroidery can not only retain the traditional charm, but also attract the interest of a new generation of audiences, so as to realize the inheritance and innovation of Shu embroidery culture. (Liu, 2024, Interview).

4.2.3 On the current situation and development model of Shu embroidery patterns

In the process of digital inheritance of Shu embroidery, the use of advanced digital technology to make the dissemination of intangible cultural heritage more scientific, modern and diverse. Although significant results have been achieved in research and practice, digital media still face some challenges in disseminating intangible cultural heritage. First of all, current research often has the phenomenon of "emphasizing technology and ignoring culture", and fails to fully integrate cultural connotation and digital technology (Dan, 2023)). Therefore, digital inheritance and preservation must not only focus on the application of technology, but also deeply consider the cultural connotation to ensure the integrity and cultural value of the work.

Second, digital transmission must rely on the deep involvement of inheritors and cultural experts. These experts are not only cultural practitioners, but also construct expressions according to the internal logic of culture. Therefore, successful digital inheritance and protection requires both technical support and expert cultural guidance to achieve the organic integration of culture and technology and promote the effective inheritance and innovation of Shu embroidery.

4.2.4 Summary

In summary, the current status of Shu embroidery patterns: the Shu embroidery pattern system is complete, covering subjects such as flowers and birds, landscapes, figures, and auspicious symbols, combining both realistic and symbolic aesthetics. The stitch system comprises over 130 types across 12 categories, with the 'double-sided special-shaped and different-colour embroidery' particularly showcasing a high level of skill. In modern applications, pattern design tends to be simplified, with traditional colour gradations reduced from 24 to just over 10, leading to a diminished sense of hierarchy. Under the impetus of intangible cultural heritage protection policies, cultural and creative products based on patterns have gradually expanded, yet the market still relies on traditional themes and lacks innovation. Issues with Shu embroidery patterns include an over-reliance on government support, insufficient endogenous market-driven forces, and a singular application scenario for patterns. It is recommended to strengthen collaboration between industry, academia, and research, promote the integration of digital design with traditional craftsmanship, and enhance the contemporary adaptability of patterns.

Table 16 Current status and problems of patterns

category	status quo	issue
animal	Dragons, phoenixes, unicorns, fish, birds, etc. are the main themes, implying auspiciousness, wealth, longevity,	The traditional image of animal patterns is not innovative enough to attract young people.

category	status quo	issue
	etc.	
	The pattern image is lifelike, the skill is exquisite, and the attention to detail is expressed.	In the international market, there are cultural differences in the understanding of symbols and meanings, which affect the promotion effect.
	It is widely used in weddings, birthday ceremonies and other occasions.	<p>The existing patterns are mainly based on traditional auspicious meanings, such as dragon and phoenix auspiciousness, pine crane longevity, etc., and the theme is relatively simple, lacking innovative designs combined with modern wedding and birthday ceremony culture.</p> <p>The younger generation has a weak understanding of the meaning of traditional patterns and a low sense of cultural identity, which has led to a decline in the appeal of Shu embroidery in modern weddings and birthday ceremonies.</p> <p>Modern weddings and birthday ceremonies are more inclined to personalized and customized services, but the pattern design and production methods of traditional Shu embroidery are difficult to quickly respond to individual needs.</p>
Botanical pattern	Including peonies, plum blossoms, bamboo, orchids,	The subject matter is relatively concentrated, and the selection of plant species is limited to traditional classics, lacking diversity.

category	status quo	issue
	<p>pine trees, etc., symbolizing nobility, wealth, health, etc.</p>	
	<p>Most of the patterns are inspired by natural scenes, with beautiful compositions and strong expressiveness.</p>	<p>Digital preservation and inheritance are insufficient, and the details of some classic patterns have not been fully recorded.</p>
	<p>It is widely used in home decoration and cultural and creative products.</p>	<p>The embroidery patterns of Shu are mainly based on traditional themes and forms, which do not fully match the simple and minimalist style of modern home decoration and cultural and creative products, which makes it difficult for some consumers to accept.</p> <p>The types of cultural and creative products of Shu embroidery are limited, mainly focusing on pillows, wall hangings, clothing, etc., and have failed to develop more diversified practical products, such as the appearance decoration of smart home equipment.</p>
<p>Geometric patterns</p>	<p>Geometric patterns are mainly manifested in symmetrical patterns that are repeatedly arranged, reflecting</p>	<p>The design of the geometric pattern is more traditional, lacking innovative elements and modernity.</p>

category	status quo	issue
	regularity and beauty.	
	It is commonly used in the design of borders and clothing details, and has the dual role of decoration and functionality.	Its application in modern design is relatively simple, and it has not been fully integrated with contemporary aesthetic needs.
	Geometric patterns are widely used in cultural and creative products, clothing design, home decoration, and gift packaging	Geometric patterns that are too abstract may lack cultural emotion and are difficult to fit into the warm atmosphere of the home environment. Too much emphasis on symmetry or repetition can appear monotonous and lacking in modernity.

Source: Liu Ying (2024)

4.3 The mode of development of traditional patterns of Shu embroidery

In this chapter, the researchers will practice based on the application of artificial intelligence knowledge graph technology in the development mode of Shu embroidery patterns. The combination of symbolism and knowledge graph can understand and convey the complex meaning of symbols in a more systematic and structured way. This approach is particularly applicable to the study and digital preservation of intangible cultural heritage, providing a new tool and perspective for the analysis, display and dissemination of cultural symbols. Based on the creative process, the researchers constructed the sample body of Shu embroidery pattern and displayed it visually.

Researchers use the following to construct a constructive research model. The theoretical model consists of four modules and seven design steps. Four modules: pre-design; mid-term design; post-synthesis; Assessment and feedback. Seven Design Links: Conceptual Design; pattern collection; define concepts and classes; Construction of Shu embroidery pattern sample; reasoning and completion; Visualization display and evaluation feedback of Shu embroidery patterns.

The 2024 intangible cultural heritage digitization policy mainly includes the Three-Year Action Plan for Digital Commerce (2024-2026) issued by the Ministry of Commerce. This action plan aims to implement the important deployment of the CPC Central Committee and the State Council on the development of the digital economy, and promote the application and development of digital commerce in the field of intangible cultural heritage. It provides guidance for the digital upgrading of traditional industries such as Shu embroidery.

The theme of the 2024 International Forum on the Digitalization of Cultural Heritage Conservation held in Beijing was "Reinventing: New Productivity of Digital Heritage", which attracted more than 300 representatives from more than 200 cultural institutions, universities and enterprises from 20 countries and regions, including Canada, Italy, Greece and South Korea.



Figure 56 The scene of the 2024 International Forum on the Digitization of Cultural Heritage Conservation

Source: Liu Ying (2024)

The rapid development of digital technology is profoundly changing our lives

and opening up an unprecedented space for the protection of cultural heritage. Xie Bing, deputy director of the State Administration of Cultural Heritage, said at the forum that in recent years, new technologies represented by virtual reality, big data and artificial intelligence have accelerated the empowerment of cultural heritage protection and inheritance, greatly promoted the innovation and development of cultural relics, and revitalized the ancient historical and cultural heritage. High-definition images are shared globally, so that people everywhere can enjoy the murals and sculptures in the caves online; Set up an online exhibition hall for Chinese Qin figurines and Greek young soldier figurines to have a cross-time and space "dialogue"; Simulate and reproduce the original appearance of the Great Wall, and demonstrate the construction methods and functions of the Great Wall in the virtual space..... At this forum, there were many cases of "digital heritage" in various places, and more and more cultural heritage was presented in a more accessible and palpable digital form, approaching the public (Zhong, 2020). The guests at the meeting said that at present, the digital economy is reshaping the development mode and industrial ecology of the cultural industry, and new digital cultural formats such as live video and digital cultural museums are emerging, and "digital heritage" is bringing opportunities for the high-quality development of cultural heritage protection.

Corning (Liu, 2024, Interview) said, "I hope more people will approach Shu embroidery. Corning said. This time, the digitization of Shu embroidery works and the use of digital technology to "activate" the memory of the millennium, injecting new vitality into the inheritance and development of traditional culture. The in-depth integration of intangible cultural heritage with digital, science and technology, cultural and creative fields, and the living inheritance full of new ideas, have opened up a new path for the dissemination and popularization of intangible cultural heritage, and helped intangible cultural heritage enter public life.

In 2024, Kang Ning, a master of Chinese arts and crafts and a national representative inheritor of China's intangible cultural heritage Shu embroidery project, launched the "Shu Embroidery Shaohua" series of digital assets, actively responding to the national "Opinions on Promoting the Implementation of the National Cultural Digitalization Strategy" and the "14th Five-Year Plan" Cultural Development Plan, exploring digital technology to empower intangible cultural heritage culture, and

reproducing the prosperity and glory of millennium Shu embroidery (Gao, 2023).



Figure 57 Kang Ningshu's embroidery works - "Autumn Mood of the Sparrow" and "Confession"

Source: Liu Ying (2024)

(Yang, 2024, Interview) said that the research on the digital protection and development and utilization of embroidery needs to strengthen the unity of content creation and embroidery process expression techniques, so as to reduce production costs without affecting the aesthetics of the process.

(Liu, 2024, Interview) said that the traditional Sichuan Chengdu Shu embroidery relies on oral and family master-apprenticeship, which effectively inherits the skills, but with the passage of time and social changes, it faces the problem of cultural connotation loss and inheritance fault. In addition, the spread of Shu embroidery still relied mainly on handmade and field teaching, limiting its influence in a wider region and among young people. In order to overcome these limitations, the introduction of digital media technology is crucial. By innovating the cultural connotation and symbols of Shu embroidery through digital means, it can better adapt to the needs of modern communication, improve the awareness and influence of Shu embroidery, and expand its global dissemination and influence

(Liu, 2024, Interview) said that Shu embroidery is an important part of traditional Chinese culture. Its inheritance and development have been widely

concerned. With the advancement of digital technology, the inheritors of Shu embroidery have seen the new opportunities brought by digital technology for the inheritance of Shu embroidery. The application of digital technology, such as digitizing Shu embroidery works and using digital technology to "activate" millennium memory, not only injects new vitality into the inheritance and development of traditional culture, but also opens up a new path for the dissemination and popularization of intangible cultural heritage. This innovative way of inheritance helps Shu embroidery into public life, so that more people can understand and appreciate the beauty of Shu embroidery

(Liu, 2024, Interview) said that digital technology can also realize the all-round and three-dimensional recording and presentation of Shu embroidery works, and preserve them indefinitely, so that the living survival and social sharing of intangible cultural heritage have been improved. The emergence of digital networks has broadened the display channels and broken the barriers of dissemination in the protection of intangible cultural heritage, through which intangible cultural heritage can have a dialogue with a wider range of audiences, which greatly enhances the influence of intangible cultural heritage and attracts people to participate in the project of intangible cultural heritage inheritance and protection.

With the advancement of the construction of digital China and the rapid development of artificial intelligence technology, AIGC technology has become the key driving force for the innovation and development of Guizhou's traditional Miao embroidery handicraft industry. This paper explores the immersive experience of AIGC technology in the Miao embroidery handicraft industry, and provides new ideas and methods for the development of the Miao embroidery handicraft industry in Guizhou. (Luo, 2024).

Research Background of Hunan Embroidery Cultural and Creative Product Design Based on AIGC - A Case Study of Hunan Embroidery Town, Shaping City, Changsha City: Hunan embroidery is the carrier of traditional Chinese excellent culture, and the excellent cultural value and artistic value it contains are worthy of our inheritance and development. In today's fast-paced smart economy, artificial intelligence (AI) technology has brought significant impact and change to various fields, and as a new generation of designers, we must keep pace with the times. AIGC (AI Generated Content) refers to the use of artificial intelligence technology to generate

content, also known as "generative AI". This paper is committed to integrating AIGC technology with traditional culture, opening up a new development path and way for the design of Hunan embroidery cultural and creative products, and promoting the sustainable development of Hunan embroidery traditional culture. (Xie 2024).

AIGC (AI Generated Content) technology makes it possible to digitally display traditional handicrafts such as Shushan lanterns and simulate the production process, allowing the audience to experience their charm firsthand. The Dazu rock carvings have been virtually restored through AIGC technology, preserving their historical style and cultural value (Yan, 2024).

Based on this, as a professional practitioner of computer digital media technology, we use computing technology to inherit and protect intangible cultural heritage, and carry out professional practice (Li, 2024). By using the theories of semiotics, communication and digital cultural reproduction, the construction of Shu embroidery pattern sample body involves the structuring and systematization of Shu embroidery knowledge system, pattern characteristics, historical background and other information. The purpose is to construct a knowledge graph of Shu embroidery patterns, and visualize the knowledge, information and data related to Shu embroidery patterns in the form of a graph, so as to facilitate research, management and inheritance. The following are the main application methods of knowledge graph in Shu embroidery:

4.3.1 Data collection and collation

The researchers will carry out the preliminary design part of the work, and through relevant expert interviews, group discussions and other methods, the use of research concepts, the conceptual design of the visual display of Shu embroidery patterns, the collection of patterns, the classification of samples, the storage of samples, the construction of ontologies, the reasoning and completion, and the visual display will be studied (Zheng, 2023). The results of the study are as follows:

This chapter uses Saussure's semiotic theory, Signifier: the form or representation of a sign, such as words, images, or sounds; Signified: The concept or meaning represented by the symbol. The symbolic meaning of Shu embroidery patterns is analyzed through "signifier" and "signified"; The combination of knowledge graphs and semiotics is an interdisciplinary field of research that aims to use the theoretical framework of semiotics to construct and interpret information and relationships in

knowledge graphs. Symbolism is a discipline that studies symbols and symbol systems, while knowledge graph is a technical means to systematize and structure data and systems. By combining the two, it is possible to better understand and express complex concepts in culture, language, and symbolic systems.

Knowledge graph combines semiotic theory, and knowledge graph is used for symbol and entity mapping, symbol system modeling, semantic understanding and reasoning. Through the perspective of semiotics, the cultural symbols in the Shu embroidery pattern are digitally expressed in the form of knowledge graphs to show their symbolic meaning, historical background and cultural value. Using the knowledge graph, the hierarchical structure of symbolic meaning can be displayed, just like the evolution and meaning change of symbols in different historical periods and different cultural backgrounds. The knowledge graph can compare and analyze similar symbols in different cultures, and understand the commonalities and differences of symbols in different cultures through semiotic methods.

summary

The combination of symbolism and knowledge graph can understand and convey the complex meaning of symbols in a more systematic and structured way. This approach is particularly applicable to the study and digital preservation of intangible cultural heritage, providing a new tool and perspective for the analysis, display and dissemination of cultural symbols.

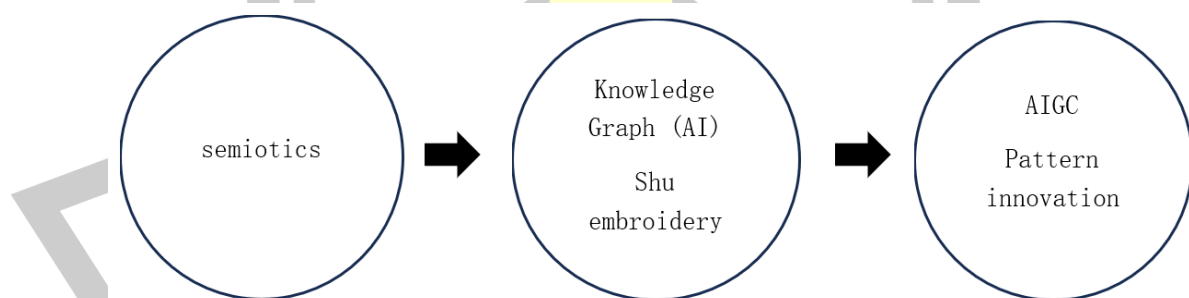


Figure 58 Research framework for the application of digital technology in the transmission and safeguarding of intangible cultural heritage

Source: Liu Ying (2024)

Before the construction of the system, the data of traditional patterns of Shu embroidery were collected and integrated through four types of data sources: historical documents and pattern classics, museums, expert interviews, and existing digital

resources.

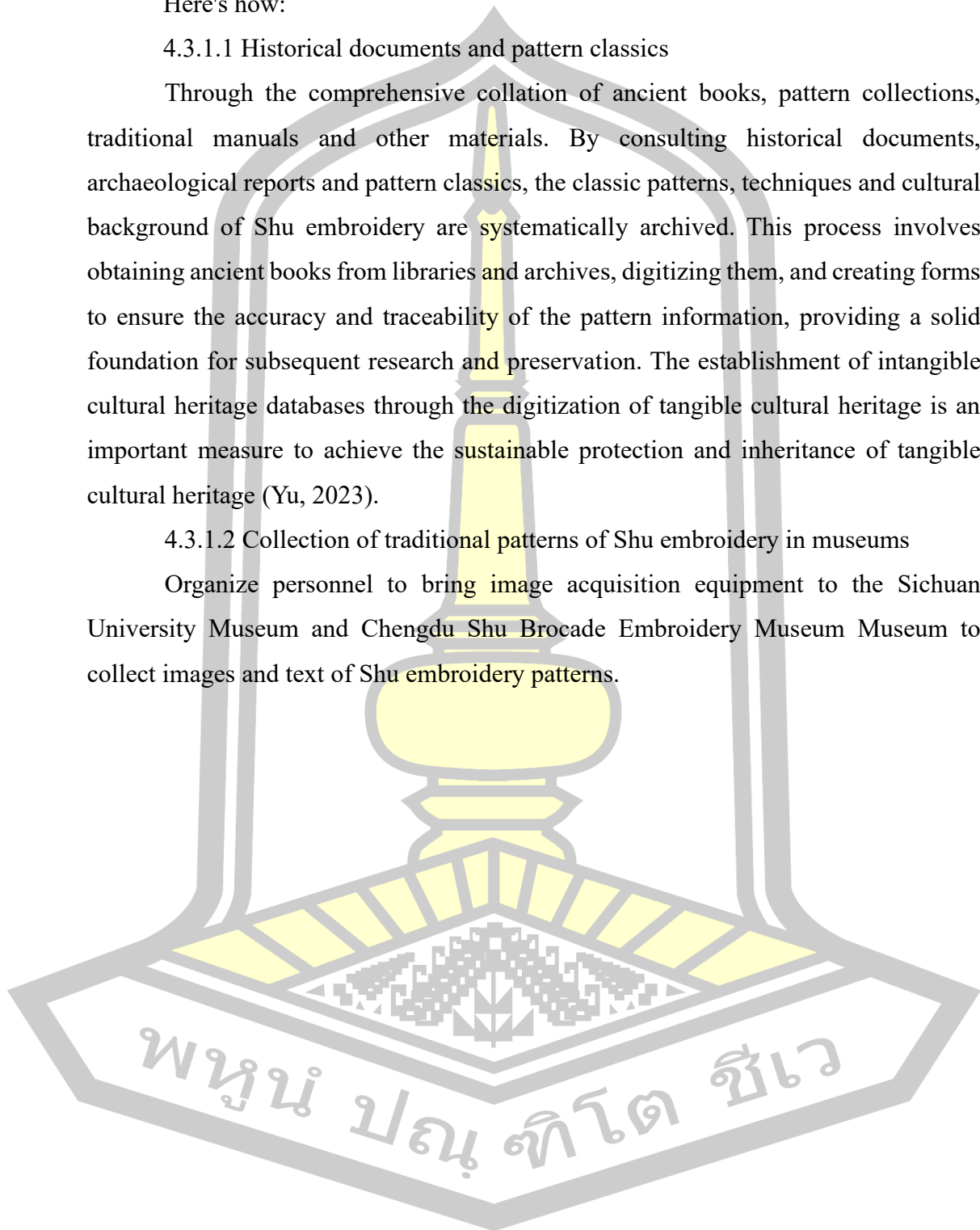
Here's how:

4.3.1.1 Historical documents and pattern classics

Through the comprehensive collation of ancient books, pattern collections, traditional manuals and other materials. By consulting historical documents, archaeological reports and pattern classics, the classic patterns, techniques and cultural background of Shu embroidery are systematically archived. This process involves obtaining ancient books from libraries and archives, digitizing them, and creating forms to ensure the accuracy and traceability of the pattern information, providing a solid foundation for subsequent research and preservation. The establishment of intangible cultural heritage databases through the digitization of tangible cultural heritage is an important measure to achieve the sustainable protection and inheritance of tangible cultural heritage (Yu, 2023).

4.3.1.2 Collection of traditional patterns of Shu embroidery in museums

Organize personnel to bring image acquisition equipment to the Sichuan University Museum and Chengdu Shu Brocade Embroidery Museum Museum to collect images and text of Shu embroidery patterns.



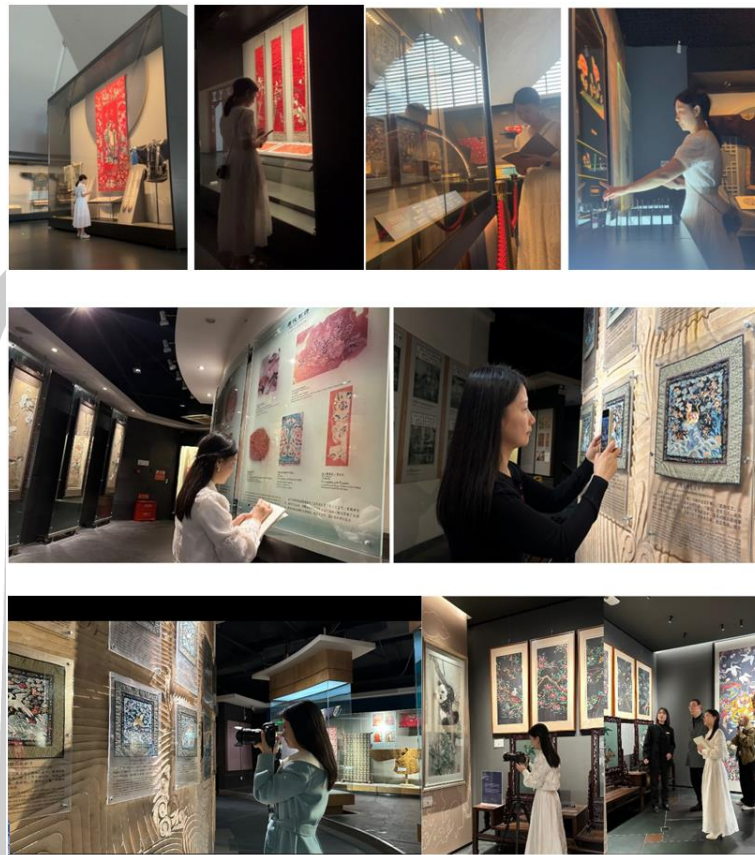


Figure 59 Collect and check patterns and text
Source: Liu Ying (2024)

The data of the traditional patterns of Shu embroidery in this paper are mainly from the Sichuan University Museum and the Chengdu Shu Brocade Embroidery Museum, which are used to obtain the data of Shu embroidery patterns, and some encyclopedia websites are used to partially supplement them when constructing the dataset



The main data fields selected for analysis are "Pattern Name", "Pattern Category", and "Pattern Image", and the "Inheritor Name", "Inheritor Gender", and "Pattern Dynasty" fields are also used in the later construction of the dataset. There are many kinds of Shu embroidery patterns, each with its own characteristics, and there is no very complete dataset for direct use, so it is necessary to construct a text corpus of Shu embroidery patterns when mining features. For the text analysis of Shu embroidery patterns, the name of the pattern is a condensation of skills, including the key points of traditional skills, and the field of pattern introduction contains a lot of information, such as the historical origin of Shu embroidery patterns, the content of traditional patterns,




the development of traditional patterns and stitches, etc., which can better reflect the information of Shu embroidery patterns. Through these letters, the corresponding information can be obtained and the Shu embroidery pattern can be described. The four fields of "Shu embroidery pattern category", "Shu embroidery pattern name", "Shu embroidery pattern diagram" and "Shu embroidery pattern meaning" can be a good supplement to the Shu embroidery pattern dataset, so these fields are also selected when constructing the dataset.


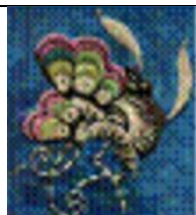

In the museum of Sichuan University, the embroidery patterns of Shu were collected, and some patterns of animals, plants, geometry, figures and other categories were collected from field investigations, photo records, and sorting out information. The main patterns are as follows:

In Shu embroidery, animal patterns are not only decorative, but also reflect the symbolic meaning of animals in traditional Chinese culture. In Shu embroidery, the selection and design of each animal are closely related to the meaning of its symbol, conveying the expectation and pursuit of a better life.

Table 17 Traditional patterns of Shu embroidery in animal parts

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
	dragon		Dragon-shaped patterns, often showing features such as long bodies, scales, and claws.	The dragon symbolizes power, dignity, prosperity and auspiciousness in Chinese culture. The dragon pattern in Shu embroidery is mostly used in the clothing of royal families or powerful figures, representing the spirit of the Son of Heaven.
	Phoen		The phoenix pattern is often manifested as a	The phoenix symbolizes peace, beauty, happiness and eternal life. When

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
animal	ix		feather abundance and a flying posture.	used with the dragon, it often symbolizes "the dragon and the phoenix are auspicious", representing family harmony and a happy marriage.
	deer		The deer-shaped pattern is an animal with slender limbs and a graceful posture, usually in a stationary or walking position.	The deer symbolizes longevity, wealth and career. The deer has the same sound as "Lu", which means that high-ranking officials are generous and have a smooth career, and are often used to wish a successful personal career.
	fish		Fish-shaped patterns, usually in a swimming posture, with distinct details.	Fish symbolizes wealth and good luck, especially "fish" and "yu", which means that there is a surplus every year, wealth and good luck.
	crane		Crane-shaped patterns, usually in the form of graceful flying postures, slender feathers, and	The crane symbolizes longevity, auspiciousness and nobility. In Chinese culture, cranes are often associated with longevity and fairyland, representing

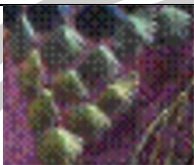

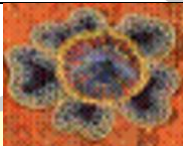
category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
			graceful postures.	otherworldliness and eternal life.
	magpie		The magpie-shaped pattern usually appears as a posture perched on a tree branch, and the feathers are elegant and delicate.	Magpie symbolizes joy, marriage, and reunion. The magpie announcement, which means good luck and happiness, is often used to bless marriage and family happiness.
	butterfly		Butterfly pattern, delicate wings, bright colors.	Butterflies often symbolize love, marriage, youth and freedom in Shu embroidery. The flutter of butterflies symbolizes love and the beauty of life.
	bat		The bat-shaped pattern has large, slender wings that usually appear to be flying or stationary.	The bat has the same sound as "Fu", symbolizing good fortune, good luck and good health. In Shu embroidery, bats are often used to express good luck, health and prosperity.





Source: Liu Ying (2024)




These plant patterns in the traditional patterns of Shu embroidery carry profound cultural connotations through their forms and meanings, and play an important role in the art of Shu embroidery. They are not only part of the aesthetic expression, but also carry the symbolic meaning of traditional culture, through inheritance and development, in the artwork endowed with multi-level emotions and

symbols, forming a unique cultural style of Shu embroidery.

Table 18 Traditional patterns of Shu embroidery in plant parts

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
Plants	pine		The pattern of the pine tree is characterized by a firm trunk and verdant foliage, often bearing the signs of age.	Pine symbolizes longevity, perseverance and tenacity. In Chinese culture, the pine tree is one of the "Three Friends of the Cold" (pine, bamboo, and plum), which symbolizes tenacity and long-term vitality.
	bamboo		The pattern of the bamboo is shown as a straight bamboo pole, lush bamboo leaves, and a full sense of rhythm.	Bamboo symbolizes ascension, perseverance and gentlemanly character. Bamboo is a symbol of "high wind and bright festival" in Chinese culture, which means unyielding loyalty and integrity.
	plums		The pattern of plum blossoms is usually characterized by lush foliage, flowers dotted on the branches, and bright colors.	Mei symbolizes perseverance and nobility, and is one of the "Three Friends of the Cold Year". Plum blossoms bloom in the harsh winter, representing tenacity, perseverance and the arrival of early spring, implying hope and new life.




category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
	lotus		The pattern of the lotus flower usually appears as a fresh, white flower, perhaps embellished with dew.	The lotus flower symbolizes purity, elegance and refinement. The lotus flower "comes out of the mud without staining", which means cleanliness and nobility, and is also one of the typical symbols in Chinese culture.
	pomegranate		The pomegranate has a pattern of multiple red fruits, which are round in shape and contain numerous seeds.	The pomegranate symbolizes fertility and prosperity. In traditional Chinese culture, pomegranates are a symbol of wealth, prosperity and family happiness.
	orchid		The pattern of the orchid usually appears as soft petals with a fresh fragrance.	The orchid symbolizes elegance, purity and integrity. In ancient times, orchids were often used to symbolize the character of a gentleman, implying a noble spirit and extraordinary temperament.
	peach blossom		The pattern of peach blossoms usually appears as pink or red	The peach blossom symbolizes love, beauty, and good luck. The peach blossom is a symbol of

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
			flowers, which are full of flowers and life.	spring in Chinese tradition, symbolizing the arrival of romance, warmth and love.
	chrysanthemum		Chrysanthemums have a pattern of five or more petals and are usually colorful when in full bloom.	Chrysanthemums symbolize longevity, nobility and strength. In Chinese culture, chrysanthemums represent the tenacity and nobility of life, especially in autumn and winter, when they can still bloom, implying tenacity and longevity.
	Bergamot		The pattern of bergamot is in the form of bergamot, which has a unique shape and is finger-shaped.	Buddha's hand symbolizes good luck, good fortune and good health. The form of bergamot symbolizes the "Five Blessings", which means health, wealth, longevity, happiness and tranquility.
	peony		The pattern of the peony usually appears as brightly colored flowers with abundant and gorgeous petals.	Peony symbolizes wealth, prosperity and magnificence. Peony is known as the "King of Flowers" in China, symbolizing wealth and dignity, and implying prosperity, wealth and good fortune.

Source: Liu Ying (2024)

The geometric patterns in the traditional patterns of Shu embroidery, each of them carries rich cultural symbols and aesthetic values. Through these patterns, Shu embroidery integrates the symbols and spiritual connotations of traditional culture in the expression of visual art, and also shows the unique artistic charm of Shu embroidery.

Table 19 Traditional patterns of Shu embroidery in the geometric category


category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
Geometry classes	Plate length		The disc stripe is made up of continuous curved lines, shaped like an endless ring, and the lines are intertwined to present an interlocking pattern.	The long pattern symbolizes eternity and circulation, implying long-term vitality, auspiciousness and prosperity. It is often used to express "longevity" and "endless blessings", representing the continuation of years and hope for the future.
	Anagram		The back pattern is composed of a series of symmetrical patterns in the shape of the word "Hui", usually showing a regular form of curves and straight lines.	The anagram symbolizes "return" and "rebirth", implying completeness, auspiciousness and harmony. In traditional Chinese culture, the echo pattern is often used to express the philosophy of "the unity of heaven and man" and "the return of stability", implying the harmony and stability of life or things.
	Swastika pattern		The swastika pattern is composed of a plurality of interconnected "10,000" shapes, and the shape is a combination of the	The swastika pattern symbolizes "Vientiane Renewal" and "Infinite Fortune", implying auspiciousness, happiness and wealth. It has a strong




category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
			"ten" glyph and the "mouth" glyph. It often forms a continuous pattern.	meaning of luck in traditional Chinese culture and is often seen as a symbol of good luck, wealth, and happiness.

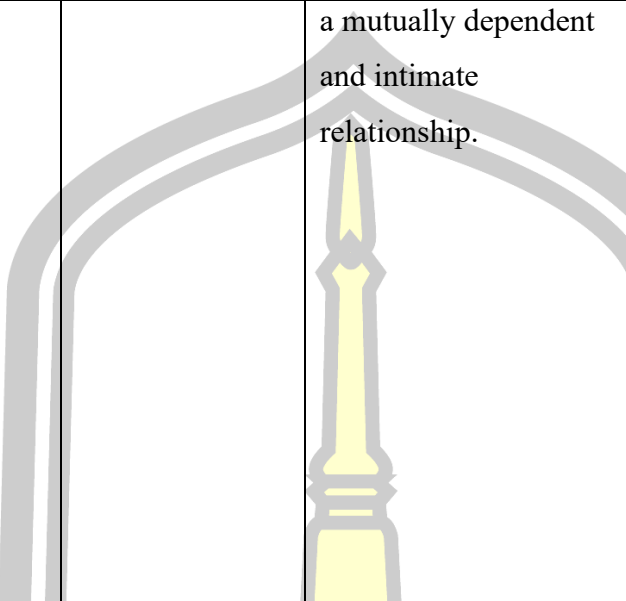
Source: Liu Ying (2024)

The character patterns in the traditional patterns of Shu embroidery are not only decorative artistic expressions, they contain profound cultural symbols and social values, showing the unique functions of Shu embroidery in art, life and emotional expression. Through these figures, Shu embroidery not only carries traditional cultural symbols, but also allows these symbols to obtain aesthetic presentation in daily life.

Table 20 Traditional patterns of Shu embroidery in the human figures

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
Character stories	opera		The patterns of opera characters are usually based on classic characters in local operas such as Peking Opera and Sichuan Opera, showing the facial expressions, costumes and movements of specific characters.	The patterns of Chinese opera convey the cultural essence of drama and express the performing arts and cultural symbols of traditional Chinese opera. It symbolizes "artistic inheritance" and "cultural prosperity", and is usually used to express respect and inheritance for the art of opera.


category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
	Birth day		The birthday star is usually a gray-haired, smiling old man, wearing a longevity hat and holding objects that symbolize longevity, such as dust whisks or peaches, and the image is kind and serene.	The birthday star pattern symbolizes longevity, health and good luck, implying longevity and family prosperity. It is often used in traditional culture to celebrate birthdays or pray for health and longevity, and to express blessings and respect for elders.
	children		Children's patterns mostly show innocent and lively children's images, often presented in postures such as holding toys and playing, dressed brightly and smiling.	The children's pattern symbolizes "innocence" and "vitality", symbolizes hope and the future, expresses blessings to the future generation, and entrusts the society's care and expectations for children.
	figure		The pattern of the two people usually shows a couple, often husband and wife or friends, side by side or hand in hand, showing	The pattern of the two symbolizes "harmony and contentment" and "love and affection", expressing loyalty and cooperation between

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
			a mutually dependent and intimate relationship.	husband and wife or friendship. It symbolizes mutual support and common progress in interpersonal relationships, and is often used for weddings, friendships and other blessing occasions.

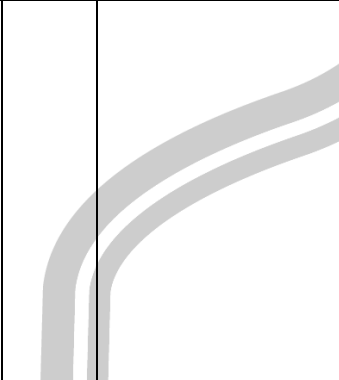
Source: Liu Ying (2024)

These natural patterns in the traditional patterns of Shu embroidery show the harmonious beauty of the natural world and the respect and dependence of human beings on the power of nature. They are not only the imitation of natural landscapes, but also the sustenance of cultural concepts and spirits, highlighting the philosophy of harmonious coexistence between man and nature.

Table 21 Traditional patterns of Shu embroidery in the natural category

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
Natural material	sun		The sun pattern usually appears as a round sun with a radiant center that may be accompanied by auspicious clouds or the image of a bird flying. The sun is often dominated by bright red, gold and other warm colors in	The sun pattern symbolizes "light and hope", meaning "new life" and "prosperity", representing strength, vitality and positive energy. In traditional culture, the sun is the source of life, and its appearance is often used to pray for good


category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
			Shu embroidery, with regular shapes and full of vitality.	luck in the future.
	cloud		The moiré pattern usually presents a curved and flowing shape, and the clouds are curly, sparsely changing, sometimes with a swirling sense of flow, often white, gray or blue, expressing the softness and lightness of the clouds.	The cloud pattern symbolizes "unpredictable" and "auspicious wishes", and means "the unity of heaven and man". Fortune rises". In traditional cultures, clouds are seen as carriers of the heavens, representing communication between heaven and earth, often associated with good luck, good fortune, and a turn of fortune.
	water		Water patterns are expressed in the form of flowing water, waves or ripples, and the patterns are smooth and soft, with flexible lines, often presented through cool colors such as blue and green. The	The water pattern symbolizes "wealth and blessing" and "flexibility", and means "smooth" and "smooth". "Moisturizing" and "Smooth". In traditional culture, water is the source of



category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
			shape of the water flow can express the movement and depth of the water.	life, symbolizing the cycle and circulation of wealth, wisdom and vitality. It is often used to express wishes for success and career progress.



Source: iu Ying (2024)

The patterns of utensils in the traditional patterns of Shu embroidery are used as independent patterns in Shu embroidery, or combined with other elements, carrying rich cultural symbols and spiritual meanings. They are not only the embodiment of decorative arts, but also reflect the pursuit of a better life, a happy family and a successful career in traditional Chinese culture.

Table 22 Traditional patterns of Shu embroidery in the utensils

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
Artifacts	Basket		The flower basket pattern is generally represented as a delicate basket containing various flowers, such as peonies, chrysanthemums, lotuses, etc., and the basket and flowers are intertwined. The colors are usually rich, often dominated by warm tones such as red, gold, and green.	The flower basket pattern symbolizes "wealth and auspiciousness", meaning "wealth", "prosperity" and ".Many sons and many blessings". The flower basket is filled with flowers that symbolize the five blessings, which are wishes for a better life and family happiness.

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
	Several cases		Several cases are represented by an ancient desk or coffee table, on which are often placed the four treasures of the study, tea sets or books, etc., which is very literati. The general color palette is simple, with wood or bronze as the main color.	The patterns of several cases symbolize the "scholarly family" and "cultural inheritance", implying "the prosperity of cultural luck" and ".Academic success". It represents a reverence and respect for culture, scholarship, and the literati way of life.
	vase		The vase pattern usually appears as a fine porcelain vase, which is filled with various auspicious flowers, such as plum blossoms, lotuses, orchids, etc. The vase has elegant shapes, delicate details and bright colors.	The vase pattern symbolizes "harmony and stability", "family happiness", "career success" and " noble". The flowers in the vase symbolize the continuation and prosperity of life, and the vase itself represents a warm and stable family life.


category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
	Fans		<p>The fan pattern usually appears as a round fan, and the fan surface may be painted with landscapes, people, flowers and other patterns, and the fan handle is usually relatively simple. The colors are mainly soft pink, light green, gold, etc.</p>	<p>The fan pattern symbolizes "elegance and softness", "gentleness" and "tranquility". The fan is usually an ornament of literati or women, expressing the pursuit of elegant life, as well as the feminine and restrained temperament.</p>
	Ancient money		<p>The ancient coin pattern usually appears as a round ancient copper coin, which may have patterns or symbols around it, and is often combined with mascots, such as Ruyi, birthday star, etc., and there will be some classic ornaments on the coin.</p>	<p>The ancient money pattern symbolizes "wealth and good luck", meaning "prosperous wealth" and "prosperous business". In traditional Chinese culture, ancient money is regarded as a symbol of fortune and fortune, and it is often used to wish success in business, wealth accumulation,</p>


category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
				and good luck.

Source: Liu Ying (2024)

Through the performance of pavilions and houses, the architectural patterns in the traditional patterns of Shu embroidery not only show the aesthetic characteristics of traditional Chinese architecture, but also convey people's yearning for an ideal living state and cherish the family and quiet life. In the art of Shu embroidery, these patterns are not only decorative, but also contain profound cultural implications, and have important social and cultural values.

Table 23 Traditional patterns of Shu embroidery in the architectural category

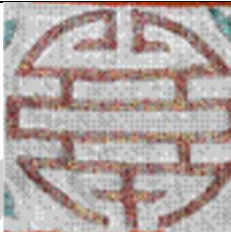
category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
building	kiosk		The pattern of the pavilion is usually shown as a delicate ancient pavilion, the roof is arched or corniced, and there are often natural scenes such as weeping willows and flowing water around, and the overall shape is elegant and unique. The pavilions are often carved with exquisite patterns, reflecting the traditional Chinese garden art style.	The pavilion pattern symbolizes "leisure and elegance", meaning "ease", "tranquility" and "harmony". Leisurely". As a place of rest, the pavilion represents people's enjoyment of nature and life, and entrusts the yearning for a peaceful, free and peaceful life.



category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
	house		<p>The pattern of the house is usually a traditional house, with a square roof in the form and prominent eaves, and there are often scenes such as courtyards, flower planting, and water release in the house, reflecting the harmonious family life and people's warmth and dependence on home.</p> <p>The details at the eaves are often meticulous and convey the traditional home culture.</p>	<p>The house pattern symbolizes "home and warmth", "family harmony" and "reunion and happiness". It represents the importance of family, warmth and tranquility in traditional Chinese culture, and conveys people's sense of belonging, stability and security at home.</p>

Source: Liu Ying (2024)

Shu embroidered traditional Chinese character patterns, which are both decorative and symbolic. They combine the power of words with art forms through exquisite craftsmanship to convey rich cultural connotations. Whether it is through the cultural atmosphere of poetry or concise and powerful text expression, the text patterns in Shu embroidery are not only the presentation of beauty, but also the inheritance and expression of traditional culture.

Table 24 The traditional patterns of Shu embroidery in the text category

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
writing	Poetry		<p>The poems and patterns are mostly based on ancient poems, famous sentences, poetry scriptures or ancient texts, usually presented in the form of calligraphy, with beautiful words and exquisite layouts, and are often combined with other patterns (such as flowers and birds, landscapes, characters, etc.) to form an overall picture with a strong cultural atmosphere.</p> <p>The content of the poems is often philosophical and emotional, conveying the ancients' perception of life, nature, life, etc.</p>	<p>The pattern of the poem symbolizes "culture and wisdom", and implies "elegant taste" and "spiritual pursuit". They are not only the display of words, but also the embodiment of cultural heritage, entrusting the yearning for a better life and the respect for ideals and morality.</p>

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
	writing		<p>Text patterns generally use short auspicious words, blessings or idioms, such as "Fu", "Lu", "Shou", "Hi", etc., the glyphs are often designed to be upright and atmospheric, and the strokes are powerful, conveying positive and positive emotions.</p>	<p>The text pattern symbolizes "blessing and auspiciousness", meaning "happiness, wealth, longevity and prosperity". They express good wishes for family, life and society through concise language, and convey positive energy and auspiciousness.</p>
	Separate text		<p>A single character pattern refers to the presentation of a single character in the embroidery, often a Chinese character with a deep cultural meaning or traditional symbol. For example, "Fu", "Shou", "Xi", "An" and other words, appearing in embroidery in a concise and powerful way. It is often found in highly decorative,</p>	<p>The individual text pattern symbolizes "spiritual sustenance and cultural symbols", meaning "blessings and prayers". This pattern usually represents people's pursuit of a better life and expectations for the future, and is an important form of emotional expression and cultural identity.</p>

category	name	Pattern drawing	Tattoo meaning	The meaning of the pattern
			simple but profound works.	

Source: Liu Ying (2024)

4.3.1.3 Expert interviews

Through interviews with the inheritors and craftsmen of Shu embroidery, I have obtained a lot of valuable first-hand information about Shu embroidery patterns. Shu embroidery patterns are derived from natural landscapes and traditional culture, such as "Meilan Bamboo Chrysanthemum" represents festival and personality, and phoenix birds, dragons, peonies, etc. symbolize auspiciousness, strength and wealth. The craftsmen introduced the meticulous production process of Shu embroidery, emphasizing the use of different stitches, such as flat needles, random needles and pick needles, each suitable for different pattern effects. The inheritor also pointed out that although the traditional Shu embroidery has maintained a unique artistic style, with the changes of the times, modern elements have been added to the traditional pattern design, which not only retains the cultural connotation, but also meets the market demand. However, Shu embroidery faces the challenges of an aging population of inheritors and a lack of participation from the younger generation, while the wave of commercialization and mechanization has put pressure on traditional crafts. The results of the interviews provide an important practical basis for my research. This information will become the basis for my further research on Shu embroidery patterns, and help me better capture the essence and innovation potential of Shu embroidery in the construction of knowledge map.

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Figure 60 Shu Embroidery Museum inheritors Peng Shiping and Liu Ying
Source: Liu Ying (2024)

4.3.1.4 Existing digital resources

Make use of the existing digital Shu embroidery pattern library or related databases. The use of the existing digital Shu embroidery pattern library or related databases can provide rich resource support for the research of Shu embroidery. These databases contain a large number of Shu embroidery pattern images, craft descriptions and historical backgrounds, providing valuable first-hand information for academic research, heritage protection and innovative design. Through data mining and analysis, researchers can better understand the evolution of Shu embroidery patterns, explore their cultural connotations, and combine modern technology to carry out innovative design of patterns, providing new ideas for the inheritance and development of traditional crafts.

(i) Keyword search for collection:

Enter relevant keywords in the Baidu gallery search box, such as "Shu embroidery pattern", "traditional embroidery pattern", "Chinese embroidery", etc., to get the Shu embroidery pattern image. Use different combinations of keywords to search for relevant patterns as comprehensively as possible. By browsing the search results, filter out the pictures related to the Shu embroidery pattern for download. Check

the copyright information of the images to make sure that the captured images are used within the scope of the law.

Enter relevant keywords in the Baidu gallery search box, such as "Shu embroidery pattern", "traditional embroidery pattern", "Chinese embroidery", etc., to obtain the Shu embroidery pattern image, the method is as follows:

Step 1: Use different keyword combinations to search for relevant patterns as comprehensively as possible, browse the search results, screen out the pictures related to the Shu embroidery pattern, and pay attention to filter out the pattern images with high quality and high image definition, so as to facilitate subsequent digitization. Check the copyright information of the images to make sure that the captured images are used within the scope of the law.

Step 2: Image Processing

Image cleanup: Use image processing software to crop the collected image, remove watermarks, unnecessary parts of the edges, etc., ensure the integrity of the image content, and adjust the contrast, brightness, saturation and other parameters of the image to enhance the visual effect of the image (Yu, 2023).

Step 3: Image Format Conversion:

Convert images to standard digital formats (such as PNG, JPEG, etc.) for subsequent application and sharing, save images with appropriate resolution, and ensure the clarity of images when displayed on digital platforms.

(ii) Collect patterns through Python tools

Web crawler is a tool that captures data by identifying web page URLs, and is often used to capture data, and the popular data collection software, plug-ins, and methods on the market mainly include :Python crawler, Hou yi collector, and octopus software (Fu, 2024). Among them, the Python crawler can automatically extract the URL of the web page and extract it in turn, supporting a variety of downloads, which can achieve relatively powerful functions, but requires a certain programming foundation. Hou yi collector is a desktop software, can be divided into two ways to collect, one of the intelligent mode is suitable for the more public, simple structure of the web page, the whole process through the Baidu gallery in the Shu embroidery pattern digital collection of crawling method involves web page data capture and image processing technology. The following is a basic crawling process, which requires some

programming knowledge and skills to implement:

Environment preparation: Programming language: Python. Libraries: requests, BeautifulSoup, selenium, pillow, os, time, browser drivers: such as chromedriver, which is used to work with Selenium to automatically crawl dynamically loaded content.

Crawl steps

Step 1: Page Analysis

Open the Baidu gallery and search for keywords related to Shu embroidery patterns.

Use the browser developer tools (F12) to analyze the structure of the web page and find the HTML element where the image is located.

Step 2: Request the web page, use the requests library to send an HTTP request to get the HTML content of the Baidu gallery search result page. The python copy code is as follows

```
import requests

url = 'https://image.baidu.com/search/index?tn=baiduimage&word=蜀绣纹样'
response = requests.get(url)
page_content = response.text
```

Step 3: Parse the HTML content, use BeautifulSoup to parse the HTML of the web page, and extract the URL link of the image.

```
from bs4 import BeautifulSoup

soup = BeautifulSoup(page_content, 'html.parser')
images = soup.find_all('img') # 找到所有img标签
image_urls = [img['src'] for img in images if 'src' in img.attrs]
```

Step 4: Handle dynamic loading, if the page is dynamically loaded content, use Selenium to emulate browser actions.

```

from selenium import webdriver

driver = webdriver.Chrome(executable_path='/path/to/chromedriver')
driver.get('https://image.baidu.com/search/index?tn=baiduimage&word=蜀绣纹样')
soup = BeautifulSoup(driver.page_source, 'html.parser')
# 和上面类似的方式提取图片链接
driver.quit()

```

Step 5: Download the image, use requests to download the extracted image URL, and save it to your local computer.

```

import os

save_dir = 'shuxiu_images'
os.makedirs(save_dir, exist_ok=True)

for idx, url in enumerate(image_urls):
    img_data = requests.get(url).content
    with open(os.path.join(save_dir, f'image_{idx}.jpg'), 'wb') as handler:
        handler.write(img_data)

```

Step 6: Handle the anti-crawler mechanism, set the request header or use proxy IP rotation to simulate human access to avoid triggering the anti-crawler mechanism.

```

headers = {
    'User-Agent': 'Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.124 Safari/537.36'
}
response = requests.get(url, headers=headers)

```

Step 7: Image Processing

Use Pillow or other image processing libraries to process the captured images, such as cropping, format conversion, adding watermarks, etc.

```

from PIL import Image

img = Image.open('path_to_image')
img_cropped = img.crop((left, top, right, bottom))
img_cropped.save('path_to_cropped_image')

```

Step 8: Storage & Management

The collected images are classified and stored, and their sources, use rights and other information are recorded for subsequent sorting and application.

Legal and ethical considerations: Before scraping data, it is important to ensure that the use of the relevant website is in accordance with the terms of use and copyright policy of the relevant website to avoid infringement of intellectual property rights.

More than 2,000 patterns were collected through the tool, and some of the contents are as follows:

Dragon pattern: In the process of the development and evolution of dragon patterns, not only the form continues to evolve, but people also combine dragon patterns with other patterns and themes to give them different meanings to show auspiciousness (Huang, 2022). Among them, the dragon and phoenix pattern depicts the dragon and the phoenix echoing each other, playing and dancing among the flowers, auspicious clouds, sea water and other ornaments. The dragon is the length of the scale insect, the phoenix is the king of the birds, all of them are auspicious things, the dragon and the phoenix are matched, often called "the dragon and the phoenix are auspicious", symbolizing happiness and auspiciousness.



Figure 61 Dragon pattern
Source: Liu Ying (2024)

Phoenix pattern: "Xiao Shao Jiu cheng, Phoenix Comes to the Ceremony" and other records appeared, the phoenix began to be given the symbolic meaning of the slave society, and the phoenix pattern also presented more solemn images. In the Qin and Han dynasties, the decoration and vividness of the phoenix pattern reached a new height, no longer presenting a monotonous and stereotypical image, but more flexible and tense.

With the introduction of Buddhism, the phoenix pattern of the Wei and Jin dynasties began to integrate plants and flowers, and the form became lighter and more

elegant. In the Tang Dynasty, the phoenix pattern entered another mature period, with a plump and agile image, not confined to a single form, and closer to life (Mao, 2022).

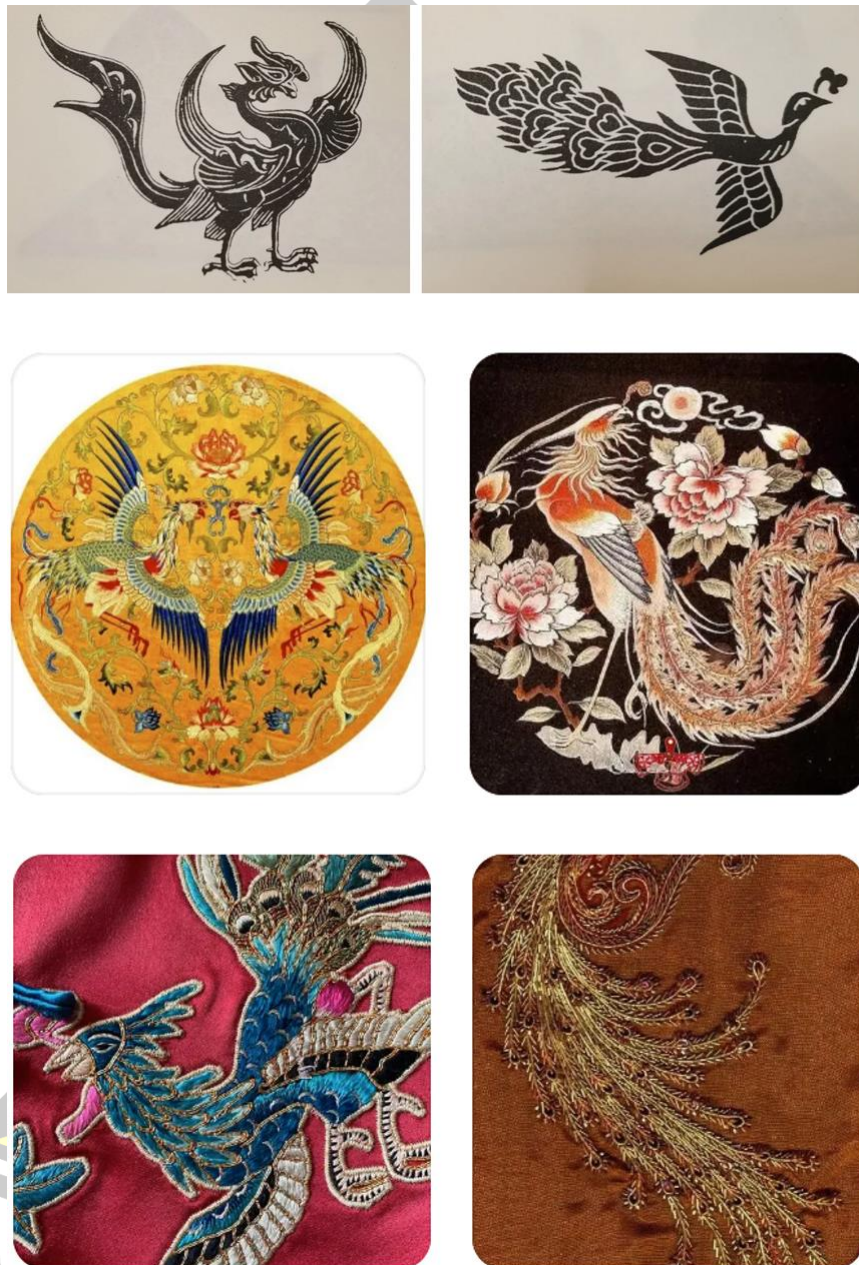


Figure 62 Phoenix pattern
Source: Liu Ying (2024)

Fish Pattern: "Historical Records of Zhou Benji" said that Zhou has birds and fish. and ""Taiping Yulan Volume 935 Customs He said: "The life of Boyu is suitable for iron." Confucius Fish, Jia thought Rui, hence the name carp, the word Bo fish. It shows that fish is also a kind of rui in the minds of the ancients. Han Dynasty portrait stone Most of the fish patterns are carp, and they are often painted in the same place

with dragons and phoenixes. At the same time, fish has the blessed meaning of fertility and fertility.



Figure 63 Fish pattern
Source: Liu Ying (2024)

lotuslineIt is a traditional Chinese flower. EryaThere is "Lotus, Fu qu..... In fact, the record of "lotus", the ancient name Fu qu or Furong, is now calledlotus When it is in full bloom, the flowers are larger, it can be seen when it bears fruit, it is edible, the leaves are round and protruding, and it was used as a decoration in the Spring and Autumn Period and the Warring States Period. Since Buddhism was introduced into China, the lotus flower has been used as a symbol of Buddhism, representing the "Pure Land", symbolizing "purity" and meaning "auspiciousness". The lotus flower is therefore inBuddhist artIt became the main decorative theme. Especially during the Northern and Southern Dynasties, Buddhism became extremely popular with the widespread spread of Buddhism. It can be found everywhere on stone carvings, ceramics, bronze mirrors and paintings. There are many variations in the forms of single line and double line, wide flap, treasure, convex, frontal, side, individual, continuous, monochrome, color, engraving and chiseling. It was also more prevalent in later

dynasties. It is one of the allegorical patterns commonly used in ancient times.



Figure 64 Even the pattern
Source: Liu Ying (2024)

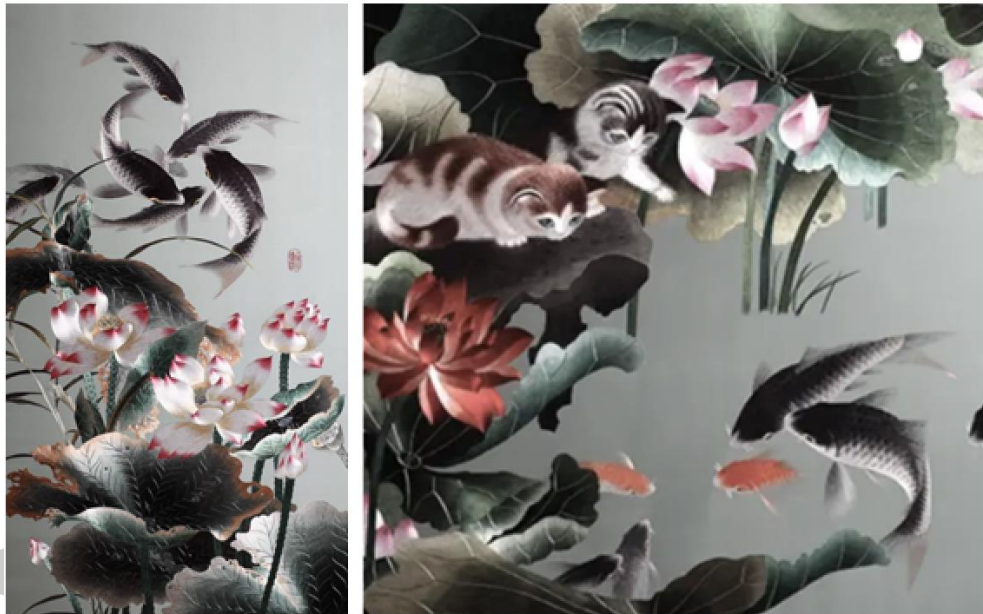


Figure 65 Koi Lotus
Source: Liu Ying (2024)

4.3.2 Construct a knowledge graph ontology database of traditional patterns of Shu embroidery

At present, the development of artificial intelligence has entered a new stage, and its rapid development is profoundly changing human social life and changing the world, becoming a new focus of international competition and a new engine of economic development. Among them, how to obtain useful information from massive data is an important issue for artificial intelligence. Knowledge graph technology

provides a means to extract structured knowledge from massive text and image data, and is the core technology of search engines, question and answer systems, etc. In the "Development Plan for the New Generation of Artificial Intelligence" issued by the State Council, it is clearly pointed out that it is necessary to develop "knowledge computing engines and knowledge service technologies", focusing on breakthroughs in the core technologies of knowledge processing, deep search and visual interaction, realizing the automatic acquisition of continuous increment of knowledge, and having the capabilities of concept recognition, entity discovery, attribute prediction, knowledge evolution modeling and relationship mining, so as to form a multi-source, multi-disciplinary and multi-data type cross-media knowledge graph covering billions of entity scales (Wang, 2018) .

A knowledge graph is a graphical model for representing and organizing structured knowledge. It represents information such as entities, concepts, relationships, and attributes in the real world in the form of graphs, forming a network structure composed of nodes and edges. These nodes represent entities or concepts in the real world, and edges represent relationships or connections between them. Knowledge graphs can be used to represent knowledge in various domains, such as natural language processing, the semantic web, artificial intelligence, and more. It can help machines understand and process information, support applications such as search engines, question answering systems, recommendation systems, and provide an intuitive way for humans to organize, browse, and query knowledge. Here are the basics about knowledge graphs:

(i) Concepts and Definitions. Entity: The basic unit in the knowledge graph, which represents a specific thing or concept, such as people, places, events, etc. Attributes: Describe the characteristics and attributes of the entity, such as the pattern name, connotation, history, and so on. Relationship: The relationship between entities, such as the relationship between patterns and connotations.

(ii) components of a knowledge graph. Nodes: Represents an entity. Edges: Represent relationships between entities. Attributes: Descriptions attached to nodes or edges.

(iii) the construction of knowledge graphs. Data sources: The data of the knowledge graph can come from structured data (such as databases), semi-structured

data (such as XML, JSON), unstructured data (such as text), etc. Data extraction: Extracting useful information from raw data, which often involves natural language processing (NLP) techniques. Entity recognition and disambiguation: Identify entities in data and solve the problem of homonyms. Relationship extraction: Identify relationships between entities from data. Graph construction: Construct the extracted entities and relationships into a graph structure.

(iv) the application of knowledge graphs. Search Engines: Enhance the accuracy and relevance of search results, such as Google's Knowledge Graph. Intelligent Q&A: Support for natural language Q&A systems, such as smart assistants (such as Siri and Alexa) that can answer complex questions. Recommender system: Recommend relevant content by analyzing user behavior and interests. Data integration: Bring together data from disparate sources to form a unified view of knowledge.

Knowledge graph has a wide range of application prospects in the field of artificial intelligence and big data, and with the development of technology, its application will be more extensive and deeper.

4.3.2.1 Define concepts and classes

Determine the technical schools, inheritors, historical events and other entities of Shu embroidery patterns in the knowledge graph, and extract the relationship between the patterns and the technical schools, and the influence of historical events on the development of the patterns (Feng, 2021). Protegé software is mainly used for the construction of ontologies in the semantic web, and is the core development tool for the construction of ontologies in the semantic web, and establishes the triplet of the historical development of Shu embroidery patterns, the triplet of Shu embroidery pattern classification, and the connotation triplet of Shu embroidery pattern expression.

(i) Through the collected data, establish a triplet relationship table related to the historical development of Shu embroidery patterns, covering the origin, development, influence, and inheritance of Shu embroidery patterns.

The importance of knowledge graphs: In today's data-driven era, data has become the new oil, and knowledge graphs are the refinery for us to refine this oil. Knowledge graphs, a technology that structures representations of real-world entities and the complex relationships between those entities, provide an effective way for machines to understand human knowledge systems. By organizing data into a network,

knowledge graphs can not only help us better understand the meaning behind data, but also reveal hidden connections between data to support a variety of intelligent applications. In many fields, knowledge graphs have shown immeasurable application potential. It can help healthcare practitioners quickly identify links between diseases and symptoms, assist financial analysts in assessing credit risk, and even improve the consumer shopping experience through personalized recommendation systems. These use cases are not limited to enhancing the intelligence of existing systems, but also include the development of new services and products, which greatly promote the innovation and development of the industry.

Representative models of knowledge representation learning mainly include distance model, bilinear model, neural tensor model, matrix factorization model, translation model, etc. This paper adopts the ransG model, which argues that a relationship may correspond to multiple semantics, and each semantic can be represented by a Gaussian distribution. The TransG model takes into account the different semantics of the relation r , and uses the Gaussian mixture model to describe the relationship between the head and tail entities of each triplet (h, r, t) in the knowledge base, which has a high degree of entity discrimination.

As a general representation of the knowledge base, triples can represent entities, relationships and complex semantic relationships between them in a more direct way through representation learning. However, there are still a lot of information related to the entities and relationships of the knowledge base in the Internet that have not been considered or effectively utilized, and if these multi-source and heterogeneous relevant information are fully integrated and utilized, it will be conducive to further improve the discrimination ability and performance of the existing knowledge representation model.

Table 25 Historical development triplet of Shu embroidery patterns

numbering	Subject	relationship	object
1	Shu embroidery pattern	origin	Bashu region
2	Bashu region	Cultural influences	Shu embroidery pattern

numbering	Subject	relationship	object
3	Shu embroidery pattern	Period of origin	Han dynasty
4	Han dynasty	develop	Shu embroidery skills
5	Shu embroidery pattern	develop	tang dynasty
6	tang dynasty	popular	Dragon and phoenix pattern
7	Shu embroidery pattern	representative	Rich pattern
8	Rich pattern	embodiment	Tang Dynasty court culture
9	Shu embroidery pattern	develop	Song dynasty
10	Song dynasty	peculiarity	Fine and soft
11	Shu embroidery pattern	develop	Yuan Dynasty
12	Yuan Dynasty	effect	Mongolian culture
13	Shu embroidery pattern	develop	Ming dynasty
14	Ming dynasty	peculiarity	The lines are sleek
15	Shu embroidery pattern	develop	Qing Dynasty
16	Qing Dynasty	popular	Dragon pattern
17	Shu embroidery pattern	affected	Central Plains Culture
18	Central Plains Culture	Fusion	Bashu culture
19	Shu embroidery pattern	Affected	Court culture
20	Court culture	drive	Shu embroidery is

numbering	Subject	relationship	object
			prosperous
21	Shu embroidery pattern	characteristic	Brilliant colors
22	Brilliant colors	representative	Rich and auspicious
23	Shu embroidery pattern	Fusion	Taoist culture
24	Taoist culture	manifestation	Tai Chi pattern
25	Shu embroidery pattern	Fusion	Buddhist culture
26	Buddhist culture	manifestation	Auspicious motifs
27	Shu embroidery pattern	evolution	Modern Shu embroidery
28	Modern Shu embroidery	peculiarity	Innovative design
29	Innovative design	include	Modern elements
30	Modern elements	apply	Shu embroidery pattern
31	Shu embroidery pattern	retain	Traditional skills
32	Traditional skills	Inheritance	Intangible Cultural Heritage Protection
33	Intangible Cultural Heritage Protection	facilitate	The development of Shu embroidery
34	The development of Shu embroidery	depend	Inheritor
35	Inheritor	Year of birth	20th century
36	20th century	magnum opus	Splendid Mountains and Rivers
37	Shu embroidery pattern	develop	digitization

numbering	Subject	relationship	object
38	digitization	apply	Shu embroidery preservation
39	Shu embroidery preservation	manner	Electronic Archives
40	Electronic Archives	content	Shu embroidery pattern
41	Shu embroidery pattern	Cover	Tradition and modernity
42	Shu embroidery pattern	show	Cultural heritage exhibitions
43	Cultural heritage exhibitions	exhibit	Shu embroidery boutique
44	Shu embroidery boutique	contain	Classic pattern
45	Classic pattern	embodiment	History and culture
46	Shu embroidery pattern	retain	Traditional colors
47	Traditional colors	representative	Red, yellow, green
48	Shu embroidery pattern	disseminate	Modern Media
49	Modern Media	nudge	Shu embroidery is popular
50	Shu embroidery is popular	outcome	Cultural identity

Source: Liu Ying (2024)

These triplet relationships are helpful to construct a knowledge map of the historical development of Shu embroidery patterns, which can be used to understand their evolution, integration and inheritance processes in various periods.

(ii) The knowledge graph entity triplet table of Shu embroidery pattern classification, which covers the classification, structure, color, theme and cultural

connotation of Shu embroidery patterns, which is helpful to fully understand the characteristics of Shu embroidery patterns and their applications in different aspects.

Table 26 Triplet table of Shu embroidery pattern classification

numbering	entity	relationship	object
1	Shu embroidery	contain	Animal patterns
2	Shu embroidery	contain	Botanical pattern
3	Shu embroidery	contain	Geometric patterns
4	Animal patterns	type	Dragon pattern
5	Animal patterns	type	Phoenix pattern
6	Animal patterns	type	Tortoise
7	Animal patterns	type	Tiger stripes
8	Botanical pattern	type	Peony flowers
9	Botanical pattern	type	chrysanthemum
10	Botanical pattern	type	lotus
11	Botanical pattern	type	bamboo
12	Geometric patterns	type	Square pattern
13	Geometric patterns	type	Circular pattern
14	Geometric patterns	type	Triangular pattern
15	Geometric patterns	type	Staggered pattern
16	Animal patterns	style	tradition
17	Botanical pattern	style	nowadays
18	Geometric patterns	style	classic
19	Dragon pattern	peculiarity	symmetry
20	Phoenix pattern	peculiarity	radiation
21	Tortoise	peculiarity	Cascade
22	Tiger stripes	peculiarity	Linear
23	Peony flowers	peculiarity	abundant
24	chrysanthemum	peculiarity	succinct
25	lotus	peculiarity	nature

numbering	entity	relationship	object
26	bamboo	peculiarity	freshen
27	Square pattern	structure	rectangle
28	Circular pattern	structure	annular
29	Triangular pattern	structure	Conical
30	Staggered pattern	structure	interweave
31	Animal patterns	color	red
32	Botanical pattern	color	green
33	Geometric patterns	color	blue
34	Dragon pattern	color	Golden
35	Phoenix pattern	color	orange
36	Tortoise	color	green
37	Tiger stripes	color	black
38	Peony flowers	color	pink
39	chrysanthemum	color	Yellow
40	lotus	color	white
41	bamboo	color	cyan
42	Square pattern	color	grey
43	Circular pattern	color	purple
44	Triangular pattern	color	red
45	Staggered pattern	color	green
46	Dragon pattern	Techniques	embroidery
47	Phoenix pattern	Techniques	embroidery
48	Tortoise	Techniques	embroidery
49	Tiger stripes	Techniques	embroidery
50	Peony flowers	Techniques	embroidery
51	chrysanthemum	Techniques	embroidery
52	lotus	Techniques	embroidery
53	bamboo	Techniques	embroidery
54	Square pattern	Techniques	embroidery

numbering	entity	relationship	object
55	Circular pattern	Techniques	embroidery
56	Triangular pattern	Techniques	embroidery
57	Staggered pattern	Techniques	embroidery
58	Dragon pattern	topic	mythology
59	Phoenix pattern	topic	auspicious
60	Tortoise	topic	longevity
61	Tiger stripes	topic	Mighty
62	Peony flowers	topic	Rich
63	chrysanthemum	topic	Noble
64	lotus	topic	freshen
65	bamboo	topic	naive
66	Square pattern	topic	stable
67	Circular pattern	topic	harmonious
68	Triangular pattern	topic	forge ahead
69	Staggered pattern	topic	complex
70	Dragon pattern	culture	Chinese tradition
71	Phoenix pattern	culture	Folklore
72	Tortoise	culture	Life wishes
73	Tiger stripes	culture	Symbol of power
74	Peony flowers	culture	A symbol of affluence
75	chrysanthemum	culture	Symbol of high and clear
76	lotus	culture	A symbol of innocence
77	bamboo	culture	A symbol of simplicity
78	Square pattern	culture	Symbol of stability

numbering	entity	relationship	object
79	Circular pattern	culture	Symbol of harmony
80	Triangular pattern	culture	A symbol of progress

Source: Liu Ying (2024)

(iii) construct the connotation of the expression of Shu embroidery patterns in a triple, showing the cultural background, symbolic meaning and expectation of a better life contained in its artistic creation. Describe the connotation, cultural background, theme and symbolic meaning of Shu embroidery patterns.

Table 27 Triple table of connotations expressed by Shu embroidery patterns

numbering	entity	relationship	object
1	Dragon pattern	expression	Power and majesty
2	Phoenix pattern	expression	Auspicious and beautiful
3	Peony flowers	expression	Wealth and prosperity
4	chrysanthemum	expression	Noble and elegant
5	lotus	expression	Purity and nobility
6	Tiger stripes	expression	Courage and strength
7	Tortoise	expression	Longevity and stability
8	Dragon pattern	connotation	Myths and legends
9	Phoenix pattern	connotation	Folklore
10	Peony flowers	connotation	A symbol of affluence
11	chrysanthemum	connotation	Symbol of high and clear
12	lotus	connotation	A symbol of innocence
13	Tiger stripes	connotation	A symbol of might
14	Tortoise	connotation	Life wishes
15	Dragon pattern	culture	Traditional Chinese culture
16	Phoenix pattern	culture	Folk culture

numbering	entity	relationship	object
17	Peony flowers	culture	Affluent culture
18	chrysanthemum	culture	Qinggao culture
19	lotus	culture	Pure culture
20	Tiger stripes	culture	A culture of strength
21	Tortoise	culture	Culture of longevity
22	Dragon pattern	topic	Myths and legends
23	Phoenix pattern	topic	Auspicious and beautiful
24	Peony flowers	topic	Wealth and prosperity
25	chrysanthemum	topic	Noble and elegant
26	lotus	topic	Purity and nobility
27	Tiger stripes	topic	Courage and strength
28	Tortoise	topic	Longevity and stability
29	Dragon pattern	symbol	Emperors and powers
30	Phoenix pattern	symbol	Happiness and prosperity
31	Peony flowers	symbol	Rich and noble
32	chrysanthemum	symbol	Elegance and purity
33	lotus	symbol	Purity and elegance
34	Tiger stripes	symbol	Strength and courage
35	Tortoise	symbol	Longevity and stability
36	Dragon pattern	significance	Mystery and authority
37	Phoenix pattern	significance	Beauty and happiness
38	Peony flowers	significance	Prosperity and affluence
39	chrysanthemum	significance	Purity and elegance
40	lotus	significance	Innocence and elegance

Source: Liu Ying (2024)

4.3.2.2 Construction of traditional pattern sample body of Shu embroidery

(i) Definition of Ontology

The concept of ontology first appeared in the field of philosophy and belongs to the branch of "metaphysics", which focuses on the relationship between the essence of entities and existence. Ontology is often used to describe complex knowledge in different fields, which is abstracted from the objective world, contains the conceptual model of basic terms and the relationship between terms in a certain field, is a common cognition of the group, and is a recognized set of concepts in the corresponding field (Li, 2023). Scholars such as Neches were the first to introduce ontologies into the field of artificial intelligence, who defined ontologies as "definitions that give the basic terms and relationships that make up the vocabulary of the relevant domain, and the rules that define the extension of those words using these terms and relations." Gruber came up with a defining of ontology in 1993 that has influenced us to this day: "An ontology is a clear normative description of a conceptual model". On the basis of Gruber, the German scholar Studer defines ontology as "a formal specification of a shared conceptual model", which includes four meanings: "sharing, conceptualization, clarity, and formalization".

There are many descriptive languages for ontologies, among which RDF (Resource Description Framework) and Web Ontology Language (OWL) are the most common.

(ii) the constituent elements of the ontology Generally speaking, ontologies are mainly composed of five elements: Classes, Properties, Functions, Axioms, and Instances.

Classes, also known as concepts, usually group multiple instances with similar properties into one category, for example, Shu embroidery patterns can be grouped together. Classes have a certain hierarchical structure, such as determining the first-level classification such as "plant pattern" and "animal pattern", and the second- and third-level classification such as "pine", "plum", "deer" and "phoenix". Defining classes and their hierarchies typically takes a top-down approach (defining the broadest concepts in the domain first, then refining them) or bottom-up (defining the most specific concepts in the domain first, and then generalizing).

Object properties are used to describe classes and play a certain role in restricting classes. Functions, a special kind of relationship. In order for ontologies to

have a clearer semantic and logical structure, it is also necessary to define the relationships between the various categories. The main relationships include: "containing" relationships: Shu embroidery works contain multiple patterns and techniques. "By... "Creation" relationship: the inheritor or designer creates Shu embroidery works. "Use" relationship: Shu embroidery works use specific techniques and colors. "Allegorical" relationship: Some patterns have specific cultural meanings.

Data attributes are the specific data embodiment of object attributes in the ontology, which is used to describe the specific data of class instances. For example, for Shu embroidery works, the data attributes may include the year of creation, creator, etc.; For patterns, the data attributes may include the meaning of the pattern, genre, and so on.

Axioms, i.e., universally recognized truths, can be derived from other related axioms by deduction. In the construction of Shu embroidery ontology, axioms can define the hierarchical structure between classes, the relationship between classes, and the constraints of attributes. Hierarchical axioms: Shu embroidery works are composed of multiple patterns, techniques, etc., and patterns are part of Shu embroidery works. Axiom of creation: Shu embroidery works must be created by an inheritor, and the inheritor must use certain techniques when creating. Axiom of attribute constraints: The allegorical attribute of a pattern is a non-empty string and must describe the cultural or artistic meaning of the pattern.

An instance, which represents an actual case in a specific class. Instances are specific data items in the knowledge graph that represent practical applications of classes. For example, specific examples of Shu embroidery works, specific pattern types, specific inheritors, etc. For example, in example 1, the "Hibiscus Koi Diagram" is a concrete example in the "Auspicious Ruyi Category" category. Example 2 "Peony pattern "Meaning" is a specific example of "wealth and auspiciousness".

Inference rules: Using the inference engine, automatic inference can be performed based on known Shu embroidery data (Haas, 2007). For example, reasoning about the cultural background of a Shu embroidery work, reasoning about the techniques that may be used in the work, etc. By setting inference rules, the system can provide more accurate and comprehensive knowledge support in the query and inference process. Reasoning example 1: If the Shu embroidery work has a pattern type

of "peony flower", and the colors of the work use "red" and "green", then the work may convey the meaning of "auspicious wishes" or "prosperity". Reasoning Example 2: If a lineage reaches 30 years and has learned the "flat needle" and "chaotic needle" techniques, then he or she can be inferred to be a master of Shu embroidery techniques. Rule of reasoning 3: If a Shu embroidery work contains a "peony pattern" and its color system is "warm color", the meaning of the work may be "wealth" or "auspiciousness". Rule of reasoning 4: If the year of creation of a Shu embroidery work is 2010 and it uses the "chaotic needle" technique, it is likely that the work was created by a modern inheritor.

(iii) Ontology building tools

Protégé is an open-source ontology editing tool that is widely used to build and manage ontologies. Using the Protégé tool, we can create the ontology structure of Shu embroidery patterns, define the different patterns, technical schools, cultural backgrounds and symbolic meanings of Shu embroidery, and transform the pattern information in Shu embroidery culture into a form that can be processed by machines, so as to promote the storage, query, analysis, reasoning and other functions of the patterns.

Protégé Software is a subsidiary of Stanford University School of Medicine Bioinformatics. The research center is based on: Java Ontology editing and language development Knowledge acquisition Software, or ontology Development tools, which is also a knowledge-based editor, belongs to Open source software. This software is mainly used for: semantic web The construction of ontologies is in the semantic web Ontology construction core development tools.

Protégé provides the ontology Conceptual classes, relationships, properties, and instances, and masking concrete ontologies Describe the language, the user only needs to be in Conceptual level on Domain ontology Model building. The following is the operation process of constructing the sample body of Shu embroidery pattern:

Preferred, data import

The collected class data command will be constructed, Individual:@[Entity Class Column Name]*; types:@[Column name of the class to which it belongs]*; Imported into the Protégé software.

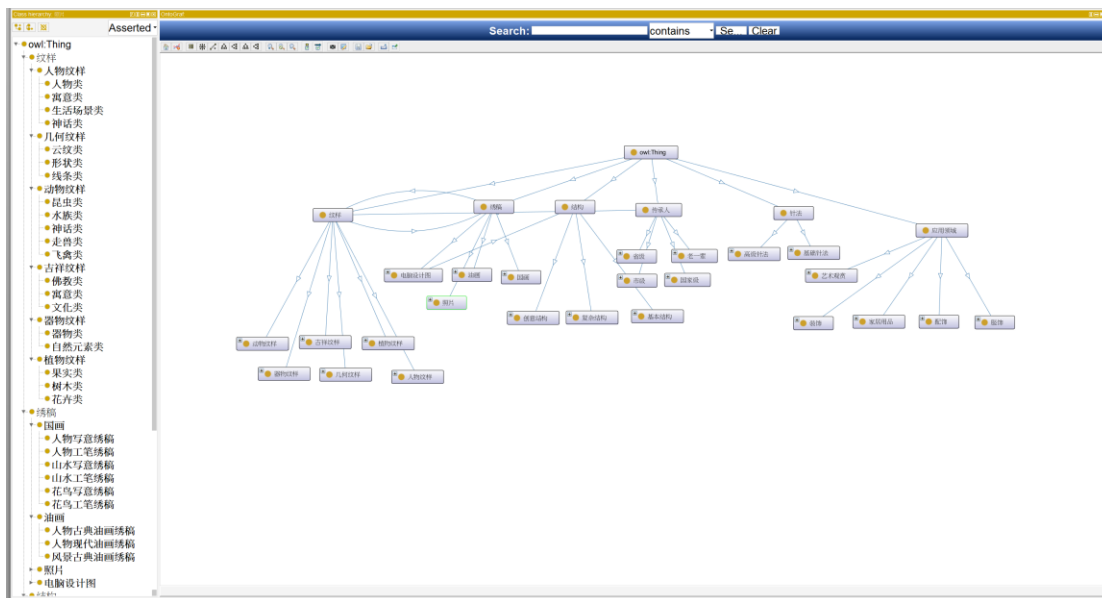


Figure 66 Data import
Source: Liu Ying (2024)

The left side of Figure 67 shows the classification of Shu embroidery patterns in the system, as shown in Table 28. On the right is the hierarchical relationship of the classification table, part of the content can be viewed, because all the content is too much, it is displayed in layers and rows, and the classification level is detailed in Table 1 based on the knowledge graph classification of Shu embroidery patterns.

Table 28 Classification of knowledge graph based on Shu embroidery patterns

Level 1 classification	Secondary classification	Three-level classification
dynasty	ancient times	Xia Dynasty, Shang Dynasty, Zhou Dynasty, Qin Dynasty, Han Dynasty, Three Kingdoms, Jin Dynasty, Northern and Southern Dynasties, Sui Dynasty, Tang Dynasty, Song Dynasty, Yuan Dynasty, Ming Dynasty, Qing Dynasty, Modern Dynasty
	nowadays	
Patterns	Animal patterns	Panda pattern, phoenix pattern, dragon pattern, elephant pattern, sheep pattern, fish pattern, acne pattern, pinnacle pattern, bat pattern, owl pattern, claw pattern, Fu pull

Level 1 classification	Secondary classification	Three-level classification
		<p>pattern, turtle pattern, monkey pattern, tiger pattern, pepper pattern, deer pattern, horse pattern, cow pattern, pavit pattern, Pu Lao pattern, deer unicorn pattern, lion pattern, four god pattern, squirrel pattern, squirrel pattern, squirrel, gluttonous pattern, frog pattern, eagle pattern, butterfly pattern, magpie pattern, crane pattern, pulsatilla pattern, brocade pattern,</p>
	Botanical pattern	<p>Bamboo pattern, pine pattern, hundred flower pattern, treasure pattern, grass insect pattern, twig pattern, melon fruit pattern, banana leaf pattern, chrysanthemum pattern, curly grass pattern, peacock pattern, orchid pattern, lotus petal pattern, lotus pattern, Ganoderma lucidum pattern, rhombic pattern, plum pattern, peony pattern, grape pattern, honeysuckle pattern, pomegranate pattern, persimmon pattern, persimmon pattern, peach pattern, group pattern, hydrangea pattern, folded branch pattern</p>
	Auspicious pattern	<p>Bagua pattern, eight auspicious, treasure pestle pattern, Fulu Shouxi, fame and wealth, melon climbing, sea house timing, Lianzhong Sanyuan, Ruyi pattern, Sanyang Kaitai, Suihan Sanyou, copper coin pattern, word pattern, text pattern, happy meeting, bud word pattern, - root vine, fistula pattern, jade bird pattern, Yutang wealth, miscellaneous treasure</p>

Level 1 classification	Secondary classification	Three-level classification
		pattern, bamboo report peace
	Geometric patterns	Hook moire, valley pattern, back pattern, brocade pattern, bead pattern, pu pattern, zigzag pattern, milk nail pattern, rope pattern, rope pattern, stripe
	Patterns of utensils	Wave pattern, Bogu pattern, landscape pattern, ribbon pattern
	Character patterns	Eight Immortal Patterns, Hundred Sons Playing Dragon Lanterns, Chang'e Running to the Moon, Blowing the Sheng, Flying Patterns, Gao Shi Patterns, Harmony Two Immortals, Bang Hai Playing Jin Toad, Lu Bu Playing Diao Chan, Magu Xianshou, Cowherd and Weaver Girl, Farming Map, Nuwa Mending the Sky, Human Face Pattern, Eighteen Bachelors, Lady Pattern, Heavenly Official Blessing, Wulun Tu Five Sons Winning the Championship, Dance Pattern, Fisherman's Family Fun Map, Fishing Wood Cultivation Reading, Zhongdao Map, Seven Sages of the Bamboo Forest
subject matter	Nature themes	Flowers, trees, landscapes, animals
	Character themes	Historical figures, mythological figures, folklore, heroic figures
	Religious themes	Buddhism, Taoism, folk beliefs, totems and symbols
	Love story	Romantic love, tragic love, marital love

Level 1 classification	Secondary classification	Three-level classification
	Poetry and Literature	Poetry, literature
implied meaning	Auspicious meaning	Longevity, wealth, well-being, happiness, peace, prosperity
	Symbolism	Love, friendship, affection, tenacity, courage, nobility, vitality, vitality
	Cultural symbols	Dragon and phoenix are auspicious, five blessings, double happiness, and mascots
	Religious and cultural symbols	Religious and cultural symbols
Inheritor	National inheritor	An important master of Shu embroidery and the inheritor of intangible cultural heritage
	Provincial inheritor	Contemporary Shu embroidery inheritor, craftsman, artist
	Municipal inheritor	
Embroiderer	Master of embroidery	Well-known Shu embroidery artist and craftsman
	Local embroiderers	Sichuan embroidery artists, craftsmen
stitch	Basic stitching	Flat needles, cross needles, rolling needles, pull needles, plum blossom needles, etc
	Advanced stitching	Three-dimensional stitching, gold stitching, silver filigree embroidery, bead embroidery, etc
color	Traditional colors	Traditional colors such as red, yellow, blue, green, white, and black
	Modern colors	Cross-cultural colors, fashionable colors, innovative color combinations

Level 1 classification	Secondary classification	Three-level classification
structure	Basic structure	Straight lines, curves, symmetry, asymmetry
	Complex structures	Multi-layered, multi-angle design, three-dimensional effect, fusion of patterns and textures
	Creative structure	Modern design thinking, free-form structure, innovative art structure
Embroidery	Traditional chinese painting	Chinese Painter, Chinese Painter, Senior Chinese Painter, First-Class Chinese Painter, Special Chinese Painter, Chinese Painting Master
	oil painting	Master Painter, Senior Painter, Intermediate Painter, Junior Painter
	Photo	Junior Photographer, Intermediate Photographer, Senior Photographer, Photographic Technician, Senior Photographic Technician
	Computer blueprints	Entry-level, beginner, intermediate, senior, art director, design director
Pattern evolution	Traditional pattern	
	Modern pattern innovation	
	Genre influence	Renaissance, Baroque, Rococo, Neoclassicism, Romanticism, Modernism, Art Deco, Bauhaus
place	museum	Sichuan University Museum, Chengdu Shu Brocade Embroidery Museum, Anjing Town Shu Embroidery Museum
	Private collection	

Level 1 classification	Secondary classification	Three-level classification
	store	

Source: Liu Ying

Then, click on Objectproperties and click Addsubproperties in the screen that appears, add object properties, and define the relationship between the patterns, such as "belongsTo" and "symbolizes". The addition of relational data is completed, as shown in Figure 68.

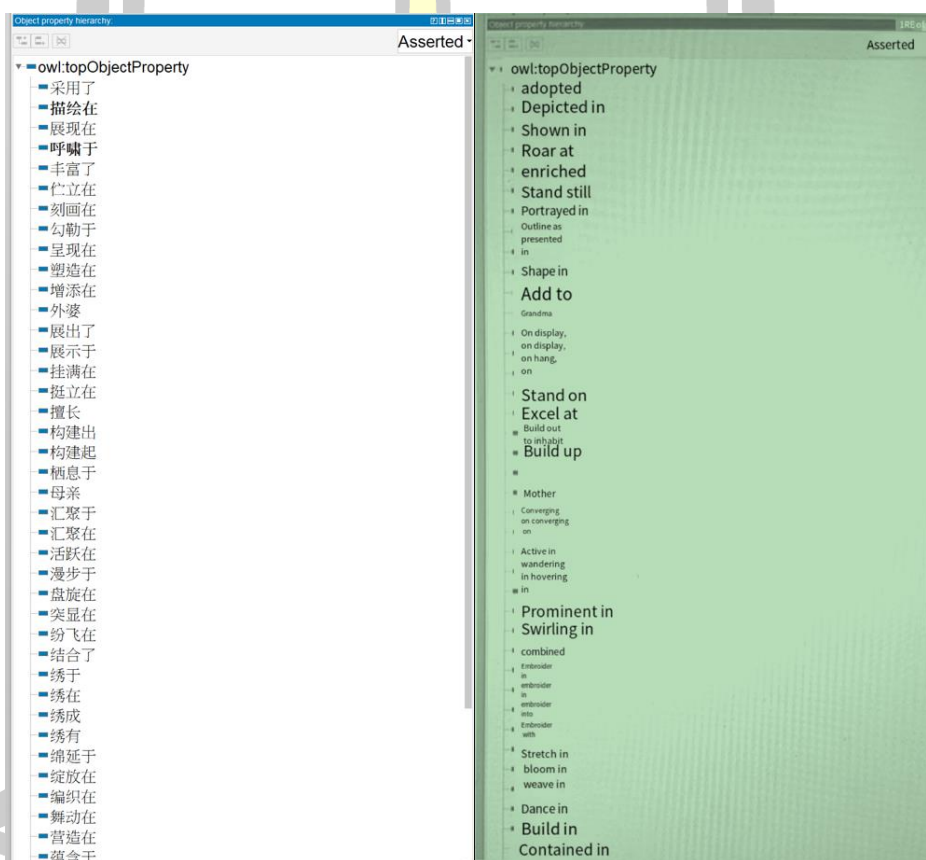


Figure 67 Adding Object Properties

Source: Liu Ying (2024)

Then, add data attributes to describe the specific characteristics of the pattern, such as "color", "stitching", and "historical background", and then add descriptions, as shown in Figure 69.

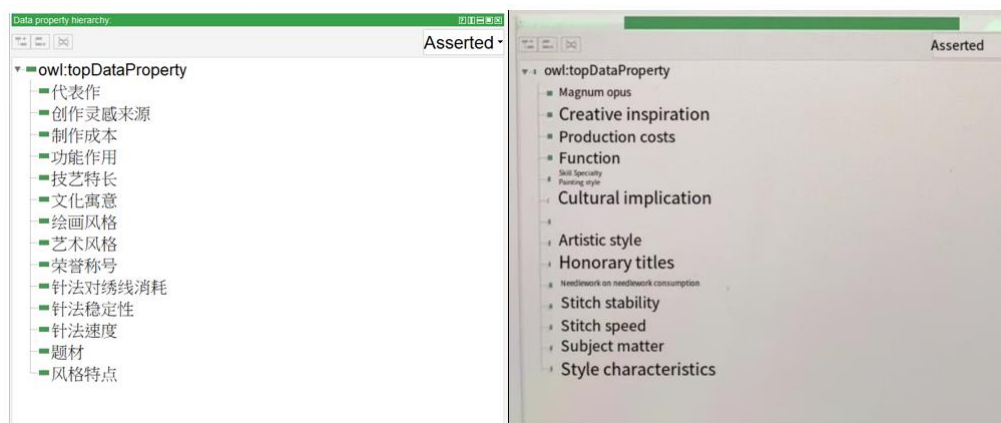


Figure 68 Adding data attributes

Source: Liu Ying (2024)

Add attributes to entities to instantiate specific Shu embroidery patterns, such as "panda pattern" instantiated into a specific pattern, and assign object attributes and data attributes. When completed, it is shown in Figure 70.

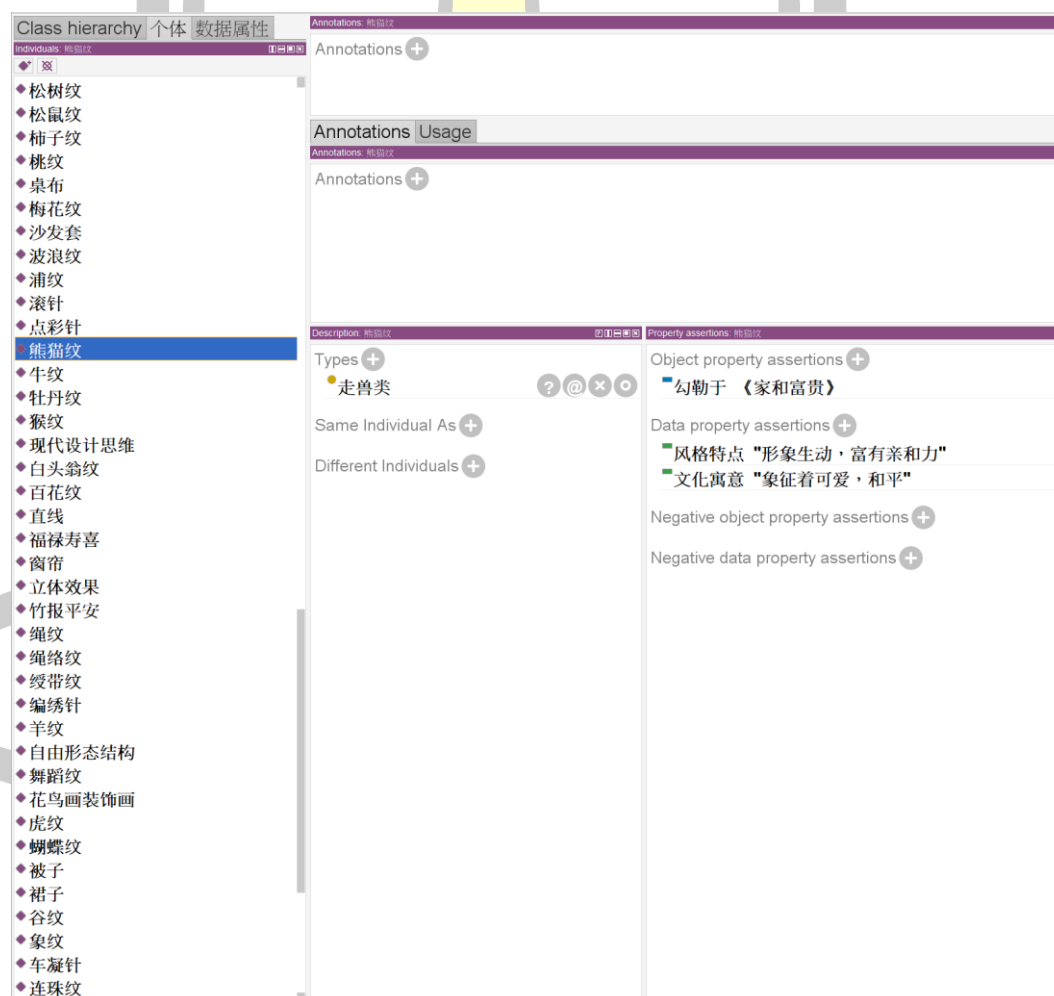


Figure 69 Shu embroidery pattern entity

Source: Liu Ying (2024)

In Figure 70 the left side shows the name of the pattern in the ontology database of the knowledge graph of Shu embroidery patterns, when the "panda pattern" is selected, the type of "panda pattern" displayed in the middle is beasts, and the right side shows the style characteristics of "panda pattern", cultural meaning, and the appearance in the work of "family and wealth".

4.3.2.3 Reasoning and completion of traditional patterns of Shu embroidery

The inference tool is Hermit, an open-source OWL ontology inference machine, which is based on the Datalog inference algorithm. It is able to reason about OWL ontologies to infer implicit knowledge and relationships in ontologies, helping developers quickly build and modify complex ontologies. When adding object attributes, add inference relationships, and then use the Hermit tool for inference, and complete the knowledge graph data through the data obtained by inference. For inference, when adding object attributes, it is necessary to pay attention to adding inference relations, as shown in Figure 130, adding inference relations, which contain the relationships that represent the embodiment.

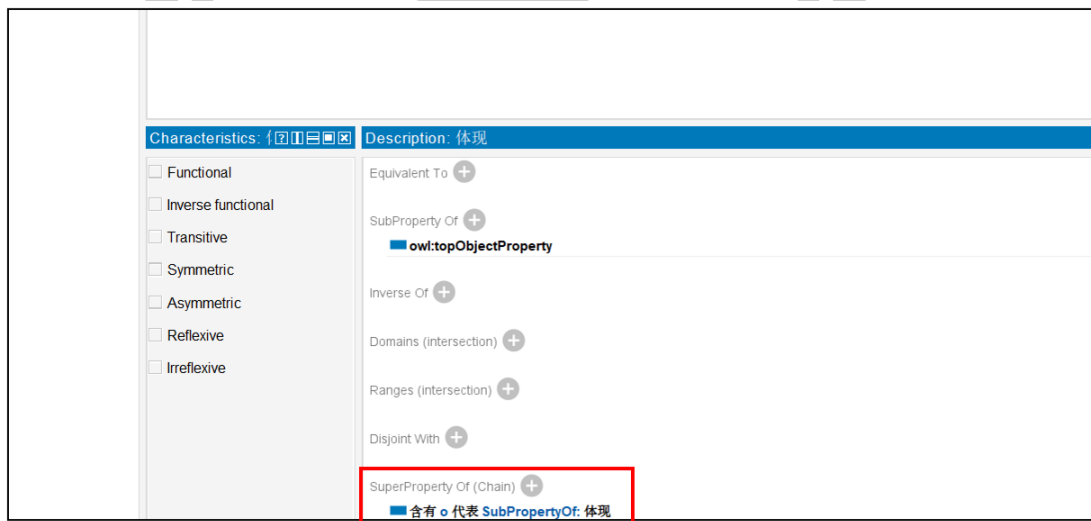


Figure 70 Inference relationship
Source: Liu Ying (2024)

Figure71 In the red box, the content of the reasoning formula is displayed, and the reasoning formula is set to "contain" plus "represents" as "embodiment", and the data is completed according to the set formula according to the existing data in the sample body library of Shu embroidery pattern.

Find Reasoner in the navigation bar, select the built-in inference HermiT, and select Startreasoner to start, and you can see the results of relational inference. The following two sets of reasoning results show that in the Shu embroidery works, the hundred flowers contain flowers, and the flowers reflect magnificent, and the use of the inference device can know that the hundred flowers reflect the magnificence.

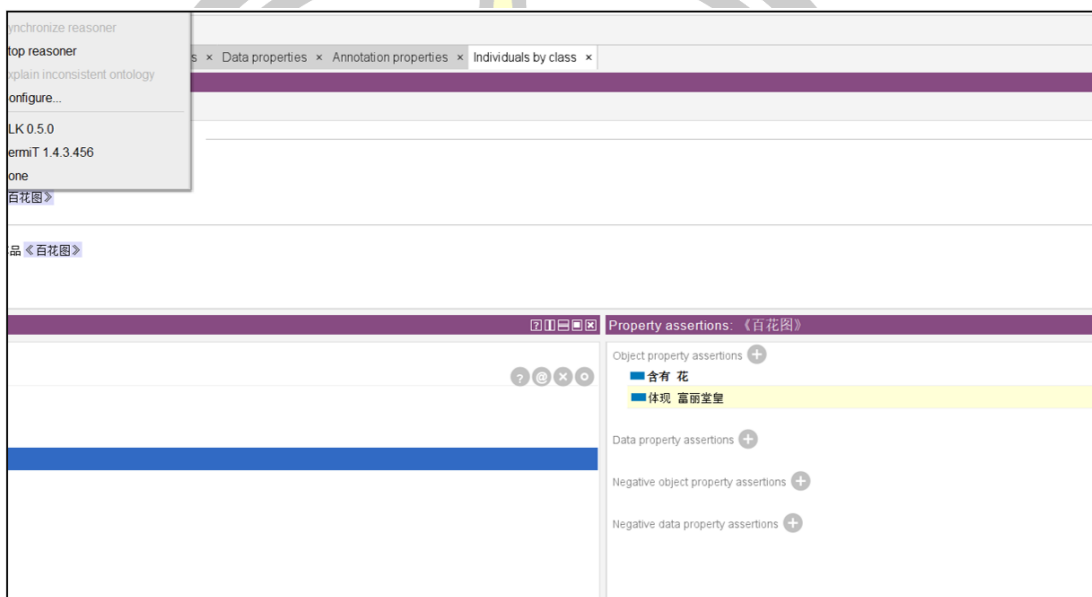


Figure 71 Inference results
Source: Liu Ying (2024)

Figure 72, the yellow part, is the new data inferred by the inference formula, the original data relationship only corresponds to "flower", and the new data relationship adds the meaning of "magnificent". The data in yellow will be automatically loaded into the knowledge graph ontology database, making the data richer.

To export the inference result, you can click Exportinferredaxiomsasontology in the File, then select the content we want to export, select the save path, and save the inference data. Complete the construction of the knowledge graph ontology library of traditional patterns of Shu embroidery.

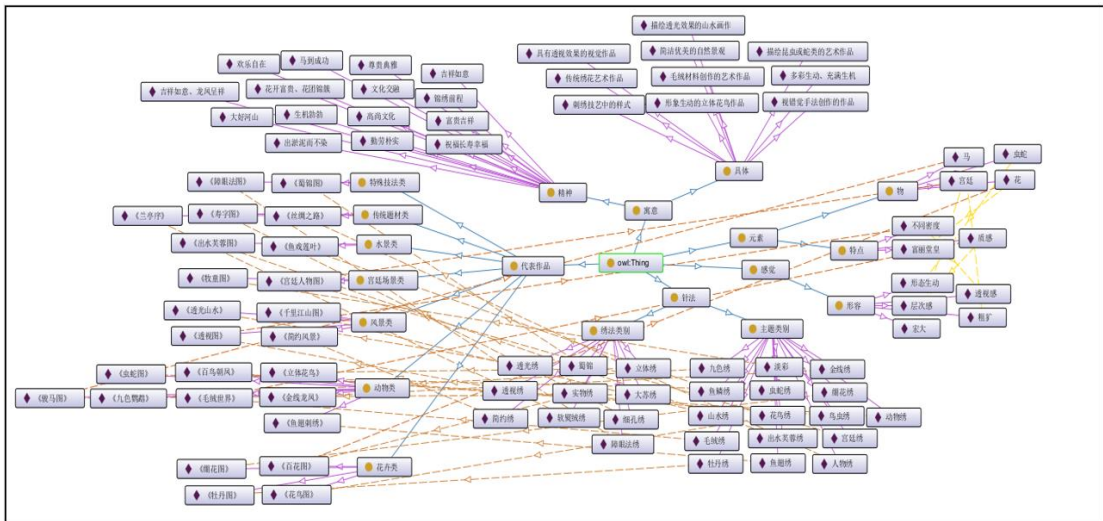


Figure 72 Visualization of the traditional patterns of Shu embroidery
Source: Liu Ying (2024)

Figure 73 The main content of the knowledge graph ontology database of traditional patterns of Shu embroidery is displayed in a visual way, which shows the history, name, meaning, color, structure, origin, inheritor and other information of Shu embroidery patterns, providing data support for subsequent intelligent and innovative patterns.

Summary: Through the realization of the classification of Shu embroidery by the Protege tool, we have a better understanding of the traditional art of Shu embroidery, and help people better understand the history, style, craftsmanship and cultural background of Shu embroidery, so as to promote the inheritance, development and promotion of Shu embroidery. By classifying Shu embroidery, people can better distinguish different types of Shu embroidery works and better appreciate and collect them. In addition, classifying Shu embroidery also helps to protect the regional characteristics and traditional skills of Shu embroidery, so that more people can understand and love this traditional craft. Ultimately, this will help promote the prosperity and development of the Shu embroidery industry and promote the inheritance and innovation of cultural traditions.

4.3.3 Intelligent Shu embroidery traditional pattern innovation

Through the knowledge graph ontology library of traditional patterns of Shu embroidery, intelligent innovation is carried out

With the OntoGraf visualization tool, people can graphically display and find relevant information in complex data structures to help analyze the relationships between data. The construction of a digital system to guide the inheritance and protection of intangible cultural heritage.

OntoGraf checks the classification of Shu embroidery and whether the entities under the category match, and whether the relationship attributes and data attributes between entities are complete and correct.

4.3.3.1 Visualization of traditional patterns of Shu embroidery based on knowledge graph

(i) The visual display of the knowledge graph of traditional patterns of Shu embroidery is as follows:

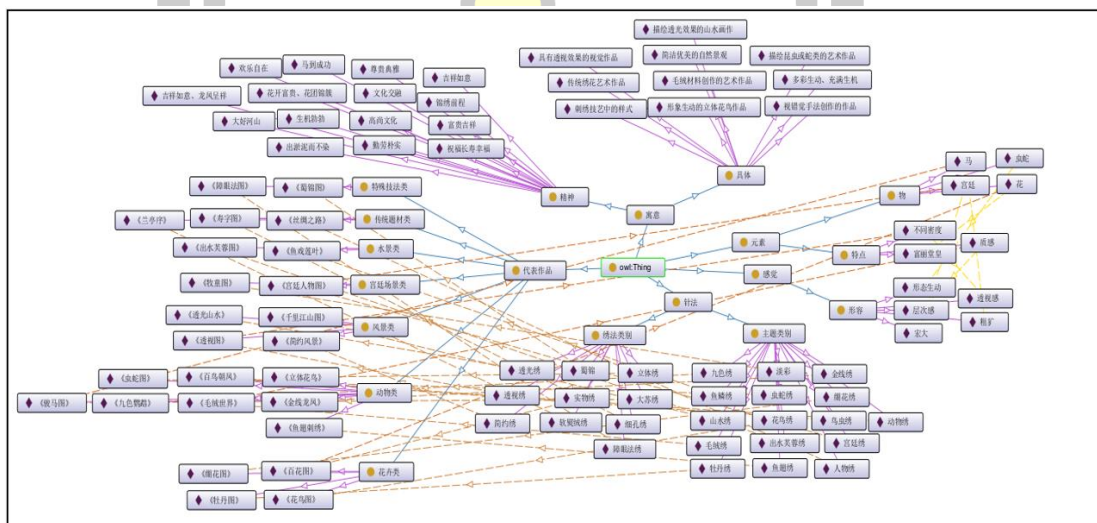


Figure 73 Visualization of traditional patterns of Shu embroidery
Source: Liu Ying (2024)

(ii) Visual display of traditional patterns of Shu embroidery

In the knowledge map of traditional patterns of Shu embroidery, patterns are an important component, and their complex structure and multi-dimensional correlation can be clearly presented through visual display. In Figure 75, the display includes animal patterns, plant patterns, character patterns, geometric patterns, etc., through the nodes and relationships of the knowledge graph, the historical background, cultural implications, design logic and specific applications of these patterns in Shu embroidery works can be revealed. Through the dynamic visualization function of the knowledge graph, you can see the multi-dimensional data structure of the pattern and its

relationship with other patterns, techniques and cultures at a glance.

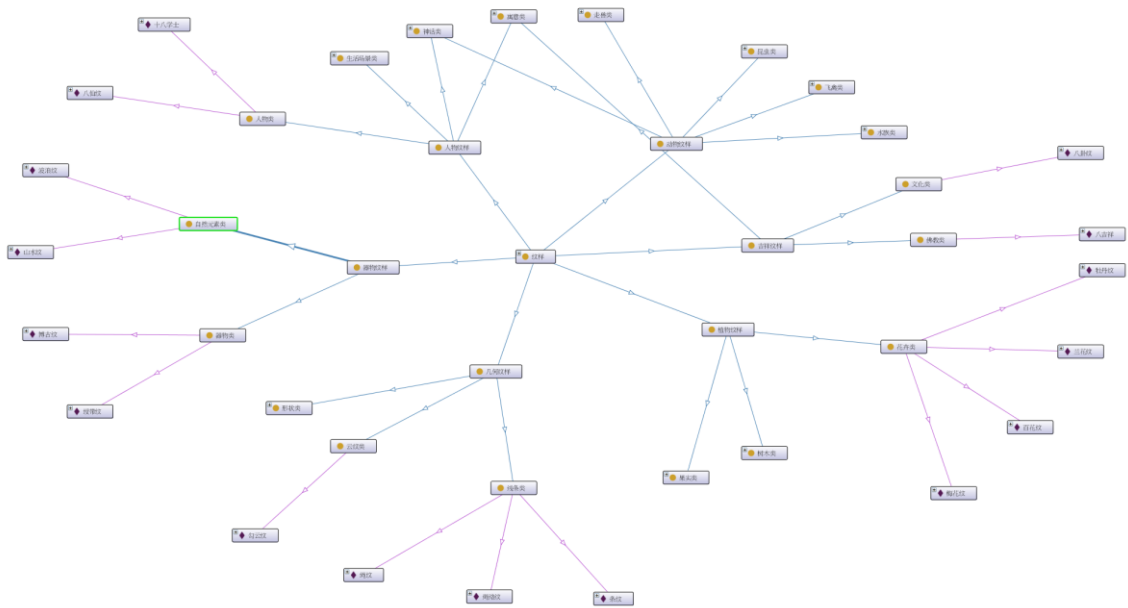


Figure 74 Visualization of traditional patterns of Shu embroidery
Source: Liu Ying (2024)

(iii) Visual display of embroidery drafts of traditional patterns of Shu embroidery

Figure 76 shows the content of the pattern embroidery in the ontology database of the traditional pattern knowledge graph of Shu embroidery, which is divided into oil painting, Chinese painting, photos, computer design drawings, the name of the designer of the embroidery, the name of the work of the embroidery, and the relationship between them.

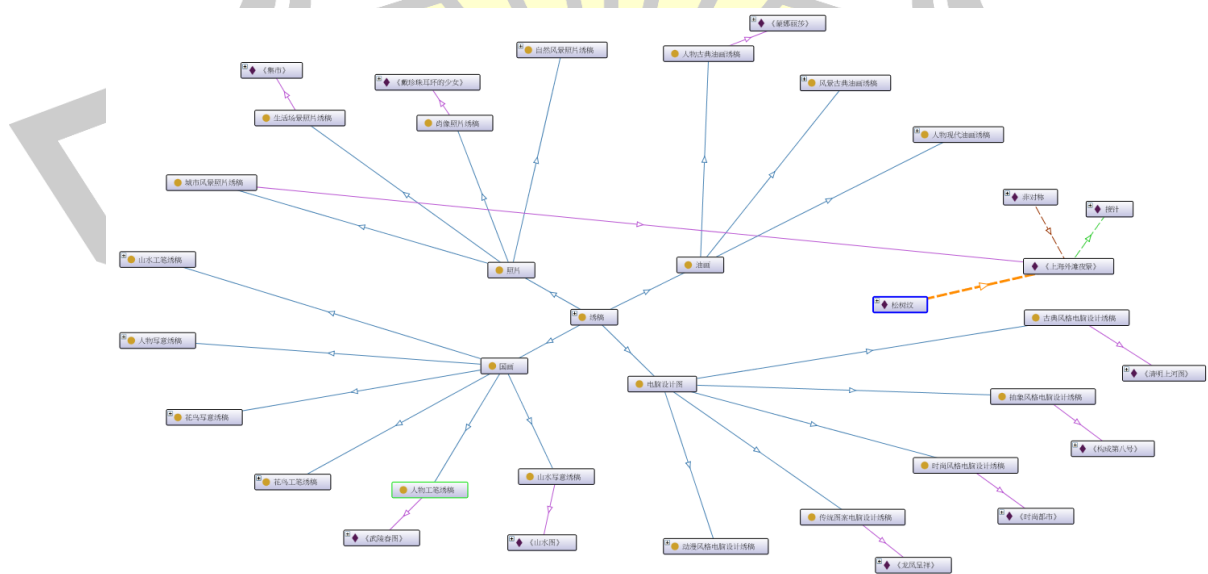


Figure 75 Visualization of the embroidery of the traditional pattern of Shu embroidery

Source: Liu Ying (2024)

(iv) Visualization of the structure of Shu embroidery patterns

Figure 77 shows the content of the pattern structure in the ontology library of the traditional pattern knowledge graph of Shu embroidery, which is divided into: basic structure (straight line, curve, symmetry, asymmetry), complex structure (multi-level, multi-angle design, three-dimensional effect, integration of pattern and texture) creative structure (modern design thinking, free-form structure, innovative art structure), and shows the relationship between them and Shu embroidery works, such as what is the structure of the hibiscus carp pattern of the work, and is connected with this structure.

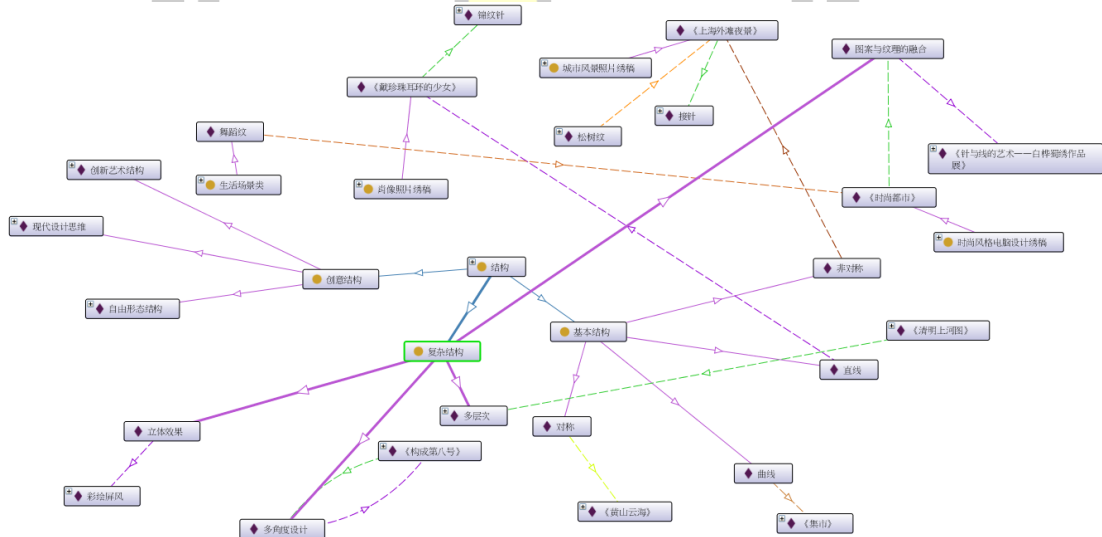


Figure 76 Visualization of the structure of the traditional pattern of Shu embroidery

Source: Liu Ying (2024)

The above operation is on the display data of the Shu embroidery knowledge graph ontology library, and after clicking on the known content, the associated data is displayed.

4.3.3.2 Keyword query carp pattern visualization display

Keyword query is a common operation in the knowledge graph, which can be found in the knowledge graph ontology library of Shu embroidery, and the visual graph generated by searching for "carp" can intuitively show the multi-level association of the pattern of "carp" in Shu embroidery culture. Through the central node "carp" and its connection with other nodes (such as meaning, historical background, design style,

related inheritors and other pattern elements), it can provide important support for the research, design and dissemination of Shu embroidery culture.

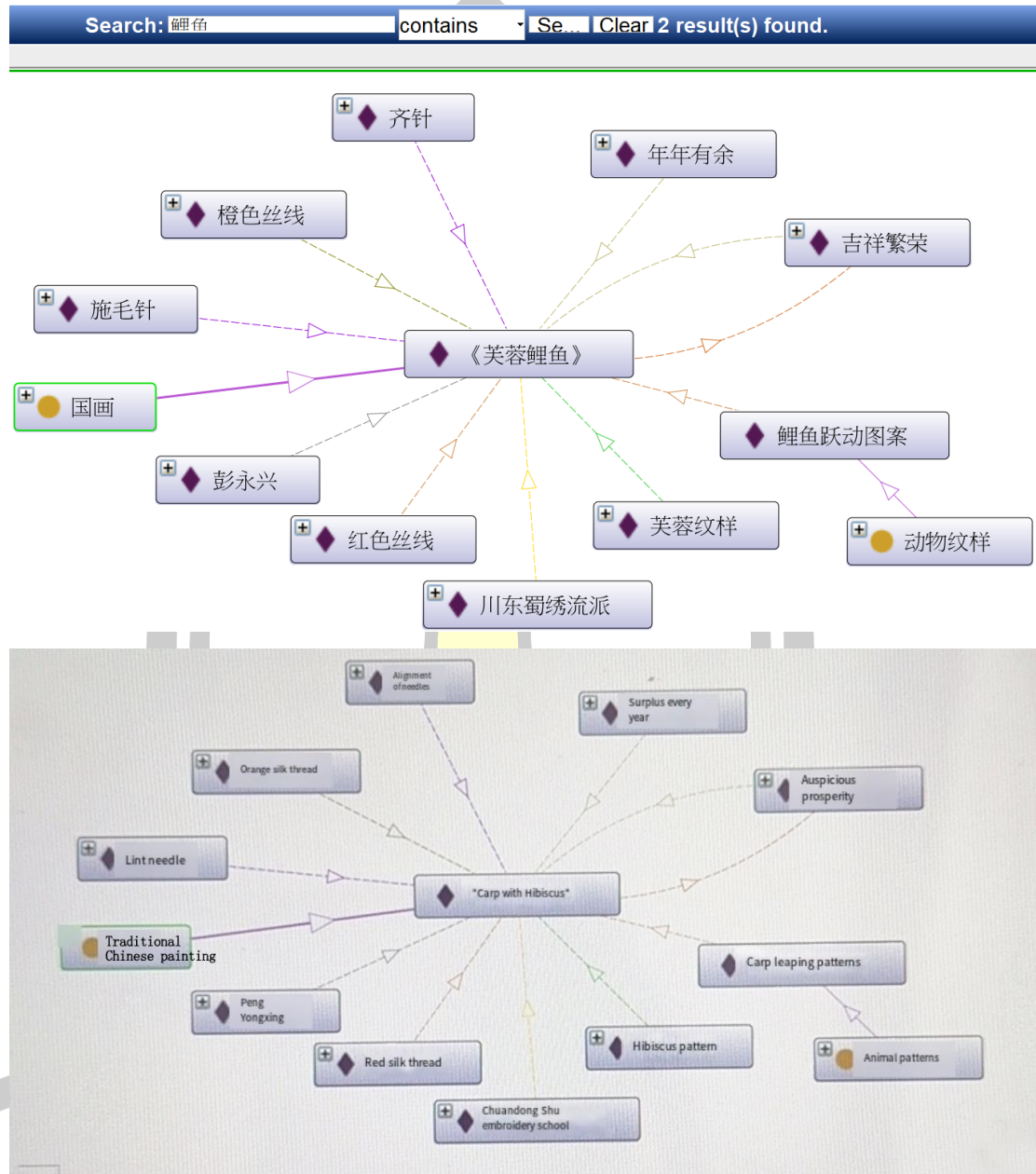


Figure 77 Visualization of hibiscus carp
Source: Liu Ying (2024)



Figure 78 Sichuan Hall of the Great Hall of the People in Beijing Hibiscus carp
Source: Liu Ying (2024)

"Hibiscus Carp" is a Shu embroidery work, which is now collected in the Sichuan Hall of the Great Hall of the People. This work was inspired by the Chinese painting works of the famous flower and bird painter Guo Ruyu, led by Peng Yongxing, and embroidered in 1981 based on Guo Ruyu's Chinese painting "Hibiscus Carp".

Body: Carp, representing wealth, good luck and longevity, the carp in the pattern usually shows bright colors and delicate scales; Hibiscus flowers, symbolizing beauty and purity, are often used as a background or decoration for carp, adding layers and beauty to the pattern.

Background: Water patterns, often used to express the environment in which carp swim, making the patterns more dynamic and realistic; Floral decorations, including the petals and leaves of hibiscus flowers, add richness and ornamentation to the pattern.

Color: carp, usually in red, gold, orange and other colors, highlighting its brightness and nobility; Hibiscus flowers, mostly pink, white or purple, contrast with the carp and harmonize the overall color.

Details: scales, the scales of the carp are meticulous and often express a lustrous feel through different embroidery techniques; The petal texture, the petal edge and the details of the center of the hibiscus flower are often displayed through fine stitching to enhance the three-dimensional effect of the pattern.

4.3.3.3 AIGC idea generation based on artificial intelligence knowledge graph data

As one of the four famous embroideries in China, Shu embroidery has profound

cultural connotation and unique artistic value. However, with the acceleration of modernization, the inheritance of traditional Shu embroidery skills faces many challenges. In order to better protect and inherit the Shu embroidery culture, the artificial intelligence knowledge graph (Knowledge Graph) technology was combined to construct the sample data of Shu embroidery patterns, and then the AIGC (Generative Artificial Intelligence, AI-Generated Content) technology was used to transform the structured cultural knowledge into concrete Shu embroidery pattern design. This method not only provides technical support for the innovative design of Shu embroidery, but also brings new design ideas and creative methods to Shu embroidery in the creation process of Shu embroidery patterns. By inputting the ontology data of the Shu embroidery pattern into the AIGC tool, the system can automatically generate innovative pattern designs according to the existing patterns, meanings and cultural connotations. This not only improves the design efficiency, but also breaks through the limitations of traditional creation and realizes the diversified innovation of Shu embroidery patterns.

(i) Select Generative Model:

Use AIGC tools that support Wensheng diagrams, such as Stable Diffusion, Midjourney, liblib, and more.

(ii) Prompt Engineering:

The Wensheng diagram is the process of inputting a text description and automatically generating the corresponding visual image by the AI model. At the heart of this generative approach is the combination of natural language understanding and computer vision technology to build complex models that can decode visual features from text semantics.

This generative formula is by far the most commonly used way and one that relies heavily on prompt words. Positive prompts: keywords used to guide AIGC to generate patterns, emphasizing the exquisite, delicate, natural and cultural elements of Shu embroidery tradition. Negative prompt words: used to limit AIGC from generating elements that are irrelevant or do not conform to the artistic style of Shu embroidery, such as simplified design, abstract graphics, etc. Return the number of seeds: determines the quantity and quality of the patterns generated by AIGC, and appropriately increasing the number of seeds can improve diversity and innovation.

Only by carefully polishing the prompts can the image-based AIGC tool understand and generate images that meet the requirements. Figure 6-4 shows an example of using the pattern data in the Shu embroidery knowledge graph to convert the input prompt words into images of the AIGC tool.

(iii) Generate patterns:

The AIGC model was used to generate a number of pattern design drawings of Shu embroidery style, and the works that met the requirements were selected for subsequent optimization.

According to the knowledge graph data of Shu embroidery patterns, design prompts are generated. Enter in the AIGC tool: "A phoenix-themed Shu embroidery pattern, the phoenix spreads its wings, the background is a peony, with a strong red and gold match, the pattern is full of symmetry, reflecting the traditional meaning of wealth and auspiciousness." "Random seed: 768533.

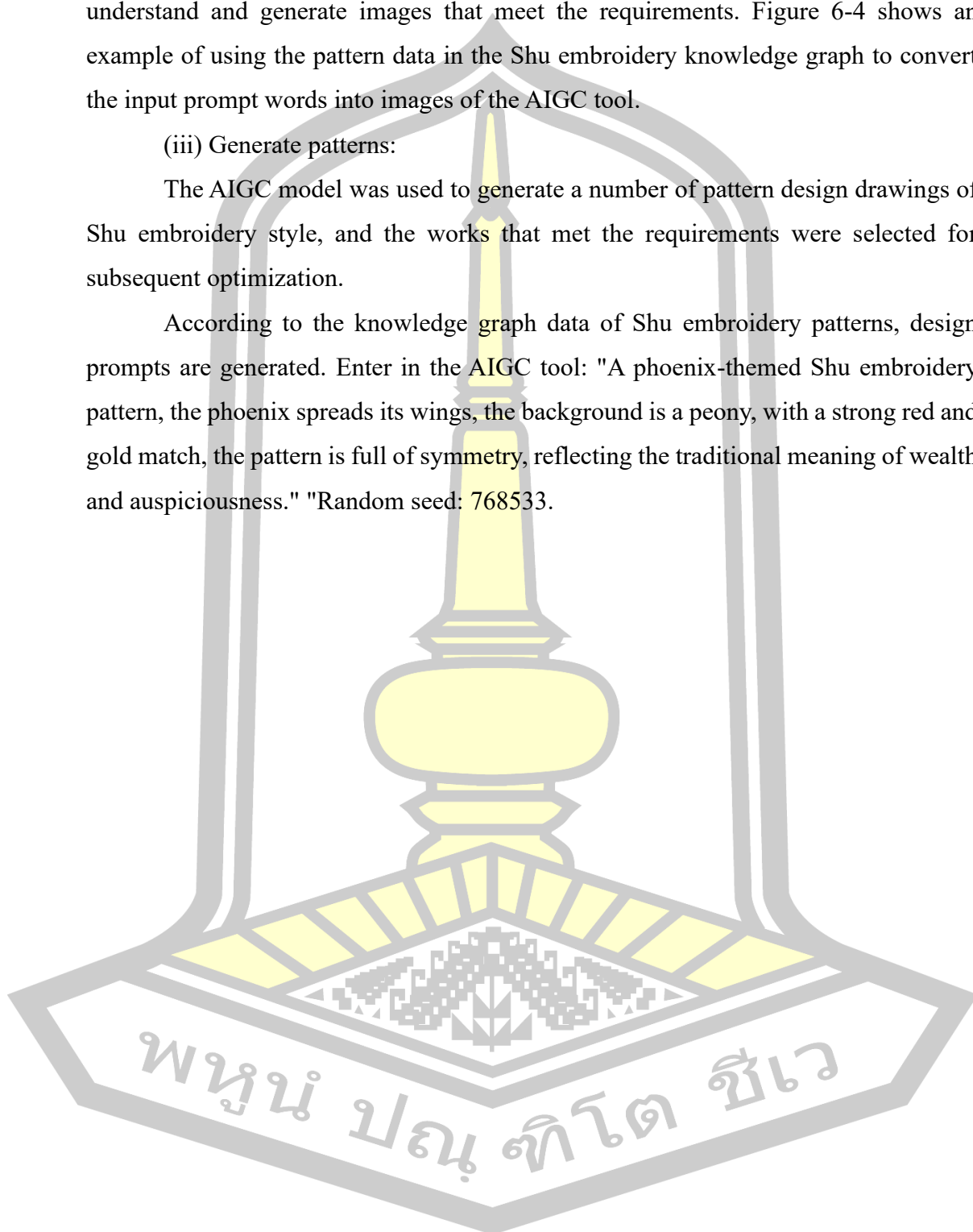




Figure 79 Phoenix theme
Source: Liu Ying (2024)

(iv) Model optimization:

The generated patterns were compared and verified with the data of the Shu embroidery knowledge graph, and the prompt words were optimized to ensure that the patterns were in line with the artistic characteristics and cultural connotation of Shu embroidery.

(v) Application scenario expansion

Pattern design innovation: Provide new pattern inspiration for clothing and home decoration design.

Cultural Communication and Education: The generated patterns can be used for intangible cultural heritage displays, textbook production, and cultural experience

projects.

Personalization: Users can generate unique patterns by entering specific requirements (e.g., wedding theme, specific color combinations).

(vi) Advantages and significance

Improve design efficiency: The complex cultural connotation of Shu embroidery is presented through the standardized structure of the knowledge graph, and the pattern design is quickly realized with the help of AIGC tools, which significantly improves the design efficiency.

Combination of protection and innovation: The integration of the pattern language of traditional Shu embroidery with modern technology can not only protect traditional culture, but also give it new artistic vitality.

Enhance communication and awareness: Attract more public attention through the generated Shu embroidery pattern works, and lay the foundation for the digital protection and commercial development of Shu embroidery.

(vii) Application Effects

The following is a prompt word generated based on the data content of the knowledge graph of Shu embroidery patterns, and the text is a map, and some of the contents are as follows.

Generate pattern effect 1: The content of the prompt word generated based on the knowledge graph data of Shu embroidery is: "With the pine crane pattern as the main body, the pine branches are coiled, the white crane flutters its wings and flies, and the background adopts auspicious cloud patterns, implying health and longevity." Song Dynasty style "Random Seed: 235672.

After being generated by the AIGC tool, the output effect is a digital design drawing that reflects the traditional Shu embroidery style, with pine trees and white cranes moving, full of the cultural charm of traditional art.



Figure 80 White crane theme
Source: Liu Ying (2024)

Generate pattern effect 2: lotus and carp

Positive prompts: lotus, carp, Chinese style, embroidery, line drawing, main color red, Song Dynasty, Chinese painting.

Negative prompts: stiff lines, too abstract

Number of seeds: 246741

พจนานุกรมศิลปวัฒนธรรม



Figure 81 Lotus and carp theme
Source: Liu Ying (2024)

Generate pattern effect 3: the combination of tradition and modernity

Positive prompts: traditional Shu embroidery, modern tones, natural elements, pine, bamboo, plum, gold, fine lines

Negative prompts: too abstract, simplistic design, single color, no emotion

Number of seeds: 120

พจนานุกรมศิลปวิทยา



Figure 82 The theme of pine, bamboo and plum
Source: Liu Ying (2024)

Generate pattern effect 4: Animals and nature

Positive prompts: cranes, deer, butterflies, green mountains and green waters, warm colors, natural environment

Negative cue words: cool tones, abstract symbols, mechanical sense

Number of seeds: 80

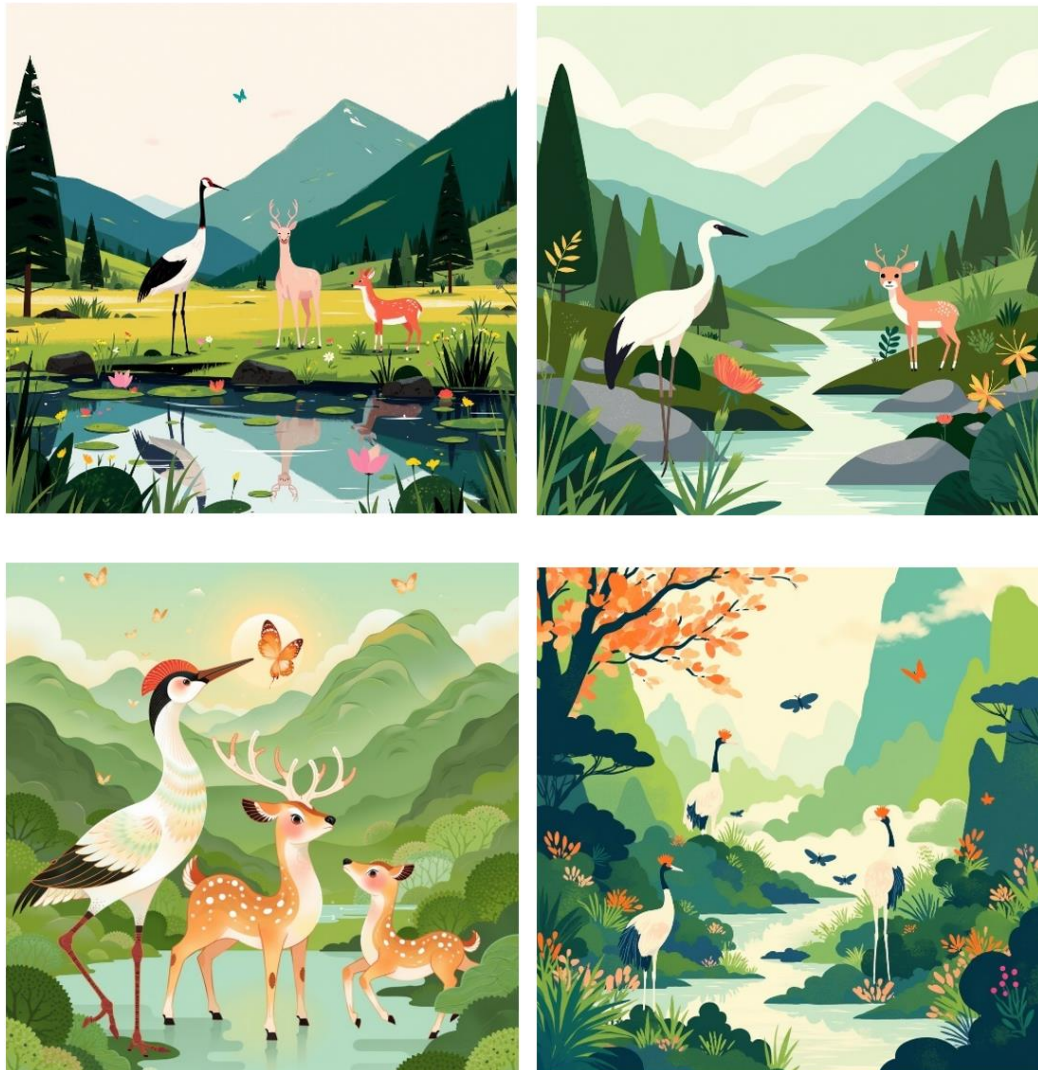


Figure 83 The crane and the deer theme
Source: Liu Ying (2024)

Generate pattern effect 5: landscape and symbolism

Positive prompts: peony, wealth, butterfly, love, beauty, wealth and auspiciousness, happy love

Negative prompts: too realistic, cold and hard tones

Number of seeds: 457821



Figure 84 The theme of peonies and butterflies
Source: Liu Ying (2024)

Combined with knowledge graph and AIGC technology, the generation and innovation of Shu embroidery patterns have entered the era of intelligence, providing a new path for the protection and dissemination of intangible cultural heritage.

The combination of these patterns is often based on the meaning of auspicious symbols in traditional Chinese culture, and expresses more layers of meaning through the clever pairing of patterns between them. In Shu embroidery works, the collocation of these patterns is common in festivals, weddings, longevity and other occasions of great significance.



Figure 85 Intelligent Pattern Usage
Source: Ying Liu (2024)

4.3.3.4 Summary

First of all, by constructing the knowledge graph of Shu embroidery patterns, the heterogeneous knowledge can be structured, a strong intelligent knowledge association can be constructed, and the intuitive visual presentation of related content such as the inheritance of Shu embroidery patterns, geographical distribution, and benchmarking projects can be realized. This not only forms a sustainable use of digital Shu embroidery pattern resources, but also innovates and develops the digital all-round association display mode of Shu embroidery patterns, becoming the country's leading and pioneering Shu embroidery pattern visualization knowledge map.

Secondly, the construction of the knowledge graph is helpful to fully grasp the social repercussions of Shu embroidery culture and the dynamic changes of the terminal consumer market, infer the development trend of Shu embroidery projects, and provide effective information support for decision-makers. Through the use of big data technology for resource sorting, we can overcome the disadvantages of cultural fragmentation caused by the lack of traditional information, and improve the effectiveness and depth of the protection of Shu embroidery cultural resources.

To sum up, the significance of the construction of knowledge graph for Shu embroidery pattern culture is to realize the digital preservation and dissemination of Shu embroidery resources, and it has become an effective means to promote the development and innovation of Shu embroidery culture by constructing the knowledge graph of Shu embroidery patterns and combining AIGC (generative artificial intelligence) technology for innovative design.

4.4 Evaluation and Feedback

4.4.1 Chinese Shu embroidery patterns

Technology empowerment: The use of artificial intelligence and digital atlas technology to enrich the dynamic expression of geometric patterns and improve their adaptability and expressiveness.

Branding: Through the design of well-designed digital products, establish a brand image with the characteristics of Shu embroidery, and expand the international market.

4.4.2 Shu embroidery pattern development model

Digital archiving: By constructing the knowledge graph of Shu embroidery patterns, various patterns of Shu embroidery and their cultural connotations can be systematically digitally archived. This not only contributes to the preservation of traditional cultural heritage, but also provides a wealth of reference materials for future generations.

Digital empowerment: Combining artificial intelligence and knowledge graph technology, build a Shu embroidery pattern database and digital creative platform, promote pattern innovation and intelligent design, and achieve wider cultural dissemination (Liu, 2023).

Inspiration library and recommendation system: Designers can quickly obtain inspiration and generate new design solutions through the pattern correlation in the knowledge graph. The system can recommend relevant patterns according to specific needs to achieve innovation and extension of creation.

Pattern combination and customization: The knowledge graph can help designers combine different Shu embroidery elements and customize unique designs that meet customer needs, while retaining traditional cultural symbols.

Digital display and dissemination: Virtual display platform: Create a virtual museum or online exhibition platform based on the sample body of Shu embroidery patterns constructed by the knowledge graph, so that the Shu embroidery patterns and their cultural stories can be more widely disseminated (Wang, 2018).

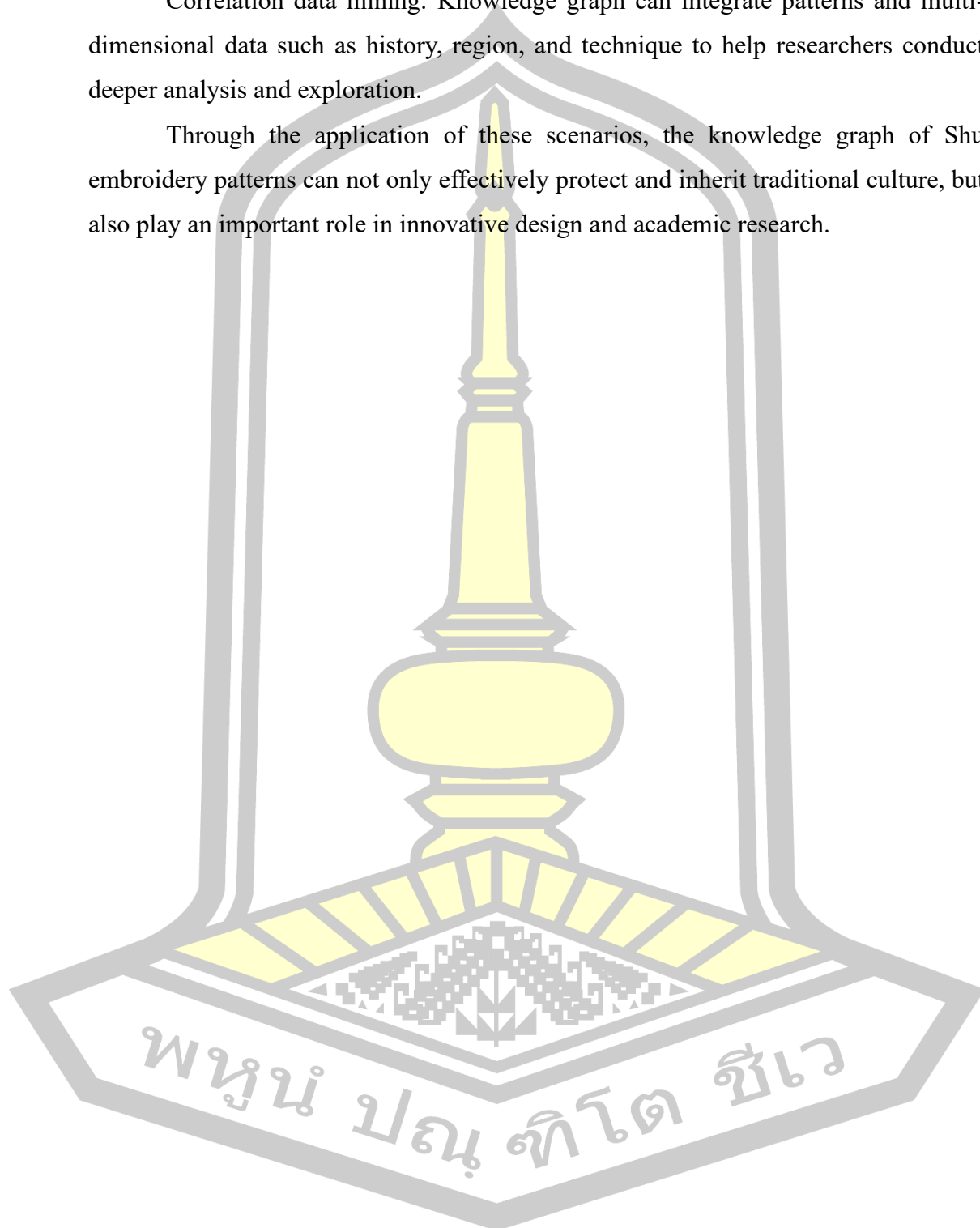
4.4.3 Cultural development in Sichuan

Research on the evolution of patterns: Through the knowledge map, scholars can analyze the evolution of Shu embroidery patterns in different historical periods, and

reveal the path of cultural transmission and exchange.

Correlation data mining: Knowledge graph can integrate patterns and multi-dimensional data such as history, region, and technique to help researchers conduct deeper analysis and exploration.

Through the application of these scenarios, the knowledge graph of Shu embroidery patterns can not only effectively protect and inherit traditional culture, but also play an important role in innovative design and academic research.



CHAPTER V

CONCLUSION, DISCUSSION, AND SUGGESTIONS

This study systematically sorts out the historical context of Shu embroidery, analysing the contemporary development bottlenecks and opportunities based on digital preservation and semiotic theory. In response to issues such as the discontinuity of pattern inheritance and lack of innovation, a knowledge graph of Shu embroidery patterns has been constructed. By utilising the data and relationships within the knowledge graph, generative artificial intelligence (AIGC) technology is introduced to achieve digital analysis and intelligent reinvention of traditional pattern symbols. On this basis, this chapter also conducts an in-depth discussion of the new knowledge obtained during the research process, summarising the theoretical contributions and practical significance of the research findings, and providing directions and suggestions.

5.1 Conclusion

5.1.1 Summary of the historical origin, artistic value and culture of traditional patterns of Shu embroidery

5.1.2 The inheritance and protection of traditional patterns of Shu embroidery

5.1.3 The role of artificial intelligence knowledge graph technology in the development of traditional patterns of Shu embroidery

5.2 Discussion

5.2.1 Shu embroidery culture from the perspective of semiotics

5.2.2 The challenge of inheriting and protecting the traditional patterns of Shu embroidery

5.2.3 The role of artificial intelligence in the inheritance and protection of traditional patterns of Shu embroidery

5.3 Recommendations

5.3.1 Protection and inheritance of cultural heritage

5.3.2 Cultural and creative product development

5.3.3 Intelligent improvement of design tools

5.3.4 Tourism and cultural communication

5.3.5 Academic and interdisciplinary research

5.3.6 Social services and universal access to education

5.1 Conclusion

5.1.1 Summary of the historical origin, artistic value and culture of traditional patterns of Shu embroidery

This study systematically reviews the historical origins of Shu embroidery and reveals its evolution from a folk art form in the Bashu region to a court tribute, and reached a peak in the Song and Yuan dynasties. Shu embroidery is famous for its exquisite stitches, bright colors and strong cultural connotations. The study deeply explores the totemic beliefs, ritual culture and social symbolic meanings contained in the patterns of Shu embroidery, and excavates the artistic value and cultural inheritance of Shu embroidery as a traditional handicraft. The pattern design of Shu embroidery not only reflects the profound heritage of traditional Chinese aesthetics, but also reflects the unique cultural characteristics and characteristics of the times in the Bashu region (Huang, 2008).

5.1.2 The inheritance and protection of traditional patterns of Shu embroidery

In the process of modernization, Shu embroidery is facing severe challenges such as the aging of inheritors, the impact of marketization and cultural faults. Through the investigation of the current situation of Shu embroidery inheritance, this paper summarizes the experience of government support policies, inheritor training models and intangible cultural heritage protection mechanisms. Specifically, a digital-based conservation strategy is proposed, including the establishment of a database of Shu embroidery patterns, the development of educational courses, and the use of multiple communication channels. These measures not only continue the craft tradition of Shu embroidery, but also provide a modern platform for the younger generation to understand and learn Shu embroidery, effectively alleviating the crisis of broken inheritance chain (Peng, 2024, Interview).

5.1.3 The role of artificial intelligence knowledge graph technology in the development of traditional patterns of Shu embroidery

In this study, the artificial intelligence knowledge graph technology was innovatively applied to the research and development of Shu embroidery patterns. With the knowledge graph as the core framework, the semantic characteristics, cultural connotations and process techniques of Shu embroidery patterns were systematically

and structurally modeled, so as to realize the intelligent classification, retrieval and cultural interpretation functions of Shu embroidery patterns. By constructing a pattern knowledge graph and a design assistance system, this paper explores the practical application of artificial intelligence in pattern innovation design, and provides a source of creative inspiration for modern designers. At the same time, the knowledge graph technology also enables the cross-border dissemination of traditional Shu embroidery in the digital context, providing new ideas for the protection and innovative development of intangible cultural heritage (Zhu, 2020).

Starting from the historical origin and artistic value of Shu embroidery, this paper focuses on the practice of its inheritance and protection, and combines artificial intelligence technology to empower the innovation and development of Shu embroidery, providing a new methodology for the integration of traditional craftsmanship and modern technology. The research results not only point out the direction for the future development of Shu embroidery, but also inject new impetus driven by science and technology into the field of intangible cultural heritage protection.

5.2 Discussion

5.2.1 Shu embroidery culture from the perspective of semiotics

As an important part of China's excellent traditional culture, Shu embroidery is not only famous for its exquisite skills and rich artistic expressions, but also carries profound cultural significance. Within the framework of semiotic theory, Shu embroidery can be seen as a complex system of symbols, with patterns, colors, and stitches that embody the symbolic meaning and social function of culture (Hao Shuping, 2024, Interview).

First of all, the pattern of Shu embroidery is a direct carrier of cultural value. From the auspicious dragon and phoenix to the auspicious wishes, these patterns not only show the traditional society's pursuit of the unity of heaven and man, but also reflect the regional characteristics of the Bashu region. From the perspective of semiotics, these patterns are not only visual symbols, but also symbols of cultural memory, carrying the life wisdom and spiritual sustenance of the ancestors.

Secondly, the color matching of Shu embroidery also has important interpretive significance in semiotics. For example, the gold and silver threads commonly used in Shu embroidery symbolize dignity and glory, red conveys festivity and warmth, and

green expresses nature and life. These colors are highly consistent with the understanding of the five elements and directions in Chinese culture, reflecting the uniqueness of Shu embroidery in color symbols.

Finally, the semiotic function of Shu embroidery covers three aspects: aesthetics, inheritance and social functions. Its aesthetic function is reflected in the uniqueness of visual arts, the inheritance function is to continue the Shu embroidery skills through intergenerational learning, and the social function is reflected in the cultural symbolic role of Shu embroidery in traditional weddings, festivals, sacrifices and other activities.

Through the interpretation of semiotics, we can understand the cultural value of Shu embroidery more comprehensively, and provide theoretical support for its modern communication and innovation.

5.2.2 The challenge of inheriting and protecting the traditional patterns of Shu embroidery

Although Shu embroidery has a long history and profound cultural value, its inheritance and protection face multiple challenges in the changes of modern society.

First of all, it is difficult to pass on skills. As a complex intangible cultural heritage, Shu embroidery has extremely high technical requirements and a long learning cycle, which makes it difficult for the younger generation to invest enough time and energy in it. At the same time, the inheritors of Shu embroidery are gradually aging, and some skills are on the verge of being lost.

Second, the contradiction between marketization and cultural protection. The demand for Shu embroidery in the modern market is more concentrated in commercialization and rapid products, which leads to the simplification of traditional Shu embroidery skills and the weakening of the cultural connotation of patterns, which further exacerbates the loss of its cultural value.

Third, there is a lack of systematic digital protection. Although digital technology has been applied in the protection of intangible cultural heritage in recent years, the digitization of Shu embroidery is still in its infancy. The lack of high-quality digital records and a structured cultural knowledge base makes the dissemination and reuse of Shu embroidery face obstacles.

In addition, the audience's perception and interest in traditional culture is also a major challenge. With the development of the times, the attractiveness of traditional

handicrafts has gradually decreased among the younger generation, and the ecological chain of cultural inheritance has been destroyed.

To meet these challenges, it is necessary to achieve the sustainable development of Shu embroidery through the multi-dimensional collaboration of education, policy, market and technology.

5.2.3 The role of artificial intelligence in the inheritance and protection of traditional patterns of Shu embroidery

The rapid development of artificial intelligence technology has injected new vitality into the protection, inheritance and innovation of Shu embroidery.

5.2.3.1 Construction of knowledge graph of Shu embroidery patterns

As a new way of knowledge expression, knowledge graph can represent things, their attributes and relationships through the graph structure of nodes and edges. In the process of inheriting Shu embroidery, the digitization, classification and systematic management of Shu embroidery patterns is one of the key challenges. By constructing the knowledge graph of Shu embroidery patterns, it can help researchers, designers, and cultural workers better understand and organize the traditional content and innovation paths of Shu embroidery patterns, and provide systematic data support for subsequent creation and protection (Wang, 2023).

As the core component of Shu embroidery, Shu embroidery patterns have rich symbolic meaning, cultural background and historical value. Each pattern is not only a combination of patterns, but also contains a specific cultural symbol or aesthetic concept. For example, the use of elements such as dragons and phoenixes, flowers and birds has an important symbolic meaning in Shu embroidery, representing traditional cultural values such as auspiciousness, prosperity, and happiness. By constructing the knowledge graph of Shu embroidery patterns, each pattern can be associated with its cultural background, historical origin, colors used, production skills and other information to form a systematic knowledge network. This network not only helps Shu embroidery researchers to understand the historical and artistic value of Shu embroidery, but also provides a digital tool for inheritance work.

In the process of building knowledge graphs, the application of artificial intelligence technology, especially natural language processing (NLP), computer vision and deep learning, has greatly improved the efficiency of automatic data processing.

Through image recognition technology, the patterns in Shu embroidery works can be automatically extracted and classified, and matched with the descriptions in the literature, so as to build a knowledge graph containing pattern attributes, evolutionary relationships, artistic characteristics and other contents. Furthermore, based on big data analysis and machine learning algorithms, the construction of knowledge graph can not only automatically classify patterns, but also identify the internal connections between patterns, revealing multi-dimensional information of their cultural, artistic and social backgrounds.

This constructed knowledge graph of Shu embroidery patterns can be used in many fields. First of all, in cultural studies, researchers can use the atlas to understand the historical origin and cultural connotation of different patterns, and conduct in-depth interdisciplinary research. Secondly, in terms of inheritance and protection, the knowledge graph can help the classic patterns of Shu embroidery to be digitally preserved, and ensure the long-term preservation and sharing of these traditional cultural symbols through the database management model. Finally, in terms of creative design, designers can use the knowledge graph to explore the variations and innovations of patterns, find sources of inspiration, and apply these patterns to modern design, so as to create innovative works that are both traditional and modern.

5.2.3.2 Generate ideas based on artificial intelligence knowledge graph data

The patterns of Shu embroidery are the embodiment of its artistic characteristics, and each pattern has a unique form, color and symbolic meaning. The traditional Shu embroidery patterns have extremely rich types and expressions, such as flowers, animals, landscapes, etc., with strong regional characteristics and cultural symbols. How to systematize and digitize these patterns and provide data support for their creative generation is the top priority for the creative development of Shu embroidery (Meng, 2024, Interview).

Knowledge graph technology can structure the various information of Shu embroidery patterns through the graph structure of nodes and edges. This information, including the morphology, historical background, cultural symbols, and material techniques of the pattern, can be processed and analyzed by artificial intelligence algorithms to form a structured data network. Through the study of a large number of Shu embroidery patterns and their related cultural backgrounds, AI can understand and

extract the intrinsic characteristics and aesthetic value of each pattern, and generate ideas on this basis.

With the support of the knowledge graph of Shu embroidery patterns, AIGC technology can automatically classify, analyze and generate different types of Shu embroidery patterns. For example, based on a specific historical period or cultural background, AI can generate patterns with specific styles and symbolic meanings. At the same time, the use of knowledge graph can effectively prevent the generated patterns from departing from the cultural and artistic foundation of traditional Shu embroidery, and maintain the unique charm of Shu embroidery.

Artificial intelligence, especially AIGC technology, has played an important role in the inheritance and innovation of Shu embroidery. Through the construction of the knowledge graph of Shu embroidery patterns, AIGC can effectively generate ideas and promote the transformation of Shu embroidery from traditional crafts to modern and international art forms. Its powerful data processing capabilities and innovative generation mechanism not only promote the artistic creation of Shu embroidery, but also provide a new technical means for its protection and inheritance. With the continuous development of artificial intelligence technology, AIGC will play an increasingly important role in the inheritance and innovation of Shu embroidery and other traditional cultural heritage.

5.3 Recommendations

The research results of this paper have a wide range of application potential, which is reflected in the following fields:

5.3.1 Protection and inheritance of cultural heritage

Digital archiving: build a digital database of Shu embroidery patterns through the knowledge graph, and provide long-term technical support for the protection of Shu embroidery.

Education and training: Provide semiotic interpretation of patterns for inheritors and learners, and help them understand the cultural connotation and design logic behind patterns.

5.3.2 Cultural and creative product development

Combination of tradition and modernity: to provide cultural and creative designers with a rich source of patterns, combined with semiotic interpretation, the Shu

embroidery pattern is applied to modern design fields such as fashion, home furnishing, packaging, etc.

Customized design: With the help of knowledge graph, generate Shu embroidery patterns that meet specific themes, cultural backgrounds or personalized needs, and give more cultural value to market-oriented products.

5.3.3 Intelligent improvement of design tools

Intelligent design support: Provide the semantic association and symbol connotation of Shu embroidery patterns for design software or platforms, and generate innovative patterns that meet user needs through AI assistance.

Design automation: Combined with the knowledge graph, the pattern generation algorithm is developed to realize the intelligent matching of batch design and symbolic themes.

5.3.4. Tourism and cultural communication

Local culture promotion: combine the connotation of Shu embroidery symbols with tourism projects, design theme patterns, and use them for scenic spot publicity and souvenir development.

Exhibition and event planning: Provide academic support, plan semiotic exhibitions or experiential activities related to Shu embroidery, and disseminate traditional cultural knowledge to the public.

5.3.5. Academic and interdisciplinary research

The combination of semiotics and artificial intelligence: promote the further application of semiotics in the field of intangible cultural heritage research and form a new paradigm of interdisciplinary cooperation.

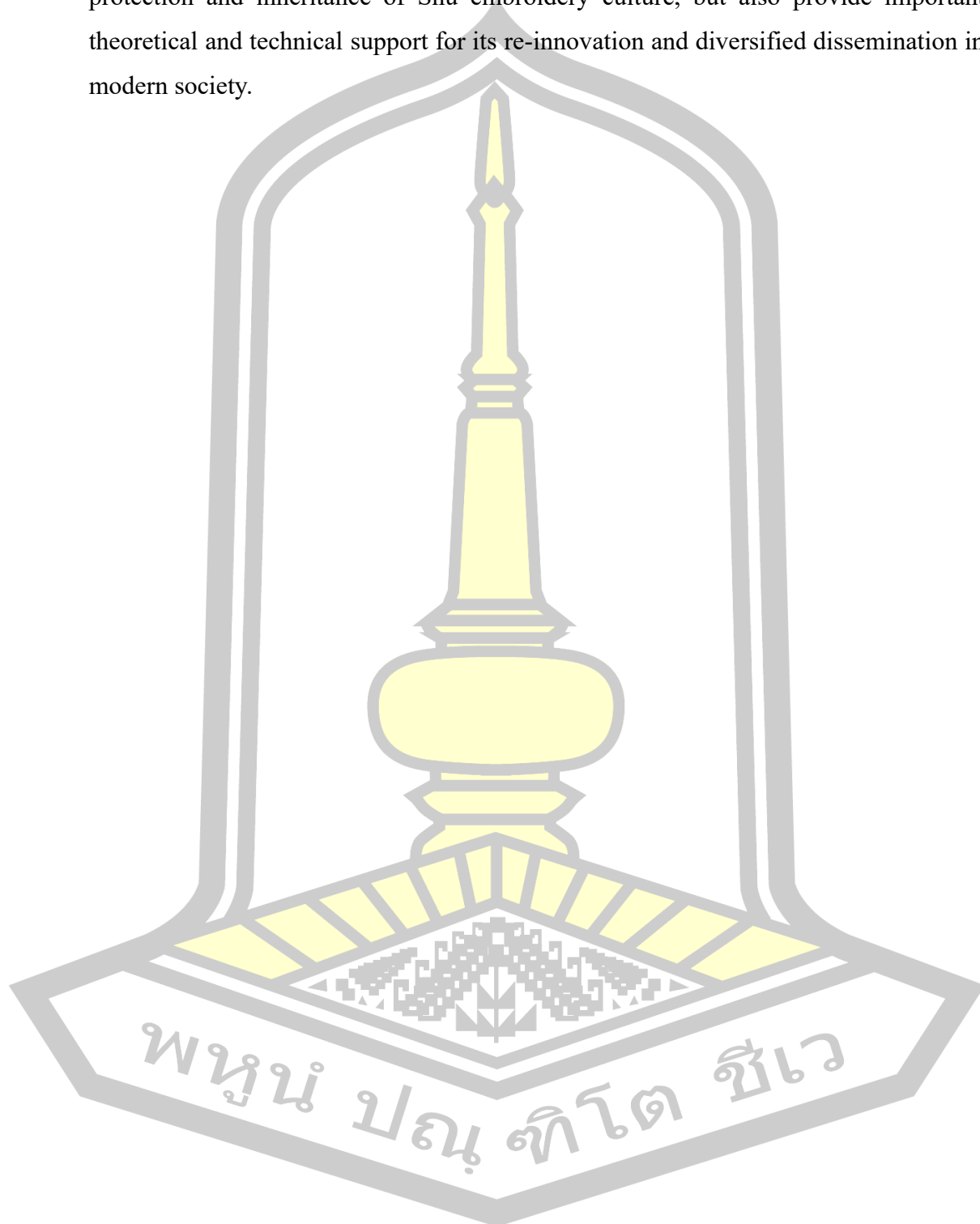
Cultural and technological innovation: The results of pattern connotation interpretation and technical construction are applied to other intangible cultural heritage fields, and the application scope of this research method is promoted.

5.3.6 Social services and universal access to education

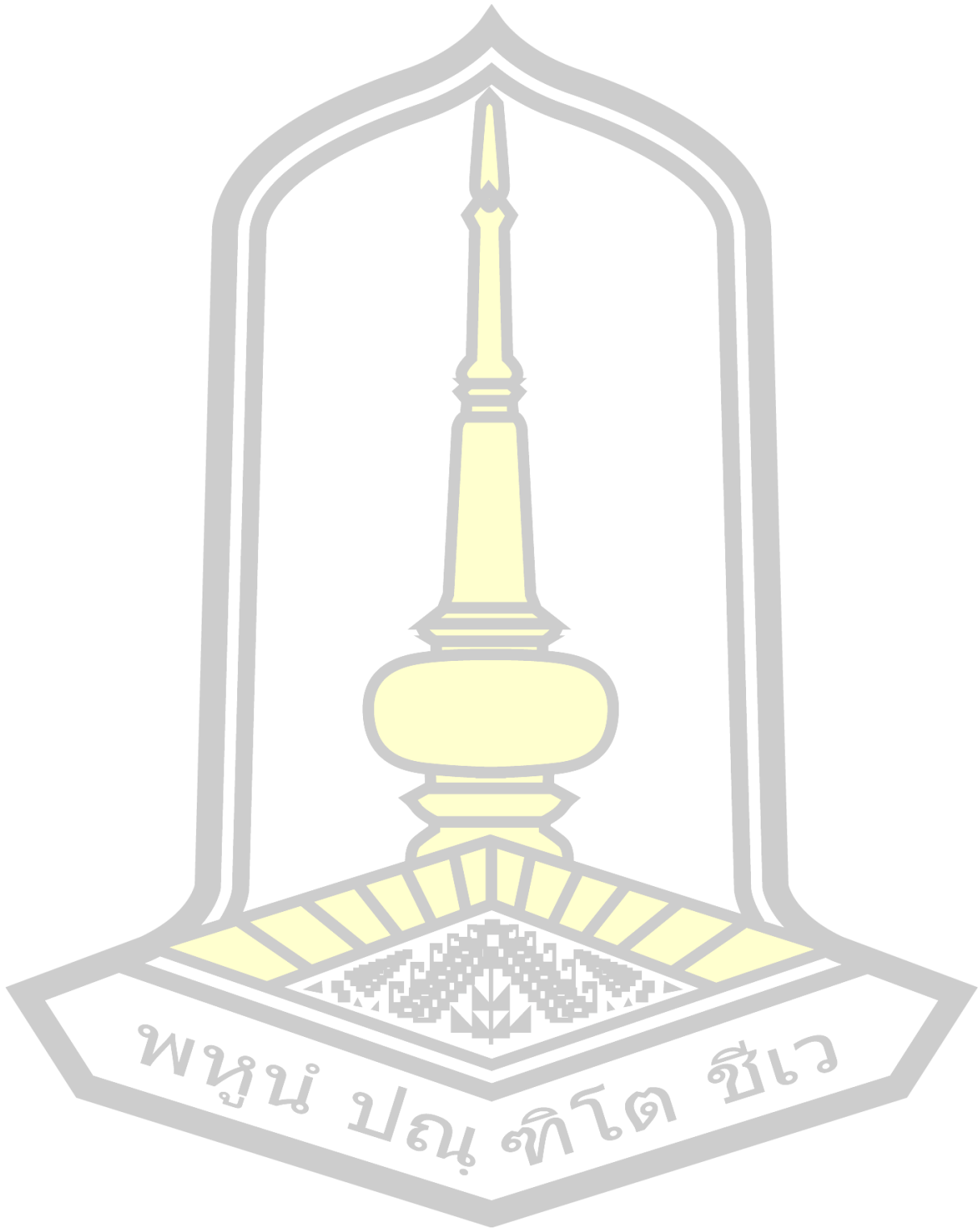
School Aesthetic Education: Provide case materials for art courses to help students understand the cultural significance of traditional art.

Community cultural activities: Transform the results of the knowledge graph into visualization tools for community promotion of intangible cultural heritage knowledge or public welfare activities.

Through these applications, the results of this paper not only promote the protection and inheritance of Shu embroidery culture, but also provide important theoretical and technical support for its re-innovation and diversified dissemination in modern society.



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