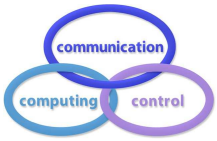
INTERNATIONAL JOURNAL OF COMPUTERS COMMUNICATIONS & CONTROL
Online ISSN 1841-9844, ISSN-L 1841-9836, Volume: 17, Issue: 3, Month: June, Year: 2022
Article Number: 3744, https://doi.org/10.15837/ijccc.2022.3.3744



CCC Publications

Optimization of Three-dimensional Face Recognition Algorithms in Financial Identity Authentication

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Abstract

Identity authentication is one of the most basic components in the computer network world. It is the key technology of information security. It plays an important role in the protection of system and data security. Biometric recognition technology provides a reliable and convenient way for identity authentication. Compared with other biometric recognition technologies, face recognition has become a hot research topic because of its convenience, friendliness and easy acceptance. With the maturity and progress of face recognition technology, its commercial application has become more and more widespread. Internet finance, e-commerce and other asset-related areas have begun to try to use face recognition technology as a means of authentication, so people's security needs for face recognition systems are also increasing. However, as a biometric recognition system, face recognition system still has inherent security vulnerabilities and faces security threats such as template attack and counterfeit attack. In view of this, this paper studies the application of three-dimensional face recognition algorithm in the field of financial identity authentication. On the basis of feature extraction of face information using neural network algorithm, K-L transform is applied to image high-dimensional vector mapping to make face recognition clearer. Thus, the image loss can be reduced.

Keywords: Financial Identity Authentication, Feature Extraction, Three-dimensional Face Recognition Algorithms, Optimization.

1 Introduction

In recent decades, the Internet has been developing at an alarming speed. People's demand for the network is getting higher and higher, enjoying the convenience and speed brought by the network.

However, the development speed of network applications is far faster than that of corresponding security facilities. Nowadays, the harm caused by various security problems is more and more serious, so the network security problem has been paid more and more attention by the leaders and people of various countries. Therefore, various encryption, access control, identity authentication technologies are proposed to improve the security of the network. Among them, identity authentication is the basis of mutual communication and e-commerce activities on the network, as well as the basis of network security system. At present, the technology of identity authentication has been widely used in various network services that people enjoy. Wire equipment and wireless equipment are widely used, which makes the demand of network security access control and network application in finance, trade and e-commerce grow rapidly. Nowadays, biometric recognition methods have been widely used, and face recognition technology is also one of the most widely used. Because of its non-contact, convenient collection, easy to accept and other characteristics, it has become an important research topic at home and abroad. Face recognition has its irreplaceable technical advantages in the application of electronic transactions, remote video conferencing, entrance guard attendance, entry and exit security, and it is one of the mainstream technologies of authentication and recognition in the future. By looking at the face to distinguish different individuals, recognition and verification of face and human identity is also in line with people's daily understanding of identity, more easily accepted by the public. To sum up, the research on network authentication based on security face recognition has certain scientific research value and practical value. This paper mainly explores the application of face recognition in network identity authentication by studying the security and practicability of face recognition scheme.

In the field of Internet-based financial services, the process of user identity authentication usually includes three links: identity registration, Token/certificate issuance and management, and identity authentication. First, the user needs to complete the identity registration. In the registration process, the registration authority collects and verifies the user's identity information to confirm the user's identity, that is, identity verification. When the user's identification is successful, the certificate service provider can apply for issuing Token/certificate to the user. A valid Token/certificate can be used in the subsequent identification process, that is, the certificate service provider confirms the user's identity according to the Token/certificate held by the user to complete the user's identification.

With the deepening of research, great progress has been made in financial identity authentication. Nair K. et al. [1] studied and analyzed the background, principle and corresponding algorithm process of fingerprint identification technology in biometrics, including fingerprint image capture, fingerprint image analysis and feature extraction, fingerprint matching and other related technologies. This paper introduces the smart card (SMART CARD), its internal structure, the setting of relevant parameters, and the information security of digital fingerprint stored in the smart card. Encryption has become an important part of the network security information system in order to ensure the safe transmission of various information in the network. In this paper, we discuss the steps and flow of DES and RSA, which are two typical encryption algorithms in symmetrical and asymmetrical encryption systems, and the cryptographic technology applied in IC cards. And as a well-known Hash function in the information summary function MD5 specific implementation process. This paper presents a secure network communication platform based on digital fingerprint identity authentication and IC card, which integrates symmetrical and asymmetrical encryption algorithms and uses information digest function to ensure the security and reliability of the transmitted information. In 2003, Rila L et al. [2] introduced the basic concept, current situation and application of smart cards closely related to identity authentication, analyzed several types of identity authentication and their advantages and disadvantages, and obtained the reason and significance of adopting two-factor identity authentication based on smart cards in financial system. And the importance and necessity of identity authentication in financial transactions. Secondly, the security requirements of EMV2000 standard and identity authentication are studied in detail. Especially, the security requirements of EMV standard are analyzed in detail. Key management, application key distribution method in smart cards, security mechanism of smart cards and security requirements of terminals are studied in detail. The transmission of secure messages and external authentication (internal authentication) have been discussed for a long time. Secondly, the authentication and encryption algorithms related to identity authentication are systematically studied. The security of symmetric and asymmetric encryption algorithms is analyzed, and

some optimizations and improvements are made. Therefore, the architecture of PKI is also studied. In 2008, Nair S K et al. [3] analyzed the needs of financial security, expounded the importance of security construction, proposed the development of security information system based on PKI system in order to solve the problem of security control, and then divided security information system into security service system and security application system. Through identity authentication and digital signature technology, the security information system is successfully constructed. Finally, the operation of the security information system is described. As the basic application technology system in the framework of banking financial service application software, security information system solves the security control problem of various banking business application systems by using PKI technology and related products. By establishing a unified authentication system, a unified authority system, a security authentication management system for counter business and a security application system, the bank has effectively protected the secrecy and integrity of data in the process of transmission and storage, and effectively identified the identity of the objects accessing the bank information system. Effectively controls access rights to access objects. The system mainly solves two problems: first, using digital certificate to authenticate the identity of the teller to solve the fragile protection of the password and password of the teller, and the problem that the transaction identity cannot be confirmed, so as to ensure that no one can imitate the identity of others to carry out relevant operations. Secondly, digital signature is used as cryptography to solve the problems of easy leakage of cryptography, low operation efficiency and the risk of forgery transaction, so as to meet the needs of centralized accounting. In 2016, Shi Junpeng studied the digital watermarking technology and fingerprint identification technology in copyright protection and identity authentication. The main work is as follows: Firstly, a dual watermarking algorithm based on support vector machine (SVM) and Krawtchouk moment in complex Contourlet domain is proposed. The robust watermarking is constructed by Krawtchouk moment invariant on the blue component of RGB host image. The green component is decomposed by complex Contourlet decomposition, and the digital watermarking is embedded and extracted by SVM prediction model. The experimental results show that the algorithm has better robustness to conventional image processing than the digital watermarking algorithm based on wavelet domain and the digital watermarking algorithm based on Contourlet domain.

With the continuous development of computer technology, two-dimensional face recognition technology has also made considerable achievements in the past 30 years, but compared with the huge prospects of face recognition applications and market demand, most of the current two-dimensional face recognition technology cannot fully meet the needs of practical applications. According to the research, information, illumination, posture, expression, make-up and age are the main factors affecting the performance of two-dimensional face recognition system. In 2002, FRVT assessed the factors that could affect the two-dimensional face recognition system. The evaluation results show that the following are the main factors affecting the two-dimensional face recognition technology. (1) Information: Two-dimensional face image is the result of projection of three-dimensional face plane, which will inevitably lead to the loss of some information and cannot effectively reflect the face identification information. The lack of information is an inherent defect of two-dimensional face recognition. (2) Illumination change: illumination change is an important factor affecting two-dimensional face recognition system, especially the face system exposed to the outside world is seriously affected by illumination, and the recognition rate needs to be improved urgently. (3) Changes in facial expressions: Changes in facial expressions can cause changes in areas such as facial muscle contraction, eye size, eyebrow beating, mouth opening and closing. These changes are the main factors affecting face recognition, which will significantly reduce the recognition rate. (4) Attitude change: Attitude change can directly affect the amount of information acquired from human face. Side face obviously cannot fully reflect the information of human face, which will seriously affect the performance of face recognition system. (5) Too many people: When there are too many people in the face database, the recognition algorithm and computer resolution are limited, and the recognition rate will decrease logarithmically with the increase of the number of people. In addition, makeup and age are also the main factors affecting face recognition. Research shows that when facial makeup is applied, face recognition will also be significantly affected. Older people are easier to recognize than younger people. Because of these unalterable defects in the two-dimensional face recognition system, researchers have begun

to develop methods to improve the performance of face recognition system or turn directly to other face recognition methods. Three-dimensional face recognition is proposed in this case. Li Ye, Wang Yinghui, Liu Jing and others [5] proposed ridge extraction and valley extraction to represent human face in view of the huge volume of three-dimensional face data and low recognition efficiency. Ridges and valleys, as extreme points of principal curvature changing along principal direction in local area of surface, can well represent three-dimensional face features. For three-dimensional face extraction ridge point model and valley point model, rough face matching is realized by generating corresponding spatial distribution density histogram after rasterization, and accurate face matching is achieved by calculating LTS-Hausdorff distance. The experimental results in GavabDB three-dimensional face database show that the method has a high recognition rate. As'Ari M A and others [6] apply the depth camera of Kinect, a high performance-cost somatosensory device launched by Microsoft, to three-dimensional face data acquisition, to a certain extent, to solve the problem of expensive and complex use of previous three-dimensional data acquisition equipment. At the same time, we can use its complete function and simple and easy-to-use program interface to pre-process the collected three-dimensional data such as noise reduction. In the aspect of three-dimensional face feature extraction, the method of Kernel Principal Component Analysis (KPCA) is used to project the three-dimensional face data from high-dimensional space into low-dimensional space under the principle of minimizing the loss of original image information, which further improves the shortcomings of Principal Component Analysis (PCA) in dealing with non-linear data. Based on the strong classification ability of support vector machine (SVM) and the advantage of solving the problem of small sample data, the classification and recognition results of reduced dimension three-dimensional face data are output by SVM. In the overall implementation of the system, this paper uses the depth camera of Kinect, a Microsoft somatosensory device, as the hardware device of face three-dimensional data acquisition, to achieve the functions of acquisition and preprocessing of three-dimensional face data, extraction of three-dimensional face features and three-dimensional face recognition. The experimental results show that the method adopted in this paper can achieve the acquisition and processing of three-dimensional face data, and has a good recognition effect. The method adopted in this paper has a certain significance for the popularization and application of three-dimensional face recognition technology. Zhan Shu, Zhang Qixiang, Jiang Jianguo et al. [7] In order to overcome the recognition difficulties caused by the changes of illumination, expression and posture in three-dimensional face recognition, a nuclear cooperative expression three-dimensional face recognition algorithm based on Gabor feature is proposed. Collaborative expression classification algorithm uses similar face data to co-represent test faces. Sparse coefficients are solved by 2 norms, and test faces are classified correctly according to reconstruction error. In this method, Gabor filters are used to extract 40 Gabor features of different scales and directions of 3D face depth maps, and then appropriate kernels are selected to map them into high-dimensional kernelspace for non-linear dimensionality reduction and feature selection. Finally, three-dimensional face recognition is completed by combining the cooperative expression classification algorithm. Experiments on Kinect face database and Texas three-dimensional face database show that this method can achieve good recognition results with fewer training samples. In order to enhance the robustness of three-dimensional face recognition system to facial expression changes, Daniyal F et al. [8], proposed a face recognition system that combines depth data with facial rigid regions. Firstly, the nose tips are located according to the geometric features of the face, and the effective facial regions are cut from the point as the center to rectify the faces with various postures to the positive postures. Then, the depth map is used as the whole feature to match the nose tips using the two-dimensional principal component analysis (2DPCA) algorithm. An improved Iterative Nearest Point (ICP) algorithm is used to match the face rigid region as the local feature. Finally, the extracted global feature matching results and local feature matching results are fused. The experimental results on CASIA 3D face database show that the recognition rate of the constructed system is higher than that of the system using a single feature, and it is robust to facial expression changes. Lv Shiwen, Da Feipeng, Deng Xing and others [9] proposed a region-based improved local binary pattern (LBP) based three-dimensional face recognition algorithm for facial expression problems in three-dimensional face recognition. Firstly, the pre-processed three-dimensional point clouds are transformed into depth maps and normalized. Secondly, according to the influence of facial expressions on the face, the rigid,

semi-rigid and non-rigid regions of the face are extracted by using binary mask. For each local region, the improved LBP features are calculated and characterized by equivalent patterns. Finally, a single local region is identified by using Sparse Representation Classifier (SRC), and a weighted Sparse Representation Classifier (W-SRC) is used to fuse the rigid and semi-rigid regions at decision level, and the final recognition results are given. The experimental results on FRGC v2.0 face database show that the method has good robustness and high recognition accuracy.

2 Proposed method method

2.1 Principal Component Analysis

The basic idea of PCA face recognition is to find the most representative feature space from the face image and remove some irrelevant features. A face image is mapped into this feature space to obtain a set of coefficients, which represent the features of the face image. If the coefficients of two face images mapped to this feature space are similar, it means that the two faces correspond to the same person. Principal Component Analysis (PCA) mainly uses K-L transform to map high-dimensional vectors representing face images into subspaces formed by several feature vectors, thus completing the optimal analysis and reconstruction of face images.

For a face image of $m \times n$ dimension size, the principal component analysis algorithm joins its columns to form a column vector of $m \times n$ dimension size,$m \times n$ is the dimension of the face image and the dimension of the image space is $m \times n$. Let M be the number of training samples.X_J represents the face image vector formed from the jth face image. Then the covariance matrix of all face image training samples is

$$\sum T = \sum_{i=1}^{M} (X_i - \mu)(X_i - \mu)^T$$

Among them,μ is the average image vector of the training sample is used.

$$\mu = \frac{1}{M} \sum_{i=1}^{M} X_i$$

Let A =$[X_1 - \mu, X_2 - \mu, ..., X_M - \mu]$,then $\sum T = AA^T$.

According to the principle of singular value decomposition, the eigenvalues and eigenvectors to be solved of AA^Tcan be obtained by solving the eigenvalues and eigenvectors of the matrix AA^T.If the r-th non-zero eigenvalue of the matrix AA^T is $\lambda_i (i = 1, 2, ..., r)$,the eigenvector ν_i of the AA^T corresponding eigenvalue, then the AA^T orthogonal normalized eigenvector is

$$\mu_i = (1/\sqrt{\lambda_i})\nu_i$$

It is the eigenvector of AA^T.If the eigenvalues are arranged from large to small $\lambda_1 \geq \lambda_2 \geq ...\lambda_r \geq 0$,the corresponding eigenvector is $\{\mu_i\}_{i=1}^{T}$the eigenvector. In this way, each face image can be projected into the subspace formed by the $\mu_1, \mu_2, ..., \mu_r$.Considering the dimension, the eigenvectors corresponding to the first p larger eigenvalues can be selected as the subspace accordingly.

$$\sum_{i=1}^{P} X_i / \sum_{i=1}^{r} X_i \geq \alpha$$

Among them, the value of is a value derived from experiments. Because the extracted eigenvector images are very similar to human faces, they are called "feature faces", so the face recognition method realized by PCA transformation algorithm is also called "feature face" method.

2.2 Support Vector Machine Algorithms

The central idea of Support Vector Machine (SVM) algorithm [13] is to find an optimal hyperplane for classification. Through learning and training a large number of face training sample data, SVM algorithm can judge whether an input belongs to one of the two categories. The algorithm is divided

into two stages: learning stage and recognition stage. In the learning stage of SVM, the algorithm follows the principle of structural risk minimization to learn the set of face images with labels, so as to determine the optimal parameters of hyperregressive plane.

The first stage, learning stage:
(1) Establishing training sample set $\{x_i, y_j\}$,$y_i \in \{-1, +1\}$,$i = 1, ..., l$.
(2)Kernel functions $K_{\{x_i,x_j\}}$ and coefficients are selected to transform low-dimensional space to high-dimensional space.
(3)Normalizing the input sample,x_i will be stipulated in $\{-1, +1\}$.
(4)Constructing the kernel matrix $H\{l, l\}$.
(5)Solution of Lagrange coefficient α_i.
The constraint condition is,$\sum_{i=1}^{i} \alpha_i y_i = 0$,$0 < \alpha_i < C$.
The objective function used is: $maxQ(\alpha) = \sum_{i=1}^{1} \alpha_i - \frac{1}{2} \sum_{i,j=1}^{1} \alpha_i \alpha_j y_i y_j K_{\{x_i,x_j\}}$.
(6) The corresponding support vectors $s\nu$ are searched and the classification hyperplane coefficient vector b is solved.
(7) Solving all kinds of parameters, constructing the corresponding optimal classification hyperplane, and completing the training. The second stage, identification stage:
(1) Enter the standard template data that has been trained in the learning stage.
(2) Utilization

$$f(x) = \sum_{s\nu} y_i \alpha_i K(x_i, x^{'}) - b$$

Calculate the output value of data feature to be classified.
(3) According to the classification function $f(x')$, the data to be classified are classified as $\{-1, +1\}$ and the classification results are obtained.

SVM has many unique advantages in solving small sample and non-linear face pattern recognition problems. Its performance is superior to many other learning methods and shows good learning ability. At the same time, SVM can get the corresponding decision rules from the limited training samples, and it can still get smaller errors for independent test sets.

2.3 Neural Network Algorithms

Neural network system [14, 15, 16] is a non-linear dynamic system with distributed information storage. The system processes information in parallel and collaboratively, and has a high recognition rate for images. Neural networks consist of many simple neurons with parallel operations, as shown in Figure 1. Neuron is a multi-input, single-output element. The input signals are divided into excitation and inhibition. The output response of a neuron depends on the result of input signal superposition synthesis, and when a certain synthetic input value exceeds a certain threshold, the neuron is activated, otherwise, the neuron will be in an inhibitory state. In the application of face recognition algorithm, most of the neural network models choose error back-propagation algorithm, that is, BP neural network algorithm. The main idea is that the error of the output layer is propagated from the latter layer to the forward layer, so that the error of the hidden layer can be calculated indirectly. The algorithm is divided into two stages: the first stage is the forward process, in which the input information starts from the input layer and calculates the output value of each unit through each hidden layer; the second stage is the back propagation process, in which the error of each unit in the hidden middle layer is calculated from the output error layer to the forward layer. At the same time, this error is used to correct the front weights. The algorithm steps are as follows:

Step 1: The initial value of the selected coefficient. Step 2: Calculate each face image sample in turn, repeat the following process until convergence:

(1) Calculate the actual output O_j of each unit in each layer from front to back, (among them,W_{ij} is the weights from the front layer to the bottom layer).

$$net_j = \sum_i \omega_{ij} O_i, O_j = \frac{1}{1 - e^{-net_j}}$$

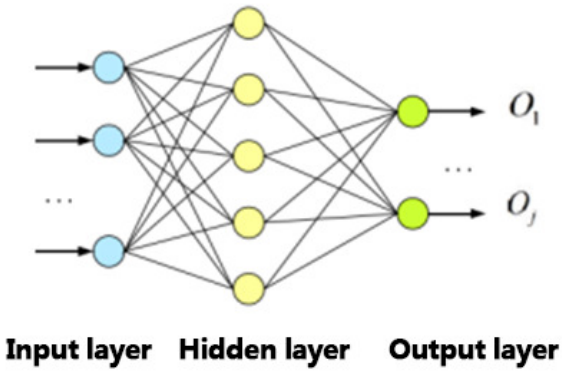

Figure 1: BP neural network

(2) Calculate the local gradient δ_j for the output layer (where y is the ideal output value):

$$\delta_j = (y - O_j)O_j(1 - O_j)$$

(3) Calculating the hidden layer from the back to the front:

$$\delta_j : \delta_{j-1} = O_j(1 - O_j) \sum_k \omega_{jk}\delta_k$$

(4) Calculate and save the weight corrections:

$$\triangle\omega_{jk} : \triangle\omega_{jk}(t) = \alpha \triangle \omega_{jk}(t-1) + \eta\delta_j O_i$$

(5) Modified weights:

$$\omega_{ij}(t+1) = \omega_{ij} + \triangle\omega_{ij}(t)$$

BP neural network [17] has the following advantages: good non-linear mapping ability, self-learning and self-adaptive ability, generalization ability, fault-tolerant ability and so on. But it also has some shortcomings such as slow convergence speed and local minimization. Using momentum rule and adaptive adjustment learning, improved BP neural algorithm has been well applied in face recognition.

3 Experiments

More and more research organizations, institutions and institutions of higher learning have begun to establish a three-dimensional face database, Bosphorus DB face database is one of them. The Bosphorus DB Face Database consists of 105 people, numbered from bs000 to bs104. Numbering method is personnel number + expression abbreviation + expression number. Everyone has different postures, expressions and occlusions. Eighteen people had beards and fifteen people had data on hair. The age of the subjects ranged from 25 to 35. The database includes 60 men and 45 women, most of whom are Caucasians. In addition, 27 professional actors are included in the database. Each person has a maximum of 54 face data, 34 people only have 31 face data, a total of 4652 faces. Each person has different postures, of which three head postures correspond to seven left and right rotations, four front and back rotations and two samples containing both left and right front and back rotations. Each face is stored in a'.bnt'file, which contains the spatial coordinates of each point on the face and the two-dimensional image of the face, as well as the pixel values of the image length and width. This paper uses the Bosphorus DB face database to verify the effectiveness of the proposed three-dimensional face recognition algorithm.

The experiment is based on Intel (R) Core (TM) i5-2330M CPU@2.20GHZ and 4G memory configuration machine. Based on the Bosphorus DB standard face image database, the validity of the algorithm is validated by face recognition experiment simulation with the application program of MATLAB 2014b.

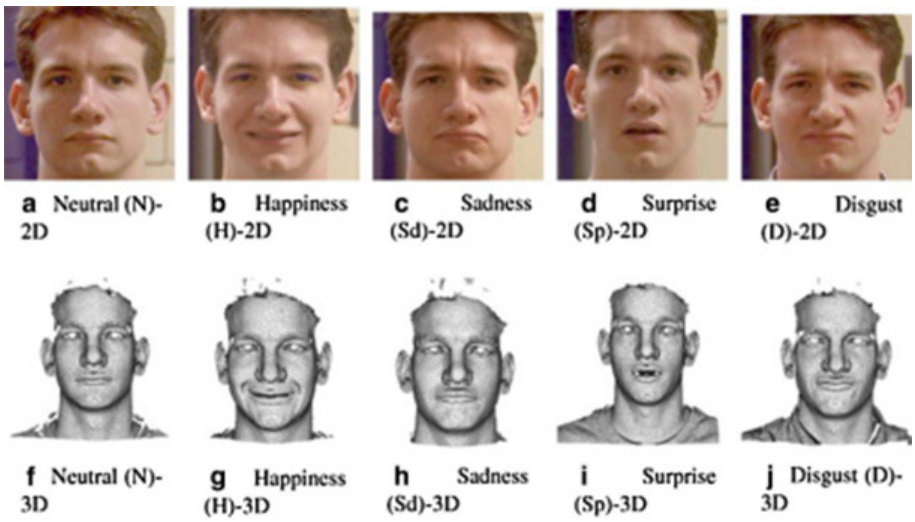

Figure 2: BosphorusDB face database example

Table 1: The recognition result of different k parameters on BosphorusDB

Incentive function parameter	0.1	0.5	1	5	10	20
Convergence time (ms)	314	423	589	812	1165	1387
Recognition rate (%)	82.3	86.9	93.6	82.7	76.3	74.1

4 Discussion

4.1 Excitation function experiment

In this paper, the S-type excitation function [18]:$f(x) = \frac{1}{1+e^{-kx}}$ as shown in Figure 3, the smaller the parameter k, the faster the convergence efficiency of the training process of the network, and the disadvantage will cause oscillation; the larger the parameter k, the longer the convergence time of the training process of the network. The difference of parameter k of excitation function will lead to different training time and recognition results. The Bosphorus DB library is used to test the relationship between different parameters and convergence speed [19] and recognition rate. The results are shown in Table 1 below.

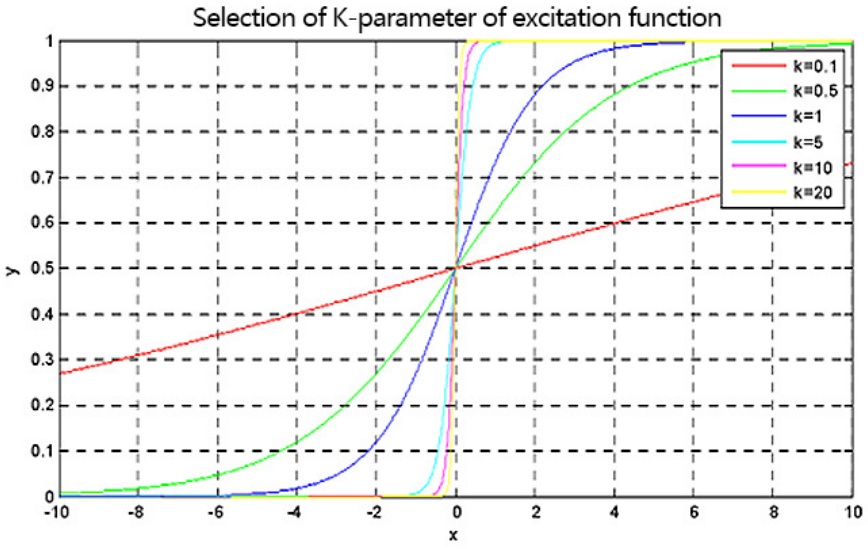

Figure 3: Incentive function

The experimental results in Table 1 above show that when the excitation function remains unchanged, the convergence time increases with the increase of the parameters, and the recognition rate

Table 2: Relations between different values of increment and decrement factors and convergence time and system recognition rate

Increment factor α	1.8	1.5	1.4	1.3	1.1	1.6
Increment factor β	0.9	0.4	0.5	0.7	0.6	0.8
Convergence time (ms)	124	562	764	462	617	189
Recognition rate (%)	81.5	88.9	91.7	86.8	93.7	83.9

Table 3: The relationship between weight adjustment mode, convergence time and system recognition rate

arrange mode	Additional momentum method	Gradient descent method	Elastic momentum method
Convergence time (ms)	827	334	613
Recognition rate (%)	88.2	85.7	94.2

reaches its maximum when the parameter k is 1.

4.2 Weight Adjustment Method Experiments

The training and learning process of BP neural network is mainly the process of adjusting weights. The commonly used methods are the additional momentum method and the gradient descent method [20]. On the basis of studying the above two methods, this paper puts forward the method of adjusting the weights of elastic momentum. The different values of parameter increment and subtraction factor will directly affect the training time and recognition rate of the network. Test 1: Test the relationship between different values of parameter increment factor α and reduction factor β and convergence time and recognition rate with the help of Bosphorus DB library. Test 2: Test the relationship between convergence time and recognition rate with the help of Bosphorus DB library using three weight adjustment methods. The results are shown in Table 2 and Table 3, respectively.

Table 2 shows that the recognition rate of the system is the highest when the incremental factor α and the decrement factor β are 1.1 and 0.6 respectively. As can be seen from Table 3, the recognition rate of the additional momentum method is higher than that of the gradient descent method, but the convergence time is longer. It can be inferred that the gradient descent method is used to trap the local minimum in the training process of the neural network. Although the convergence time of the improved elastic momentum weight adjustment method is longer than that of the gradient descent method, the recognition rate is higher than that of the additional momentum method and the gradient descent method, which proves that the adjustment method is feasible.

4.3 Performance of PCA + BP Neural Network

The purpose of this experiment is to compare and analyze the PCA+BP algorithm based on category pattern with the commonly used classification algorithm, and set the excitation function of BP network as follows: $f(x) = \frac{1}{1+e^{-x}}$ using elastic momentum weight adjustment method, the number of nodes in input layer is 30, and the number of nodes in hidden layer is 90 in Bosphorus DB library. The output layers are 40. The results are shown in Table 4.

Comparing table 4, PCA + BP classifier has more advantages than ordinary algorithm. In the result record of Bosphorus DB library, the recognition rate is up to 98.7%. Thus, the PCA + BP classifier proposed in this paper is superior to the nearest neighbor classifier and SVM.

5 Conclusions

With the rapid development of artificial intelligence, face recognition technology has been widely used in identity recognition because of its direct friends and other characteristics, and e-commerce, banking and other fields involving people's capital and property are also increasingly trying to use face recognition as a means of authentication. However, face recognition system is vulnerable to deception such as photographs, videos and human skin masks. The security threats it faces have become an important factor hindering its application and development. How to make people feel safe in using

face recognition system will also become the trend of future face recognition research. In this paper, from the point of view of security, the research work on face recognition algorithm is carried out.

(1) Based on the analysis of the traditional face recognition system based on network identity authentication, according to the threats faced by the development of face recognition applications. On the basis of the traditional algorithm, we optimize it. The principal component analysis method is used to extract the features of the image. A feature extraction method of BP neural network algorithm and K-L method are defined for the optimal analysis and reconstruction of the image. The results show that the method of three-dimensional face recognition can achieve information recognition very well.

(2) Feature extraction of pre-processed face images. The classical principal component analysis (PCA) method is used to analyze the traditional face features.

(3) The improved BP neural network is used to realize face recognition. The experimental results show that the method is robust to illumination noise.

Although this algorithm realizes face recognition, due to the limited personal energy and ability, there are still some shortcomings to be improved. The following is the outlook of the content to be improved.

(1) This algorithm is mainly aimed at single person's face detection, but does not take into account the multi-face situation in the same image, and fails to achieve accurate location. Therefore, how to use effective algorithms for multi-face detection will be the direction of future research.

(2) In this paper, we use the existing face detection methods for location detection. In the follow-up work, we will study the algorithm of face location.

Funding

This work was supported by Guizhou Key Laboratory of Big Data Statistics Analysis (No.: Platform Talent Plan[2019] 5103); Guangdong Philosophy and Social Science Planning Project (GD21CYJ31); Characteristic Innovation Project of General Higher Education in Guangdong Province (2021WTSCX206).

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Cite this paper as:
Luo, C.; Fan, X.; Yan, Y.; Jin H.; Wang X. (2022). Optimization of Three-dimensional Face Recognition Algorithms in Financial Identity Authentication, *International Journal of Computers Communications & Control*, 17(3), 3744, 2022.
https://doi.org/10.15837/ijccc.2022.3.3744