SIFT based Face Recognition System

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Abstract. In the era of rapid development of this technology, we are enjoying the convenience of technology, but also bear the personal information and property risks. Therefore, the information security technology is also constantly improving and development. From the traditional password password gradually turned to the protection of biometric technology. Face recognition is an important feature of biometrics, so face recognition is quickly applied and promoted. In this paper, the face recognition system based on SIFT algorithm is studied, and the algorithm is used as the core to identify the characteristics of face and match. It is found that the algorithm is effective in face recognition system and is worth popularizing.

Face Recognition Background

In the era of rapid development of science and technology and information networks, computers were the greatest inventions of this era. In personal life and scientific research and other fields play an important role. Computer awareness of the level of things with the development of the times has been greatly improved [1]. The study of biometrics has also benefited from the rise of computers. In the field of biometric technology, face recognition has a very good individual uniqueness, while through the face can reflect the personal expression, emotions, health and other rich information. Furthermore, the application of face recognition has a convenient and friendly user experience, so it has been widely used in real life.

Among the many algorithms, the SIFT (Scale Invariant Feature Transform) algorithm is a local feature extraction algorithm, which treats an image in the scale space to find the extreme point. The position, the scale and the invariant feature quantity are extracted, and then the similarity degree matching between the different images is matched. SIFT algorithm has high robustness to image scale, rotation transformation and noise interference, so it is more suitable for real life scenes. Its algorithm has high research value in face recognition field [2].

SIFT Algorithm Overall Introduction

SIFT is called the scale invariant feature conversion, and Lowe's theory in 1999 was perfected in 2004. Its application range includes object identification, robot map perception and navigation, image stitching, 3D model establishment, gesture recognition, image tracking and action comparison. This algorithm has its patent, and the patent owner is the University of British Columbia. It can be seen from the name that the algorithm is based on a scale space under the extreme value of the image processing, these extreme points on the relative position, contrast, rotation and other interference has a good robustness [3]. So you can get high accuracy when the image is matched.

Research Status of SIFT Algorithm. SIFT algorithm originated in 1999, David Lowe proposed a scale-based, for the image enlargement and reduction, rotation invariance and other characteristics of the local feature description sub-algorithm. Until 2004 the algorithm has been improved. Because the SIFT algorithm has good robustness. Many industry researchers have a strong interest in the algorithm. Also in 2004, Y.Ke proposed a SIFT algorithm based on principal component analysis (PCA-SIFT) to improve the real-time matching of the algorithm by reducing the dimension of the descriptor. Since the beginning of the SIFT algorithm is based on black and white images as experimental data , In 2006, Farag proposed a scale-invariant feature transformation algorithm

(CSIFT) that can be used for color image processing, extending the versatility of the SIFT algorithm; then in 2009, Morel M proposed a new SIFT improvement The SIFT algorithm (ASIFT) of the affine transformation further enhances the robustness of the SIFT algorithm, and LI Jing et al. Improved the data storage form, and proposed an improved algorithm B-SIFT which stores the SIFT descriptor information in binary form algorithm.

With the continuous efforts of many researchers, the SIFT algorithm has improved qualitatively in terms of safety and versatility. But also makes the application of SIFT algorithm in face recognition field more extensive and mature. Coupled with SIFT's own algorithmic characteristics, without the need for a large number of pre-sample training can also achieve the desired recognition accuracy, the use of cost greatly reduced. Face recognition is now widely used in all walks of life and not just in the field of information security [4,5].

SIFT algorithm flow. The SIFT algorithm does not focus on the overall image characteristics and focuses on the local features of the image. The feature points that are not changed by the effects of rotation, translation, affine transformation are extracted from the local area. After the feature points are extracted, the SIFT algorithm uses the descriptor to describe the feature points. The essence of the SIFT algorithm is to construct a scale pyramid model of different scales at different scales, and to find possible extreme points in different scale spaces. Edge filtering and low contrast elimination after initial screening. Leaving the key point, to give the direction of the key, thus forming the eigenvector as a description. And finally generate a highly robust, anti-interference ability characteristics of the point. The process of the algorithm is divided into five steps:

(1) To build the scale space: the image to be detected as the master to build different scales of Gaussian scale space, the formation of Gaussian scale pyramid, and then through the Gaussian pyramid to get its differential pyramid, in the differential pyramid through the extreme value detection to obtain the initial key points.

(2) The precise positioning of key points: the candidate key to three-dimensional quadratic function to determine the location of the key points. The key points are further screened by low contrast detection and edge detection.

(3) To determine the direction of the key point: the direction of the key point of the space in which the adjacent point of 26 pixels in the direction of the distribution of the characteristics of the decision, the direction of its contribution to the direction of the key point. The key point gives the direction to ensure that it is not rotated.

(4) Generate key point descriptors: Each key point is given a 128-dimensional data length of the vector descriptor, the descriptor of the normalized processing can increase the characteristics of the point of illumination and viewing angle tolerance.

(5) Matching feature points: After the normalized descriptor, you can match the angle between the eigenvectors. The matching rule is used to match the descriptor of the detected image to the two descriptors closest to the sample image, and if they are less than a certain threshold, they are considered to be matched.

In summary, the SIFT algorithm produces a feature that is unique and unique and easy to integrate with other characteristics of the eigenvector, is a practical image local feature extraction algorithm [6].

SIFT Application in Face Recognition. As a face recognition system, its previous condition is to have a larger contrast database. The main drawback of SIFT operator is that it is computationally complex and has a long matching time. If you want to apply it to the actual production applications, I am afraid the user experience will not get a better evaluation. Therefore, we need to first use the SIFT algorithm to generate the descriptor and store it in the corresponding database, so that each time the matching process does not have to spend most of the time on the generation of the SIFT descriptor. But directly to the feature point matching can be. This greatly reduces the system's operating time. In addition, in the algorithm design, the basic function is the most basic guarantee, as far as possible on the data space and redundancy to optimize, to avoid taking up too much system resources. The running time of the program should not be too different from the expected value of the user. For example, the recognition time for each of the recognition processes is within an

acceptable range of 1 to 4 seconds. The time to generate the database can not be too long, the size of the image with the sample library was a reasonable time relationship. The main process of the face recognition system set up in this paper is based on the database as shown in Fig. 1.
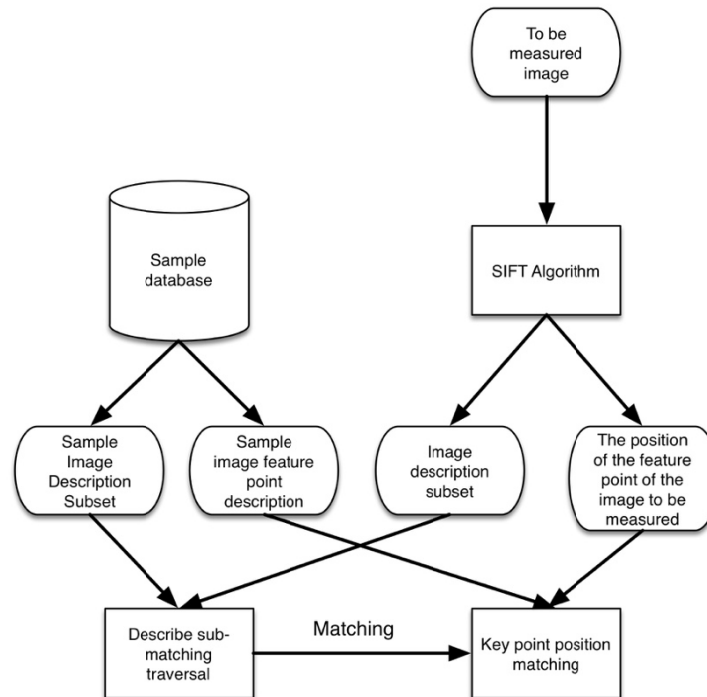

Figure 1. Face recognition system database diagram

System Simulation Test

The face recognition system test software platform for the Windows10 operating system, MATLAB 2014a operating environment and SQL SERVER 2012 database environment. The sample image library selects IMM_face_db face database images and Cambridge University's face database characters, different angles of face images as training sets [7]. After testing proved that the system works well, basically meet the requirements of the face recognition system.

Feature Point Test. Using the SIFT algorithm to locate the feature points, the positioning results are shown in Fig. 2 and Fig. 3. From the results of the positioning, the system basically extracted the important feature points of the face, and for the background layout without significant transformation, SIFT The feature points are not extracted, which indicates that the feature points extracted by the algorithm are of high value. The feature points of the extracted feature points are abundant, and the adjacent feature points can be extracted separately.

Figure 2. Positioning results

Figure 3. Positioning results

Feature Point Matching. Key points After the above steps to generate descriptors, the key points with the rotation invariance, illumination invariance and so on. Since the descriptor has already done a normalized operation. So you can use the angle to match to simplify the matching process. The matching criterion is that the ratio of the descriptor of the image to be detected to the

nearest two descriptors of the sample image is less than a threshold ratio and is considered to be matched. The specific results of the match are shown in Fig. 4.
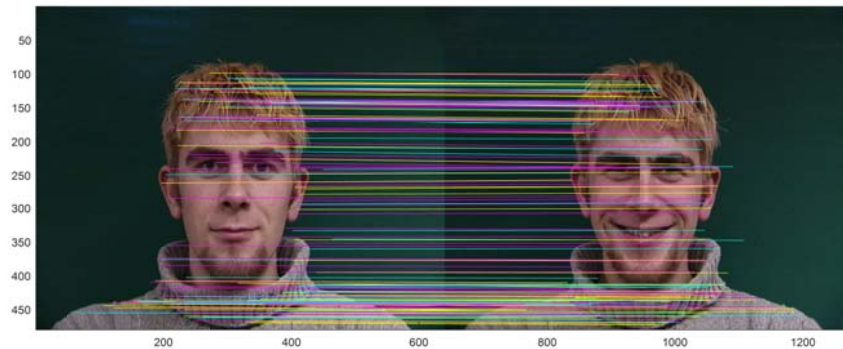

Figure 4.   The specific results of the match

By the matching of the characteristics of the results can be seen, the same person different demeanor, the matching results can still achieve better results [8]. Then, we let different people match, matching the results shown in Fig. 5, the figure shows, different people almost no match with the characteristics of points. Thus, SIFT algorithm for the description of the feature points is rich in detail.

Figure 5.   Matching the results of different people

Test Set Test. In order to better test the performance of SITF in face recognition, we expanded the capacity of the test. The sample image library selected 200 different characters in the face database of Cambridge University, and the face images of different angles were used as training sets. 200 images Each character has 5 different angles of the photo, there are 40 groups of characters. After the system test, a total of three results of the wrong test, 37 results are positive solution. The overall correct recognition rate is 92.5%. It is shown that the SIFT algorithm achieves the ideal results in the recognition effect.

Conclusion

Now we are in the era of rapid development of information technology, means that useful and harmful information is full of our lives [9]. Harmful information is likely to cause personal information to be leaked or even stolen by illegal personnel. So the need for security of information security. Face recognition technology in recent years has been rapid development. The use of its convenience and uniqueness of the advantages of information authentication, public security systems, financial industry, mobile communications and other fields have been widely used. This paper realizes a face recognition system based on SIFT algorithm [10,11]. After this system is implemented, it is systematically tested. Using 200 face Cambridge University face database as a sample database, selected 40 test sets for testing, the overall recognition rate has been a more ideal results.

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