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Research on Network Information Security Management System Based on Face Recognition

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With the vigorous development of the new generation of information technology, the field of human identity recognition has been paid more and more attention. Compared with the traditional manual verification, face recognition has higher security. The current research in this field is still a blank, and it is also a hot research direction of current artificial intelligence. On the basis of Open CV4 open source computer vision library, this paper develops a security management system based on face recognition. The face recognition part is based on face pre-processing, face detection, and the face detection algorithm based on Ada Boost is used. The LBPHFACE (Local binary mode histogram face) based on LBP (Local Binary Pattern) is studied. This algorithm is used for face recognition. After real-time and accuracy tests, the real-time and accuracy meet the requirements.

Keywords: face recognition, data fusion, Ada boost face detection, LBPHFACE, information security

1. INTRODUCTION

As early as 1888 and 1920, Galton published two papers on face recognition in Nature. In 1910, Galton proposed using the distance between the key points and the key points to construct a feature vector for face recognition, which is the embryonic form of face recognition based on geometric features, but is not a true automatic face recognition. The most authoritative international conferences in the fields of pattern recognition, machine vision and image processing, such as IEEE CVPR, IEEE ICCV, IEEE ICASSP, ECCV, ICPR, pay attention to the research of face recognition every time.

The advantage of face recognition is that as long as the user appears in a specific location, the authentication process can be completed automatically without any user action. Focus on the face recognition methods based on image features, that is, Eigenface, Fisherface and Local Binary Pattern Histogram (LBPH), and take the recognition rate and recognition time as the criteria to study the recognition effect of these three methods on several standard face databases [1]. It is found that LBPH-based face recognition method is slow but robust to light. Eigenface method is very sensitive to light; After proper light pretreatment, the recognition rate obtained by Fisherface method can be improved. On the basis of Open CV4 open source computer vision library, the handheld Android device management terminal can view real-time or historical access at any time and handle any abnormality.

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Based on Open CV4.6 open source computer vision database, this paper mainly studies the security management system based on face recognition [2]. The security management system of face recognition in this study mainly includes face recognition in the order of face pre-processing, face detection and face recognition (training). Face detection uses a face detection algorithm based on AdaBoost. The main face recognition algorithms are studied: LBPHFACE face recognition algorithm based on LBP. This algorithm is used for face recognition. After real-time and accuracy tests, the real-time and accuracy meet the requirements.

2. RELEVANT THEORIES AND METHODS

Face feature information comparison is an important way of biometric comparison, which is usually unique. Biometric identification technology is a technology that analyzes and calculates the relevant characteristic information of organisms through computer technology. At present, the mainstream and commonly used biometric related technologies mainly include human iris recognition technology, finger fingerprint recognition technology and face recognition technology.

2.1 Ada Boost Based Face Detection Algorithm

As a very effective method of biometric recognition, face recognition plays a very important role in biometric recognition. Compared with other biometric authentication signals such as fingerprints and iris, face feature recognition technology is more simple and direct. Any device with camera function can detect and identify at any time and any place. At the same time, its uniqueness and resolubility are relatively high. Therefore, the face authentication algorithm needs to overcome these external factors in the large-scale face database, and carry out effective differentiation under the disturbance of large infra-class changes. It needs to keep the probability of different people being mistaken for the same person very low, and the probability of the same person being considered as the same person high.

(A) Haar-like characteristics

Face detection by Ada boost algorithm is based on eigenvalues, which are obtained by features. In essence, the eigenvalue of this method refers to the result of the sum difference of the pixel gray value in some regions. Ada boost algorithm, the selection of weak classifier should follow the principle of simple features and concise judgment conditions, so that the classifier is easy to be processed in the future. Generally speaking, several basic simple rectangles are selected for feature selection, and the judgment condition requires that the classification accuracy of each classifier is not less than 50% [3]. This can also achieve a good performance of running fast. Based on the above selection principle, Viola-est all.

According to the characters of 1 Haar-like the shape of the structure, 2– rectangle features can be used to extract and detect the edges of the image feature information, 3– rectangle features can be used to extract and detect linear feature of the image, the shape is very suitable for testing people's eyes, the characteristics of a 4 - rectangle can be used to extract and detection has the characteristics of a certain direction. So far, there have been dozens of extended Haar-like features, allowing the Ada boost algorithm to be applicable to a wide variety of situations, such as non-upright images, small Angle profile images, and so on.

For each Haar-like feature, its side length meets the ergonomic condition, that is, its side length changes arbitrarily within a certain range [4]. However, in order to meet the shape structure conditions of the four basic features, the rectangle must also meet the condition (*s*, *t*), and the rectangle that meets this condition is called a conditional rectangle. (*s*, *t*) condition is defined as follows:

Step 1: The horizontal length of the rectangle can be equally divided into s segments;
Step 2: The vertical length of the rectangle can be equally divided into *T* segments.

The corresponding relationships between the simplest rectangular features and (*s*, *t*) conditions are shown in Table 1 below.

Table 1. Conditions of (*s*, *t*) corresponding to different rectangles.

Characteristics of the template					
(*s*, *t*) condition	(2, 1)	(2)	(3, 1)	(1, 3)	(2, 2)
Quantity (PCS)	42300	43200	26700	27600	20376

The last line is the sum of the number of features corresponding to the five basic features when the scan window is 24×24.Its calculation method is: (1) In Eq. (1), m represents the size of the child window, and s and t represent the two conditional limiting variables of the conditional rectangle. For a 24×24 scan window, there are more than 160,000 cases. For a 20×20 scan window, there are more than 70,000 cases. In the training need to add some restrictions, to a certain extent to reduce the number of cycles.

$$\Omega_{(s,t)}^{m}=\sum_{x1=1}^{m-s+1}\sum_{y1=1}^{m-t+1}p\cdot q=\left(\left[\frac{m}{s}\right]+\left[\frac{m-1}{s}\right]+\cdots+\left[\frac{s+1}{s}\right]+1\right)\cdot\left(\left[\frac{m}{t}\right]+\left[\frac{m-1}{t}\right]+\cdots+\left[\frac{t+1}{t}\right]+1\right) \tag{1}$$

(B) Integral diagram

Another main concept of Ada boost algorithm is integral graph, which is also a key concept to the improve running speed of the deep algorithm. As the name implies, integral means the sum over one dimension. Integral graph refers to the integral of the pixel gray value from the upper left corner of the image to the point of a certain position in the graph [5]. As shown in Fig. 1.

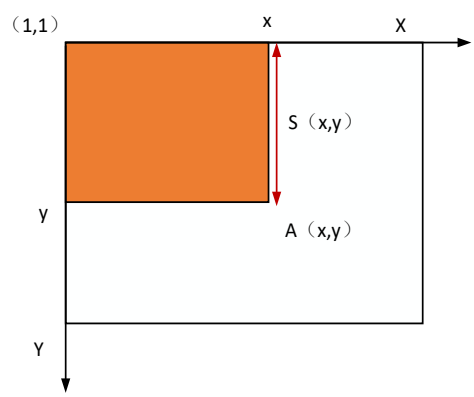

Fig. 1. Schematic diagram of integral diagram.

For A point A in A two-dimensional matrix, the stored data is not the gray value of the point, but the sum of the gray value of the whole gray area in the figure. The calculation method of data at point A is expressed in Eq. (2):

$$A(x, y) = \sum_{x' \le x, y' \le y} I(x', y'). \tag{2}$$

In the formula, $I(x', y')$ represents the gray value of point (x', y') in the original image, and the value range is 0~255. To obtain a complete integral graph, the original image needs to be scanned. The calculation principle can be expressed in Eqs. (3) and (4):

$$s(x, y) = s(x, y - 1) + I(x, y), \tag{3}$$

$$A(x, y) = A(x - 1, y) + s(x, y). \tag{4}$$

Where, $S(x, y)$ represents the integral of the pixel gray value of the image of pixel point (x, y) in the y direction, also known as the "column integral sum", which can be expressed in Eq. (5):

$$s(x, y) = \sum_{y' \le y} I(x, y'). \tag{5}$$

We define the preconditions $S(x, 0)$ 0, $A(0, y)$ 0. Once the integral graph is obtained, to calculate the sum of the grayscale values of the gray pixels in a region, it is not necessary to add them up in a circular way. By giving corresponding coordinates, the sum of the grayscale values of the gray pixels in a certain area can be obtained directly from the integral graph, which greatly reduces The Times of calculation and the time of single image processing. The sum of the gray values of a square region can be obtained from the coordinates of the corresponding endpoints [5]. As shown in Fig. 2, the characteristic values of the rectangle in the calculation can be expressed as:

$$\begin{aligned} F_{val} &= (A+B+C+D+E+F) - (A+B+C) - (A+B+D+E) + 2\times(A+B) \\ &= A(f) - A(c) - A(e) + 2\times A(b). \end{aligned} \tag{6}$$

The capital letters in the formula mean the sum of the gray values of the corresponding region in Fig. 2. $A(f)$ represents the sum of the gray values of the region determined by the origin and points. When using the integral graph to calculate the eigenvalues, the sum of the gray values in each rectangular area only needs to visit the corresponding integral graph for 4 times.

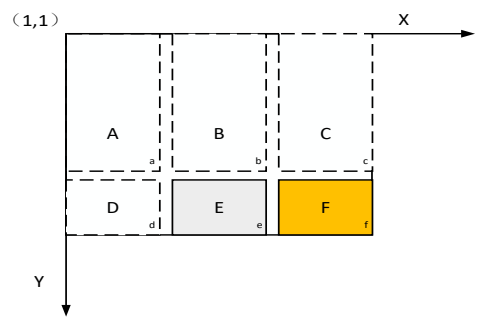

Fig. 2. Calculation of eigenvalues by integral graph.

(C) Construction of classifier

Haar feature and integral graph are the basis of training classifier [6]. The weak classifier is composed of the corresponding feature information and the corresponding threshold information, and its mathematical structure can be expressed as:

$$h(x, f, p, \theta) = f(x) = \begin{cases} 1, & pf(x) < \theta \\ 0, & \text{other} \end{cases}. \tag{7}$$

Where, f refers to the category of features, θ refers to the threshold of the classifier, p refers to the sign direction of the weak classifier inequality, and x refers to one of the detection sub-windows. In essence, a weak classifier has only one threshold value, but to be trained as the optimal weak classifier, a relatively complex judgment is needed.

(D) Face detection

Since the Ada boost algorithm calculates the two-dimensional data corresponding to the grayscale image, the first step of detection needs to grayscale the image. The reason is that when the position and size of the detection window of a face change little, there will be many situations satisfying the classifier, as shown in Fig. 3. This is obviously not the expected detection result, so it is necessary to combine these Windows and finally output an optimal face position and size information. Generally speaking, there are two principles to be followed when merging [7]. First, the rectangles with overlapping areas can only be merged if they meet certain conditions. Second, rectangles that are not far apart can be merged.

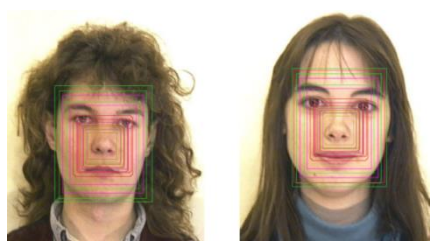

Fig. 3. Unmerged detection results.

For the image with only one face, it is easier to detect the similar rectangular detection box. However, for images with multiple faces, there may be two or more faces that are relatively close to each other. In this case, simply combining them in accordance with the above principles is likely to result in the merging of different face detection result boxes.

2.2 Face Recognition Algorithm Based on LBPHFACE

Face feature extraction is to transform face image into adult face feature vector. Face contains rich pattern features, including color, contour, structure, transformation domain and other feature models. How to select useful features or effective comprehensive features is the key to feature extraction research. The realization of general face authentication needs to undergo five processes: face detection, face alignment, face normalization, face feature extraction and feature matching.

(A) Description of LBP operator

The most at the beginning of LBP operator is defined as within the 3×3 scratch-able

latex, take the center pixel gray value size as a threshold, the adjacent area of 8 pixel gray value one by one, compared with the threshold, if the neighborhood pixel gray value is greater than the center image point grey value, the position of the pixel is marked as 1, otherwise 0. After comparison of 8 points in the neighborhood, 8-bit binary number is finally generated, which is then converted to decimal number. In other words, LBP value of the center pixel of the nine-grid is obtained, with 256 kinds in total. This is shown in Fig. 4.

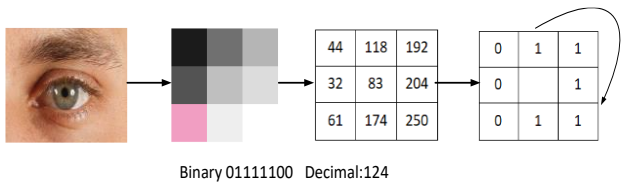

Fig. 4. Description of the LBP operator.

(B) Rotation invariant mode of LBP operator

From the definition of LBP, it can be seen that the same image region will get different LBP values as it rotates clockwise or counterclockwise continuously. Maenpaa eat all. proposed the LBP operator with rotation invariant property. The smallest value is selected as the LBP value of the neighborhood, and the coding results generated by each specific LBP coding mode must be the same after clockwise rotation.The group of LBP operators is obtained by rotation of the same operator [8]. The 12 distinct LBP modes in the figure correspond to the clockwise rotation invariant LBP mode 00001111.

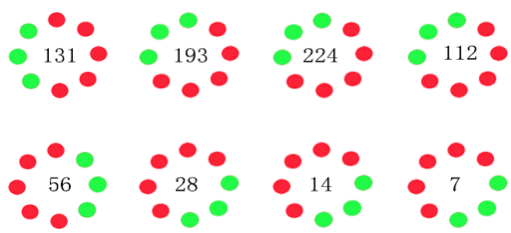

Fig. 5. Schematic diagram of rotation invariant LBP operator.

(C) Face recognition process based on LBP algorithm

From the process of LBP feature extraction algorithm, it can be seen that LBP is actually a local feature extraction algorithm, which loses the global features of the face at the beginning, and it is helpless to deal with the variability of face patterns. However, LBP feature has good characteristics, such as translation, scale, distortion and rotation invariant. The process of face recognition based on LBP algorithm is shown in Fig. 6.

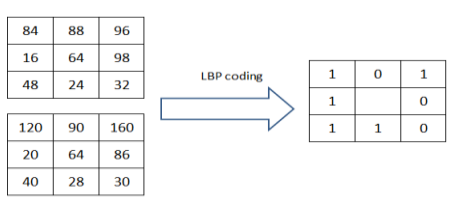

Fig. 6. Schematic diagram of different texture information corresponding to the same LBP value.

In order to better solve the above problems, In the forward transmission process, the low-level network extracts the edge and corner features of the image. It is generally believed that the first layer does not contain specific semantic information. In the latter layer, the features of the former layer are non-linear combined, and the combined results are transmitted to the higher layers. The process is continuously extended to the higher layers to obtain the global features. Finally, the classification layer is used to map the features into a probabilistic model.

3. IMPROVEMENT OF FACE RECOGNITION ALGORITHM

Caffe based on deep learning framework design and implementation of network structure for face recognition, combined with the network structure and training data to train the convergence of three face recognition model, then using the model selection algorithm with the validation data selecting one of the highest verify accuracy of face recognition model as the final model for face recognition. The main components of the security management system based on face recognition are shown in Fig. 7 below.

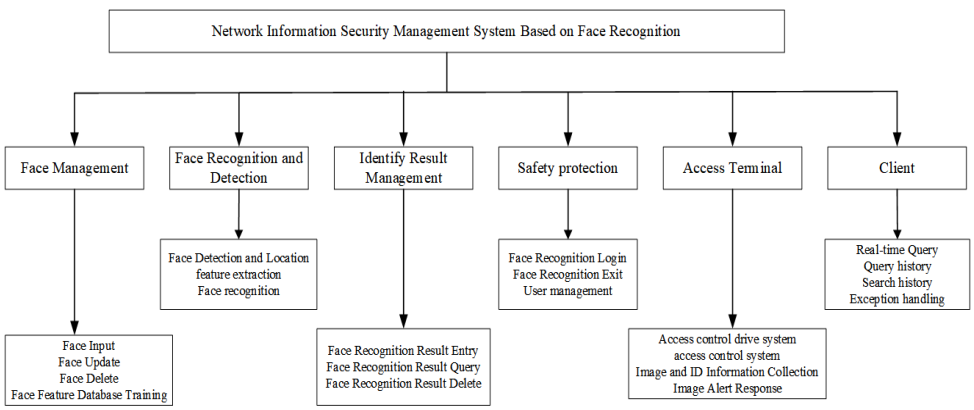

Fig. 7. Function module diagram of the system.

3.1 Improvement of Ada boost algorithm

Shown in the Fig. 8 below, this paper mainly introduces the improvement of Ada boost algorithm. If the traditional Ada boost algorithm is not restricted by conditions, the number of runs is very large.

First of all, the type of the trained image should be enriched. If there is no rich training material, you can artificially add noise, mirror image, rotate the face image at a small Angle, and so on. Thus, the changed image and the per-changed image are added to the training sample database together.

(A) Increase training sample types

The advantage of this approach is that if the sample to be tested has any of the above three conditions, the test results will be improved, as shown in Fig. 9.

(B) Reduce the number of training sample features

For a scan window of 2020, 78,640 features can be obtained according to the exhaustive method, but some of them can be discarded [9]. When calculating Haar-like features, two layers of nested cycles are needed (in the program, there are four layers of nested cycles). The first layer is the starting coordinate of the upper-left corner of the basic structure rectangle, and the second layer is the size of the basic structure rectangle itself, as shown in Fig. 10.

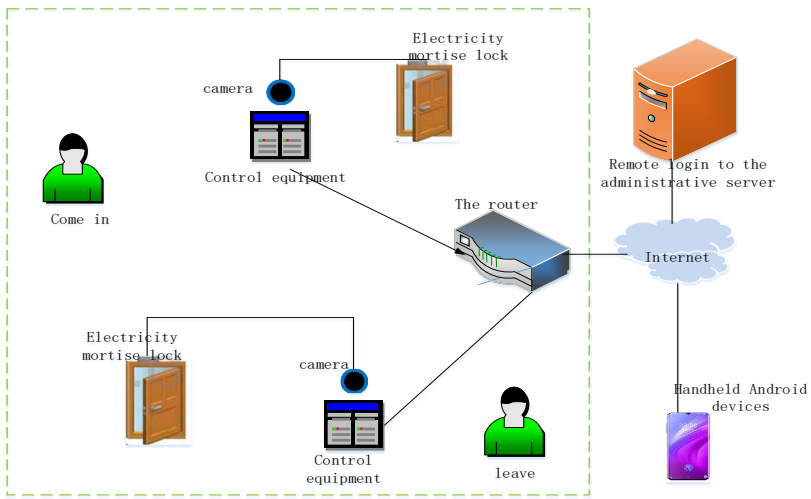

Fig. 8. System working diagram.

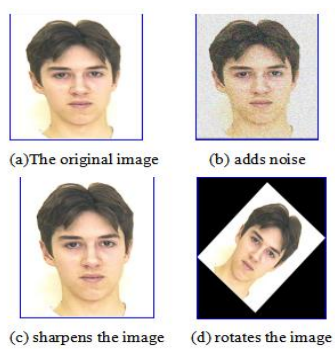

Fig. 9. Facial sample expansion instance.

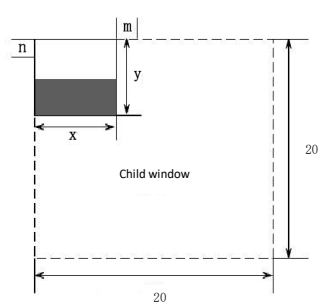

Fig. 10. Calculates the number of features.

Fig. 10 is a child window with a size of 20*20, in which the length *x* and width *y* are the basic structural rectangles in the child window (*s*, *t*) is the Haar-like feature of condition (1, 2). In the figure, *m* and *n* respectively represent the horizontal and vertical sliding increments of the basic structure rectangle in each cycle [10].

(C) The improvement of weak classifier extraction method

As a result of these two aspects, the process of obtaining the optimal weak classifier is time-consuming and resource-consuming. It took more than 124 hours of training before the improvements, but less than 24 hours after the improvements.

Mitex face image database, the most commonly used for Ada boost algorithm training, contains 7087 image samples, including 2706 and 4381 non-face images respectively. Meanwhile, generally speaking, the minimum size of the training sample is 19*19 pixels, and images smaller than this size are generally considered undetectable. This also leads to the fact that the number of features cannot be effectively reduced, thus increasing the number of sorts. Table 2 shows the time complexity of each sorting algorithm.

Table 2. Comparison of several sorting algorithms.

Sorting method	Time (preferably)	Time (worst)	Time (average)	The stability of
Bubble sort	O(N)	O(N)2	O(N)2	stable
Quick sort	O(N*log2)N	O(N)2	O(N*log2)N	unstable
Heap sort	O(N)	O(N)2	O(N)2	unstable
Selection sort	O(N)	O(N)2	O(N)1.3	unstable

As can be seen from the table, the time complexity of sorting is generally higher than the first power of sorting elements, which also leads to exponential explosive growth. In order to solve this problem, this paper studies the training method of double threshold for the new optimal weak classifier. The double threshold is adopted because of the eigenvalues of face and non-face samples, as shown in Fig. 11.

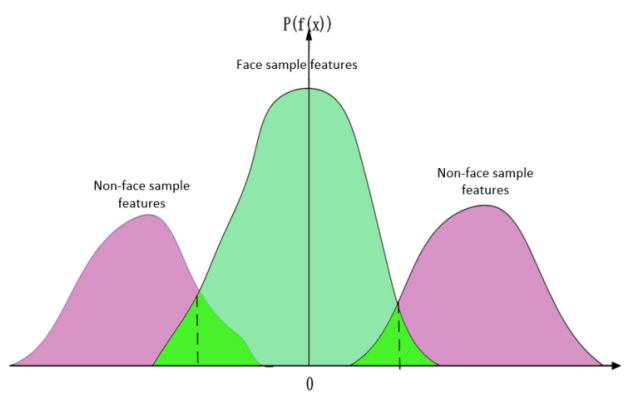

Fig. 11. Feature distribution of face and non-face samples.

One disadvantage of the traditional Ada boost algorithm is that it consumes too long time when the amount of training data is huge. And with the increase of data, the growth of time is higher than the first power of the number of samples, that is, the growth of train-

ing time is far more than the growth of training samples when the training data is huge. The Ada boost algorithm requires the richness of training samples, which requires that the amount of data should not be too small.

3.2 Face Recognition Algorithm Design for Network Information Security System

Ada boost face detection algorithm is used for face detection, and the face detector provided by OpenCV is used to integrate the detection module of adult face. LBBP based LBPHFACE algorithm is the main face recognition algorithm, using the functions provided by OpenCV to train and recognize the face data set, and finally integrate the adult face recognition module [11]. LBPH (Local Binary Patterns Histogram) Local Binary coded histogram, based on the basic idea of LBPH face recognition method is as follows: Firstly, the relationship between each pixel and the gray value of the surrounding pixels is judged, and the binary encoding is performed to obtain the LBP encoded image of the whole image.

The face classifier mylbph Facemodel.xml is identified through predict(), and the main code is as follows:

Prepossessing and face detection	The relevant code
one	#include<opencv2\opencast.app>
two	#include<opencv2\face.app>
three	using name space CV;
four	using name space face;
five	using name space std;
six	char win_title [40] = {};
seven	int main(int arc, char** argv)
eight	{//named Window("input",CV_WINDOW_AUTOSIZE);
nine	CV.showtime('Lean',img) #Show the image);
ten	CV.wait-Key(0)\n); }

4. SYSTEM EXPERIMENT AND SIMULATION

In this paper, the improved LBP algorithm is used to extract the features of the segmented images and distinguish the features. In order to better verify the practicability and advancement of the system, it is necessary to test the face recognition algorithm used. In this paper, CASIA-Webface data set is selected as the training set and test set of the convolutional neural network. CASIA-Webface data set is the face data set of Internet celebrities collected and organized by the Chinese Academy of Sciences. The data set contains more than 10,000 categories of data in total, and a total of about 500,000 face images. The average person has about 50 facial data. However, the image quality of the dataset was poor, and the number of faces of each person was unevenly distributed, with some people having as many as a few hundred faces, while others had less than 10.First of all, the need for data cleaning, including face detection, face alignment and to dry, try to improve the quality of the image and select 40 images of each type of extra classes used as this paper eventually training data set, the final out 2741 categories, each category of using six face image as a test set, so the test set size of 16446,The rest of the full images were used as the training set, including 239,027 training images.

4.1 System Module Test

The traditional LBPH algorithm is simulated in three aspects: illumination robustness, local texture description and similarity discrimination. The running time of the improved algorithm and the classical algorithm were tested.

(A) Experimental simulation of illumination robustness

LBPH algorithm is based on grayscale image calculation, the input RGB color image first needs to be converted to single-channel grayscale image, so the algorithm itself is not sensitive to light conditions, the global features can still be extracted under the condition of sharp changes in light intensity [12] as shown in Fig. 12.

Fig. 12. Simulation of illumination robustness of LBPH algorithm.

(B) Experimental simulation of local texture histogram

LBPH algorithm for feature extracting based on sub-block (block) for the unit, divided the whole image into several blocks after each sub-block abstraction as a feature vector, different sub-block represents the different information, describes the different local texture, each feature vector contains a certain texture information, so LBPH algorithm is sensitive to the texture characteristics.

4.2 Analysis of System Test Results

(A) Face recognition accuracy test comparison

The face is not a constraint. Fig. 13 shows partial samples on two datasets. The S-LBPH experiment was carried out on two data sets respectively, and the accuracy of face detection was observed with the classical LBPH algorithm.

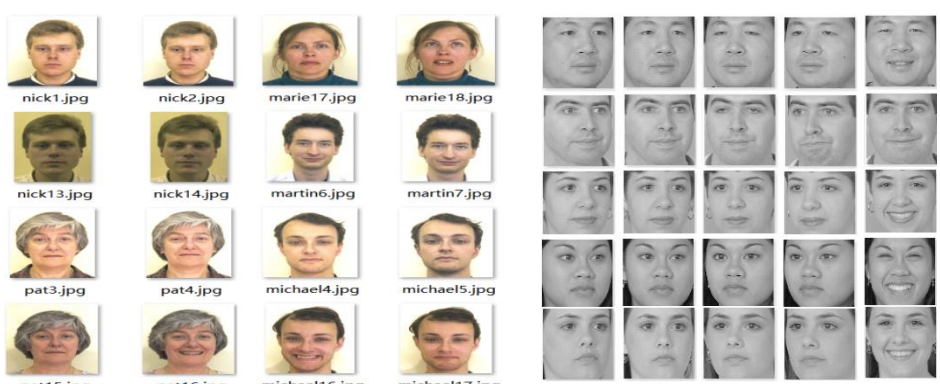

Fig. 13. Sample FERET_FACE and Casia FACEV5 datasets.

Experiment 1: Since FERET_FACE data set belongs to faces under limited conditions and the amount of data available for training is small, the training model does not need to be classified by personnel, but can be directly predicted and calculated.200 different face photos in FEI data set were used as database information, and the remaining 200 were used for detection. All face photos were 360*360, 4*4 sub-blocks were used, and the statistical histogram bins was 32, in which the coincidence threshold of S-LBPH was $t = 4$. The size of the sensitive feature block is one quarter of the face scale (90*90). The three faces with the smallest LBPH calculated similarity (Dist) are weighted to obtain the final S-LBPH similarity. Comparison of the recognition accuracy of LBPH and S-LBPH algorithms on FERET_FACE dataset is shown in Table 3.

Table 3. Comparison of recognition accuracy between LBPH and S-LBPH on FERET_ FACE dataset.

algorithm	Face recognition accuracy
LBPH	98.50% (197/200)
S-LBPH	99.50% (199/200)

Table 4. Comparison of face recognition accuracy between LBPH and S-LBPH on Casia FACEV5 dataset.

algorithm	Face recognition accuracy
LBPH	56.40% (564/1000)
S-LBPH	58.40% (584/1000)

Experiment 2: First, the minimum global similarity between each category and the face to be detected is calculated. Then, the first three samples with the minimum similarity are selected to carry out sensitive feature weighting calculation. Finally, the minimum similarity label after the weighted sensitive feature is output to predict the face. The identification accuracy ratio of LBPH and S-LBPH on Casia FACEV5 data set is shown in Table 4.

Through the above two groups of experiments, it can be found that higher recognition accuracy can be achieved under the face limitation condition, but the recognition rate needs to be improved in the non-face limitation environment. Especially when the number of face samples is large enough, the recognition rate will produce errors due to similarity calculation. However, compared with the classical LBPH algorithm, the S-LBPH algorithm achieves 1% and 2% improvement on the two universal face datasets respectively. It fully shows that the S-LBPH algorithm based on sensitive feature recognition plays an important role in reducing the similarity of the same class and expanding the similarity of the different class.

(B) Running time for testing

Firstly, the running time of the improved algorithm and the classical algorithm is tested. Fig. 14 is a comparison of the running time between the training method of the traditional Adaboost algorithm and the method using the double threshold of the weak classifier. The operation content is from reading the image to obtaining all qualified weak classifiers.

In addition, the effect and performance of the improved method and the classical method are tested. The number of non-faces in the training data used in this experiment is the same. The variable used in this experiment is the number of training samples. As shown

in the figure, the total number of training samples ranges from 100 to 2000. There are three kinds of results for detecting an image: correct results, false results and undetected results. Therefore, common measurement criteria for evaluating the performance of face detection include Precision and Recall, which are calculated as follows. The test results are shown in Fig. 14.

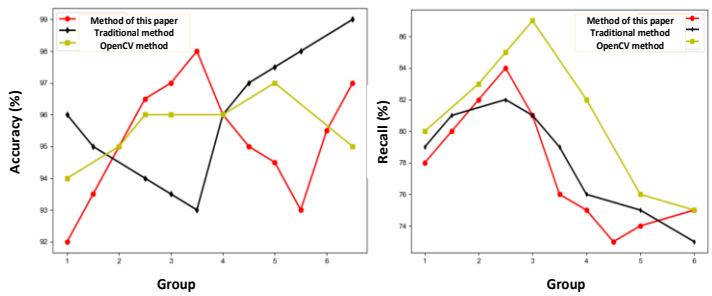

Fig. 14. Face detection performance results.

In the three groups of experiments, the performance of the traditional method was similar to that of the proposed method, and the accuracy of the classifier trained by Open CV was up to 4.2% higher than that of the proposed method.

Table 5. Experimental results of three training methods (%).

The experimental group		A group of	Group B	C group
The traditional method	accuracy	94.0	94.1	93.7
	The recall rate	80.1	80.5	76.0
In this paper, methods	accuracy	93.9	98.1	97.2
	The recall rate	79.0	84.0	77.0
Open CV	accuracy	98.1	97.6	96.8
	The recall rate	82.9	88.0	84.0

In terms of recall rate, the classifier performance after Open CV training was still the best. Except for the last group, the performance is higher than the recall rate of the proposed method and the traditional method by more than 2.8%.

4.3 Analysis of Real-time Test Results of the System

The real-time performance of the system mainly depends on the response time of a single module of the system. In this paper, the system focuses on the time consumed by face preprocessing, transmission, face detection and face recognition in the process of image acquisition. Table 6 shows the average real-time test results.

Table 6. Average results of real-time test of the system (unit ms).

Acquisition and transmission time	Face detection time	Face Preprocessing Time	Face recognition time
804	32	20	95

It can be concluded from the data in the above table that the total operation time of this system is about 952ms, It's perfectly acceptable of the system.

4.4 Analysis of System Accuracy Test Results

System accuracy test focuses on two aspects, face detection and face recognition accuracy. This system is mainly due to the use of active collection of face image data acquisition, that is, the face is facing the camera, can make the face in the middle of the image, so to detect can make the face detection accuracy is relatively high.

Table 7. System accuracy test results (in ms).

Collect number	Correct number of face detection	Face detection accuracy	Face recognition correct number	Face recognition accuracy
2000	1936	96.8%	1860	93%

Due to the current use of ID card verification, face recognition combined with the two channels to detect, the result is that up to now is not in the training sample of the data, the success of recognition. However, due to the limitations of some objective conditions and technologies, although the resampling interpolation method is adopted for amplification, facial features are still not clearly expressed and cannot be recognized, and the accuracy and precision are not enough. Therefore, the recognition algorithm needs to be further improved.

5. CONCLUSION

Combined with the traditional ID card verification method and Open CV Open source computer vision library, mainly introduces face recognition technology from biometric recognition, convolutional neural network face feature extraction and face recognition process; histogram equalization are analyzed, and based on the face detection algorithm Ada Boost research and algorithm improvement and can be well used, based on the LBP LBPHFACE face recognition algorithm is studied and the algorithm is used for face recognition. Aiming at the problem that the global feature similarity of LBPH algorithm is easy to amplify the common ground of different targets, the S-LBPH algorithm based on sensitive feature weighting is proposed. The threshold matching problem of sensitive feature block similarity under specific conditions is further studied. Experiments show that the S-LBPH algorithm significantly reduces the similar distance and it can effectively improve the accuracy of face recognition. Facts have proved that the face recognition using this algorithm, through real-time test and accuracy test, real-time and accuracy are in line with the requirements.

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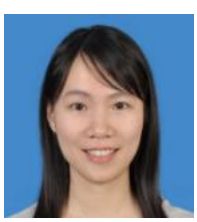

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