Application Research of Trademark Recognition Technology based on SIFT Feature Recognition Algorithm in Advertising Design

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Abstract*—Now-a-days, due to the sharp increase in the number of advertising designs, creative duplication is easy to occur in advertising design. If this situation is not discovered in time, it may cause legal disputes and cause damage to the reputation and property of the enterprise. In view of the above situation, this paper proposes a trademark recognition technology based on SIFT feature recognition algorithm to avoid duplication of advertisement design and cause copyright disputes. Aiming at the defect that the dimension of the image feature vector extracted by SIFT algorithm is too high, the principal component analysis method is used to reduce its dimension. For the problem of unsatisfactory image recognition rate accuracy of SIFT algorithm, a support vector machine is used to classify the extracted feature vector, so as to improve the image recognition rate. Based on the above content, build a trademark recognition model. The research results show that the recognition accuracy of the model reaches 98.82%, 0.66% and 0.58% higher than that of Model 1 and Model 2; AUC value of model 3 is 0.962, 0.039 higher than model 2 and 0.107 higher than model 1. The above results show that the proposed trademark recognition model can better identify similar advertising designs, thereby avoiding design duplication and legal disputes.

Keywords*—SIFT algorithm; trademark recognition; advertising design; support vector machine; principal component analysis

I. Introduction

Good advertising design can keep a product in the memory of consumers for a long time, thereby increasing the popularity and sales of the product. Therefore, advertising design is of great significance to the development of enterprises. Trademark design is an important part of advertising design. Due to the increase in the number of enterprises and the huge number of trademark designs, duplication of ideas is an unavoidable problem. Reputation and property have caused certain losses [1-2]. Therefore, trademark recognition technology based on computer vision technology has gradually emerged and has received extensive attention from all walks of life. It has important applications in product monitoring, trademark protection and commercial information mining. The application of trademark recognition technology in advertising design is as follows: through the identification of trademark design features, trademark images with similar characteristics are matched in the data set, so as to determine whether the design results are repeated with other trademark designs [3]. Scale invariant feature transform (SIFT) algorithm has strong local feature extraction ability and matching ability, and is less affected by light and noise, so it has an important application in trademark recognition. However, the feature dimension extracted by the SIFT algorithm is high, which leads to long image recognition time and unsatisfactory recognition accuracy, so it needs to be improved [4-5]. The principal components analysis (PCA) is used to reduce the dimensions of the feature vectors extracted by SIFT algorithm, and the support vector machine (SVM) is used to classify the feature vectors. Through the above operations, the trademark recognition model based on SIFT-PCA-SVM is built, so as to improve the efficiency and accuracy of image recognition and matching. The results show that the precision and efficiency of the research model are significantly higher than the existing models. The research builds a trademark recognition model based on SIFT-PCA-SVM to achieve efficient trademark recognition and avoid the repetition of advertising design ideas to the greatest extent. There are three main innovations in the research. The first point is to build a trademark recognition model based on SIFT algorithm to achieve intelligent detection of plagiarism in advertising design. The second point is to use PCA to reduce the dimension of feature vectors and improve the processing efficiency and accuracy of SIFT algorithm. The third point is to introduce SVM to classify the output feature vectors, so as to improve the accuracy of trademark recognition.

II. Related Works

In today's highly developed economy and technology, the number of enterprises is increasing, and various products are emerging on the market one after another. In an increasingly fierce market environment, excellent advertising can make products more famous, thereby increasing product sales and improving corporate efficiency. Therefore, the importance of advertising design is becoming more and more prominent. In order to improve the effect of advertising design, many scholars take the advertising design of various products as an example, and put forward guiding suggestions for advertising design. Choi SJ et al. assessed the correlation between ad spend and data breaches using a gamma distribution using data from non-federal acute care inpatient hospitals as an example [6]. Kininmonth S believes that the frontier media market will have a certain impact on the advertising industry, and discusses the advertising market prospects under the trend of digital advertising [7]. Shieh CH et al. invited 363 consumers to participate in a field experiment in a shopping mall to explore the correlation between consumers' purchase intention and location-based advertising [8]. Wright MJ et al. used the logistic regression analysis method to discuss and analyze the marketing effect of digital advertising in the case of consumer distraction, and believed that the marketing effect of emotional advertising is better than rational advertising in special circumstances [9]. Lacoste-Badie S et al. took 50 French children as the research object, evaluated the children's attention to the health problems in snack advertisements, and suggested that the French authorities should take measures to strengthen the health warnings in advertisements based on the results [10]. Taking a coffee shop brand as an example, Busser JA et al. used structural equation model to study the impact of consumer-generated advertising on consumers' brand trust and brand loyalty. Brand loyalty has a positive impact [11]. Levin E et al. discussed the relationship between the service quality of advertising companies, advertising companies and customer relationship management from the social and economic aspects [12]. M Méndez-Suárez et al. used the partial least squares equation model to study the impact of Internet advertising and digital advertising on brand awareness, as well as the impact of brand awareness on product sales [13]. Basch CH et al. analyzed the prevalence of sugar-sweetened beverage advertisements on LinkNYC kiosks in New York City to evaluate and recommend the work of the New York Department of Health [14]. Sahin S et al. analyzed the influence of green advertising image on consumer psychology, and the results show that green advertising image can promote consumers' purchasing behavior [15].

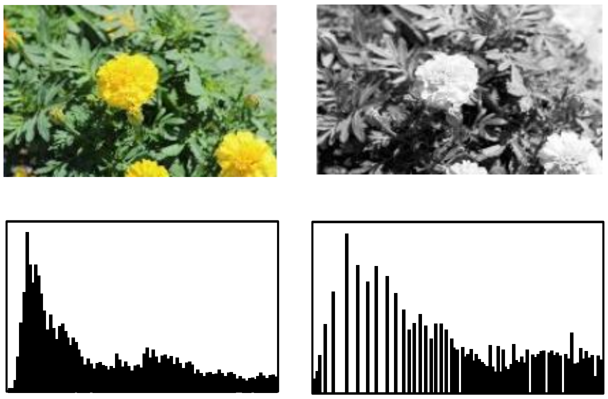
The SIFT algorithm is a common algorithm in image processing, which can detect and describe the key features of the image, and is a local feature descriptor. The SIFT algorithm has the characteristics of strong discrimination, more feature vector extraction, and less influence by noise and illumination. It has a key application in digital image feature matching. A large number of scholars have conducted in-depth discussion and analysis on the application and improvement of SIFT. Combining tensor theory and based on spatial and spectral information, LI et al. proposed a tensor gradient SIFT and applied it to feature extraction and matching of hyperspectral images [16]. Li J et al. used PCA and SIFT to predict protein-protein interactions in organisms through protein sequences, and verified by five-fold cross-validation method, the accuracy of this method exceeded 97% [17]. Combining SIFT and patch matching, Henan et al. proposed a 3D view image quality improvement method. The simulation results show that the method has strong feasibility and effectiveness [18]. Raveendra K et al. optimized the performance of SIFT through the global optimization feature of ant colony optimization (ACO), and constructed a hybrid model for document retrieval in the dataset, and the accuracy of the model exceeded 95% [19]. Hwang SW uses artificial neural networks (ANN) and SIFT algorithms to build a model to automatically classify wood knots based on macroscopic images [20]. Wulandari I et al. introduced the SIFT algorithm in the citra fusion technology and used it in treatment and medical treatment. The experimental results show that the method has good application effect in the medical field [21]. Taking the official currency of Singapore as an example, Prasasti AL [22] proposed a foreign currency identification method based on the improved SIFT algorithm based on ANDROID. Dalai R et al. introduced the SIFT algorithm into the Mask-R-Convolution Neural Network (Mask-RCNN) to extract and match the feature points of the image, thereby realizing image processing and fast detection of objects in the image [23]. Karim A et al. proposed an Arabic handwriting recognition model combining SIFT and SVM. The experimental results show that the recognition accuracy of this model reaches 99.08% [24]. Misra I et al. used the pattern-guided SIFT algorithm for feature detection, thereby improving the accuracy of remote sensing image registration and facilitating subsequent Earth observation data analysis. The experimental results show that the RMSE of this method is 0.12 [25].

As can be seen from the above content, there are many research results on advertising design and SIFT algorithm, but few people apply SIFT algorithm to advertising design. Through the feature extraction and feature matching capabilities of the SIFT algorithm, it can help advertising designers avoid creative duplication, thereby improving the effect of advertising design and increasing corporate profits. To this end, the research builds a trademark recognition model based on the SIFT algorithm, and discusses the practical application effect of the model in advertising design.

III. Construction of Trademark Recognition Model Based on Improved SIFT

A. Image Preprocessing and SIFT-Based Trademark Recognition

For the survival and development of enterprises, the use of advertisements to enhance the popularity and sales of products has become a major concern of major enterprises. Therefore, the number of advertisements is increasing, flooding all aspects of people's lives. In advertising design work, especially in trademark design, creative duplication is an unavoidable problem. When the duplication of trademark design is not discovered in time, copyright and legal disputes are likely to occur, causing damage to the reputation and property of enterprises, products and advertising designers. Therefore, it is very necessary to realize trademark recognition through image recognition technology, so as to avoid repeated plagiarism of trademark design. When performing trademark image recognition, it is necessary to extract the feature values of the image to achieve image feature matching. However, the original image has many problems, such as noise and different sizes [26]. Therefore, image preprocessing is required. First, the digital image histogram is used to process the gray value of the image, as shown in Fig. 1.



(a) Before pretreatment (b) After pretreatment

Fig. 1. Gray value processing of image by histogram

Then, a Gaussian filter is used to filter the image, and the Gaussian function is shown in formula (1).

$$g(i, j) = e^{-\frac{(i^2+j^2)}{2\sigma^2}} \quad (1)$$

In formula (3), $[i, j]$ is a certain pixel point, (i^2+j^2) is the radius of the Gaussian function, and σ is the standard deviation. Finally, the redundant data of the image is removed by the method of data compression, and the image compression is realized. Data compression refers to reducing the amount of data processed with the same amount of information. Data redundancy can be expressed as formula (2).

$$R = 1 - 1/C \quad (2)$$

Formula (2), R, C the number of bits of data redundancy and the compression rate are respectively expressed. The definition of the compression ratio is shown in formula (3).

$$C = b/b' \quad (3)$$

Formula (3), , b and b' respectively represent the number of bits in the information to be processed before compression and the number of bits in the information to be processed after compression. The SIFT algorithm has strong anti-interference ability, and has excellent feature extraction and feature matching capabilities. The SIFT algorithm is used to build a trademark recognition model. First, the scale space is constructed with the help of Gaussian blur. For an image whose scale space is set to $L(x, y, \delta)$, its size can be expressed as Equation (4).

$$L(x, y, \delta) = G(x, y, \delta) * I(x, y) \quad (4)$$

In formula (4), (x, y) is I the coordinate of the pixel point of the image, δ which is the scale space factor, and its value determines the smoothness of the image. The δ smaller the value, the more obvious the detailed features of the image, which $*$ means convolution, which G means the Gaussian function, such as formula (5) shown.

$$G = \frac{1}{2\pi\delta^2} e^{-\frac{\left(x-\frac{m}{2}\right)^2+\left(y+\frac{n}{2}\right)^2}{2\delta^2}} \quad (5)$$

In formula (5), it m, n represents the dimension of the Gaussian template. SIFT can use Gaussian blur to search for key feature points in each scale space. The calculation of the Gaussian blur template is mainly based on the normal distribution, as shown in formula (6).

$$G(r) = \frac{1}{\sqrt{2\pi\delta^2}^{N}} e^{-\frac{r^2}{2\delta^2}} \quad (6)$$

In formula (6), δ is the standard deviation of the normal distribution, the smaller the value, the clearer the image; r it represents the distance between the elements in the fuzzy template and the center of the template; N it represents the dimension of the space where the normal distribution is located. Gaussian blurring is performed on the image at different scales and downsampling is performed to construct a Gaussian image pyramid, as shown in Fig. 2.

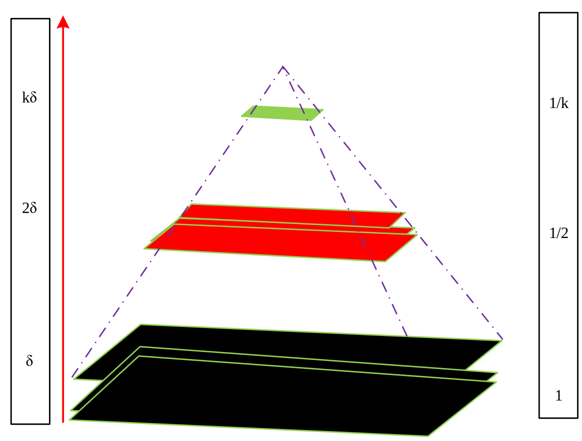


Fig. 2. Gaussian image pyramid

The difference between each layer of the Gaussian pyramid is recorded as Difference of Gaussian (DOG), and the key feature points can be obtained by using the difference Gaussian to describe the image features. The extreme points in the DOG space are sampled and detected to locate key feature points. DOG is greatly affected by edges and noise. In order to obtain a more stable image feature description, it is necessary to remove low-contrast and unstable points, which are realized by using Harris Corner detector and two-dimensional Hessian matrix respectively. After obtaining the stable extreme feature points, in order to describe the rotation invariance of the feature points, the pixel gradient and direction of the feature point neighborhood are obtained by calculating the image gradient, as shown in Fig. 3.

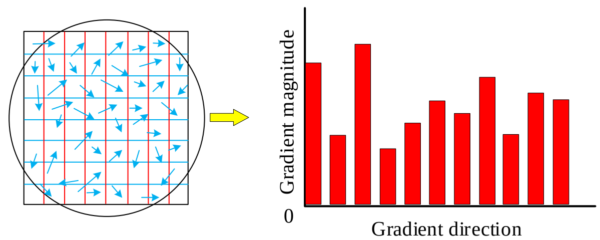


Fig. 3. Description of feature point direction

Based on the above content, information such as the position, scale, and direction of the feature points can be obtained, so as to ensure the uniqueness of the feature points. After using the SIFT algorithm to obtain the eigenvalues of an image, the eigenvalues of the image are matched with the eigenvalues of other images to achieve image recognition. However, the eigenvalues between images are not in a one-to-one correspondence, so it is necessary to quickly match the eigenvalues between images through data indexing [27]. The research uses KD-Tree algorithm crop eigenvalue matching algorithm. For two images A and B, first obtain a set of eigenvalues from image A, denoted as $F_a=\left\{y_1^a,y_2^a,\ldots,y_N^a\right\}$, and denote the set of eigenvalues in image B $F_b=\left\{y_1^b,y_2^b,\ldots,y_N^b\right\}$ as.

$$d\left(F_a,F_b\right)=\sqrt{\sum_{i=1}^{n}\left(y_i^a-y_i^b\right)^2} \tag{7}$$

After obtaining the ratio between the closest distance and the second closest distance, compare whether the ratio satisfies the set threshold, so as to determine whether it is a similar point. Repeat the above operation to match all similar feature points. Through the above content, we can realize trademark recognition and judge whether the trademark design is repeated on a large scale.

B. Optimization path of Trademark Recognition Model based on SIFT Algorithm

When the trademark recognition model based on SIFT algorithm is used for trademark recognition, its recognition effect is more dependent on the quality of the extracted feature values. However, the feature dimension extracted by the SIFT algorithm is high, which leads to long image recognition time and unsatisfactory recognition accuracy. Aiming at the defect that the dimension of the image feature vector extracted by the SIFT algorithm is too high, the PCA algorithm is used to reduce the dimension of the feature vector. Since the image feature vector extracted by the SIFT algorithm is basically 128-dimensional, the dimension is relatively high, and it is very easy to cause a dimensional disaster, resulting in an exponential increase in the amount of data calculation, which seriously affects the accuracy and efficiency of trademark recognition. The PCA algorithm can simplify the 128-dimensional information, thereby reducing the dimension of the eigenvalue descriptor. The dimensionality reduction process of PCA for eigenvalues is: obtaining a 128-dimensional matrix vector C_X, and each column in the matrix represents an eigenvector. Calculate the covariance of all eigenvectors Σ_X, and obtain the eigenvalues of the covariance matrix by solving Equation (8).

$$\det\left(\lambda_i I-\Sigma_X\right)=0 \tag{8}$$

In formula (8), λ_i represents the i th eigenvector. According to the solution of formula (8), the corresponding eigenvectors are obtained w_i. Considering the acquired feature vector as a column vector W, the new transformed feature is obtained by formula (9).

$$C_Y=C_X W^T \tag{9}$$

In formula (9), W^T is the column vector matrix. Select eigenvectors with larger values and set eigenvectors with smaller values to 0, thereby reducing the eigenvector dimension. The identification and matching of trademark images can be regarded as a binary classification problem. In view of the problem of too many feature points in feature matching, which leads to low efficiency and accuracy, SVM is used to match feature values [28]. SVM is essentially a linear classifier, which has excellent performance for nonlinear identification problems in high-dimensional space. The mathematical model of SVM can be expressed as Equation (10).

$$f(x)=sign(wx+b) \tag{10}$$

In formula (10), w the normal vector of the b classification surface is represented, and the constant term of the classification surface is represented. When formula (11) is satisfied, it means that the current hyperplane is the optimal hyperplane.

$$wx+b=0 \tag{11}$$

After obtaining the optimal hyperplane by formula (11), in order to make the model more optimized, it is necessary to find the farthest distance from the sample points of different sample classifications in the data set to the hyperplane, so as to find the maximum interval hyperplane. The specific model is shown in the Fig. 4.

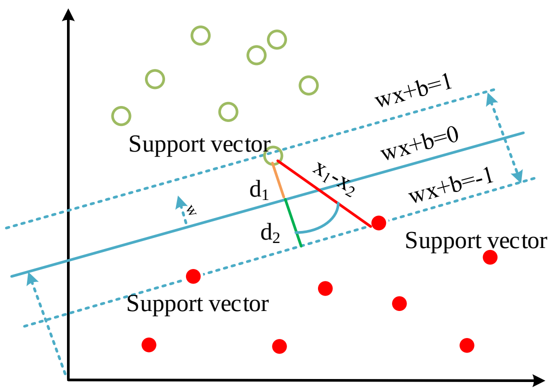


Fig. 4. Schematic diagram after optimization of support vector machine

In Fig. 4, the maximum margin hyperplane solution can be transformed into the function minima problem in Eq. (12).

$$\varphi(w) = \frac{1}{2}\left\|w^2\right\| \tag{12}$$

By formula (12), some linear problems can be solved. However, for nonlinear problems, SVM needs to use the conversion function to upgrade the original space to convert the original problem into a linear problem in a high-dimensional space, so as to facilitate the calculation and solution of the optimal classification hyperplane in the high-dimensional space, and finally to the non-linear problem. Solve linear problems. In SVM, the process of converting a nonlinear problem into a linear problem using a transfer function is shown in Fig. 5.

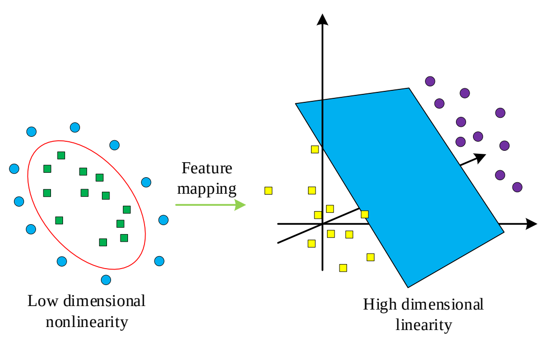


Fig. 5. The process of transforming a nonlinear problem into a linear problem

In the research, the Sigmoid kernel function is used as the transformation function. The expression of the sigmoid kernel function is shown in formula (13).

$$K(x_1, x_2) = \tanh\left(\eta\langle x_1, x_2\rangle + \theta\right) \tag{13}$$

In Formula (13), η is the learning rate and θ is the vector feature. Nonlinear mapping $\phi : R^d \rightarrow H$ can map the sample data in the input space to the high-dimensional feature space H, the kernel function K can be used to obtain formula (14).

$$K(x_1, x_2) = \phi(x_i)\cdot\phi(x_j) \tag{14}$$

Through the formula (14), the inner product operation is performed in the high-dimensional space to obtain a nonlinear classification decision function. SVM mainly solves the two-class problem, and has poor performance for solving the multi-class problem. The classification of trademark image feature values is a multi-classification problem, so it is necessary to build a multi-classifier according to SVM. There are generally two ways to construct the SVM multi-classifier. The first is to modify the objective function of the multi-classification problem, so as to solve the multi-classification problem at one time. However, this method requires a huge amount of calculation, takes a long time, and the establishment of the objective function is very difficult. Therefore, another method is used to construct SVM multi-classifiers in this study, that is, construct n binary classifiers, and perform the analysis on these binary classifiers. Combinatorial solutions to solve multi-class problems. When the feature values of the image have N classes, the number of binary classifiers of SVM is shown in formula (15).

$$n = \frac{N(N-1)}{2} \tag{15}$$

By combining the binary classifiers, the voting method is used to obtain the category of the feature value of the trademark image. Based on the above content, a trademark recognition model based on SIFT-PCA-SVM is constructed, so as to realize the recognition and matching of trademark images, prevent legal disputes caused by plagiarism and infringement, and avoid economic and reputation losses of enterprises and advertising designers.

IV. Performance Analysis of Trademark Recognition Model Based on SIFT-PCA-SVM

Aiming at the problem that the current trademark design is prone to creative duplication and legal disputes, this paper studies the construction of a trademark recognition model based on SIFT-PCA-SVM. In order to verify the performance of the model, the research uses the FlickrLogos dataset for experiments. The FlickrLogos dataset contains images related to 32 kinds of trademarks. The study selects 3000 images, of which 2500 images are used as the training sample set to train the model, and the other 500 images are used as the test sample set to test the performance of the model. The test environment is as follows. The operating system uses Windows, OpenCV3.0 alpha as the development tool, and Python as the programming tool. The processor is Intel (R) Core (TM), and the memory is 6GB.The data of training sample set and test sample set are preprocessed by the method proposed in the study. Build a trademark recognition model based on SIFT algorithm (Model 1), a trademark recognition model based on SIFT-SVM (Model 2) and a trademark recognition model based on SIFT-PCA-SVM (Model 3), respectively, and compare the training of the above three models Effects and test effects to validate the performance of the proposed trademark identification method in the study. The three models are trained using the training sample set. During the training process, the performance of the three models is shown in Fig. 6.

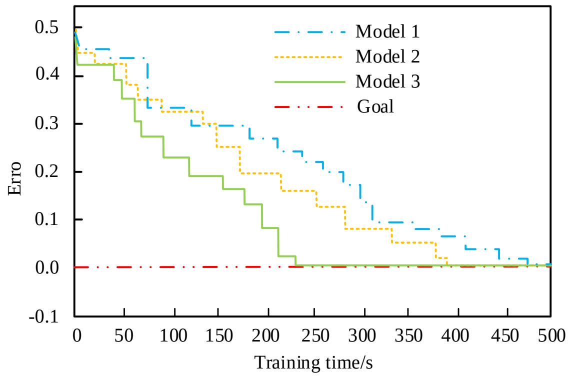


Fig. 6. The performance of the three models in the training process

As can be seen in Fig. 6, the training performance of Model 3 is significantly better than the other two models. Model 3 achieves the target accuracy when the training time is 241 seconds; Model 2 achieves the target accuracy when the training time is 393 seconds, which is 152 seconds more than the training time of Model 3; Model 1 achieves the target accuracy when the training time is 476 seconds, more than Model 3 takes 235 seconds more to train. From the above results, it can be shown that the training performance of Model 3 is better, which can greatly save training time and improve the efficiency of trademark recognition. Aiming at the defect that the dimension of image feature vector extracted by SIFT algorithm is too high, the PCA algorithm is used to reduce the dimension of its feature vector , so as to reduce the number of invalid feature points extracted and improve the feature extraction efficiency and feature matching accuracy. In order to verify the improvement effect of the PCA algorithm on the SIFT algorithm, the study randomly selects three trademark images from the FlickrLogos data set, denoted as image A, image B and image C respectively. Three images are used to test the feature point extraction effect of SIFT algorithm and PCA-SIFT algorithm. The number of feature points extracted by the SIFT algorithm and the PCA-SIFT algorithm for the three images and the matching accuracy of the feature points are shown in Fig. 7.

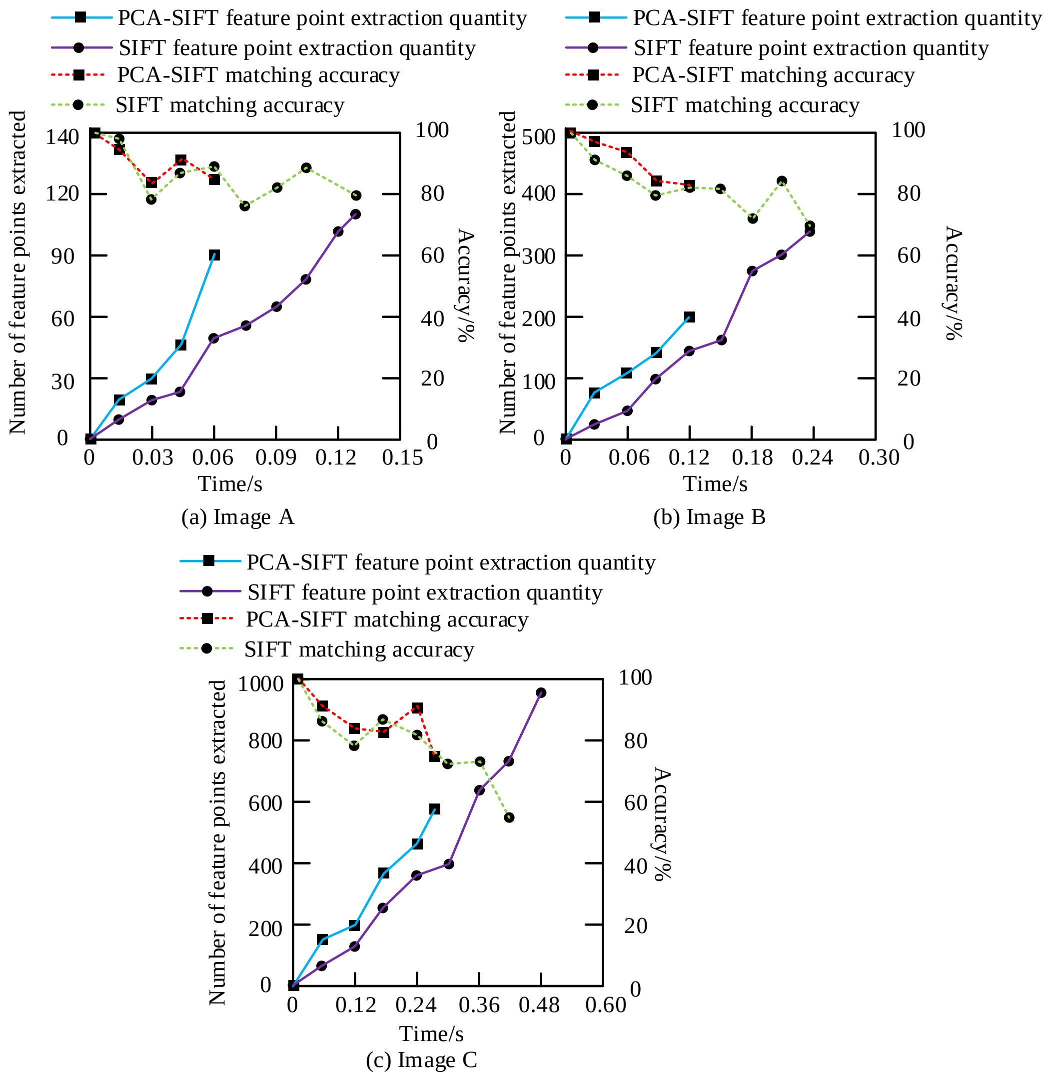


Fig. 7. Improvement effect of PCA algorithm on SIFT algorithm

In Fig. 7, it can be seen that when processing the same image, the number of image feature points and feature point extraction time of the PCA-SIFT algorithm are significantly lower than those of the SIFT algorithm, and the feature point matching accuracy is significantly higher than that of the SIFT algorithm. For the three images, the average extraction time of feature points of PCA-SIFT algorithm is 0.16s, the average number of feature points extracted is 284, and the average matching accuracy of final feature points is 80.62%; the average extraction time of feature points of SIFT algorithm is 0.31s, Compared with the PCA-SIFT algorithm, the average number of feature points extracted is 485.2, which is 201.2 more than that of the PCA-SIFT algorithm. The average matching accuracy of the final feature points is 78.41%, which is 2.21% lower than that of the PCA-SIFT algorithm. The identification and matching of trademark images can be regarded as a binary classification problem. In view of the problem of too many feature points in feature matching, which leads to low efficiency and accuracy, SVM is used to match feature values. In order to verify the recognition accuracy of the proposed trademark recognition model, a test sample set was used to test Model 1, Model 2 and Model 3 to compare the trademark recognition accuracy of the three models, as shown in Fig. 8.

In Fig. 8, the trademark recognition accuracy of Model 3 is significantly better than Model 1 and Model 2, and the number of iterations required to achieve the best accuracy is also significantly less than Model 1 and Model 2. The trademark recognition accuracy of Model 3 is 98.82 %, which is 0.66% higher than Model 1's 98.16% and 0.58% higher than Model 2's 98.24%. In the FlickrLogos dataset, images of four trademarks including Adidas, Aldi, Apple, and Becks were selected for testing. For the above four trademarks, the recognition time and recognition accuracy of the three models are shown in Table I.

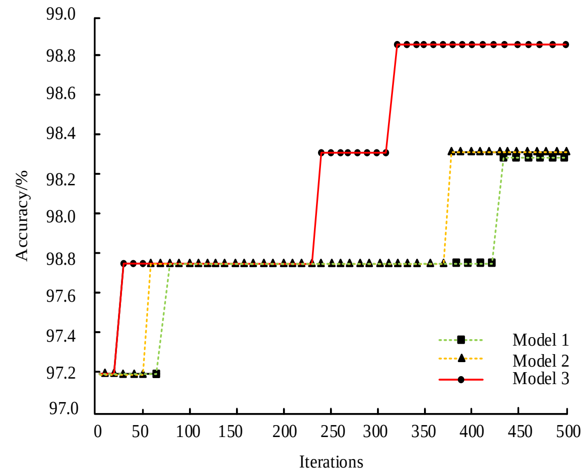


Fig. 8. Trademark recognition accuracy of three models

TABLE I. RECOGNITION TIME AND ACCURACY OF THREE MODELS

Model	Trademark	Time/s	Accuracy/%
Model 1		68.6	89.32
Model 2	Adidas	32.4	93.65
Model 3		35.3	98.42
Model 1		76.6	86.46
Model 2	Aldi	44.3	92.03
Model 3		45.6	98.14
Model 1		55.2	90.06
Model 2	Apple	24.0	96.33
Model 3		26.8	99.25
Model 1		108.4	88.44
Model 2	Becks	65.3	91.09
Model 3		70.2	98.62
Model 1		77.2	88.57
Model 2	Average	41.5	93.28
Model 3		44.5	98.61

In Table I, the trademark recognition accuracy of model 3 is significantly higher than that of model 1 and model 2, and the recognition time of model 3 is much shorter than that of model 1, slightly higher than that of model 2. Among them, in the identification of Adidas trademark, the identification time of model 3 is 35.3s, and the identification accuracy is 98.42%; The recognition time of model 2 is 32.4s, 2.9s less than model 3, and the recognition accuracy is 93.65%, 4.77% less than model 3; The recognition time of model 1 is 68.6s, 33.3s more than model 3, and the recognition accuracy is 89.32%, 9.10% less than model 3. This shows that the accuracy and efficiency of Model 3 are much higher than those of Model 1 and Model 2. In order to further evaluate the performance of the three models, the area under the ROC curve is introduced to evaluate the three models. Generally speaking, the larger the

AUC value is, the better the performance of the model is. Test the two prediction models with the test data sample set, and the AUC curves of the three models are shown in Fig. 9.

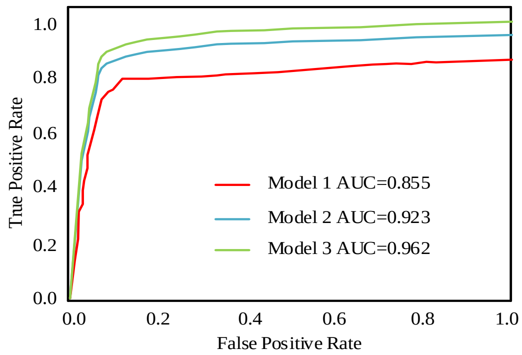


Fig. 9. AUC curve of three models

As can be seen in Fig. 9, the AUC value of Model 3 is 0.962, which is 0.039 higher than Model 2's 0.923 and 0.107 higher than Model 1's 0.855. To sum up, the proposed SIFT-PCA-SVM-based trademark recognition model can identify trademarks with high efficiency and high precision, so as to avoid legal disputes caused by infringement and plagiarism, and has positive significance for advertising design.

V. Conclusion

Aiming at the problem that the current trademark design pattern is easy to repeat and causes legal disputes such as plagiarism and infringement, an SIFT-PCA-SVM algorithm is proposed to build a trademark recognition model. The experimental results show that model 3 achieves the target accuracy when the training time is 241s, 152 seconds less than model 2, and 235 seconds less than model 1. The trademark recognition accuracy of model 3 is 98.82%, 0.66% higher than 98.16% of model 1, and 0.58% higher than 98.24% of model 2. The area under ROC curve is introduced to evaluate the three models. AUC value of model 3 is 0.962, 0.039 higher than 0.923 of model 2, and 0.107 higher than 0.855 of model 1. In conclusion, the trademark identification model based on SIFT-PCA-SVM proposed in the study can identify trademarks efficiently and accurately, so as to avoid legal disputes caused by infringement, plagiarism and other issues, which is of positive significance to advertising design. The trademark recognition model proposed in the study is mainly used to identify the problem of pattern type advertisement design plagiarism. The recognition effect of video and audio advertisement design plagiarism is poor, which is also the direction that needs to be improved in the next step of the study.

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