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RESEARCH ON SHE NATIONALITY CLOTHING RECOGNITION BASED ON COLOR FEATURE FUSION WITH PSO-SVM

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Abstract:

Although the color characteristics of She nationality clothing are slightly different, there are multiple similarities in shapes and textures. Therefore, it is difficult to effectively distinguish different branches of She nationality clothing. To address this problem, this article, taking into account color feature fusion, proposes a recognition method based on a hybrid algorithm of particle swarm optimization and support vector machine (PSO-SVM). First, the color histogram and color moment (CM) feature descriptors were extracted from the five branches of She nationality clothing, and the color feature distribution of each branch was obtained. Then, color feature fusion is performed through optimization and dimensionality reduction of principal components. Furthermore, PSO was introduced to independently optimize parameter combinations. Finally, the different branches of She nationality clothing were automatically recognized. The results demonstrated that the proposed method could effectively distinguish different branches of She nationality clothing. Compared with the recognition accuracy of approaches using single-color histogram and CM feature, the performance of our proposed method was increased by 5.25 and 6.44%, respectively. When the penalty parameter γ and kernel parameter δ^2 of SVM were 123.29 and 1.16, respectively, the recognition accuracy of the model was the highest, reaching 98.67%. The proposed method could be a reference for the subdivision recognition of She nationality clothing.

Keywords:

She nationality clothing, color feature fusion, PSO-SVM, clothing recognition

1. Introduction

The She nationality is a minority in southeast China with a unique dress culture. Still, it retains many distinctive clothing characteristics, which are a symbol of the nationality and a basis of ethnic cognition [1]. She nationality clothing can be mainly divided into five branches: Jing Ning, Fu An, Luo Yuan, Xia Pu, and Fu Ding branches. Nevertheless, they are similar in shape, material, and other aspects. For example, they are all T-shaped and made of ramie, with the dominant colors (DCs) being blue and black. Therefore, they are difficult to be effectively distinguished, which directly affects the recognition accuracy.

Nowadays, automatic recognition of national clothing through image recognition technology has become the mainstream research direction of computer vision. Nawaz et al. [2] realized the interclass recognition of tops, bottoms, suits, and other garments using the convolutional neural network. Fu and Liu [3] characterized the clothing silhouette information with feature size, reference point, and silhouette curve, and established the calculation model of silhouette form value and form ratio for style recognition. However, the aforementioned methods mainly focus on clothing styles with significant differences in silhouette and have poor recognition accuracy for styles with great similarity and subtle category differences [4]. Therefore, related scholars proposed to convert the color image into a grayscale one to reduce the color interference. Then the local fine-grained features such as the scale invariant feature transform combined with a bag-of-words model were applied to recognize the She nationality clothing with similar silhouettes [5]. Nevertheless, a single feature can only describe the style information from one perspective, which has a small scope of application and a number of limitations. To solve the aforementioned problems, Surakarin and Chongstivatana [6] extended the applicability of feature descriptors by feature-level fusion of weighted speeded-up robust features and local binary pattern through the bag of features. Yao and Keand [7] performed generic intelligent scenery textures (GIST) and speeded-up robust features (SURF) fusion through weight proportion, demonstrating that multifeature fusion could effectively improve the accuracy of style recognition.

In terms of the selection of the feature descriptors of the traditional national clothing, Xing et al. [8] extracted the color features through mean-shift clustering algorithm, completing the color expression of traditional national clothing. Liu et al. [9] characterized the colors of fabric images based on color histogram feature descriptors and applied the three-level weight method to extract the DC system representing the image information. In terms of establishing a recognition system based on color features, Zhang et al. [10] fused the feature sets of the DCs and color moments (CMs) based on the underlying color features, reaching 87% recognition accuracy. This also showed

the effectiveness of color features in characterizing image information, which provides a research idea for this article. However, due to the similarities in shapes and textures, it is impossible to characterize the differences among them, and it is difficult to distinguish different branches of She nationality clothing with shape and texture feature descriptors. Therefore, considering the different branches of She clothing that have various decorative details and are difficult to recognize, this article recognizes different branches of She clothing by fusing color features.

This article proposes a method for the recognition of different branches of She nationality clothing based on color feature fusion with particle swarm optimization and support vector machine (PSO-SVM). First, the non-uniform quantization of the pixels of the three color channels H, S, and V was carried out in the hue saturation value (HSV) color space. Second, the color histogram and CM features were extracted as feature descriptors. Third, principal component analysis (PCA) was applied to reduce the dimension of the extracted color features. Finally, the clothing recognition model for different branches of She nationality clothing based on PSO-SVM was constructed, which provides a new research idea for the recognition of similar clothing subdivisions in the field of computer vision.

2. Experiments

2.1. Experimental samples

The garments of the five branches of the She nationality – Jing Ning, Fu An, Luo Yuan, Xia Pu, and Fu Ding branches – which are from China She Nationality Museum and related monographs, were selected as the experimental samples. There are 74 samples with 370 authentic images for each branch, as shown in Figure 1. The experiments were implemented on a PC with Intel(R) Core(TM)i7-10700 CPU and AMD Radeon R5 430 GUP. The operation system was Windows 10 with Matlab R2022a. Nikon 5200 was used as the camera device.

2.2. Color feature fusion

2.2.1. Color space conversion

The color space directly affects the color feature extraction results. The HSV color space, consisting of three color channels – hue (H), saturation (S), and value (V), conforms to the visual perception of human eyes [11,12]. In this article, the experimental images were converted from RGB to HSV. Then, the color histogram and CM features were extracted to represent the characteristics of She nationality clothing of different branches. Specifically, the color histogram was applied to reflect the color composition distribution, while the CMs were used to characterize the color information distribution.

2.2.2. Histogram color feature extraction

To obtain the effective features, non-uniform quantization was performed on the H, S, and V channels of the images. This purpose was to improve the efficiency of the recognition accuracy. The non-uniform quantization levels were set to be 16 for the H channel, and 4 for both S and V channels [13]. The three-color channel quantities were transformed into one-dimensional color feature vectors to reduce the feature dimensionality, as shown in the following formula:

$$L = H \times Q_S \times Q_V + S \times Q_V + V, \quad (1)$$

where L represents the merged one-dimensional variable; both Q_S and Q_V are set to 4, representing the quantization series of the S and V channels, respectively. Formula (2) is obtained as follows:

$$L = 16H + 4S + V. \quad (2)$$

As shown in formula (2), the quantized color space consisted of 256 color eigenvalues. The eigenvector $\{L_0, L_1, \ldots, L_{255}\}$ of the color histogram was obtained.

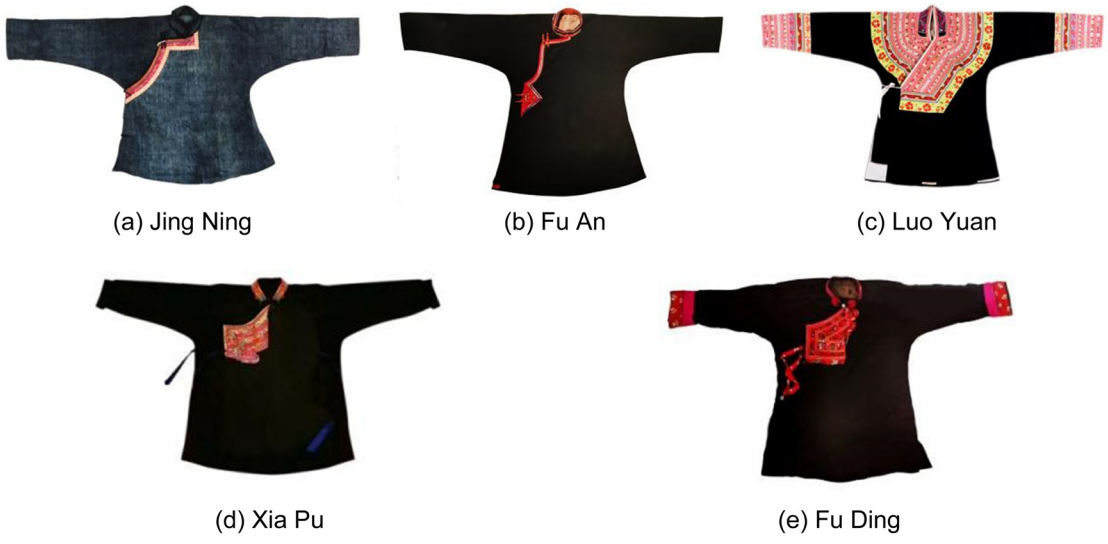


Figure 1. Experiment samples: (a) Jing Ning, (b) Fu An, (c) Luo Yuan, (d) Xia Pu, and (e) Fu Ding.

2.2.3. CM feature extraction

To compensate for the problem that the color histogram ignores the pixel location distribution, this article introduced CMs for effective supplementation. The color information was mainly distributed in the lower-order moments. Thus, the first-order moments (μ_i), second-order moments (σ_i), and third-order moments (ω_i) of the image were extracted, as shown in formula (3). In the experiment, nine CM features of the She nationality clothing image were extracted to form a one-dimensional CM feature vector $\{\mu_H, \mu_S, \mu_V, \sigma_H, \sigma_S, \sigma_V, \omega_H, \omega_S, \omega_V\}$ [14]:

$$\begin{aligned} \mu_i &= \frac{1}{N}\sum_{j=1}^{N} P_{i,j}, \\ \sigma_i &= \left[\frac{1}{N}\sum_{j=1}^{N}(P_{i,j}-\mu_i)^2\right]^{1/2}, \\ \omega_i &= \left[\frac{1}{N}\sum_{j=1}^{N}(P_{i,j}-\mu_i)^3\right]^{1/3}, \end{aligned} \tag{3}$$

where N represents the total number of pixels and $P_{i,j}$ represents the ith color channel of the jth pixel.

2.2.4. Principal component optimization feature fusion

The large data dimension leads to excessive training time for clothing recognition models. It directly affects the recognition accuracy. Therefore, PCA was applied to reduce the feature dimension of the She nationality clothing feature vector. The optimized fused color feature was obtained after dimensionality reduction, as shown in formula (4).

The dimensionality reduction of the original data was achieved by calculating the variance contribution of each principal component and selecting m ($m < p$) principal components according to the cumulative variance contribution [15].

$$\begin{cases} Y_1 = \alpha_{11}X_1 + \alpha_{12}X_2 + \cdots + \alpha_{1p}X_p \\ Y_2 = \alpha_{21}X_1 + \alpha_{22}X_2 + \cdots + \alpha_{2p}X_p \\ \cdots\cdots \\ Y_p = \alpha_{p1}X_1 + \alpha_{p2}X_2 + \cdots + \alpha_{pp}X_p, \end{cases} \tag{4}$$

where: $X_1, X_2, \cdots, X_p$ are the p indexes of sample X, parameter α is the index coefficient, and the comprehensive index Y_i (i = 1,2,…, p) is a linear combination of p indexes.

2.3. Construction of the PSO-SVM recognition model

In this article, SVM was selected as a clothing recognition classifier. The kernel function was introduced to map samples to a high-dimensional linear space as the solution, which has the advantage of a short training period and is suitable for small samples. Considering the linear indivisibility of the experimental samples, the radial basis functions were used as the kernel function in SVM. As the combination of penalty parameter (γ) and kernel parameter (δ^2) in the radial basis function has a large impact on the model prediction and generalization performance, and SVM cannot optimize the parameters in a large parameter space autonomously, PSO was introduced to realize the autonomous optimization of the combination [16].

PSO is a highly efficient and fast convergent swarm intelligence algorithm [17]. Each particle's own state is described by a set of

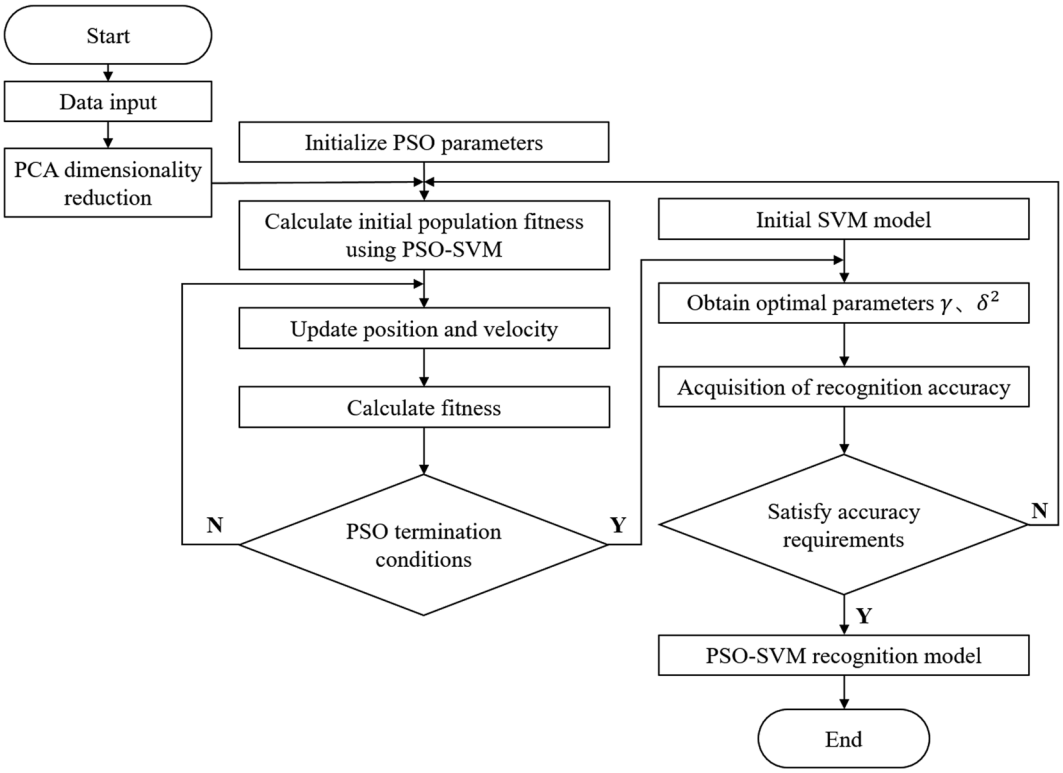


Figure 2. Flowchart of PSO-SVM model.

position and velocity vectors that respectively represent the feasible solution of the problem and its direction of motion in the search space. The particle continuously learns the group optimal solution and neighbor optimal solution it discovers, and finally achieves a global optimal search. Particle velocity and position are shown in formulas (5) and (6):

$$v_{id}^{k+1} = wv_{id}^{k} + c_1 r_1(p_{id} - u_{id}^{k}) + c_2 r_2(p_{gd} - u_{id}^{k}), \quad (5)$$

$$u_{id}^{k+1} = u_{id}^{k} + v_{id}^{k+1}, \quad (6)$$

where c_1 and c_2 represent the learning factors, indicating local and global search capabilities, respectively, and r_1 and r_2 random functions in the [0,1] interval.
The overall construction process of the PSO-SVM model in this article is shown in Figure 2.

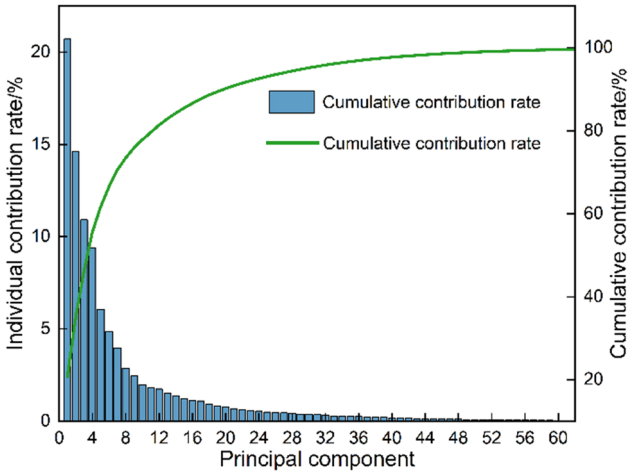


Figure 3. Accumulative contribution rate.

3. Results and discussion

3.1. Color features of the She nationality clothing

3.1.1. Analysis of the color features

To ensure the integrity of color feature extraction of She nationality clothing, the 256_d color histogram and the 9_d CM feature vectors were extracted in the HSV color space model. They were used to represent the information characteristics of different branches of She nationality clothing. Moreover, the color quantification method was used for the analysis (Table 1).

As shown in Table 1, the color composition of different branches is relatively similar. The DCs are black and dark blue, whose brightness value is close to 0%, with relatively weak brightness contrast. The proportions of the DC for each branch range from 55.91 to 96.65%. Specifically, Luo Yuan's DC proportion is significantly lower than other branches, and Jing Ning reaches the highest of 96.65%.

The matching colors (MCs) of clothing of different branches of the She nationality are mainly vermilion, ocher, etc., and small-area color designs such as embroidery and lace form a sharp contrast in brightness and saturation. Among the five branches, the proportions of the MCs range from 3.35 to 44.09%. It can be seen from the comparison of Luo Yuan > Fu Ding > Xia Pu > Fu An > Jing Ning that Luo Yuan branch is the richest in color.

Furthermore, Jing Ning is concentrated in medium–low saturation and medium brightness areas. Fu An is concentrated in medium–high saturation and medium brightness areas. Luo Yuan is concentrated in medium–low saturation and medium–high brightness areas. Xia Pu is concentrated in medium saturation and medium brightness areas, and Fu Ding is concentrated in high saturation and medium brightness areas.

3.1.2. Feature fusion for Initial parameter settings of PSO

In the feature level of the five branches of She nationality clothing, the 256_d color histogram and the 9_d CM feature vectors were fused to obtain 265 fused color feature vector sets. According to PCA, the cumulative contribution rate of the principal component was obtained, as shown in Figure 3. It could be seen that the cumulative contribution rate of the 60th principal component has reached 99.5%, which indicates that the first 60 principal components contain most of the information in the fused feature vector of She nationality clothing.

To analyze the influence of cumulative contribution on recognition results, 20 sets of data with different principal component dimensions were selected at the cumulative contribution rates ranging from 90 to 100%. The relationship between the cumulative contribution rate and recognition accuracy was analyzed. The recognition model was trained by the training set, and the recognition results were obtained by the testing set. The recognition accuracy is shown in the following formula:

Table 1. Color distribution of She nationality clothing

Branch	DCs	HSV	Ration/%	MCs 1	HSV	Ration/%	MCs 2	HSV	Ration/%
Jing Ning		[217, 74, 3]	96.65		[17, 38, 81]	1.20		[6, 51, 51]	1.10
Fu An		[45, 49, 2]	96.43		[0, 71, 66]	1.36		[7, 45, 61]	1.31
Luo Yuan		[239, 46, 1]	55.91		[0, 50, 88]	10.76		[358, 35, 91]	8.79
Xia Pu		[69, 66, 2]	94.23		[8, 66, 56]	2.31		[16, 49, 57]	1.82
Fu Ding		[3, 71, 1]	87.66		[2, 79,72]	4.13		[0, 84, 53]	3.24

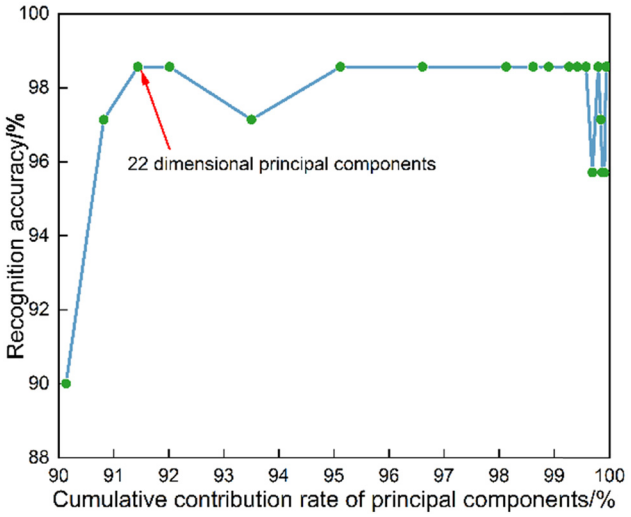


Figure 4. Comparison of recognition effect.

$$\text{Accuracy} = \text{sum}(Y_{\text{label}} = y_{\text{label}})/\text{Length}(y_{\text{label}}) \times 100\%, \quad (7)$$

where Y_{label} represents the true category and y_{label} represents the recognition category of the model.

Figure 4 shows that when the cumulative contribution rate is 91.4%, the recognition accuracy of the first 22 principal components is the highest, reaching 98.57%. Therefore, on the premise of ensuring the recognition accuracy, 60 feature vectors were further downscaled and optimized, and 22 fused feature matrices characterizing the She nationality clothing images were obtained.

3.2. She nationality clothing recognition based on color fusion features

In the recognition model, the dataset was divided into the training set and testing set by 300:70 random samples. Then, the fused color feature matrix obtained by feature extraction on the training set, and the category labels of different branches of

Table 2. Initial parameter settings of PSO-SVM

Parameter variable	Parameter value	Parameter variable	Parameter value
Learning factor c_1	0.5	Particle rate $[V_{\min}, V_{\max}]$	[−0.25, 0.25]
Learning factor c_2	0.5	Particle take value $[\text{pop}_{\min}, \text{pop}_{\max}]$	[0.001, 200]
Population size	20	Inertia factor $[\omega_{\min}, \omega_{\max}]$	[0.4, 0.6]
Evolution times	200		

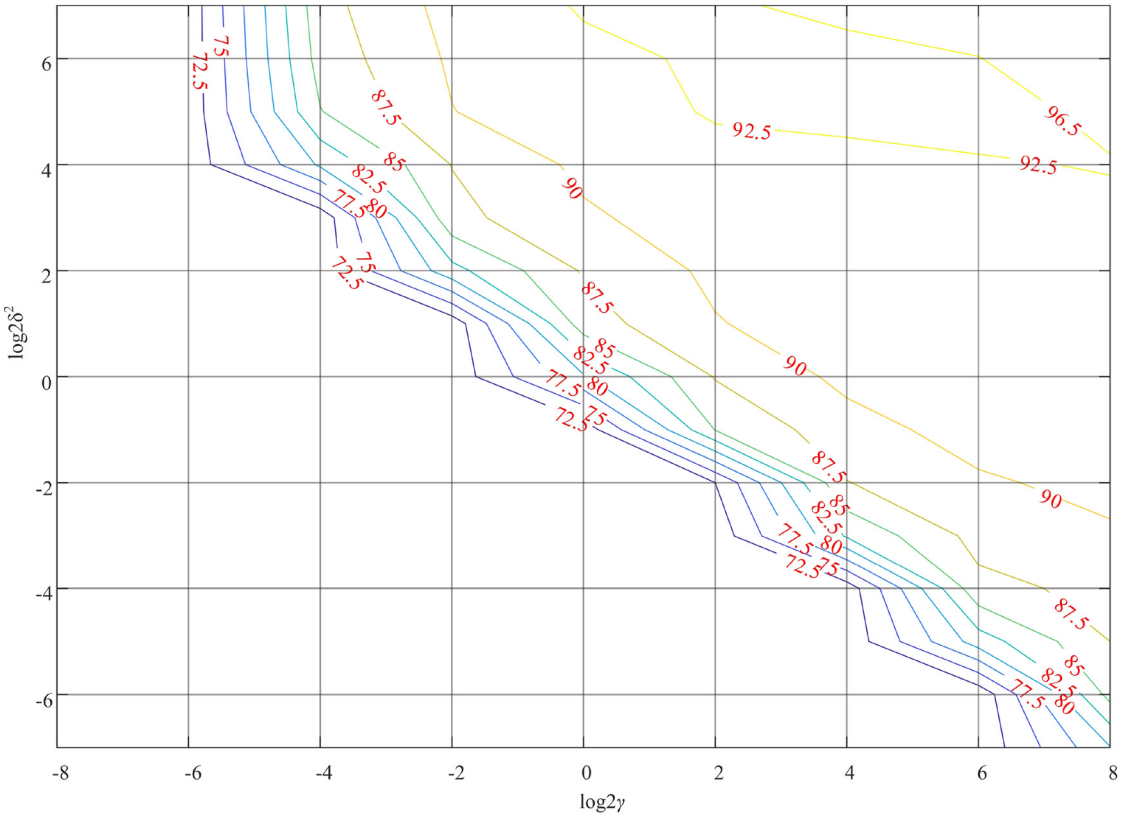


Figure 5. SVM parameter selection results.

Table 3. Recognition results of She nationality clothing in different branches

Branch	Jing Ning	Fu An	Luo Yuan	Xia Pu	Fu Ding	Accuracy (%)
Jing Ning	9	0	0	0	0	100
Fu An	0	11	0	0	0	100
Luo Yuan	0	0	14	0	0	100
Xia Pu	0	0	0	21	0	100
Fu Ding	0	0	0	1	14	93.33

Table 4. Comparison of recognition methods

Color recognition method	Method	CM feature vector	Color histogram feature vector	PCA	Optimal parameters	
					γ	δ^2
Single-color feature	I	√			200.43	1.52
	II		√		198.67	1.31
Multi-color feature fusion	III	√	√		156.84	1.23
Proposed method	IV	√	√	√	123.29	1.16

"√" indicates that the method uses the corresponding construction module.

She nationality clothing were respectively selected as input and output. The initial settings of the parameters of the PSO-SVM model are shown in Table 2. The PSO was applied to autonomously optimize SVM parameters and obtain the optimal fitness γ = 123.29, δ^2 = 1.16, and the weighted average recognition accuracy was 96.5%, as shown in Figure 5.

The PSO-SVM recognition model was constructed by PCA. The 22 color fusion features and the corresponding branch categories after dimensionality reduction were analyzed. Table 3 shows the recognition results. It can be seen that the PSO-SVM recognition model has a good recognition effect on the five branches of She nationality clothing. However, among the 15 pieces of clothing from the Fu Ding branch, one was misidentified as Xia Pu's. The main reason for misidentification is that there are "plum blossoms" in the collar area of the latter branch. Compared with the whole garment, the color characteristics of the "plum blossoms" are relatively small and cannot form sufficient feature difference, making it difficult to distinguish or even misidentify.

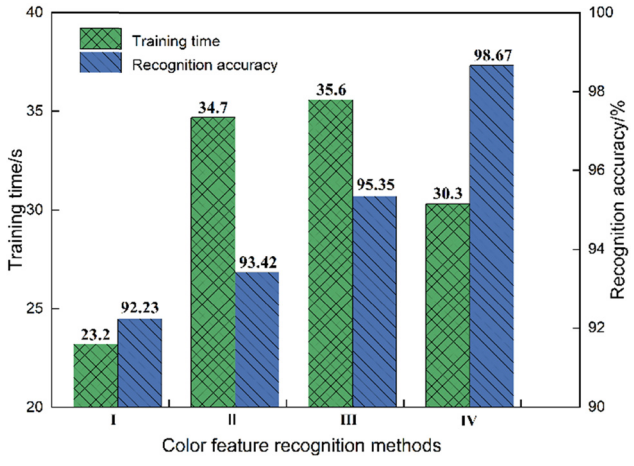


Figure 6. Comparison of training time and recognition accuracy.

3.3. Comparison of recognition methods of different branches of the She nationality clothing

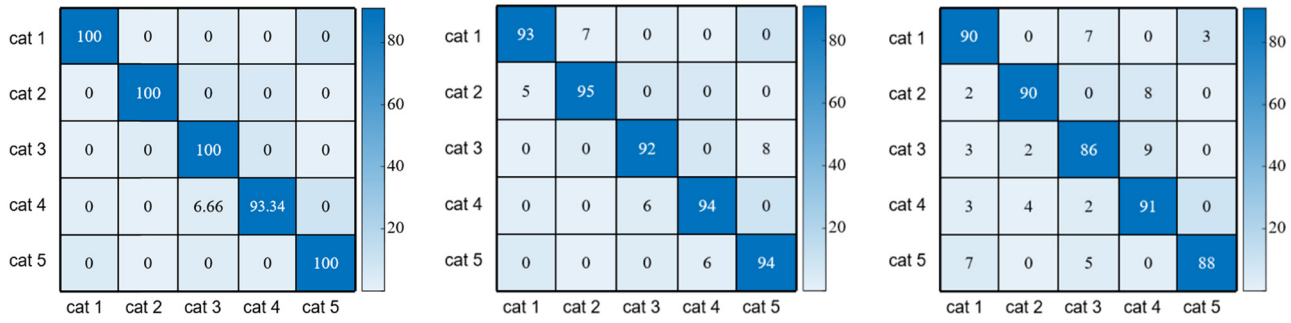
3.3.1. Comparative analysis of color feature recognition methods

To search for suitable color feature descriptors for different branches of She nationality clothing, four clothing recognition methods, including two single-color feature methods, one multi-color feature fusion method, and one method proposed in this article, were established (Table 4). Figure 6 shows the training time and recognition accuracy of the recognition methods.

As shown in Figure 6, methods II and III spend more time in training, and method I takes the shortest time. It shows that the training time is positively correlated with the feature dimension. It can be seen from the recognition accuracy comparison that method IV > method III > method II > method I. PCA could retain the original important features of She nationality clothing of different branches after dimensionality reduction. Besides, the average recognition accuracy improved by 5.01%. Considering the training time and accuracy, method IV had the best recognition effect on different branches of She nationality clothing, with the recognition accuracy reaching 98.67%.

3.3.2. Comparative analysis of SVM parameter optimization methods

In response to the problem that SVM penalty parameter γ and the kernel parameter δ^2 are challenging to determine, various optimization-seeking algorithms, such as genetic algorithm



(a) PSO-SVM confusion matrix (b) GA-SVM confusion matrix (c) SVM confusion matrix

Figure 7. Confusion matrix of She nationality clothing recognition: (a) PSO-SVM, (b) GA-SVM, and (c) SVM.

(GA) [18] and PSO, have been used to solve the parameter-seeking problem. A comparison was performed to verify the effectiveness under the same test samples and search area. Figure 7 shows the results. The categories 1–5 represent Jing Ning, Fu An, Luo Yuan, Xia Pu, and Fu Ding, respectively.

As illustrated in Figure 7, relative to GA-SVM and SVM models, the PSO-SVM model's recognition accuracy was improved by 5.07 and 9.67%, respectively. This is mainly because the GA algorithm is prone to fall into "premature convergence." It has the characteristics of crossover and mutation and requires manual experience to set parameters. Compared with the GA algorithm, PSO-SVM can better recognize She nationality clothing.

4. Conclusions

In this article, the clothing recognition method based on PSO-SVM with color feature fusion was proposed. The main conclusions were drawn as follows:

(1) The 265 color histogram and CM feature vector sets of the five branches of She nationality were extracted, and the color feature distribution of each branch was obtained. The DCs of She nationality clothing are black and dark blue, taking a proportion ranging from 55.91 to 96.65%. Among the five branches, Jing Ning branch has the highest proportion in terms of DCs. The MCs are mainly vermilion, ocher, and other colors, with the proportion ranging from 3.35 to 44.09%. It can be seen from the comparison of Luo Yuan > Fu Ding > Xia Pu > Fu An > Jing Ning that Luo Yuan branch is the richest in color.

(2) The PSO-SVM recognition model for She nationality clothing with the fusion of color features was established. Compared with the models built by singer-color histogram and by CM features, the recognition accuracy of the proposed model was improved by 5.25 and 6.44%, respectively. When the penalty parameter γ and kernel parameter δ^2 were 123.29 and 1.16, respectively, the average recognition accuracy of the model was improved by 5.01, reaching 98.67%.

(3) Compared with the GA-SVM and SVM models, the prediction accuracy of the PSO-SVM recognition model improved by 5.06 and 9.67%, respectively.

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References

[1] *Chen, L. Y. (2012). Evolution causes analysis of She's ancient costume from perspective of cultural change. Journal of Textile Research, 33(17), 111–115.*

[2] *Nawaz, M. M. T., Hasan, R., Hasan, M. A., Hassan, M., Rahman, R. M. (2018). Automatic categorization of traditional clothing using convolutional neural network. In 2018 IEEE/ACIS 17th International Conference on Computer and Information Science (ICIS) (pp. 98–103). IEEE, Singapore.*

[3] *Fu, B. L., Liu, X. G. (2019). An intelligent computational framework for the definition and identification of the womenswear silhouettes. International Journal of Clothing Science and Technology, 31(2), 158–180.*

[4] *Wu, H., Ding, X. J., Li, Q. M., Du, L., Zou, F. Y. (2019). Classification of women's trousers silhouette using convolution neural network CaffeNet model. Journal of Textile Research, 40(4), 117–121.*

[5] *Ding, X., Zou, C., Chen, J., Zou, F. (2016). Extraction and classification of She nationality clothing via visual features. Textile Research Journal, 86(12), 1259–1269.*

[6] *Surakarin, W., Chongstivatana, P. (2015). Classification of clothing with weighted SURF and local binary patterns. In 2015 International Computer Science and Engineering Conference (ICSEC) (pp. 1–6).*

[7] *Yao, L., Keand, H. (2018). Robust image retrieval for lacy and embroidered fabric. Textile Research Journal, 89(13), 2616–2625.*

[8] *Xing, L., Zhang, J., Liang, H. E., Li, Z. J., Liu, J. J. (2017). Intelligent inspection of dominant colors for Chinese traditional folk Yunjian. Journal of Textile Research, 38(11), 110–115, 123.*

[9] Liu, S., Jiang, Y., Luo, H. (2018). Attention-aware color theme extraction for fabric images. Textile Research Journal, 88(5), 552–565.

[10] Zhang, N., Xiang, J., Wang, L., Xiong, N., Gao, W., Pan, R. (2020). Image retrieval of wool fabric. Part II: based on low-level color features. Textile Research Journal, 90(7–8), 797–808.

[11] CinKo, O. U., Becerir, B. (2019). Dependence of colour difference formulae on regular changes of colour coordinates in CIELAB colour space. Industria Textila, 70(3), 248–254.

[12] Sinsh, S., Batra, S. (2020). An efficient bi-layer content based image retrieval system. Multimedia Tools and Applications, 79(25), 17731–17759.

[13] Zhang, C. (2017). Research of object tracking algorithm based on color space nonuniform quantization and multi-information fusion (pp. 26–28). Changsha University of Science and Technology.

[14] Jing, J., Li, Q., Li, P., Zhang, L. (2016). A new method of printed fabric image retrieval based on color moments and gist feature description. Textile Research Journal, 86(11), 1137–1150.

[15] Indrie, L., Bellemare, J., Zlatev, Z., Tripa, S., Diaz-Garcia, P., Montava, I., et al. (2021). Contemporary customized clothes using folk motifs. Industria Textila, 72(6), 632–638.

[16] Yu, C. B., Xi, Z. W., Lu, Y. L., Tao, K. X., Yi, Z. (2020). K/S value prediction of cotton fabric using PSO-LSSVM. Textile Research Journal, 90(23–24), 2581–2591.

[17] Qiao, Y., Zhang, S., Wu, N., Wang, X., Li, Z., Zhou, M., et al. (2019). Data-driven approach to optimal control of ACC systems and layout design in large rooms with thermal comfort consideration by using PSO. Journal of Cleaner Production, 236, 11758.

[18] Cheng, P., Chen, D., Wang, J. (2020). Research on underwear pressure prediction based on improved GA-BP algorithm. International Journal of Clothing Science and Technology, 33(4), 619–642.