Digital Regeneration and Database Construction of Hunan Embroidery Needlework under the Perspective of Artificial Intelligence

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Abstract

In order to explore the development path of Hunan embroidery under the vision of artificial intelligence, promote the digital regeneration and database construction of Hunan embroidery stitches, the communication, and interaction between Hunan embroidery brands and the public, and create more possibilities for revitalizing the culture and industrial development of non-heritage Hunan embroidery. In this paper, a mechanics model of Hunan embroidery stitch is established based on the finite element idea under the view of artificial intelligence. The single yarn in the yarn is regarded as a frictionless articulation of some rows of elastic rods with a circular cross-section. The elastic rod can only be subjected to axial force without a moment, and it is a uniform, continuous, and completely elastic isotropic body. Using the displacement method, the displacement of the unit node is taken as the basic unknown quantity, the displacement in the unit is assumed to be linearly distributed, and the displacement of any node in the unit is obtained by linear interpolation. The strain, stress, and stiffness matrices of the elastic rod unit are derived, the equilibrium equations are given, and a database is established. The results of the study showed that consumers of all age levels thought that the patterns representing Hunan embroidery mainly include Hunan characteristic landscapes, portraits of Hunan great men, traditional flowers, birds and animals, and totems of Chu culture, etc., among which Hunan characteristic landscape accounted for 54% of the largest proportion. It provides a development direction for the inheritance and protection of Hunan embroidery skills.

Keywords: Artificial intelligence; Hunan embroidery stitch; Digital regeneration; Database construction; Mechanics model

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1 Introduction

With the advent of the Internet era and the maturity of information technology, Hunan embroidery is facing opportunities and challenges in many aspects, such as cultural dissemination, craft heritage, talent training, product innovation, and marketing [1]. In addition to facing the increasingly obvious problem of age discontinuity of embroiderers, single products, lack of individuality and vitality, and other status quo constants [2]. Hunan embroidery enterprises lack a brand concept, neglect to adjust their own positioning according to the objective market, and still have a single, traditional, flat, and passive approach in brand communication channels and means, which further distances Hunan embroidery from the times and the world [3-6]. We need to take advantage of the Internet, online communication, digital media with real-time interaction, small limitations, and other advantages [7]. Influence brand communication to the development situation of touching the whole network, integrating resources, omni-channel promotion, and multi-means propaganda through the comprehensive use of digital communication media, combined with diversified means of communication, to achieve deepening and amplifying the effect of brand communication and improving brand recognition and customer trust [8-11].

As an important member of the national intangible cultural heritage, most of the current research on Hunan embroidery in the direction of digital dissemination, from the level of cultural data recording and craft transmission, stays in digital recording, digital preservation, and digital display in the field of historical and cultural, craft materials and needlework research [12-15]. The display of results is mainly based on the establishment of Hunan embroidery websites, the construction of Hunan embroidery digital museums, and professional databases [16]. Based on the future development of the Hunan embroidery industry, building and improving the digital communication system of the Hunan embroidery brand from various aspects, such as brand image design, operation mode, and strategy implementation, is also receiving more and more attention and research from scholars [17].

Hunan embroidery has a deep cultural heritage and is a cultural card of Hunan and even the whole country [18]. However, traditional Hunan embroidery has a small consumer market space, and there are many problems, such as single structure, monotonous form, and insufficient creativity in many aspects of product types, quality, function, decoration, subject matter, packaging, and preservation, which are still far from meeting the growing cultural needs of people [19-21]. The sharp decline in cultural status has made the development of Hunan embroidery face great challenges [22]. Under the wave of rapid development of cultural tourism and supply-side to structural reform, expanding the Hunan embroidery market into the Hunan tourism industry market is bound to bring a new dawn to the Hunan embroidery industry [23-24]. Hunan embroidery products are the product of excellent cultural crystallization and an important entry point for integration into the tourism industry [25]. Therefore, to grasp the current situation of the tourism industry, adhering to the “artisan spirit” and innovating and designing the desired Hunan embroidery tourism products is an important issues to realize the development of Hunan embroidery.

The literature [26] is an application of hand embroidery technique to produce the effect of polyester quilting using water-soluble film paper as a medium. Experimental and implementation methods of textile crafts were used. The results of the study showed that water-soluble film paper could be used as a medium for applying hand embroidery techniques to make polyester quilts, that this medium is profitable, and that it does not leave any residual waste. Therefore, this medium is considered to be environmentally friendly. Based on the scope of textile craft research, this method can be applied to bring out elements of handicraft. Functional products made using this method are also expected to provide aesthetic value in the room. This research is important and useful to introduce the community to alternative sources of waste from the local garment industry that can be created into new products with higher value. The literature [27] found that Hunan embroidery has been around for more than
2000 years, and its development and evolution witnessed and recorded the changes in the daily habits and cultural and artistic styles of the people of Chonan. During this long development, Xiang embroidery has gradually evolved its own unique characteristics. The article attempts to discuss the cultural and artistic connotation and development of Hunan embroidery from the perspective of its cultural and artistic characteristics. The literature [28] found that Hunan embroidery is one of the four famous embroideries in China and is the cultural and artistic card of Hunan. It compares the development and evolution of Hunan embroidery in the Republic of China from the perspective of art sociology, explores the influence of social development on Hunan embroidery, analyzes the role played by Hunan embroidery in social life, and digs deeper into the deep connection between Hunan embroidery and social development, so as to provide references that can be used for the transformation and upgrading of Hunan embroidery in the new era. The literature [29] argues that Hunan embroidery, as a bright star of Hunan culture, has slowly declined with the development of society, the advancement of production technology, and the change of people's concept of material and cultural needs. Hunan embroidery is slowly declining, both in terms of popularity and reputation at home and abroad, as well as in terms of industrial scale and profit, and the whole industry has been in a depressed state for decades. How to change the current predicament, preserve traditional art, and keep Hunan embroidery alive is particularly important. The literature suggests that, at present, traditional offline demonstration teaching is the main method of inheritance and development for Hunan embroidery. In order to adapt to the contemporary context and further inherit and protect Hunan embroidery culture, the article composes the source and development of Hunan embroidery and digitalization, combines the cultural characteristics of Hunan embroidery, combines the historical background of Hunan embroidery, traditional craftsmanship, etc. with digital technology, and proposes a digital display method suitable for Hunan embroidery culture, so as to better inherit and develop Hunan embroidery.

This paper analyzes the current situation of lack of innovation in Hunan embroidery products and the Hunan embroidery market through field visits to Hunan red cultural, scenic spots, Hunan embroidery enterprises, and Hunan embroidery tourism market survey, focusing on the current Hunan embroidery tourism products and market from the perspective of consumer groups, purchasing motives, and purchasing power in a systematic way. At the same time, we digitally collect and organize the embroidery-related contents with digital cameras under the vision of artificial intelligence, and finally establish integrated data from the Hunan embroidery database, especially in the details of digital collection and database establishment, and improve the efficiency and dissemination through some technical means and interface design methods, so that the Hunan folk embroidery database can serve as a window to understand and learn Hunan embroidery skills, and allow the art of Hunan embroidery to be The database can be used as a window to understand and learn the art of Hunan embroidery so that the art of Hunan embroidery can be more widely disseminated, and the combination of tradition and modernity can be realized, and innovation can be developed to form an industrial project so that Hunan embroidery can be better exploited and this intangible cultural heritage can be sustainably passed on.

2 Artificial Intelligence Perspective

Artificial intelligence was first proposed by the founder of modern computer science, the British applied mathematician Turing, in 1947 (abbreviation: AI) [30-30]. After continuous efforts, AI has been able to complement and replace human intellectual thinking in many fields, enabling information collection and screening as well as the optimization of autonomous choices and behaviors and shouldering a large number of tasks such as identification and response. The market is still in the “weak artificial intelligence” stage, more mature supervised learning still needs a lot of data labeling,
and unsupervised learning is the learning mode of the human brain. The long-term goal of industry and academia in this field is “strong AI,” as shown in Table 1.

Figure 1. Evolution of the era of artificial intelligence

All the situations in Figure 1 are signs that humanity is facing a new and challenging era of artificial intelligence. The Darwinian theory of evolution, with “natural selection” and “survival of the fittest” as its core, proves scientifically that the organic and inorganic worlds, including human beings, are “advancing” and “rising.” “From the perspective of individual development of government leaders, leaders are the pioneers who give full play to the idea of change and put it into practice. Based on this, government leaders should, first of all, perceive the need for a change of the times with a keen mind, give full play to their subjective initiative, and take into account the situation to introduce a series of policies and guidelines to promote the development of big data and artificial intelligence technology. Therefore, government leaders and cadres should fully understand the opportunities and challenges brought by AI to the human world, rationally understand the series of social impacts and governance dilemmas caused by AI, and clarify the direction and principles of precise innovation for government leaders and cadres in the era of AI.

Compared with previous IT technologies, AI neural networks can acquire knowledge and capabilities through multidimensional, timely, and comprehensive data learning training. Real-time and complete perceptual data requires various types of front-end hardware, and the ready, real-time, and privacy data processor determines the need for local AI computing terminals, while “from tangible to intangible” and the development of more natural interaction determines the need for AI capabilities in terminal hardware. From the perspective of media, the Internet will achieve intelligent media and act as a media assistant and “social radar” by virtue of AI, which is constantly approaching human intelligence under the conditions of explosive data accumulation, new algorithms based on neural
network models and the maturity of more cost-effective computing power. The intelligent media will rely on AI to filter a large amount of data, text, images, and videos, will realize the information aggregation and distribution of all media functions, and provide users with comprehensive, timely, in-depth, personalized, intelligent, real-time, and accurate products and services.

3 Digital Regeneration and Database Construction of Hunan Embroidery Needlework

3.1 Digital regeneration of Hunan embroidery stitches

It is difficult to solve the mechanical problems of Hunan embroidery stitching directly by the method of general rigid body mechanics because the yarn is a flexible body. In this paper, we assume that the yarn is twisted by three layers of 19 single yarns with a circular cross-section, so every single yarn in the yarn is regarded as a finite set of elastic rod units that are frictionlessly articulated by axial force only based on the finite element idea. On this basis, the stress, strain, stiffness, friction, and contact of the single yarn finite element unit are analyzed to establish the equilibrium equations.

Yarn is a flexible body with high tensile strength but little bending stiffness. The yarn is twisted by 19 single yarns, which are in contact with each other, and the solution is very computationally intensive, considering only the single yarn elasticity without bending stiffness. In addition, the single yarn has a large aspect ratio, so the single yarn is considered a series of elastic rods with a constant circular cross-section. The elastic rods are only subject to axial force but not the moment, and they are uniform, continuous, and fully elastic isotropic bodies. The position of each node of the single yarn in the intermediate state of Hunan embroidery, i.e.:

\[ P_{ind} = S^{m} (u_{ind}) = x(u_{ind})i + y(u_{ind})j + z(u_{ind})k \]  
(1)

Where \( ind \) is the node number, \( ind = 1, 2, ..., cnt \) is the number of nodes, and where \( u_{ind} \) is the NURBS curve node according to Eq. 3-(6).

Take a flexible rod unit with nodes \( i, j \) at both ends, and set the flexible rod on the local coordinate axis \( \xi \).

The displacement method is used, with the unit node displacement as the basic unknown quantity. Let the nodal displacement vector of the unit be \( u_{e} = [u_i \ u_j]^T \), according to the finite element idea, the displacement of any arbitrary point in the unit can be obtained from the nodal displacement. Assuming that the displacement in the unit is linearly distributed, the displacement of each point on the elastic rod \( u(\xi) \) is obtained from Lagrange interpolation by the formula:

\[ u(\xi) = \begin{bmatrix} \xi_j - \xi_i & \xi_j - \xi_i \\ \xi_j - \xi_i & \xi_j - \xi_i \end{bmatrix} \begin{bmatrix} u_i \\ u_j \end{bmatrix} \]

(2)

can be abbreviated as:

\[ u = Nu_{e} = [N_i \ N_j] \begin{bmatrix} u_i \\ u_j \end{bmatrix} \]

(3)
Where $N$ is the displacement function, $u$ is the displacement of any point in the cell, 
$$N_i = \xi_j - \xi_i,$$
$$N_j = \xi_i - \xi_j.$$  
In the local coordinate system of this model, the nodal displacements $u_i, u_j$ of node $i, j$ correspond to the parameters $\xi_i = -1, \xi_j = 1$, respectively:

$$u(\xi) = \left[ \frac{1}{2} (1-\xi) \frac{1}{2} (1+\xi) \right] \begin{bmatrix} u_i \\ u_j \end{bmatrix}$$  
(4)

Among them, $N_1 = \frac{1}{2} (1-\xi), N_2 = \frac{1}{2} (1+\xi)$.

The unit strain $\varepsilon$ can be expressed by the nodal displacement, and since the elastic rod is a one-dimensional rod, its unit strain is:

$$\varepsilon = \frac{du}{d\xi} = \left[ \frac{dN_i}{d\xi} \frac{dN_j}{d\xi} \right] \begin{bmatrix} u_i \\ u_j \end{bmatrix} = \left[ -\frac{1}{\xi_j - \xi_i} \frac{1}{\xi_j - \xi_i} \right] \begin{bmatrix} u_i \\ u_j \end{bmatrix}$$  
(5)

Among them:

$$\varepsilon = \begin{bmatrix} -\frac{1}{2} \\ -\frac{1}{2} \end{bmatrix} \begin{bmatrix} u_i \\ u_j \end{bmatrix}$$  
(6)

writing it in matrix form.

$$\varepsilon = \frac{du}{d\xi} = \frac{dN}{d\xi} = Bu$$  
(7)

Where $B$ is the strain matrix:

$$B = \frac{dN}{d\xi}$$  
(8)

The expression for the stress $\sigma$ at any point on each section of the cell expressed in terms of nodal displacements can be obtained from Hooke’s law:

$$\sigma = E\varepsilon = EBu$$  
(9)

Where $E$ is the modulus of elasticity.

According to the principle of imaginary work, the imaginary displacement of an elastomer under the action of an external force, calculated for any equilibrium position, has an imaginary strain that can be equal to the virtual work of the external force. The virtual displacement at node $i, j$ is $\delta u_i, \delta u_j$. 
and the nodal force is $F_i, F_j$, respectively. The virtual displacement at any point in the rod is $\delta u$, the virtual strain becomes $\delta e$, and the virtual strain satisfies $\delta e = B \delta u$. By the principle of virtual work:

$$ \int_V \delta e^T \sigma dV = \delta W \quad (10) $$

Due to the arbitrary nature of the imaginary displacement, there is:

$$ \left( \int_V B^T EB dV \right) u = F \quad (11) $$

Among them:

$$ F = K u \quad (12) $$

Where the stiffness matrix is given by:

$$ K = \int_V B^T EB dV \quad (13) $$

For elastic rods, there are:

$$ K = A \int_{\xi_i}^{\xi_j} B^T EB dV = AE \int_{\xi_i}^{\xi_j} \left[ -\frac{1}{\xi_j - \xi_i} \right] \left[ -\frac{1}{\xi_j - \xi_i} \frac{1}{\xi_j - \xi_i} \right] d\xi 
= AE \left[ \frac{1}{(\xi_j - \xi_i)^2} - \frac{1}{(\xi_j - \xi_i)^2} \right] = \frac{AE}{(\xi_j - \xi_i)^2} \left[ 1 -1 \right] $$

$$ \frac{1}{(\xi_j - \xi_i)^2} \left[ 1 -1 \right] \quad (14) $$

i.e.:

$$ K = \frac{AE}{(\xi_j - \xi_i)^2} \left[ 1 -1 \right] \quad (15) $$

Where $A$ is the cross-section of the rod, and is a constant. In the local coordinate system established in this paper, the expression of the stiffness matrix is:

$$ K = \frac{AE}{4} \left[ \begin{array}{cc} 1 & -1 \\ -1 & 1 \end{array} \right] \quad (16) $$

The elastic rod is in three-dimensional space, and the solution requires transforming the local coordinates established by each elastic rod into the overall three-dimensional coordinates. Each node has three displacement components and nodal force components, and the nodal displacement components and nodal force components of the cell are:
In the local coordinate system, its cell equilibrium equation is:

\[ F = Ku \]  

In three-dimensional space, the equation:

\[
\begin{bmatrix}
F_{xi} \\
F_{yi} \\
F_{zi} \\
F_{xj} \\
F_{yj} \\
F_{zj}
\end{bmatrix} = \frac{AE}{1} \begin{bmatrix}
1 & 0 & 0 & -1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 \\
-1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix} \begin{bmatrix}
u_i \\
v_j \\
w_i \\
u_j \\
v_j \\
w_j
\end{bmatrix}
\]

Where \( A \) is the cross-section of the rod, and \( l \) is the length of the elastic rod. The expression of the stiffness matrix is as follows:

\[
K = \frac{AE}{1} \begin{bmatrix}
1 & 0 & 0 & -1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 \\
-1 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}
\]

In order to form the overall equilibrium equation from the unit equilibrium equations, a coordinate transformation is required, i.e., the unit equilibrium equation in the local coordinate system is transformed into the form in the overall coordinate system.

Assume that the coordinate transformation matrix for conversion from local coordinates to integral coordinates is \( L \). \( L \) is an orthogonal array with the equation:

\[ L^{-1} = L^T \]

The cell stiffness matrix in overall coordinates is:

\[ K' = L^T KL \]

The single yarn unit mass matrix takes a centralized mass matrix. The centralized mass matrix concentrates the unit masses on the nodes. That is, the masses are only on the nodes so that the nodes are acceleration independent and uncoupled from each other to improve the calculation speed. The
unit masses are equally distributed to all nodes for a one-dimensional elastic rod cell with two nodes, where the mass matrix is:

\[
M = \frac{pAl}{2} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}
\]  

(24)

where \( p \) is the material density, \( A \) is the cross-sectional cell area, and \( I \) is the length of the elastic rod cell. For the elastic rod cell in three dimensions, the mass matrix is:

\[
M = \frac{pAl}{2} \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}
\]

(25)

Considering the equilibrium problem of any volume \( V \) in a continuous medium, for the volume of space occupied by a part of the object in a timely configuration and its boundary surface \( S \), this part of the continuous medium is subjected to the surface force \( t \) and volume force \( f \) per unit area. When in equilibrium, this part is subjected to a combined force and a combined moment of zero. Since the elastic rod model of a single yarn is subjected to only axial forces and does not transmit moments, only the combined force of zero is considered here.

\[
\int_S t dS + \int_V f dV = 0
\]  

(26)

Where \( t = n \cdot \sigma \), \( \sigma \) is the stress matrices of the points, and \( n \) is the normal to the \( S \) points. According to Gauss’ theorem, the equation is derived as:

\[
\int_S t dS = \int_V \left\{ \left( \frac{\partial}{\partial x} \right) \cdot \sigma \right\} dV
\]

(27)

Then there are:

\[
\int_V \left\{ \left( \frac{\partial}{\partial x} \right) \cdot \sigma + f \right\} dV = 0
\]  

(28)

Since the volume is arbitrary volume, the equilibrium equation in differential form is:

\[
\left( \frac{\partial}{\partial x} \right) \cdot \sigma + f = 0
\]

(29)

The differential form of the equation of motion is:

\[
\left( \frac{\partial}{\partial x} \right) \cdot \sigma + f = M \frac{\partial^2 u}{\partial t^2}
\]

(30)
### 3.2 Database construction

The content of the fields in the tables created in the database system design is related to the business of the application system and is mainly used to record relevant information in the business and also to provide an effective database for the management system. The system architecture is composed of many structural elements and various views or perspectives, and the various views are mainly based on the linkage and interoperability between the constituent elements. The system architecture is shown in Figure 2.

**Figure 2. System structure diagram**

According to the organization of the system and the richness and diversity of the content, the file organization of the data uses text, image, video, and other file types, depending on the actual needs of the functional requirements at the time of system design. Embroidery display platform craft browsing classification browsing permission management registration verification email retrieve password detailed browsing classification browsing detailed browsing login logout project evaluation project display posting reply message personal information modification project discussion game classification browsing discussion module web game trial.

Considering the security of the system, user rights are functionally set to three levels. The first level is the super administrator, who has all the database permissions, such as adding items, password modification, publishing items, project management, item review, adding and deleting managers, and managers’ permissions assignment. The second level is the entry reviewer, who is with the corresponding section to add, review and delete items, publish items, password change, content management, content review, and browser permissions. The third level is the general entry staff. He is with permission to add and delete news, password change, browse, etc. The fourth level is the general user, who only has browsing permission. The specific use case analysis is as follows: Users...
who are not logged in or logged in but not verified have the functions of logging in, registering, browsing pages, browsing forum posts, browsing web games and game trials, searching items, etc. As shown in Figure 3.

Figure 3. System user rights map

Logged-in and verified users have all the functions of non-logged-in users except registration and have the additional functions of forum posting, viewing personal information, profile modification, in-site posting, safe logout, etc. Administrators have all the functions of ordinary members and have additional functions such as project management, advertising management, posting management, and member management.

The production of the Hunan folk embroidery database is mainly from the collection of digital resources in the early stage, editing and processing in the middle stage, and the integration of resources and database production in the late stage. The main functions include (1) a Graphic introduction of Hunan folk embroidery, mainly including the introduction of artistic style and techniques of Hunan folk embroidery. (2) Hunan folk embroidery skills video display, in the form of live shooting, showing the demonstration of Hunan folk embroidery techniques and processes. (3) Interactive games of Hunan folk embroidery to experience the different design contexts brought by the art of embroidery in an interactive form.

System hardware and software requirements, hardware requirements: minimum Pentium-class computer configuration, memory configuration of at least 32M. Software requirements: (1) Microsoft Windows95/98/2000/XP operating system. (2) IE5.0/6.0 or other browsers. (3) PS\FLASH when the user starts the IE browser, in the address, directly enter the address of the server where the system is located. You can enter the main interface of the system. Users can also set the system’s home page as the browser’s home page in the following way: select the browser menu “Tools, Options” pop-up browser configuration dialog box in the address bar, directly enter the system home page URL, click the “use the current page” button can be. If the current page happens to be the system home page, click the “Use current page” button to confirm, then the home page of “Hunan Folk Embroidery Digital Communication System” can be set as the browser’s provincial home page. The content of the Hunan embroidery art database is basically managed through the backend. Users can enter the login and password to enter the system management interface and perform the corresponding operations according to the authority to realize the information dissemination of Hunan folk embroidery digital communication.
4 Results and analysis

In order to understand the main communication channels of Hunan embroidery, the survey results show that information transmission through human-to-human communication activities is still the main way of cultural transmission by Hunan embroidery. Hunan embroidery products often have ornamental value through multiple forms of embroidery, physical forms, and natural colors. At the same time, Hunan embroidery products also carry the value of commemorating the experiences and experiences of tourists during their travel in Hunan. These experiences and experiences may be the activities that tourists have personally experienced during their journey, and they may also be the respect and curiosity of tourists for certain regional beliefs and Hunan human customs. Tourism products that combine these experiences and experiences will resonate with tourists’ interests and generate good interaction and memories, and thus have their ornamental and special commemorative values. Consumers’ evaluation of the current situation of Hunan embroidery products is shown in Figure 4.

![Figure 4. Consumers’ evaluation of the current situation of Hunan embroidery products](image)

It can be seen from Figure 4 that, when further investigating Hunan embroidery products, inconvenience in carrying, single variety, rough packaging, and old-fashioned themes were mostly considered as the shortcomings of Hunan embroidery products. There was not much difference in the perception of inconvenience and variety among the three age groups of the respondents. However, the proportion of people under 30 years old who thought the packaging and themes of Hunan embroidery products were boring and old-fashioned was significantly higher than that of people over 50 years old, which indicates that the appreciation and aesthetic interest of traditional Hunan embroidery products have changed greatly among the younger generation, and also indicates that Hunan embroidery needs to integrate modern art development and aesthetic interest in order to achieve innovative development. Through field surveys and questionnaires, in order to understand the real response of current tourists to Hunan embroidery tourism products, we have better analyzed the consumer groups of Hunan embroidery tourism products and laid a solid foundation for the positioning and creative design of Hunan embroidery tourism products. We mainly collected from
three age levels of Hunan tourism scenery consumers under 30 years old (including 30 years old), over 50 years old (including 50 years old), and 30 to 50 years old, and the results are shown in Figure 5.

(a) Age group analysis of tourism consumers in Hunan tourism scenic spots

(b) Graph of the proportion of purchase motives

Figure 5. Analysis of consumer groups of Hunan embroidery tourism products
From Figure 5(a), it can be seen that there is a significant difference in the age group of travelers purchasing Hunan embroidery tourism products. In the statistical analysis of tourism consumers’ age data, the proportion of people aged below 30 years old (including 30 years old) accounts for 25% of the population. In terms of consumer demand for travel products, this segment of the population is often limited in their ability to spend financially and has limited spending power. However, it is worth noting that people at this age level are active in their thinking and love to travel. We further find that there is little gender difference in the people in this age group who pay attention to Hunan embroidery tourism products, all of them show some interest in Hunan embroidery, but they have more perceptual knowledge about Hunan embroidery tourism products and will buy them if they think they are suitable. While paying attention to the exquisiteness of Hunan embroidery products, they are more inclined to buy Hunan embroidery tourism products with a unique personality.

However, in the age group greater than 50 years old (including 50 years old), people only accounted for 11% of the total population. This group of consumers in the tourism product consumption market is more conservative. 30 to 50 years old people reached 64% of the proportion. The proportion of consumer age composition is mainly middle-aged people, and they have a certain degree of financial ability and time allocation. The rigid demand for tourism is greater, but this part of the population in the occupation, like the direction of the difference, is worth noting that this part of the group is more mature, smooth thinking, has a unique view of things, more concerned about the deeper connotations of the product. Such as tourism products in wood products can be used to create paperweight or pencil holder, or teacup, especially in the process of tourism often focus on tourism products with a personal style and strong art, one hand to meet the practicality of the same time, but also to meet the needs of the inner culture.

It can be seen through Figure 5(b) that the main motivation in purchasing tourism products is because of the symbolic meaning of the product pattern, product function, reasonable price, convenience to carry, good craftsmanship, very fashionable, etc. The shares of these proportions are not similar. The proportion representing Hunan Hunan embroidery patterns is shown in Figure 6.
As the results in Figure 6 show, consumers of all ages think that the patterns representing Hunan embroidery mainly include Hunan characteristic landscapes, portraits of Hunan great men, traditional flowers, birds and animals, and totems of Chu culture, etc., among which Hunan characteristic landscape accounts for 54% of the largest proportion.

The regional cultural aspects of Hunan embroidery tourism products are often known through the information visitors have before or during the tour or the experiences and experiences they have during the tour. These experiences and experiences may be respectful and curious about certain regional beliefs and human customs. Therefore, the integration of local and regional culture into Hunan embroidery tourism products has vitality and vigor. It can be seen that people’s demand for regional culture is the very demand for the universal pursuit of tourism products, reflecting people’s love for culture with local characteristics.

5 Conclusion

With the development of science and technology, with the application of new technology, it is in line with the development of the diversified era while not losing its originality, although the modern science and technology on the inheritance technology of Hunan embroidery art fit research all still have their own defects. This paper presents Xiang embroidery art by using digital data source integration construction database, interactive virtual reality display design and digital innovation design, and other technological means, which is the trend of the times, realizes all-round and three-dimensional digital communication, helps to promote traditional culture, creates cultural value, plays a positive role in promoting the inheritance of Xiang embroidery, and highlights the importance of its innovative inheritance. The results of the study show that the proportion of Hunan embroidery tourism products purchased by people in the relevant departments of state-owned enterprises is 60%, ranking first, while the proportion of Hunan embroidery tourism products purchased by people in the relevant departments of private enterprises is 23%, and these two categories constitute the mainstream of the Hunan embroidery tourism products market. Hunan embroidery can be preserved to this day, it is passed down through highly exquisite and unique embroidery skills through generations of inheritors, and the integration of traditional conservation is to allow Hunan embroidery to have inheritance and development so that this new development model can serve humanity and society more effectively.

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