A Partial Feature Adaptive SIFT Model for Morphed Image Recognition

Priyanka
Research Scholar
Department of Computer Science and Engineering
Ganga institute Of Technology & Management, Kablana

Dr. Yashpal Singh
Associate Professor
Department of Computer Science and Engineering
Ganga institute Of Technology & Management, Kablana

Abstract

Facial Recognition is having various challenges associated in it. One of critical challenge is the morphed image recognition. Morphed images can be the composed picture form generated from two or more persons. In this paper, a partial feature analysis approach is defined to recognize all persons composed in morphed image. In this work, the separation of facial physical features of person is done. Now each physical feature is represented under SIFT model to represent featured image. Finally, distance adaptive mapping is performed to recognize the image. The experimentation is here applied on real time morphed images. The adaptive results show that the high accuracy for individuals is obtained from the work.

Keywords: Biometrics, SIFT (Scale Invariant Feature Transform), SURF (speeded–up Robust Features), Face recognition, recognition Rate, improved SIFT

I. INTRODUCTION

A. Face Recognition

Face Recognition has been carried out intensively in the past and still there is a way for improvement for the researchers in this domain. Most probably the face expression recognition can be done using two approaches, especially, global feature based algorithm and local feature based algorithm. In the first method, the image is pre-processed and segmented to obtain the global features to recognize the face image, while the second one requires the extraction of the local features to recognize the face image due to variations in pose, illumination, rotation, scaling and translation. Face Recognition is having the importance to provide biometric authentication with easy image acquisition that can be used for online and offline applications. So that, an improved SIFT (Scale Invariant Feature Transform) is required to improve the recognition rate on morphed images. SIFT is the approach that uses the location descriptor as the key feature points to perform the recognition over the images.

B. Face Recognition System

Facial recognition system store video or photographs and try to find recognizable facial characteristics and match them against known facial templates to identify individuals. Most current facial recognition system processes the 2D camera image, although recent products have emerged that try to map the face in 3D using multiple camera angles.

Face recognition has the greatest advantage of not requiring any sort of contact, so there are no hygienic concerns. The biometric samples here are typically taken as 2D images of the frontal section of the face, using one or more digital cameras. Typical technical approaches to achieve this recognition include geometrical, eigenfaces, template and graph matching, neural networks and Hidden Markov Models, or a combination of these.

C. Why Use the Face for Recognition

Biometric-based techniques have emerged as the most promising option for recognizing individuals in recent years since, instead of authenticating people and granting them access to physical and virtual domains based on passwords, PINs, smart cards, plastic cards, tokens, keys and so forth, these methods examine an individual's physiological and/or behavioral characteristics in order to determine and/or ascertain his identity. Passwords and PINs are hard to remember and can be stolen or guessed; cards, tokens, keys and the like can be misplaced, forgotten or duplicated; magnetic cards can become corrupted and unreadable. However, an individual's biological traits cannot be misplaced, forgotten, stolen or forged.

D. Model Used

In the presented work, a four stage model has been used to perform the effective recognition.

1) *Stage 1: Filtration*

This stage is basically used to handle the most common problem of real time images. The problems include the noise problem, un-equal brightness problem etc. The work performs the filtration against different kind of noise as well as verification by using the statistical method so that the identification of the effective filtration of image can be easily performed.

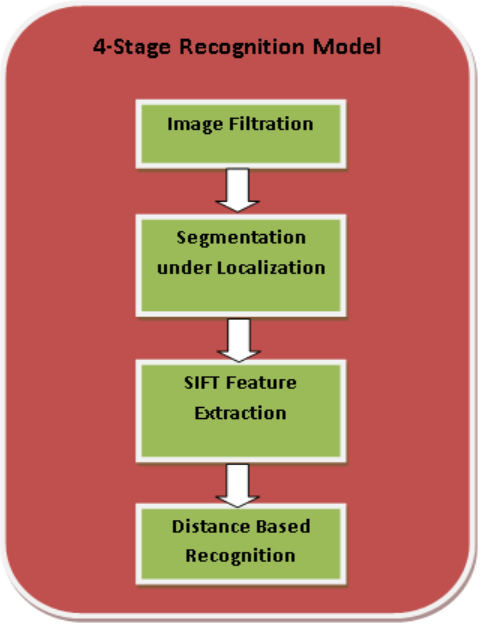

Fig. 1: 4-Stage Model

2) *Stage 2: Segmentation*

The second stage of the work is to identify the physical features from the face image. These features include the eyes, nose, lips etc. The positional analysis approach is implemented to identify these features from the face image.

3) *Stage3: SIFT Feature Extraction*

The SIFT is here been applied to extract the features over the facial images. The location descriptor is been used to extract such features.

4) *Stage 4: Distance based Recognition*

In this stage, the recognition process is performed on individual feature by using distance based analysis. This recognition process is applied on individual region and then combined to generate the total recognition rate.

E. Various Challenges in Face Recognition

1) Deformations- These are the result of injury or accident on the face.
2) Expressions- This shows the mood of the person. From expressions it is easy to determine whether the person is happy or sad.
3) Aging- With age wrinkles appears on the face. The wrinkles change the formation of the face to a great extent.
4) Facial hairs- Man have moustaches and beard which change the look of the face when shaven.
5) Cosmetics- Cosmetic surgery has become one of the widely used techniques to enhance your facial features.

II. RELATED WORK

Weicheng Shen and Tieniu Tan [1] have proposed a typical automated biometrics-based identification/verification system that consists of the following major components:

1) Data acquisition component that acquires the biometric data in digital format by using a sensor.
2) Feature extraction component that uses an algorithm to produce a feature vector in which the components are numerical characterizations of the underlying biometrics. The feature vectors are designed to characterize the biometrics so that biometric data collected from one individual, at different times, are ‘‘similar,’’ while those collected from different individuals are ‘‘dissimilar.’’ In general, the larger the size of a feature vector (without much redundancy), the higher its discrimination power which id defined as the difference between a pair of feature vectors representing two different individuals.
3) Matcher component that compares feature vectors obtained from the feature extraction algorithm to produce a similarity score. This score indicates the degree of similarity between a pair of biometrics data under consideration.
4) Decision-maker component is the last component of the system that finally provides/rejects access to the user based on some pre-determined criterion.

Caixia Yang, Jiande Sun[2] a gray difference-based pre-processing scheme is proposed, which utilizes the gray difference between the face, pupils and reflecting points on the cornea to detect the eyes. When the proposed scheme is tested under a cross-ratio invariant- base gaze tracking system with subjects wearing glasses and accessories, the adaptability and practicality of the test system is improved greatly. The experimental results show that the system can achieve average accuracies of about 0.5

degree in a view field of 14×20×10(cm), which is almost the same as most of commercial gaze tracking systems. That demonstrates the proposed pre-processing scheme is so effective and helpful that it is promising to be adopted into gaze tracking system.

In Year 2011, Junying Gan performed a work," An Over-complete Sparse Representation Approach for Face Recognition under Partial Occlusion". Author introduces B-JSM theory. Then Author analyze the reason and B-JSM is improved: the feature is extracted after "getting rid of" the region containing the maximal information. A series of experiments with the Extended Yale B database show that Presented improved approach is effective to solve the problem of partial occlusion and robust to the low-dimensional image or only a few images of an individual.

In Year 2012, Xingjie Wei performed a work," Robust Face Recognition under Varying Illumination and Occlusion Considering Structured Sparsity". In this paper, Author proposes an approach considering structured sparsity to deal with the illumination changes and occlusion at the same time. Presented approach represents a face image taking into account that the face images usually lie in the structured union of subspaces in a high dimensional feature space. Considering the spatial continuity of the occlusion, Author proposes a cluster occlusion dictionary for occlusion modeling.

In Year 2013, Xiao-Xin Li performed a work," Structured Sparse Error Coding for Face Recognition with Occlusion". Author proposes a morphological graph model to describe the morphological structure of the error. Due to the uncertainty of the occlusion, the distribution of the error incurred by occlusion is also uncertain. However, Author observe that the unoccluded part and the occluded part of the error measured by the correntropy induced metric follow the exponential distribution, respectively. Incorporating the two aspects of the error structure, Author propose the structured sparse error coding for face recognition with occlusion.

In Year 2014, S.Jenifer performed a work, "Face Identification from Manipulated Images using enhanced SIFT and SURF". In this paper, the extraction of the recognition of morphed images is been done using SIFT based feature analysis approach. The SIFT is here applied on whole image as the location descriptor. This feature dataset will be used for the recognition.

III. RESEARCH METHODOLOGY

A. Problem Definition

The face is an important biometric quality for the identification of a person. With the time, the face recognition is also integrated with number of associated challenges. These challenges include the incompleteness of images, noise, distortion etc. One of such common problem identified in these days is morphed images. A morphed image is the edited image using some image processing software or tool. These morphing can be done in terms of inclusion of some effect, merging two images, changing the hair cut etc. Because of this, the detection of person in these morphed images is a challenge. so that, an improved SIFT (Scale Invariant Feature Transform) is presented to improve the recognition rate on morphed images. In this work, the complete image is divided in several sub images based on the locational features. These features include eyes, nose, mouth etc. Once the locational segmentation is performed, the next work is to apply the SIFT on each location segment to extract the key features over it. At the final stage, the distance level analysis over the images is performed to recognition. The work is implemented in matlab environment. The work is about to improve the recognition rate.

B. Flow Chart

The block diagram of face identification from morphed images using improved SIFT is shown in Fig. 2

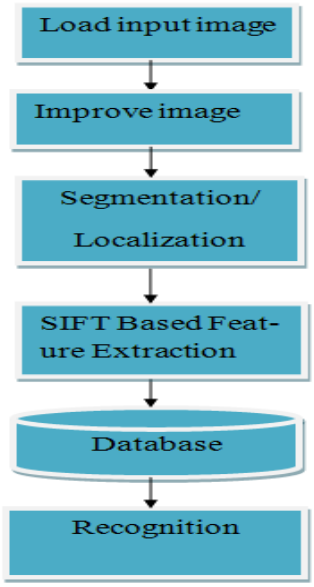

Fig. 2: Face Identification from morphed images Using improved SIFT

Various blocks of this diagram are:-

1) *Load an Input Image:-*

It means read an input image for which we want to perform recognition. Here, large numbers of images are available in database read one of them. After reading an image it will be converted to grey-scale. Because mostly operations are possible on 8-bit images.

2) *Improve the loaded image:-*

Improvement basically handles the most common problems of real time images. The problems include the noise problem, un-equal brightness problem, illumination etc. This block will perform the filtration against different kind of noise as well as adjust the size, illumination and brightness. By using this block effective identification of the improved image will be performed.

3) *3) Segmentation/Localization:-*

Here the complete image is divided into several sub-images. This stage of the work is performed to identify the physical features from the face image. These features include the eyes, nose, lips etc. The positional analysis approach is implemented to identify these features from the face image.

4) *SIFT Based Feature Extraction:-*

After segmentation, features of each location is extracted by using SIFT approach. Here blocks wise division of face image is done. The SIFT is applied here to extract the features over the facial images. The SIFT approach applies to whole image at once. But here, SIFT is applied to each sub-images separately.

5) *Database:-*

The database consists of set of images from which an input image is selected. Before loading the input image for recognition we must load the complete dataset, then improve it, localization of database and feature extraction of database is done.

6) *Recognition:-*

In this stage, the recognition process is performed on individual feature by using distance based analysis. This recognition process is applied on individual region and then combined to generate the total recognition rate. In improved SIFT approach, recognition of individual region is performed independent of another region.

IV. EXPERIMENT

A. Define Database

The dataset consists of 72 images of 24 subjects (14 men & 10 women) with different facial expressions and illumination conditions. For each subject 3 instances are available. Images in database are of JPEG (.jpg) type and in colored form. But the query images are converted into grey scale by improving it. Few of the samples are shown in Fig. 3. Images in database are of resolution, 480x640.

Fig. 3: Database Images

B. Results

Figure 4 shows the results of retrieving all the morphed images using improved SIFT technique. The recognition rate is shown in Table 1.

Figure 5 shows the recognition rate Chart.

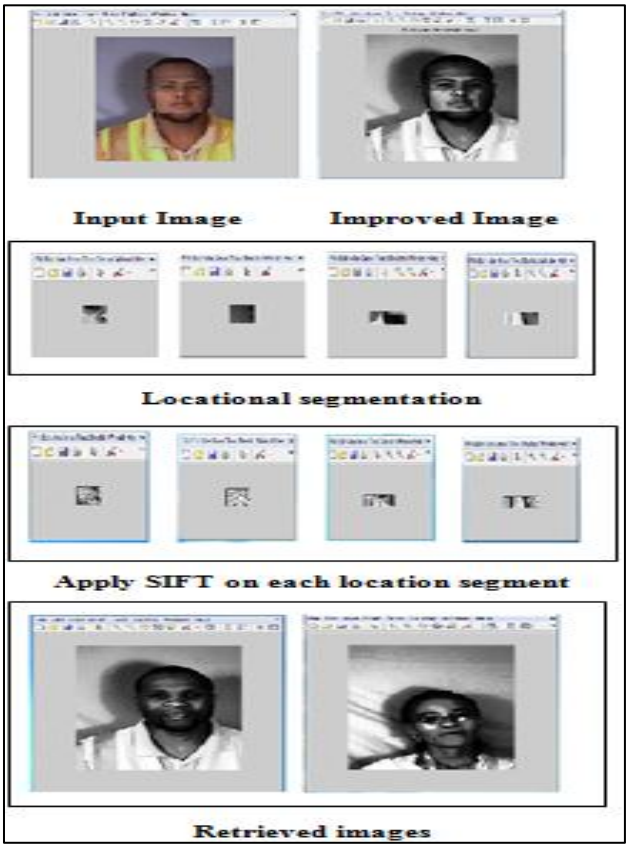

Fig. 4: Face Identification using improved SIFT approach

Table 1: Recognition Rate

Properties	*Values*
Number of Test Images	*10*
Number of Persons	*7*
Number of Instances	*2 for 3 persons & 1 for 4 persons*
Type	*Color*
Variation	*Contrast*
Number of Images Combined	*2-3*
Morphing	*Eyes, Lips, Shape, Nose*
Recognized Correctly I	*9*
Recognized Correctly II	*10*
Recognized Correctly III	*8*
Recognized Correctly IV	*9*
Recognition Rate % I	*90%*
Recognition Rate % II	*100%*
Recognition Rate % III	*80%*
Recognition Rate % IV	*90%*
Average Recognition	*90%*

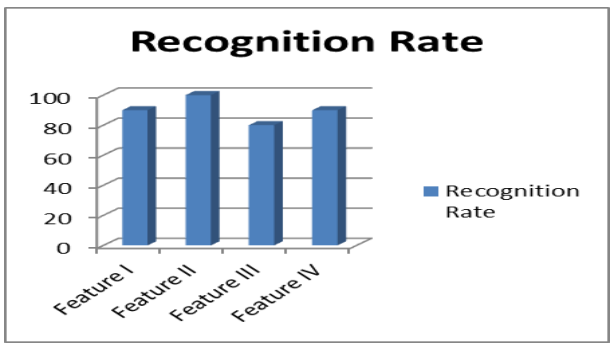

Fig. 5: Recognition Rate Chart

V. CONCLUSION

In this paper, a partial physical feature based SIFT model is presented for identification of individuals from morphed images. At first, the location adaptive segmentation is applied to separate the physical features. Finally, the distance adaptive recognition is applied on individual physical feature. The results show that the accurate individual identification from morphed images is obtained.

REFERENCES

[1] Weicheng Shen and Tieniu Tan, "Automated Biometrics-based personal Identification", Arnold and Mabel Beckman Center of the National Academics of Sciences and Engineering in Irvine,CA, August 1998.
[2] Caixia Yang, Jiande Sun, Ju Liu, "A Gray Difference-Based Pre-Processing for Gaze Tracking", 978-1-4244-5900-1/10©2010 IEEE .
[3] Junying Gan," An Over-complete Sparse Representation Approach for Face Recognition under Partial Occlusion", Proceedings of 2011 International Conference on System Science and Engineering, Macau, China - June 2011, 978-1-61284-471-8/11 ©2011 IEEE.
[4] Xingjie Wei," Robust Face Recognition under Varying Illumination and Occlusion Considering Structured Sparsity", 978-1-4673-2181-5/12 ©2012 IEEE .
[5] Rui Min," INPAINTING OF SPARSE OCCLUSION IN FACE RECOGNITION", 978-1-4673-2533-2/12©2012 IEEE .
[6] Xiao-Xin Li," Structured Sparse Error Coding for Face Recognition with Occlusion", IEEE TRANSACTIONS ON IMAGE PROCESSING 1057-7149 © 2013 IEEE .
[7] S.Jenifer, S.Andrews, "Face Identifica-tion from Manipulated Images using enhanced SIFT and SURF", INTER-NATIONAL CONFERENCE ON ELECT-RONICS, COMMUNICATION AND COMPUTATIONAL ENGINEERING, pp 1201-1204, 2014.