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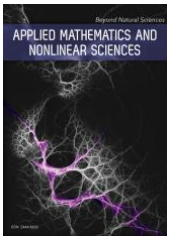

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Research on the expression and creativity of traditional ethnic cultural elements in clothing design based on the fusion of multi-source and multi-objective statistical information

Yun Ma[1], Lei Zhang[2,†]

1. Liuzhou Vocational & Technical College, Liuzhou, Guangxi, 545006, China.
2. Qiongtai Normal University, Haikou, Hainan, 571100, China.

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Abstract

The use of multi-source, multi-objective statistical information fusion is utilized in this paper to identify garment design targets, and the correlation is judged based on garment data. Some parameters are pre-set to generate linear garment descriptions for multi-source, multi-objective information fusion and find the adaptability of ethnic elements under random coefficients using element information relationships. The clothing width vector of the radial basis function is calculated by clustering ethnic culture element data using centroid information. The results show that the innovation rate of ethnic elements of Miao batik reaches the highest 0.57, the average adaptation value in the garment design is increased by 4.92%, and the ethnic-cultural elements are embodied 280 times, which indicates that the proposed method can promote the traditional excellent culture.

Keywords: Multi-source multi-objective; Elemental information; Random coefficients; Ethnic elements; Radial basis functions.
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†Corresponding author.
Email address: zhanglei@mail.qtnu.edu.cn

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1 Introduction

1.1 Background of the study

Traditional clothing is one of the important carriers of traditional cultural elements and the main source of inspiration in modern ethnic clothing design, showing the profound cultural connotation and unique charm of ethnic clothing design [1-2]. Traditional culture in various forms provides many creative inspirations and design ideas for modern ethnic clothing design and is an effective way for ethnic clothing designers to build ethnic clothing brands and manifest contemporary clothing art [3-5]. With the country's increasing strength as a whole, the general public has become more aware of ethnic clothing culture, which requires modern ethnic clothing designers to have a more in-depth understanding and mastery of traditional culture [6-8]. The unique cultural charm of ethnic clothing design is revealed by the innovative application of traditional cultural elements [9-10].

1.2 Methodology of this paper

A model for expressing traditional ethnic and cultural elements is created by integrating multi-source and multi-objective statistical information with clothing design in this paper. The relevance of clothing design is judged through identifying and fusing clothing design targets during the design process. The distribution probability density function is described by the pre-set partial parameters of traditional ethnic culture elements, which are given by the target fusion statistics of the element parameters. According to the distance between elements to form a uniform distribution state, as a measure of the clothing design morphological effect of quality evaluation index, control parameters for clothing design adjustment, the clothing design constraint clustering problem is described. By clustering the ethnic culture element data, the centroid of the radial basis function of the implied layer is obtained in this way. The input clothing design data are passed through the implied and output layers for relevant calculations. The traditional gradient descent method is used to continuously correct the ethnic culture element parameters to the output layer for linear calculation of the weights. This paper analyzes the expression and creative research of ethnic and cultural elements to fully demonstrate the change of cultural communication from form to divinity, prompting traditional culture to give important aesthetic value meaning to modern ethnic clothing design and further promoting the inheritance and innovative development of traditional excellent culture.

2 Literature review

Traditional ethnic and cultural elements are gradually formed in the evolution and development of ethnic culture and can greatly reflect the material culture as well as the spiritual culture of the nation. The uniqueness of traditional Chinese ethnic culture can be fully reflected through the strong ethnic characteristics of traditional ethnic cultural elements. The literature [11] examines how the ethnic cultures of different tribes in Botswana can be used to inspire the design of new products. Through a case study of students at the University of Botswana on a specific theme of ethnic and cultural knowledge to inspire the design of future innovative products, visual analysis was used to assess the inclusion of ethnocultural meanings in the students' clothing designs. Students utilized cultural heritage to design and modernize ethnic and cultural symbols to create symbolic, innovative, and futuristic clothing products. The literature [12] examines the innovative use of traditional folk art combined with other fashion and design techniques. Using literature research and physical investigation, an image library is established after classifying paintings, and image extraction techniques are used to extract characteristic elements with cultural symbols and

representative colors to build a corresponding element resource library. The creative transformation of folk art into fashion clothing design is achieved by creating works with regional characteristics based on modern design aesthetics and clothing craft design means.

The literature [13] observes the similarities and differences in the understanding of national identity by contemporary Chinese and Korean fashion designers. A model of factors influencing designers' sense of national identity was developed, emphasizing cultural characteristics, the openness of social systems, and international and economic status, which influence the national identity expressed in designers' fashion work. National identity is often adopted in clothing design about traditional Chinese national elements, and Chinese designers have a deeper understanding of traditional national culture or philosophy and a stronger civic national identity. From the late 20th century to the early 21st century, the literature [14] demonstrates the characteristics of ethnic design in applied arts. The use of various elements of ethnic design in decorative arts depends on appropriateness and the author's preference, and the attraction to the past and popular cultural sources through the critical path of ethnic design development lays the foundation of ethnic design to embody a certain idea, a specific image. Using ethnic design in specialized thematic environments to present national cultural traditions, ethnic design is a human need for spiritual support of national traditions and the interconnection of generations.

Analysis of the research mentioned above reveals that it is difficult for modern ethnic costume design to meet the public's dressing needs and design ethnic costumes that meet the modern public's artistic and aesthetic interests, which in turn cannot fully display the essence of ethnic costumes and allow the modern ethnic costume design level to be further improved.

3 Integration of multi-source and multi-objective statistics with apparel design

3.1 Build a model of traditional national cultural elements expression

Modern clothing design is holistic, emphasizing coordination and unity among diverse factors like color, fabric, and style [15-16]. The reasonable application of traditional ethnic culture in clothing design makes clothing design solutions take on a new vitality, and because traditional ethnic, and cultural elements vary and have different connotations, different expressions are used to reflect different design meanings [17-18]. The efficient integration between traditional cultural elements and design works is promoted by fully exploring the artistic beauty of traditional cultural elements. As shown in Figure 1, this paper constructs an expression model of traditional national cultural elements based on this.

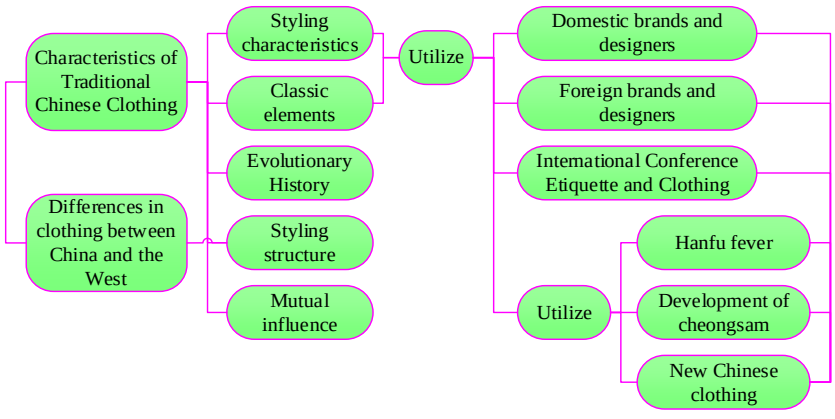


Figure 1. Expression model of traditional ethnic cultural elements

It is important to integrate traditional ethnic and cultural elements into clothing design and actively break away from the relatively traditional clothing design concept in the past. The main way to spread traditional ethnic culture is by creating a model for expressing traditional ethnic and cultural elements in apparel design. In-depth understanding of the historical and cultural background of each ethnic group, reading the cultural connotation and aesthetic qualities contained in the pattern patterns of the elements, fusing them with modern cultural and popular elements, and applying them to the clothing design. Actively exploring the excellent traditional costume cultural resources, taking non-heritage costume skills as an example, various types of embroidery crafts, batik inheritance skills, silk cloth piecing, etc. Ensure that the development history of Chinese costume crafts is fully demonstrated. The modeling characteristics, classic element use, and evolution history in Chinese traditional costume features can be compared with the modeling structure of Chinese and Western costumes, and the national elements can be applied to modern costume design to experience the cultural connotation of national costumes, find aesthetic elements with national characteristics, and integrate them into modern costume design to interpret the new charm of national style costumes truly.

3.2 Multi-source and multi-objective information fusion

Based on the cultural beliefs, living customs, totem worship, pattern patterns, and traditional craft scriptures of traditional ethnic and cultural targets, clothing design target identification and fusion are performed to judge the relevance of clothing design [19-20]. Multi-source multi-objective information fusion is expanded through data interconnection and the definition of conditional probabilities.

$$\beta_{jt}(k) = \Pr\left\{\theta_{jt}(k)\middle|Z^k\right\} \tag{1}$$

$\beta_{jt}(k)$ represents the probability of target t picking up at k moments, and clothing design target j is derived from clothing design target t. In particular, when $t=0$, it means that both targets are unrelated, while the probability that the j th measure is interconnected with the target is:

$$\beta_{jt}(k) = \Pr\left\{\theta_{jt}(k)\middle|Z^k\right\} = \Pr\left\{\bigcup_{j=1}^{n_k}\theta_{jt}^{j}(k)\middle|Z^k\right\} \tag{2}$$

Where $\theta_{jt}^{i}(k)$ event represents the measured clothing model, n_k is the total number of joint events, and $\theta_{jt}(k)$ is the i th of these joint events, from which the state estimate of target t at moment k can be obtained as follows:

$$\hat{X}^t\left(k\middle|k\right) = E\left[X^t(k)\middle|Z^k\right] = \sum_{j=0}^{m_k}\beta_{jt}(k)\hat{X}_j^t\left(k\middle|k\right) \tag{3}$$

Where, $\hat{X}_j^t\left(k\middle|k\right)$ denotes the state estimate of the j rd measurement at moment k for the apparel design target t, and $\sum_{j=0}^{m_k}\beta_{jt}(k)$ denotes the association probability to set the target correlation, assuming a memory system with a measurement equation and state equation of the form:

$$x_k = A_k x_{k-1} + B_k u_{k-1} + W_k w_{k-1} \tag{4}$$

A_k, B_k, W_k are the parameters of the traditional national cultural elements part of the system pre-set, cultural elements parameters available system configuration clothing design file, given by the target fusion statistics of the element parameters, u_k is the memory system given the input signal, w_k is the Gaussian white noise in the variable of Eq.

An effective model is constructed using a linear clothing design process with multi-source multi-objective information fusion, which can generate a multi-source multi-objective information fusion linear clothing description, calculated in the form of:

$$x(t) = x_0 + \lambda t + \sigma B(t) \tag{5}$$

x_0 represents the initial garment design state, λ represents the ethnic element prediction coefficient, t represents the element prediction time, σ represents the element diffusion coefficient, and $B(t)$ represents the element motion function, which can be combined with the descriptive formula to calculate the probability density function of the life distribution, and the expression is:

$$f(t|\lambda) = N(x_0 - N_\lambda) \tag{6}$$

In Equation (6), N represents the number of random individuals, N_λ represents the ethnic element prediction parameter, and the information relationship between the elements is used to generate a multi-objective statistical information clothing design, expressed as:

$$R = \frac{\omega}{\sqrt{2\pi t^3\left(c_r^2 t + c_B^2\right)}} \exp\left(-\frac{w - x_0}{2t}\right) \tag{7}$$

Where $\frac{\omega}{\sqrt{2\pi t^3\left(c_r^2 t + c_B^2\right)}}$ represents the ethnic element fitness, c_r represents the random coefficient, c_B represents the a priori information constant, and w represents the cultural threshold.

Assume that the element target in the search ethno-cultural region moves in a straight line with the state vector:

$$S_k = \left[x_k \ x_k \ y_k \ y_k \ z_k\right]^T \tag{8}$$

Where x_k and y_k denote the position distance of the cultural element target in the x and y directions, respectively, x_k and y_k denote the velocity of the target in the x and y directions, respectively, and z_k denotes the echo intensity of the target, whose magnitude is unknown. The discrete form of the target state equation can be expressed as:

$$S_k = FS_{k-1} + V_k \tag{9}$$

Where, V_k satisfies the noise of the zero-mean Gaussian process with covariance Q, S_k indicates the state vector of the garment target at the k th sweep.

The study of clothing design tends to traditional national cultural elements, according to the distance between elements to form a uniform distribution state, as a measure of the quality of clothing design morphological effect evaluation index, the expression is:

$$Q_s = K_s\left(\sum_i \sum_{j\in\left(d_{ij}<R_{incommn}\right)} w_i^j\left(P^i - P^j\right)\left(1-\frac{R_{desise}}{d_{ij}}\right)\right) \tag{10}$$

Among them, P^i is the location of clothing design form, $d_{ij} = \left|P^i - P^j\right|$ is the distance between ethnic culture elements, $R_{incommn}$ is the clothing design expression distance, through the design expression to obtain the specific design form range, w_i^j is the clothing design influence weight, through the control parameters for clothing design adjustment, R_{desise} is the clothing constant expectation.

Through the analysis of different clothing design elements expression, it is found that the application of traditional ethnic culture elements can better show the clothing form, and in order to reduce the complexity of clothing design, the optimization objective function is redesigned, and the sub-table metric moves the position change, and the clothing design effect:

$$fun6^i = \begin{cases} 1, & if \quad \exists d_n^i \le R_{zn} \\ 0, & if \quad \forall d_n^i \le R_{zn} \end{cases}, n \in \left(n < N\right) \tag{11}$$

In equation (11), N and n are the total number of elements and serial number of the clothing design area, R_{zn} is the radius of the nth clothing design area, and d_n^i is the distance between the i th ethnic culture element and the center of the design area.

The dataset can be expressed in the form of a concatenation of the measurement sets of multiple garment sensors, defining the measurement set of garment sensor s, where m_s is the number of elemental data points in garment sensor s, and the dataset Z can be expressed as:

$$Z:\left\{S_1, S_2, \cdots, S_n\right\} = \left\{z_1^1, z_2^1, \cdots, z_{m_1}^1\right\} \tag{12}$$

Where n is the number of garment sensors, the garment design clustering problem requires the data set to be divided into k clusters, defining the clutter in data set Z as C_0 and the observation set of the target as C_T. By calculating the Gaussian kernel function distance $d\left(Z_i^s, Z_j^e\right)$ between the measurement data points Z_i^s of garment sensor s and the measurement data points Z_j^e of other garment sensors e, $e \in \left\{1, 2, \cdots, n\right\}$ in the data set, as shown in Equation (13):

$$d\left(Z_i^s, Z_j^e\right) = \exp\left(-\frac{\left\|Z_i^s - Z_j^e\right\|^2}{2\sigma^2}\right) \tag{13}$$

Where σ is the observed noise, and if $d\left(Z_i^s, Z_j^e\right)$ is smaller than the truncation distance ε_i, then Z_i^s and Z_j^e are determined to be interrelated, and the points with the smallest distance between Z_i^s and the other sensors are selected and clustered as cluster C_i.

Screening of suspected target measurements relies on a priori regular sensor s to produce the measurement data points of target i. The Euclidean distance matrix of the measurement data set Z produced by other sensors, where the average of the first n minimum distances should be less than 3 times the observed noise, can be changed to:

$$\overline{d_i} = \frac{\sum_{T=1}^{T=r} d_i\left(T, z_i^L, Z\right)}{r} \tag{14}$$

$\Sigma_{T=1}^{T=r}$ is the sensor with the most filtered measurement data points, z_i^L is the sensor with the most measurement data points, and $\overline{d_i}$ is the average of the first n minimum distances between data point z_i^L and measurement set Z.

Multi-source Multi-objective Information Fusion algorithm uses the linear system state equation to optimally estimate the system state from the system input and output observations. The optimal estimation can be considered a filtering process because the observed data includes the effects of noise and disturbances in the system. In this project, the multi-source, multi-objective information fusion algorithm is used to filter the continuous output values of the fused target data and finally obtain the continuous and stable UAV fusion results.

The flow of multi-source and multi-objective information fusion algorithms can be seen in Figure 2. It can be seen that the output of garment product design is carried out by initially fusing garment design target data and using the principle of prediction function, whereby the error expression of traditional national cultural elements in garment design is understood. According to the prediction function and correction function coefficients, the continuity information fusion target output is carried out, and the cultural element expression data of clothing design is input to form a multi-source, multi-objective network. Integrating public aesthetic concepts and evaluation standards, the national costume elements are refined and combined with clothing design objectives and perfectly grafted and interpreted with modern clothing design. By reflecting ethnicity and tradition, the apparel products contain design energy and cultural connotations and uncover the basic point of apparel design expression and creativity. Widen the path of clothing design selection and create clothing design schemes, styles, patterns, and other elements. Tend to be diverse and effectively meet the diversified consumption needs of consumer groups.

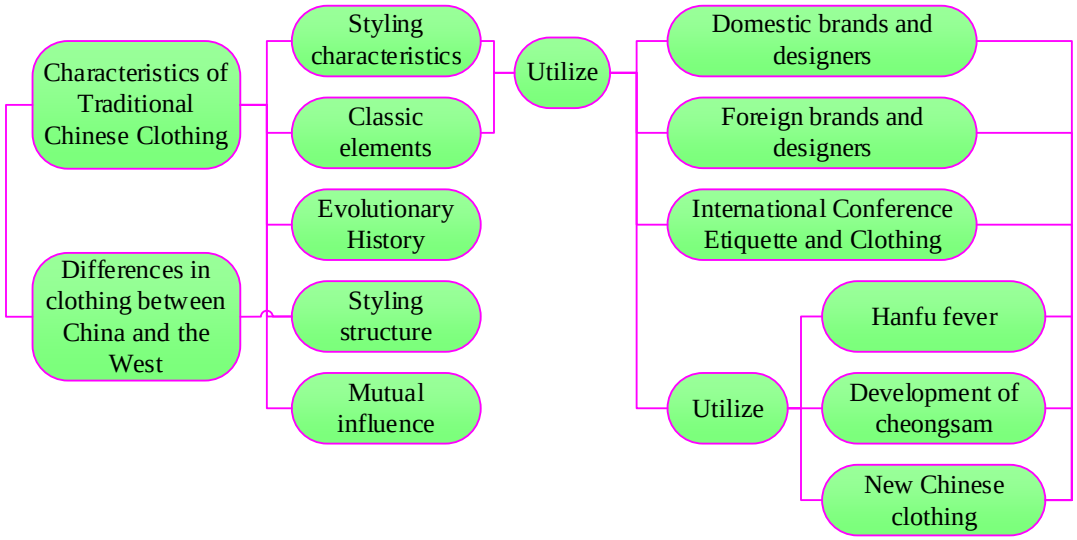


Figure 2. Process of multi-source and multi-objective information fusion

3.3 Swarm intelligence optimization algorithm

The cluster intelligence optimization network mainly processes the input clothing data from two parts by clustering the ethnic culture element data to obtain the centroid of the radial basis function of the hidden layer and use the centroid information to calculate the clothing width vector of the radial basis function and the width vector is calculated as follows:

$$\sigma_j = c_{\max} / \sqrt{2h} \tag{15}$$

Where $c_{\max}$ is the maximum distance between element centroids, $c_{\max}$ is the number of element nodes, and the input garment design data is calculated to the implicit layer and output layer respectively, and the output of the j th node of the implicit layer of input sample x_i is calculated by the following formula:

$$\phi(x_i, j) = \exp\left(-\frac{1}{2\sigma_j^2} x_i - c_j\right) \tag{16}$$

c_j and σ_j are the centroid and width vector of the j rd node of the hidden layer, respectively, and the output of the m th node of the input sample x_i in the output layer, the node output is:

$$y_m = \varphi\left(\phi(x_i, j) * \omega_m\right) \tag{17}$$

ω_m is the weight of the node, φ is the activation function, and the gradient value of each parameter is calculated by the error function, and the traditional gradient descent method is used to continuously correct the parameters of the ethno-cultural elements, taking the weights used for linear calculation in the output layer as an example, the update formula is as follows:

$$\omega_t = \omega_{t-1} - \mu * \frac{\partial E}{\partial \omega_{t-1}} \tag{18}$$

Where, E is the error function and μ is the error calculation rate, the centroid and width vector of the hidden layer are generated directly and randomly, after which the gradient correction according to the supervised process is applied.

The apparel design data is passed to the pattern layer, and the number of element nodes in this layer is the feature dimension of the input data, and the input data is processed using a Gaussian function, and the number of nodes is the number of training samples, which is calculated as follows:

$$g_i = \exp\left(-\frac{\left\|x_i - x_j\right\|}{2\sigma^2}\right) \tag{19}$$

x_i is the apparel design sample, x_j is the apparel design learning sample, and σ is the smoothing factor. Suppose the output sample dimension is k, the number of cultural element nodes in the layer is $k+1$, one node output S_D is the arithmetic sum of the pattern layer output, the rest of the node outputs S_{Ni} are the weighted output of the clothing design pattern layer, the number of element nodes in each layer of the structure are n, i and m, respectively, and the input data of the jth node of the hidden layer is calculated when the clothing design data is passed from the output layer to the hidden layer:

$$S_j = \sum_{k=1}^{n} \omega_{kj} x_k,\ j = 1, 2, \ldots, i \tag{20}$$

x_k is the knd sample data in the input garment data, ω_{kj} is the connection weight of the implied layer node, and the result is a scaling change of the wavelet basis at the implied layer node with the transform form:

$$\phi(x) = \cos(1.75x) * e^{-x^2/2} \tag{21}$$

$$h_j = \phi\left[\left(S_j - b_j\right) / a_j\right] \tag{22}$$

$\phi(x)$ is the wavelet basis function, b_j is the clothing smoothing factor of the basis function, a_j is the clothing scaling factor of the basis function, h_j is the output clothing design data of the jth node of the hidden layer, the output data of the node of the hidden layer enters the output layer, the node output calculation formula:

$$y_t = \varphi\left(\sum_{j=1}^{i} \omega_{jt} h_j\right), t = 1, 2, \ldots, m \tag{23}$$

In equation (23), ω_{jt} is the connection weight of the output layer in the garment design, and φ is the activation function. The apparel data is passed from the input layer to the calculation layer of the affiliation function, and the number of nodes in the calculation layer is the input variable, which constitutes the number of fuzzy conditions, and the affiliation function is chosen as a Gaussian function:

$$u_{ij} = e^{-\left[\left(x_i - c_{ij}/b_{ij}\right)\right]}, i = 1,2,\ldots,n; j = 1,2,\ldots,m \tag{24}$$

u_{ij} is the output of the culture element node, x_i is the input garment design data, c_{ij} is the centroid of the affiliation function, b_{ij} is the garment width vector of the affiliation function, and m is the number of fuzzy grading of the input. The garment data are passed to the rule generation layer, and the garment data are output for each fuzzy rule applicability degree, weighted by:

$$y = \sum_{j=1}^{m} \omega_j \beta_j \tag{25}$$

ω_j is the connection weights of cultural elements in the output layer, and the weights are set based on the dimensionality of the output variables of the clothing design network. When the dimensionality of the output variables increases, the weights will be adjusted accordingly, and the centroids of the affiliation function, the width vector and the connection weights of the output layer will be optimized.

Each cultural element searches for information according to its own situation and dynamically adjusts with the elements of other national cultures to determine the information iterations, and then updates the information of the location of the clothing national elements to generate new solutions, and the solution update method is as follows:

$$X_i^{t+1} = X_i^t + V_i^t \tag{26}$$

X_i^t denotes the position of the i nd elemental particle at the t rd iteration, V_i^t denotes the velocity of the i th particle at the t th iteration, and the velocity of each elemental particle can be calculated using the following equation:

$$V_i^{t+1} = \omega \cdot V_i^t + c_1 \cdot r_1 \cdot \left(p_{best}^{t,i} - x_i^t \right) \tag{27}$$

Where, ω is the inertia coefficient of the cultural element, c_1 represents the optimal weight value of the element, r_1 represents a random number generated by a uniform distribution with the range [0, 1], $p_{best}^{t,i}$ represents the optimal position of the i th element at t iterations, and the iteration can calculate the optimal position of all clothing design elements at the time.

Each ethnic culture element node clothing design pattern collection is connected, keeping the connecting line between two element nodes moving within the expression area and keeping a safe distance to reserve a certain space for clothing design expression. According to the generated data of ethnic culture element nodes, the group intelligent optimization algorithm is used to prompt the ethnic element nodes in the path to guide the overall creative direction of clothing design. Figure 3 shows the flow of the group intelligent optimization algorithm.

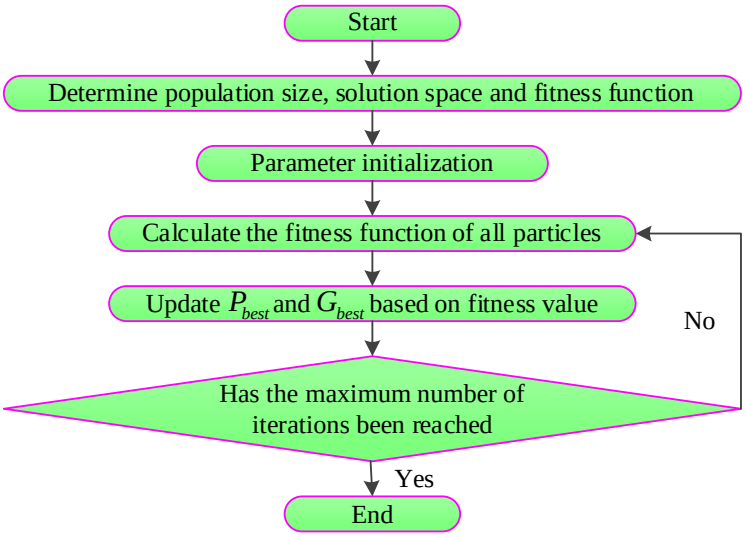


Figure 3. Process of swarm intelligent optimization algorithm

Define the ethnocultural key parameters using the swarm intelligence optimization algorithm and randomly start the position and velocity vectors of the elements. The fitness function values of each elementary particle are calculated, and the solutions are ascended according to these values so that the cultural elements are ordered based on the fitness function values. When the expression of national culture is not included in the scope of clothing design planning, the cultural elements are planned one by one by serial number.

The relative position information of traditional ethnic and cultural elements is first obtained, and the degree of integration of the ethnic and cultural elements with the garment design is judged based on this information. The traditional ethnic culture clothing field is designed with a special cultural connotation expression of the relevant patterns based on the specific meaning of traditional patterns. Multi-objective optimization is carried out in the corresponding field to select the optimal design direction and design concept, and finally update the current position of the ethnic cultural elements to understand these traditional design elements by heart for a short time, to grasp the content and information conveyed, and then to be able to realize better the expression and innovation of ethnic culture in clothing design.

4 Analysis of the expression and creativity of traditional national cultural elements in clothing design

4.1 Analysis of the Expression of national cultural elements

To analyze the multi-source, multi-objective statistical information fusion algorithm in performing the expression of ethnic, and cultural elements in clothing design, the ethnic, cultural elements dataset was selected for experimental analysis, which contains a total of 1000 sets of data, and 500 sets of data were randomly selected for analysis in the traditional ethnic cultural elements expression model. Calligraphy, Chinese knot, Su embroidery, Miao batik, dragon and phoenix patterns, totem auspiciousness, and fine flourishing flowers are among the traditional cultural elements in the dataset. Table 1 shows the representation of the seven ethnic elements in clothing design.

It can be seen from the embodiment status of the seven elements in the clothing design that the higher the correlation between the elemental characteristics of the model and the clothing design,

the better the expression effect of the ethnic and cultural elements of the model. Among the seven elements, the smallest value is the Chinese knot, with a score of 10.26 mg, and the difference between the smallest value of Miao batik and totem auspiciousness is only 0.09. Totem auspiciousness and fine flourishing flower ethnic and cultural elements are better reflected in the clothing design with the maximum value of 294.35 mg and 212.78 mg, and the relatively poor one is Su embroidery with only 114.98 mg. The highest mean value of the calligraphy element is 98.47. The smallest standard deviation is 14.23mg and 12.49mg for Su embroidery and Miao batik, respectively, indicating that the expression of traditional ethnic, cultural elements in clothing design is very good, the innovation and transformation of traditional cultural elements, the organic integration of traditional cultural elements and modern ethnic clothing design, the deepening of the cultural connotation of modern ethnic clothing design, and the design of modern innovative clothing design. Contextualize and design ethnic clothing that meets modern and innovative features.

Table 1. The embodiment of ethnic elements in clothing design

Category	Minimum Value (mg/kg)	Maximum Value (mg/kg)	Average Value (mg/kg)	Standard Deviation (mg/kg)
Calligraphy	12.29	182.36	98.47	26.65
Chinese Knotting	10.26	165.31	70.16	16.01
Suzhou Embroidery	14.02	114.98	58.19	14.23
Miao Batik	16.17	159.27	90.32	12.49
Dragon and Phoenix Pattern	13.32	177.62	62.33	18.71
Totem Auspiciousness	15.18	294.35	84.18	23.16
Fine and Dense Flowers	11.03	212.78	80.03	20.26

To prove that inertial design, random design, and partial design in ethnic and cultural elements can substantially improve the expression integration of clothing design and ethnic elements, this paper further explains the effectiveness of each clothing design approach. Experiments on the expression of clothing design were conducted from the ethnic and cultural elements of calligraphy, Su embroidery, Miao batik, and totem auspiciousness, and Table 2 compares the expression degree values of the ethnic and cultural elements.

All three clothing design approaches have good expression results in terms of optimal fitness value, worst fitness value, average fitness value, and standard deviation, indicating that inertial design, random design, and local design can all enhance the expression of ethnic elements in clothing design. The inertial design approach improved the mean fitness values by 1.32%, 1.78%, and 1.46%. The random design approach increased the average adaptation values by 4.92%, 4.88%, and 3.69%. The average fitness values were improved by 2.63%, 2.81%, and 2.87% in the local technology approach, respectively. Based on the above data analysis, using the average fitness value as an indicator, the random garment design approach obtained better results than the other two design approaches. It can be seen that through various creative means, the modern aesthetics of traditional ethnic culture can be enhanced so that the traditional ethnic, and cultural elements can be revitalized in clothing design and become an important element in modern clothing design to inherit and carry forward traditional ethnic culture.

Table 2. Comparison of expression values of ethnic cultural elements

Element	Index	Inertial Design	Random Design	Local Design
Calligraphy	Best	113.54	114.69	111.48
	Worst	92.59	102.10	94.76
	Mean	101.86	108.63	103.57
Suzhou Embroidery	Best	45.47	46.89	45.16
	Worst	36.60	39.41	35.18
	Mean	41.95	42.76	40.68
Miao Batik	Best	174.46	171.59	168.36
	Worst	161.56	169.28	167.19
	Mean	159.87	165.06	161.26
Totem Auspiciousness	Best	70.79	71.44	72.16
	Worst	66.69	64.93	63.15
	Mean	68.17	67.19	65.13

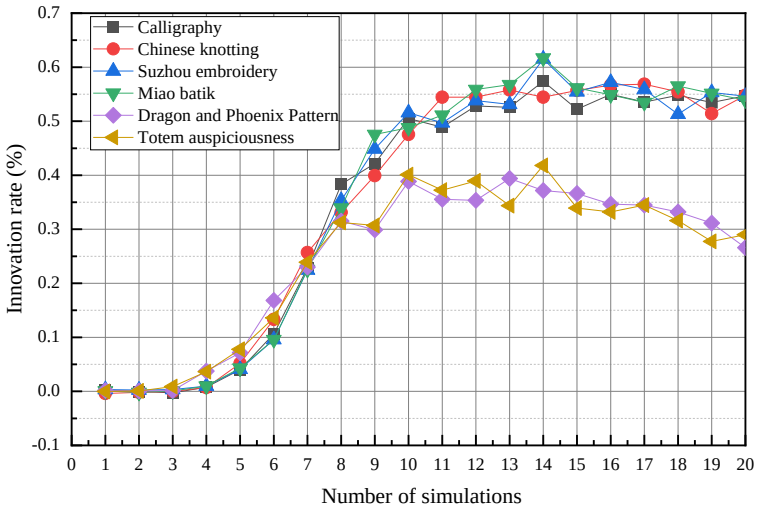
4.2 Creative Analysis of national cultural elements

To verify the specific innovation performance of traditional ethnic and cultural elements in the apparel design environment, this paper takes the traditional ethnic cultural elements expression model as the application background and conducts simulation experiments on six traditional ethnic and cultural elements in two directions, radially and tangentially, and Figure 4 shows the innovation index analysis of traditional ethnic, cultural elements in the apparel design.

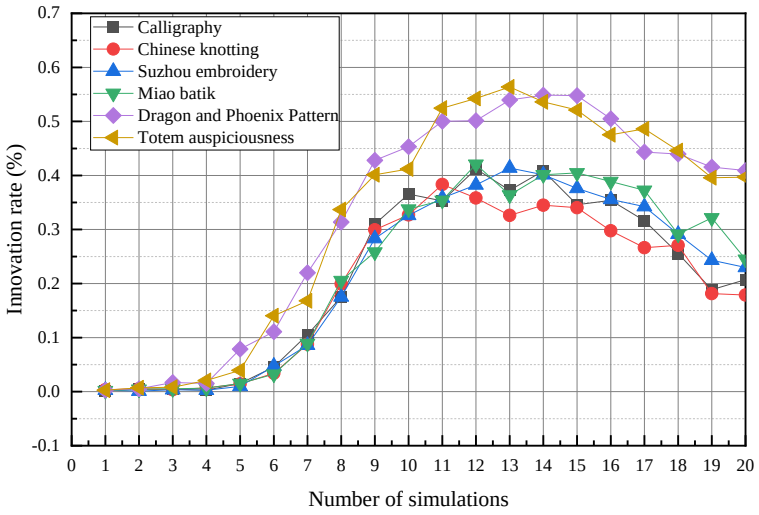
Figure 4(a) shows the radial innovation performance in the clothing design environment, and the innovation probabilities of various ethnic and cultural elements all show a relatively large change as the number of simulations increases. At the number of simulations from 1 to 5 times, the innovation rates of various ethnic elements do not significantly change. When the number of simulations was 5~10, the innovation rates of dragon and phoenix patterns and totem auspiciousness increased significantly, while the innovation rates of calligraphy, Chinese knot, Su embroidery, and Miao batik differed very little. The innovation rate of Miao batik reached the highest rate of 0.57 at 13 times of simulation, and the peak rate of Su embroidery at 14 times of simulation was 0.62. As the number of simulations increased, the innovation rate of dragon and phoenix patterns, totems, and auspicious rituals gradually decreased to the lowest rate of 0.27. It indicates that the traditional national cultural elements will be obvious with the increase in the number of simulations to improve the creativity of garment design.

The performance of tangential innovation in the clothing design environment is shown in Figure 4(b). When the number of simulations is 7~15 times, the innovation rate of four ethnic cultural elements, namely calligraphy, Chinese knot, Su embroidery, and Miao batik, gradually increases and finally stabilizes between 0.31~0.40 and gradually decreases after reaching the highest value of innovation expression. When the number of simulations was 15~20, the innovation rate decreased from about 0.35 to 0.21. As the number of simulations increased, the creative expressions of calligraphy, Chinese knot, Su embroidery, and Miao batik were in the average position of innovation in garment design. It shows that the enrichment of clothing design elements after broadening the path of clothing design can give clothing design ethnic characteristics and personalized features, add clothing design with beauty, inject a constant impetus for innovative

clothing design, and improve the effect of traditional cultural elements in clothing design in all aspects.



(a) Radial Innovation Performance in Fashion Design Environment



(b) Tangential innovation performance in the clothing design environment

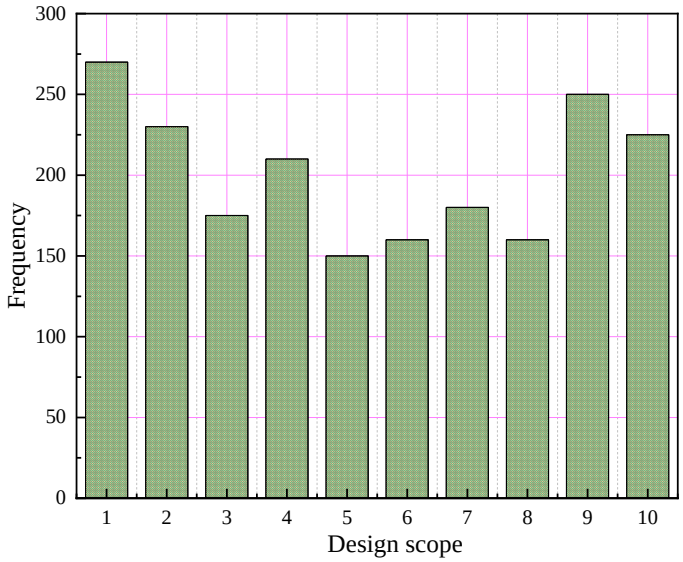
Figure 4. Analysis of innovative performance in the clothing design Environment

To improve the embodiment of ethnic and cultural elements in clothing design, a multi-source, multi-objective information fusion algorithm and group intelligence optimization algorithm are introduced to analyze the embodiment rate of elements through the traditional ethnic and cultural elements expression model, and the elements are embodied in the range of 1~10. Figure 5 shows the embodiment of ethnic and cultural elements in clothing design by both algorithms.

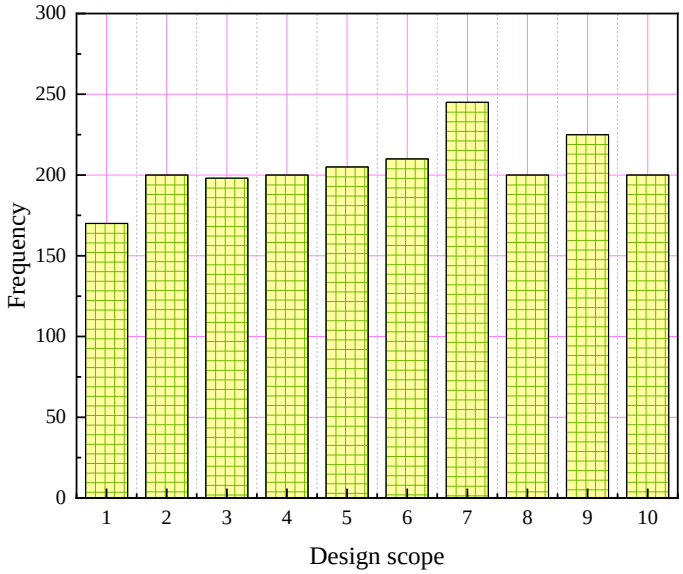
Figure 5(a) shows the integration of ethnic and cultural elements using the multi-source and multi-objective information fusion algorithm. In the design range 1~3, the embodiment of ethnic cultural elements gradually decreases from 280 to 162. When the design range is 57, the number of ethnic culture elements embodied begins to increase, and it increases by approximately 30 times. The number of ethnic culture elements embodied in the 910 design range is only 20 times. It indicates that incorporating ethnic and cultural elements in clothing design is excellent in the multi-source

and multi-objective information fusion algorithm and can accurately reflect ethnic and cultural characteristics.

Figure 5(b) shows the embodiment of ethnic and cultural elements under the group intelligent optimization algorithm. With the increase of the design range, the number of embodiment of ethnic cultural elements is slight; the maximum value is 210 times, and the minimum value is 160 times. The number of ethnic culture elements in the 28 design range is stable and maintained approximately 200 times. It indicates that incorporating ethnic culture elements is not evident in the group intelligent optimization algorithm and cannot be fully integrated into the clothing design. It indicates that analyzing the embodied value of traditional culture in clothing design can provide more possibilities for developing the Chinese clothing design industry.



(a) Embodiment of ethnic elements with multiple sources and objectives



(b) Optimizing Ethnic Elements through Group Intelligence

Figure 5. Comparison of Traditional Ethnic Cultural Elements

5 Conclusion

In summary, this paper is based on the fusion of multiple sources and objectives to identify and fusion apparel design targets. The multi-source, multi-objective information fusion is expanded based on data interconnection, the garment model is measured after defining conditional probability, and the garment design file is configured using cultural element parameters. According to the distance between elements to form a uniform distribution state, as a quality evaluation index to measure the effect of clothing design morphology, the ethnic, cultural elements data are clustered using the swarm intelligent optimization algorithm as a way to obtain the centroid of the radial basis function of the implicit layer. The results show that the highest average adaptation value of clothing design in the multi-source multi-objective information fusion algorithm is increased by 4.83%, the peak innovation rate of Su embroidery is 0.62, and the difference in the number of embodied ethnic cultural elements is only 20 times. To enhance the visual effect of people through the integration of cultural elements, enhance the modifying effect of modern clothing, and further improve the attractiveness of modern clothing to people, to promote the improvement of the level and strengthen the ability of professional designers of Chinese clothing design.

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About the Author

Yun Ma, Gender: Female, Native Place: Loudi City, Hunan Province, Present job unit: Liuzhou Vocational & technical college, Title or position: lecturer, Research area: Innovative design of national clothing.

Lei Zhang, Gender: Female, Native Place: Haikou, Hainan province, Present job unit: Qiongtai Normal University College, Title or position: lecturer, Research area: Craft Design and Fashion design.