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Face Recognition Via GroupWise Registration Method

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***Abstract*—** One of the important research area in image processing is face recognition. We introduce a new framework for tackling face recognition problem. Here propose a new way technique of face recognition problem, which is formulated as group wise deformable image registration and feature matching. The main contributions of the proposed method is to suppresses image noise without reducing the image sharpness we will use Median filtering, Each pixel in a facial image is represented by an anatomical signature obtained from its corresponding most salient scale local region Based on the anatomical signature calculated from each pixel, a novel Markov random field based group wise registration framework is proposed to formulate the face recognition problem.

Keywords- *Face recognition, group wise registration, Markov random field, Local binary pattern .*

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I. INTRODUCTION

A face recognition system is a technique which automatically identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to achieve this is by comparing selected facial features from the image and a facial database. It is mostly used in security systems and it is compared with other biometric recognition systems. Face is the most common biometric used by humans Applications range from static, uncontrolled face identification in a cluttered background.

Face is the most important biometric technique used to identify human faces but there are some challenges of face recognition:
1. Automatically locate the face.
2. Recognize the face from a general view point under different illumination conditions, aging effects and facial expressions.

This concept is used in many applications like systems for factory automation, toll booth monitoring, and security surveillance. The human face plays an important role in our social interaction, conveying people's identity. Facial or face recognition analyses characteristics of a person's face image input through a camera and can be broadly classified into static and dynamic/video matching. Facial recognition systems at a very high level work by recognizing a human face from scene and extract it. The system measures overall facial structure, distances between eyes, nose, mouth, and jaw edges, then compares these nodal points to the nodal points computed from a database of pictures in order to find a match. Facial recognition is used for both identification (1: n) and verification (1:1).

Existing techniques [2, 3, 4, 5, 6, 7] used for single image. However, the existing method requires more time for processing and the performance is degraded consequently. If database contain large number of images then face recognition is more complicated. These types of tackle face recognition is challenging problem.

In this paper we propose a new way technique for handling face recognition problem, which is formulated as a group wise deformable image registration and feature matching using classifier Support Vector Machine.

II. RELATED WORK

The major motivation of automatic face recognition work is done by T. Tian, T. Kanade, and J. Cohn,Ying-li Tian, and Jeffrey F. Cohn[2] . Automatic face recognition (AFR) plays an important role in computer vision. AFR is challenging research topic mainly due to three issues. First, facial expressions of the same person can cause large and deformable motions across different facial images [2]. Second, the image appearances can be significantly altered due to illumination changes. Third, facial images taken under different poses also bring additional difficulty in achieving high recognition rates [3], [4].

Turk and Pentland [7] used the principle component analysis (PCA), which is also known as "eigenface" to project the

facial images to the subspace with minimum least square reconstruction error. They used PCA to compute a set of subspace basis vectors for a database of face images, and projected the images in the database into the compressed subspace.PCA is used for dimensionality reduction and subspace learning.

Jie Zou, Qiang Ji, Zhen Lei and Shengcai Liao presented the local feature matching problem. Local feature matching methods extract image appearance features from different local regions of facial images, and the extracted features are combined and served as the input to a classifier. It is shown that local feature matching methods generally are more robust to local illumination changes and expression variations [6], [7].

Timo Ahonen, Matti Pietikainen proposed a novel and efficient facial image representation based on local binary pattern (LBP) texture features..Gabor and local binary patterns (LBPs) [8] are two representative features. Gabor wavelets capture the local structure corresponding to specific spatial frequency (scale), spatial locality, and selective orientation which are demonstrated to be discriminative and robust to illumination and expression changes. LBP operator which describes the neighboring changes around the central point is a simple yet effective way to represent faces.

Belhumeur et al. [9] proposed the use of linear discriminant analysis (LDA) to project facial images to the subspace which simultaneously maximizes the inter-class distances while minimizing the intra-class variations.LDA is supervised method. Objective of LDA is for dimension reduction based on discrimination purpose.LDA can be used for any kinds of classification problems.

Sander Koelstra, Maja Pantic, and Ioannis (Yiannis) Patras proposed new method to model the facial expression process as diffeomorphic transformations [10] to aim the recognition task. Image registration is also served as a possible solution for pose-invariant face recognition problems.

III. PROBLEM DEFINATION

We have studied some proposed algorithms in related work. But all these algorithms incur the problem of producing a low face recognition rate. So, recognition rate degrades the performance in terms of execution time and space.

IV. PROPOSED SYSTEM

FACE recognition is one of the most important research topics in computer world. The applications of face recognition can be found at Air port, Police station, telecommunication, Banks, law enforcement, biometrics, school, colleges and surveillance. Motivation of this method is to formulate the face recognition problem as deformable image registration and feature matching problem. Proposed method will automatically detect the input image by using Group wise Registration in Markov Random Field. This method will also produce the encouraging results in achieving the recognition rate and verification rate of images.

Image registration process is different from all previous methods. Previous method uses Euclidean distance for classification. So these methods requires more time for execution as compared to this one. To improve the existing system we will use Support Vector Machine i.e. (SVM) for more accuracy and rapid execution for high resolution images. In proposed method we will take images of different poses and calculate the mean of these images. It replaces the pair wise registration which requires a little bit more processing time. Proposed method will improve execution time in less memory with the help of group wise registration. By calculating group mean and each image feature we will calculate discrimination using cross Survival Exponential Entropy.

System Architecture of the proposed system shows the group wise registration using Markov Random Field (MRF). The training image contains images of different poses and variations. The image is extracted from the database. Then group wise registration is apply on images.

System Architecture of proposed system is as follows:

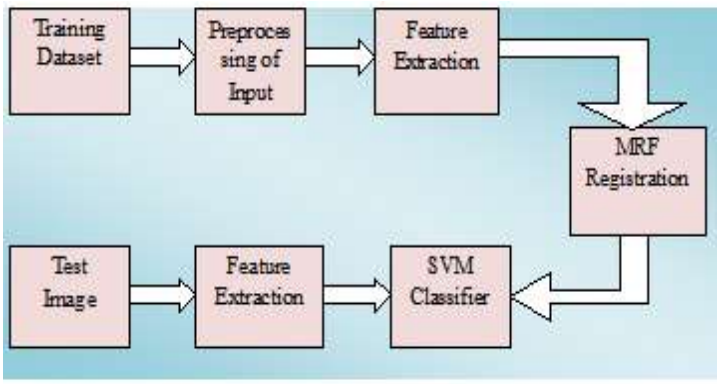

Fig. 1 System architecture

V. METHODOLOGY

Module 1: Preprocessing of Input [1]

A face images are obtain through available Databases from Internet such as FERET and CAS PEAL R1 database. Each image is crop and normalized to the resolution of 128*128.

Histogram equalization is performed to reduce the possible distortions caused by illumination changes. To suppresses image noise without reducing the image sharpness we will use Median filtering, which is a non-linear smoothing method that reduces the blurring of edges and significantly eliminates impulse noise.

Module 2: Group wise Image registration [1]

In pair wise registration the geodesic distance between the fixed image and some of the moving images represented by deformable transformations may be very large and difficult to register. Therefore, group wise registration strategies have become widely used.

Group wise registration does not explicitly select an image as the template. Instead, it simultaneously estimates the template (i.e., the group mean). To construct the group mean space is to first construct the group mean image of each subject, and then perform group wise registration among the subject-specific group mean to obtain the final group mean image.

Module 3: Anatomical Feature Extraction [1]

Anatomical features are extracted from each pixel position at its corresponding most salient scale as the pixel signature. For feature extraction we use LBP local binary pattern algorithm. This step extracts salient anatomical features at each pixel location to reflect the structural property around the pixel in facial images.

The saliency of features is closely related to the scale from which the features are extracted. Important structures in facial images such as noses, mouths, and eyes have different sizes and shapes. Therefore, anatomical features should be extracted with different scales of interest from different facial regions to ensure their saliency. The best possible scales are defined within a range from 4 to 20 pixels.

Module 4: MRF GroupWise Registration Model [1]

To find Group mean facial image space and deformable transformation we will use MRF GroupWise registration model. It is calculated using alpha expansion algorithm using extracted features. The basic principle of GroupWise registration is that, facial images with similar appearance are clustered into a group.

The a-expansion is a popular move-making energy minimization algorithm. The algorithm starts from an initial labeling and makes a series of moves, which involve label change of the random variables, until there is no decrease in the energy. After each iteration of a-expansion, the random variable in the MRF retains either its current label or takes a new label a. One cycle of a-expansion algorithm involves iterating over all the labels.

Module 5: SVM Classifier

Support vector machines (SVM) are learning machines that classify data by shaping a set of support vectors. SVMs provide a generic mechanism to robust the surface of the hyper plane to the data through. Another benefit of SVMs is the low expected probability of generalization errors. SVM creates a hyper-plane between two sets of data for classification. In our work, we separate the data into two classes:

1. Face belongs to the train database.
2. Face doesn't belong to the train database.

Input data X that fall one region of the hyper-plane.

VI. CONCLUSION

There are various face recognition methods but there is no single method which gives best result, i.e. there are some limitations of every method which are proposed. In proposed work the method Group Wise Registration is implement with the classifier Support Vector Machine(SVM).With the help of this technique it achieves good result for face recognition. During the recognition phase, each query image is transformed to the template space and compared with the existing training images. Proposed method achieves the highest recognition and verification rates among other methods under comparison.

VII. FUTURE WORK

In future work the proposed method will implement using parallel method.

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