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GroupWise Image Registration Technique for Face Recognition

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ABSTRACT

The biometric is study of human features and behaviour. The face recognition is technique of biometric. There are many approaches are used for it. A survey for some of these approaches is discussed in this paper. Face recognition is one of the emerging branches of biometrics for the security. In this paper we introduce new way for face recognition known as GroupWise Image Registration in which we will use publically available databases like FERET.

Keywords : Markov Random Field Group wise Image Registration, Template, and Anatomical Signature.

I. INTRODUCTION

Humans use faces to identify individuals in computing capability over past few decades. At first face recognition algorithms used the simple geometric models, but now recognition process has matured into science mathematical representations and also matching processes. Mostly advancements and initiatives in past ten to fifteen years have propelled face recognition technology into spotlight. Face recognition technology can be used for both identification and verification (open-set and closed-set). In face recognition technique it identifies faces present in videos and images automatically. It is divided into two types: 1. Face verification (authentication) 2. Face identification (recognition).

In the face verification or authentication process there is a one-to-one matching which compares a query face image against the template face image in which whose identity is being claimed. In the face identification or recognition process there is a one-to-many matching that compare a query face image against all template face images in database to determine identity of query face image. There is another face recognition scenario involves watch-list check, where query face is matched to the list of suspects (one-to-few matches). Performance of face recognition methods has improved significantly since first automatic face recognition system was developed by Kanade (T.Kanade, 1973).

Now there are various techniques uses for face recognition, facial recognition is one of most universal and accessible techniques or Automatic Face Recognition [1] (AFR) is a particularly better biometric approach. It focuses on identifier that humans usually use for distinguish one person from another. Its main objective is to understand the complex human visual system and basic knowledge about how humans represent their faces to discriminate the different identities with better accuracy.

As we know detection stage is the first stage in which identifying and locating the face from an image and recognition stage is second stage in which feature extraction, where basic information for discrimination is saved, and the recognition result is given by the face database. There are different types of existing techniques 1) The holistic method and 2) The local feature matching method. In the holistic method entire face image is used as raw input for recognition system. For ex.: well-known PCA-based systems which is introduced by Kirby and Sirovich, and also followed by Turk and Pentland. [5], [7], [10]. In the local feature matching method the local features are extracted, like nose, eyes and mouth etc. their local appearance (statistics), locations are the basic input to the

recognition stage. Elastic Bunch Graph Matching (EBGM) is an example for this technique. [2], [6], [3].

II. IMAGE REGISTRACTION PROCESS

The major role of group wise image registration process is to transform images which are taken from the sensors, viewpoints, times, or different co-ordinate system in the common coordinate system, so comparisons can be done across the various images in common image space.

Suppose n are given input images $I_1 \ldots I_n$, then for the conventional pairwise registration strategy first selects an image from set $I_1 \ldots I_n$, then call it as fixed image I_{fix} , Now the I_{fix} will serve as group mean which is also called as template image. Now, simply transform each image $I_i (i = 1\ to\ n)$ call it as moving image I_{mov} to space of fixed image I_{mov}. Figure below shows pairwise image registration technique.

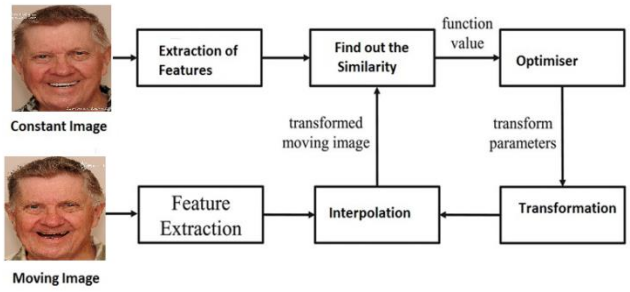

Figure 1. Pairwise Registration Technique.

First, an image features are extracted from the input image, and then optimal transformation i.e. $\emptyset_{opt}$ is measured based on deformable transformation. The $\emptyset_{opt}$ can be estimated by optimizing value of similarity measures function E, and then it reflects registration quality at the current iteration. Optimization scheme is required to the optimize E. Interpolation of the moving image is also required in case that some pixels of the transformed moving image don't fall exactly on image grid of fixed image. So registration process can be expressed as follow.

$$\emptyset_{opt} = \arg\, min_{\emptyset}\ \sum(\psi \otimes I_{fix}, \Phi(\psi \otimes \Phi(I_{mov}))) \qquad (I)$$

Here ψ denote the feature extraction kernel and $\otimes$ denote the convolution operation. By selecting any of images as fixed image will lead to problem in registering all of other images to it. The simple reason behind that the geodesic distance between the fixed image and the moving images can be large and it is very difficult to register. So, the group wise image registration strategies have become widely used [4], [9], [8].

Group wise image registration framework never explicitly selects an image as template. But, instead of it simultaneously estimates template $\hat{I}$. (The group mean) and the transformation $\emptyset_i$ to wrap each image. The general group wise image registration technique is illustrated in below Fig. 2.

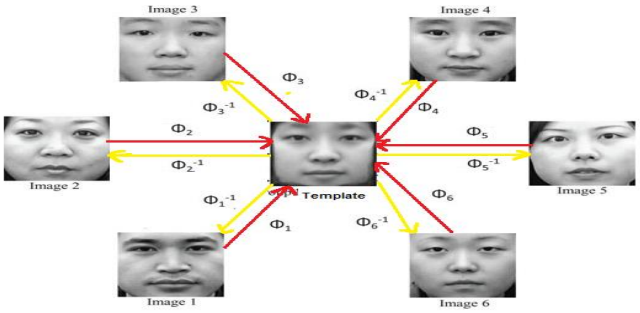

Figure 2. The Schematic Illustration of Group wise Registration.

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

III. MATHEMATICAL MODEL

A. Model I

We have proposed novel group wise image registration for face recognition, Basic principle of the proposed method is summarized in the following algorithm.

1. Input:-Test the image I_{new} n training images(I_1 to n).

2. Output: - Class label I_{new} assign $I_{new.}$

3. Build the group mean by performing groupwise registration among training images I_1 to I_n. Label this template as $\bar{I}$ and deformable transformation from I_i(i=1 to n) to $\bar{I}$ as $\emptyset_i$.

4. Now register I_{new} to $\bar{I}$, name this query image as $\emptyset_{new}$ (I_{new}). Where $\emptyset_{new}$ is the optional transformation to wrap I_{new} to $\bar{I}$.

5. Now calculate similarity between each of $\emptyset_i$ (I_i). and $\emptyset_{new}$ (I_{new}), now set (I_{new}). as class label of training images (transformed) which is similar to $\emptyset_{new}$ (I_{new}).

6. At last return I_{new}.

B. Model II

Here we build template image based on input training images. We have proposed the hierarchical group wise image registration strategy which have basic principle that, all the facial images with similar appearance are clustered together in the group. If group contains much more facial images and have large variations across each other, then it may be further classified in different smaller groups. So, the pyramid of groups is formed, and the template image can be formed in the hierarchical bottom-up manner.

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

2. Output: - Group mean image $\hat{I}$, and transformation $\emptyset_i$ to wrap each image I_i to $\hat{I}$.

3. First set $\hat{I} = \frac{1}{n}\sum_{i=1}^{n} I_i$.
$for\ i = 1\ to\ n\ do$
Perform the α expansion algorithm to estimate deformable transformation $\emptyset_i$ to warp I_i to $\hat{I}$. With MRF labeling framework.
$end\ for$

4. Update $\hat{I} = \frac{1}{n}\sum_{i=1}^{n} \emptyset_i(I_i)$.

5. Now repeat same operation 2 to 5 until $\hat{I}$ converges.

6. At last return $\hat{I}$ and $\emptyset_i$.

IV. RESULT ANALYSIS

Following are the figures showing result analysis of proposed system. We have divided task in two pars 1) Pre-processing for finding template image and 2) Image detection or recognition.

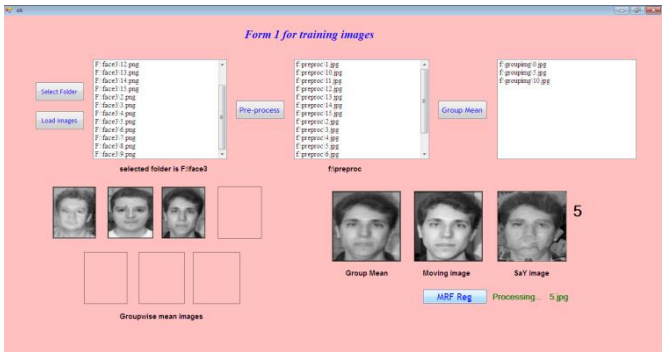

Figure 3. Finding Template Images

Above figure shows the process of finding group mean images from multiple images.

Figure 4. Group Wise Image registration for Face Recognition

V. CONCLUSION

There are various face recognition techniques but there is not a single method, which gives accurate results, because, there is some limitation for every technique. In this proposed system, new technique that is Markov Random Group Wise Image Registration Framework is used which gives better result for face recognition. Still it fails to give accurate results for face detection because human faces are not dead object; expression will be changed as per the person's mood and atmosphere. So it has become very complicated to identify particular face. This proposed system will achieve highest recognition rate as compared to previous methods.

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