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Face Matching Based on SIFT Algorithm in Campus Scenarios

Wu Wei, Liu Zhongwei, Liu Kao, Li Jinyan, Pan Mingtao, Yang Hang

College of Engineering, Zunyi Normal University, Honghuagang District, Zunyi City, Guizhou Province, China, 563006

Corresponding to: Yang Hang

Abstract: Face matching is an important technology in the field of computer vision and image recognition, face matching technology has been widely used in many fields, face matching will also be affected by the complexity of its lighting conditions, angles and other environments to affect the accuracy of face recognition, and the face recognition methods applied to face recognition can be divided into two types: based on local features and based on global features. Based on the learning of the SIFT algorithm, this paper proposes research on face matching based on SIFT algorithm in the campus environment, and conducts face matching experiments through MATLAB programming Under different lighting conditions, the feature points of the image in the face library are matched with the image to be matched. The results show that under normal lighting, face matching can be well realized, and the success rate of face matching gradually decreases under the condition that the light gradually dims, and even the face matching is unsuccessful. The SIFT algorithm can better identify the feature points extracted by the SIFT algorithm when the same face image is matched with different face images.

Keywords: SIFT Algorithm, Feature Point, Feature Matching, Face Matching, Grayscale Map

1 INTRODUCTION

Technology is an area in which important breakthroughs have been made in the field of artificial intelligence in recent years, and it has a wide range of application prospects in face recognition, biometric recognition, and security verification. With the rapid development of computer vision, pattern recognition, and deep learning, face matching technology has been widely used in many fields, including security monitoring, face unlocking, and face authentication. Face matching technology continues to integrate new algorithms and methods to make face recognition more accurate and reliable in more application scenarios. The research of face matching technology aims to use computer algorithms to compare and match the input face images with the face images in the database. By extracting the feature vector of the face image, and then using the similarity or distance metric to calculate the similarity between two faces, so as to determine whether it is the same person.

The face recognition method applied to the face recognition can be divided into two types: based on local features and based on global features, and face recognition based on local features is to use the position, size and distance of each person's facial features to locate feature points to achieve the purpose of face recognition. The face recognition method based on the overall feature is to treat the face image as a two-dimensional gray distribution, and use different dimensionality reduction and feature extraction methods to obtain the face representation of each person for recognition. From an algorithmic point of view, early face recognition mainly used geometric feature-based methods and template matching methods [1]. Nowadays, there are many algorithms used for face matching, such as Principal Component Analysis (PCA), also known as Eigenface [2], Fisher face [3], Independent Component Analysis (ICA) [4], and Probabilistic PCA (PPCA, Probabilistic PCA [5][6], Elastic graph matching (EGM) [7][8], wavelet transforms, neural networks, support vector machines, Hausdorff distances, and many new models are some of the algorithms commonly used in facial recognition today. In order to reduce the influence of multiple factors such as lighting, expression, noise, and posture, TDJ proposed an improved SDV to calculate the singular features of face images, and constructed a face feature representation method that fuses multi-scale global features and local features, and used a rough intensive simplification algorithm for feature selection and SVM for classification and recognition on the basis of obtaining multi-scale fused face features[9]. The key to face matching lies in the localization of face features, and YLM has also proposed methods for the localization of facial features, such as template matching method and grayscale projection method [10]. The positioning of the key points of the face is accurate, and the face matching will also be accurate. YY proposed a multi-region semi-random sampling method based on local feature analysis in complex environments to improve the speed and accuracy of matching [11]. The speed and accuracy of face matching is key.

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The face matching process includes feature extraction and feature matching, which are very core roles in the entire face matching system. However, due to the complexity and diversity of face images, face matching faces a series of challenges and dilemmas. For example, factors such as lighting changes, expression changes, occlusions, and pose changes can all have an impact on the accuracy and reliability of face matching.

Therefore, in order to improve the accuracy and reliability of face matching, this paper proposes a face matching method that is different from the above algorithm, and the face matching algorithm in this paper is based on the face matching method of the feature points extracted by the SIFT algorithm, which is the feature points extracted by the SIFT algorithm, and then the face matching is realized through the matching between the feature points. The Scale-Invariant Feature Transform (SIFT) algorithm is an image feature description method proposed by Lowe [12] in 2004, and is widely used in image stitching, image matching and other fields. SIFT algorithm is a common feature extraction method. SIFT algorithm, which can robustly extract key points and feature descriptors in face images. These feature descriptors are stable under scale and rotational changes, and have good discrimination ability.

2 Principles of the SIFT Algorithm

For the SIFT algorithm to achieve feature matching, there are three main processes: First, extract key points: key points are some very prominent points that will not disappear due to factors such as lighting, scale, rotation, etc., such as corner points, edge points, bright spots in dark areas and dark points in light areas. This step is to search for image locations on all scale spaces. Gaussian differential functions are used to identify potential points of interest with scale and rotation invariance. Second, locate key points and determine feature orientation: at each candidate location, a finely fitted model is used to determine the position and scale. Key points are selected based on how stable they are. Then, based on the gradient direction of the image part, one or more directions are assigned to each key location. All subsequent operations on the image data transform relative to the direction, scale, and position of the keys, providing invariance to these transformations. Finally, through the feature vectors of each key point, several pairs of feature points matching each other were found to establish the corresponding relationship between the scenes.

3 Experimental Methods

Based on the learning of MATLAB software, the program code that can realize face matching is obtained by programming MATLAB software, and the face matching experiment is carried out through the pictures of the face library. The principle of the face matching code is as follows: firstly, the face image is processed with a grayscale image, and then the feature points of the grayscale image are extracted by the SIFT algorithm, and then the matching image and the face image are matched by the Euclidean distance.

3.1 *Grayscale Image Processing on Face Images*

For The Input Image, It Should Be Processed With Grayscale Image First, And The Reliability Of Subsequent Face Feature Extraction Can Be Enhanced Through The Image Grayscale Processing Operation, Which Is More Conducive To Face Matching.

(a) original (b)grayscale

Fig. 1 Grayscale Image Processing

3.2 *Feature Points*

Feature point refers to the point where the gray value of the image is drastically transformed or the point with large curvature on the edge of the image, the feature point can reflect the essential characteristics of the image, and can identify the target object in the image, and the extraction of feature points plays a very key role in face matching

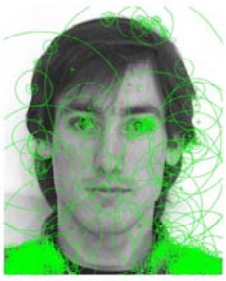

Fig.2 Feature Points Extracted By SIFT Algorithm

3.3 *Feature Point Matching*

Eigenmatching is the calculation of the distance between eigenvectors, and the commonly used distances include Euclidean distance, Hamming distance, cosine distance, etc. SIFT feature points are matched using Euclidean distance, first extracting one feature point in the first image, then extracting

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the feature point of another image, and recording the two closest Euclidean points. Second, compare the Euclidean distance of the last step and compare the Euclidean distance of the last step. If the value of the minimum distance of the second minimum distance is less than the threshold, the two points are successfully matched, and vice versa. In practical applications, the quality of feature point matching directly affects whether the face can be successfully matched.

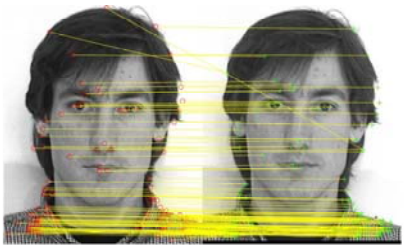

FIG. 3 MATCHING OF FEATURE POINTS.

4 EXPERIMENT

4.1 EXPERIMENTAL DESIGN

Two different sets of experiments were designed, the first group matched faces under different lighting conditions, and the second group used the feature points of the face images to be matched in the face database.

4.2 MATCHING OF FACES UNDER DIFFERENT LIGHTING CONDITIONS

FIG.4 IMAGES OF FACES UNDER DIFFERENT LIGHTING CONDITIONS.

FIG. 5 THE FEATURE POINT MATCHING RESULTS BETWEEN THE MATCHING IMAGE AND THE IMAGE TO BE MEASURED.

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FIG. 6 IMAGE MATCHING RESULT

4.3 USE THE MATCHING IMAGE TO MATCH THE FEATURE POINTS OF THE IMAGE TO BE MATCHED IN THE FACE LIBRARY

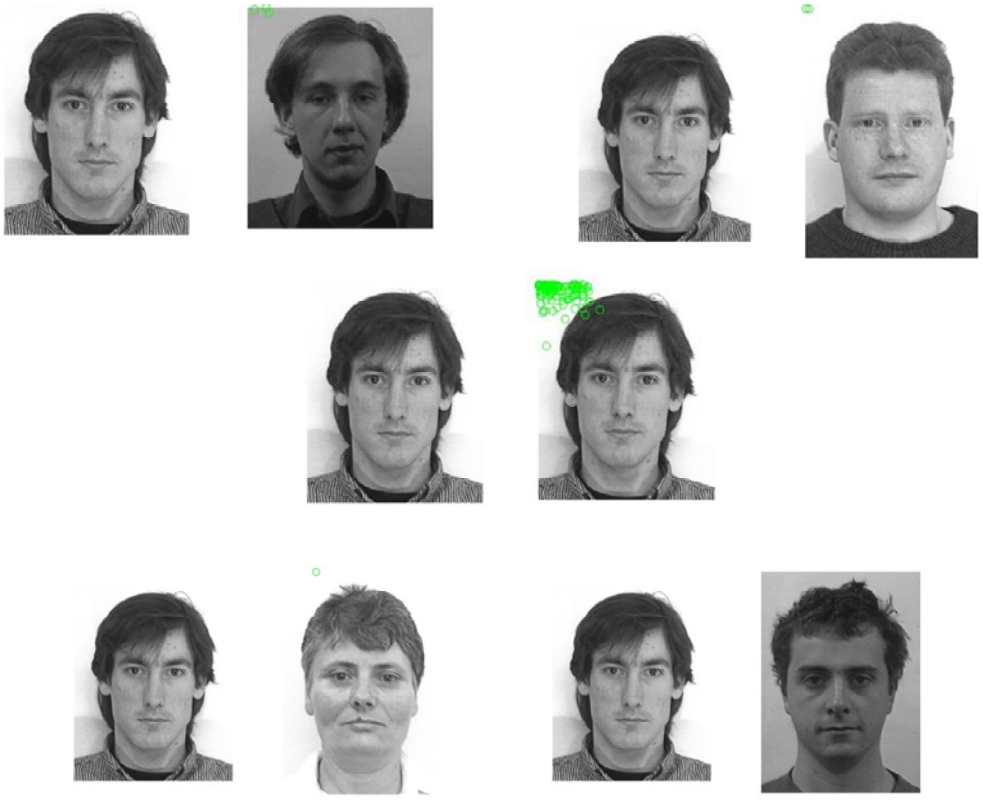

FIG. 7 MATCHING RESULT BETWEEN THE MATCHING IMAGE AND THE MATCHING IMAGE IN THE FACE DATABASE

CONCLUSION

The face matching based on the SIFT algorithm proposed in this paper is different from the face matching proposed in the introduction, this paper constructs a model based on the SIT algorithm through the understanding of the SIT algorithm and programming through MATLAB software. Experiments are carried out with face images from the face database to verify the feasibility of face matching based on SIFT algorithm proposed in this paper.

In the face matching of different lighting conditions, the influence of lighting is also obvious, there are many points

matched by features in the case of bright lighting, and as the lighting gradually dims, the points matched by features will gradually decrease.

When the image to be matched and the image in the face database are not a person, there are few or no feature points matched, and when the image to be matched and the face image in the face library are the same person, the more feature points are matched, indicating that when the same face image is matched with different face images, The SIFT algorithm can be better identified.

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