GroupWise Registration for Human Face Recognition

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***Abstract*- Now day's actions are being handled electronically, instead of face to face, pencil and paper. A face recognition technology in which a person is automatically identify through a digital image. It is basically used in security systems. The face recognition directly captures information about the shapes of faces. The advantage of facial recognition is it recognizes each individual's skin tone of a human face's surface, such as the curves of the eye hole, chin and nose etc.**

There are many techniques used for face recognition in this paper we are going to discusses new technique known as "Markov Random Field GroupWise Registration Framework" in which the similarity between various facial images are calculated based on deformable transformations. The proposed system requires publically available databases such as: FERET, CAS-PEAL-R1, FRGC, and the LFW. Experimental results demonstrate that the proposed system achieves the better recognition rates as compare to among all the methods.

***Index Terms*- Markov random field, Group means, Anatomical Signature, GroupWise Registration.**

1. INTRODUCTION

As the requirement for higher levels of security rises day by day, the technology is bound to swell to fulfill these requirements. Any new development, technology, or concept should not be complicated for end users. So there is strong demand for user-friendly techniques which can protect our privacy and secure our assets without losing our original identity is called biometrics. Biometrics is the area of bioengineering. It is a method of recognizing human face based on a behavioral or physiological characteristic. There are various existing biometric systems such as finger prints, signature, voice, retina, iris, hand geometry, ear geometry, and face. Among all these techniques, facial recognition is one of the most universal, accessible techniques. Biometric face recognition technique, or Automatic Face Recognition (AFR) [1], is a particularly great biometric approach. It basically focuses on same identifier that humans use to distinguish one person from another person: their "faces". Its main goal is to understand the complex human visual system and basic knowledge about how humans represent faces to discriminate different identities with highest accuracy.

The face recognition technique can be divided in basically two main stages: 1) face verification (or authentication), 2) face identification (or recognition). A detection stage is the very first stage which includes identifying and locating the face in an image. Then recognition stage is the second stage which includes feature extraction, where basic information for discrimination is saved, and also the matching, where recognition result is given with the help of face database. There are some different classifications of existing techniques such as follows.

Holistic Methods: In this technique the whole face image is used as raw input to recognition system. An example is well-known PCA-based systems introduced by Sirovich and Kirby, and followed by Turk and Pentland. [2], [3], [4].

Local Feature-based Methods: In this technique local features are extracted, such as nose, eyes and mouth. Their local statistics (appearance) and locations are the basic input to the recognition stage. Elastic Bunch Graph Matching (EBGM) is an example of this technique. [5], [6], [7].

Progress in the face recognition technique has been encouraging. In this paper we are going to discuss about new method, i.e. GroupWise registration. The main principle of proposed technique is to first construct the group mean facial image, and similarity among facial images is compared by warping the facial images to common group mean space. The basic main contributions of proposed method are, first instead of using pixel intensity alone, the

anatomical features are extracted of the facial images from its most salient scale local regions. Second, based on anatomical signature calculated, a feature guided Markov random field (MRF) groupwise registration technique is proposed to construct group mean facial image space. And finally, the proposed technique is an unsupervised learning technique.

2. GROUPWISE IMAGE REGISTRACTION

The main role of image registration is to transform images which are taken from different sensors, times, viewpoints, or different coordinate systems in a common coordinate system, So that comparisons can be done across various images in common image space.

Suppose that n are given input images I_1…I_n, then for conventional pairwise registration strategy first selects an image from I_1…I_n, and named it as fixed image I_fix , Now this I_fix will serve as template. Then, transform each image I_i(i=1 to n) and named it as moving image I_mov to the space of fixed image I_mov . The pairwise image registration process viewed as shown in following Fig. 1.

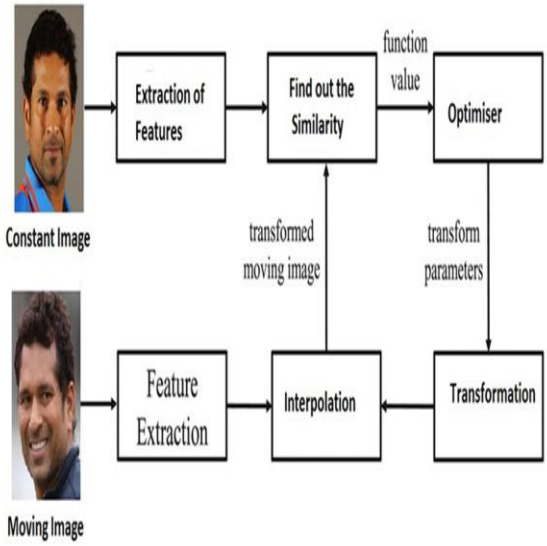

Fig -1 Pairwise Registration Process.

Firstly, image features are extracted from input image, as we know most simple features is the original facial images alone. After that optimal transformation Ø_opt is calculated based on the deformable transformation.

Ø_opt is estimated by optimizing value of similarity measures function E, it reflects registration quality at current iteration. An optimization scheme (i.e., optimizer) is needed to optimize E. Interpolation of moving image is also required in case that some pixels of transformed moving image don't fall exactly on image grid of fixed image. So registration process can be expressed as follows.

Ø_opt=arg 〖min〗 _Ø ∑▒ 〖(ψ〗 ⊗I_fix, Φ(ψ⊗Φ(I_mov))), (1)

Where ψ denotes feature extraction kernel. ⊗ denotes the convolution operation.

Selecting any images as the fixed image will lead to problem in registering all other images to it. The main reason behind that geodesic distance between fixed image and moving images may be very large and difficult to register. So, groupwise registration strategies have become widely used [8], [9], [10].

Groupwise registration framework does not explicitly select the image as template. But, it simultaneously estimates template Iˆ (i.e., the group mean) and the transformation Ø_i to wrap each image. General groupwise registration technique is illustrated in Fig. 2.

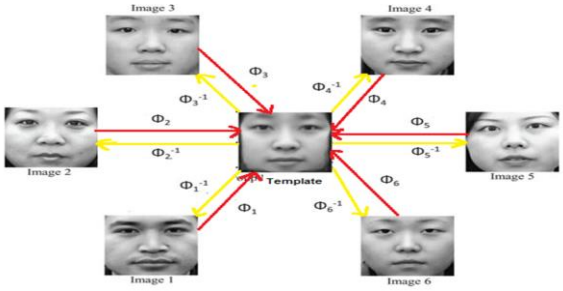

Fig -1 The Schematic Illustration of Groupwise Registration.

In above figure group mean is calculated which has smallest geodesic distances among all six input images. Each image I_i can be transformed to template space with the transformation Φ_i (red arrows). Template can also be warped to each of the individual image's space by Ackward transformation 〖Φ_i〗 ^(-1) (yellow arrows).

3. MATHEMATICAL MODEL I

We have formulated face recognition problem as the deformable image registration and feature matching problem. Most straightforward solution is register each query image with each training image in pairwise manner, and classify query image to person which has resulting smallest energy function value as in Equation (1). There are two major problems in this way 1) Query image is to be transform each of the individual training image's space for the comparison, comparing energy function value obtained in the different image space is problematic. 2) This method

is sensitive to the outliers. To overcome these limitations we propose novel groupwise registration for face recognition, Basic principle of proposed method is summarized in following algorithm.

Algorithm 1 -The Group wise image registration

(Step I)

Input: - Test image I_new n training images (I_1 to n).

(Step II)

Output: - A class label I_new assign I_(new.)

(Step III)

Construct group mean by performing the group wise registration among training images I_1 to I_n. Label this group mean as Ī and deformable transformation from I_i(i=1 to n) to Ī as Ø_i .

(Step IV)

Now register the I_new to Ī, label this query image as Ø_new (I_new). Where Ø_new is the optional transformation to wrap I_new to Ī.

(Step V)

Calculate the similarity between each Ø_i (I_i). and Ø_new (I_new), now set (I_new). as class label of the training images (transformed) which is similar to Ø_new (I_new).

(Step VI)

At the ends return ⟦ I⟧ _new.

4. MATHEMATICAL MODEL II

With Algorithm II, we can construct template image based on input training images. We propose a hierarchical groupwise registration strategy which have basic principle is that, all facial images with similar appearance are clustered together into group. If group contains more facial images having large variations across each other, it may be further clustered in different smaller groups. Hence, pyramid of groups is formed, and the template image can be formed in the hierarchical bottom-up manner.

Algorithm 2- Estimate the group mean and transformation of each of the image.

(Step I)

Input: - n images I_i (i=1 to n).

(Step II)

Output: - Group mean image Iˆ, and the transformation Ø_i to wrap each image I_i to Iˆ.

(Step III)

Firstly set Iˆ=1/n ∑_(i=1)^n I_i .

for i=1 to n do

Perform the α expansion algorithm to estimate deformable transformation Ø_i to warp I_i to Iˆ. with the MRF labeling framework.

end for

(Step IV)

Update the Iˆ=1/n ∑_(i=1)^n ⟦Ø_i ⟦(I⟧ _i)⟧ .

(Step V)

Now Repeat same operation 2 to 5 until Iˆ converges.

(Step VI)

At the end Return Iˆand Ø_i.

5. SVM CLASSIFIER

SVM stands for the Support vector machine. They are learning models with associated learning algorithms that analyze data and recognize patterns, used for classification and regression analysis. SVMs provide the generic mechanism to robust surface of hyper plane to the data through. Another advantage of SVMs is low expected probability of the generalization errors. Moreover, once data is classified in two classes, an appropriate optimizing algorithm may be used if needed for feature identification, depending on application. Support Vector Machine creates hyper-plane between two sets of the data for classification. In proposed work, we separate data in two classes: as follows a) Face belongs to the train database and b) Face does not belong to the train database.

6. CONCLUSION

There are already many face recognition methods but there is not single method which gives best result, i.e. there are some limitations of every method which are proposed. In this work new method that is Markov Random Group Wise Registration Framework is used. With the help of this method it achieves better result for face recognition. Yet it fails to give the best results for identifying images because human faces is not a dead object, Expression will be change as per the persons mood. So it's become more complicated to identify particular face. But proposed work will achieve the highest recognition rate and verification rates as compared to previous methods.

7. REFERENCES

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