An Improved Hybrid Face Recognition Based on PCA and Subpattern Technique

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Abstract: In this paper a new technique for face recognition Based on PCA is implemented .Subpattern PCA (SpPCA) Is actually an improvement over PCA. It was found to give Better results so in this paper Integration of Different SpPCA methods with PCA was done and found to get Improvement in recognition accuracy.

Keywords: Principle Component Analysis (PCA, Subpattern PCA (SpPCA), SpPCA I, SpPCAII

I. INTRODUCTION

Humans have been using physical characteristics such as face, voice, gait, etc. to recognize each other for thousands of years. With new advances in technology, biometrics has become an emerging technology for recognizing individuals using their biological traits. Now, biometrics is becoming part of day to day life, where in a person is recognized by his/her personal biological characteristics. Examples of different Biometric systems include Fingerprint recognition, Face recognition, Iris recognition, Retina recognition, Hand geometry, Voice recognition, Signature recognition, among others. Face recognition, in particular has received a considerable attention in recent years both from the industry and the research community.

A) Facial Expression Recognition

Recognition of facial expression is important in human computer interaction, human robot interaction, digital entertainments, games, smart user interface for cellular phones and games. Recognition of facial expression by using computer is a topic that has become under consideration not more than a decade. Facial expression in human is a reaction to analeptics. For example reaction to a funny movie is laughter, laughing changes the figure of the face and state of the face muscles. By tracing these states changing and comparing them with the neutral face, facial expression can be recognized. Primary facial expressions which are anger, disgust, fear, happiness, sadness and surprise. Figure 1 illustrates these states of expressions. Implementing real time facial expression recognition is difficult and does not have impressive results because of person, camera, and illumination variations complicate the distribution of the facial expressions. In this paper facial expressions are recognized by using still images.

Fig.1 illustrates 6 states of facial Expressions

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PCA, SpPCA are the feature extraction methods which have been used in this report in order to recognize the facial expressions. Each of the mentioned method shows different performance in terms of recognizing the expressions. The objective of our project is to create a matlab code that can be used to identify people using their face images.

This papert gives a brief background about biometrics.

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A particular attention is given to face recognition. Face recognition refers to an automated or semi-automated process of matching facial images. Many techniques are available to apply face recognition of which is Principle Component Analysis (PCA). PCA is a way of identifying patterns in data and expressing the data in such a way to highlight their similarities and differences. Before applying this method to face recognition, a brief introduction is given for PCA. SpPCAI & SpPCAII has also been applied. The Matlab code for a Hybrid Algorithm has been designed which consists integration of SpPCAI with SpPCAII.

The traditional PCA [1] is a very effective approach of extracting features and has successfully been applied in pattern recognition such as face classification [2]. It operates directly on whole patterns represented as (feature) vectors to extract so-needed global features for subsequent classification by a set of previously found global projectors from a given training pattern set, whose aim is to maximally preserve original pattern information after extracting features, *i.e.*, reducing dimensionality. In this paper, we develop another PCA operating directly on sub patterns rather than on whole pattern These sub patterns are formed via a partition for an original whole pattern and utilized to compose multiple training Subpattern sets for the original training pattern set. In this way, SpPCA can independently be performed on individual training subpattern sets and finds corresponding local projection sub-Vectors, and then uses them to extract local sub-features from any given pattern. Afterwards, these extracted sub-features from individual subpatterns are synthesized into a global feature of the original whole pattern for subsequent classification.

II. PRINCIPAL COMPONENT ANALYSIS (PCA)

The purpose of PCA is to reduce the dimensionality of data sets without losing significant information PCA is reducing the dimensionality of data set by performing covariance analysis between multidimensional data sets [31, 32]. Because PCA is classical technique that can do something in linear domain, applications that have linear models are suitable, for image processing. The main idea of using PCA for face recognition is to express the large 1-D vector of pixels constructed from 2-D facial image into the compact principal components of the feature space. This can be called eigenspace projection. Eigenspace is calculated by identifying the eigenvectors of the covariance matrix derived from a set of facial images (vectors)

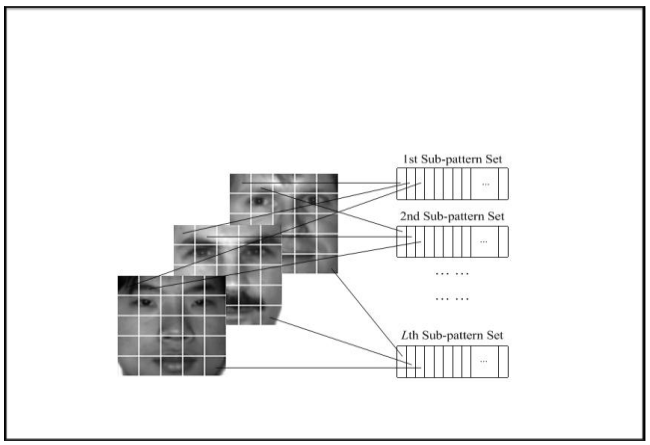

Fig.2 Original cropped image and image with 4 non-overlapped subpatterns

III. PROPOSED SPPCA

Sketch of a Pattern Recognition Architecture

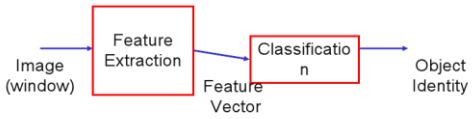

Fig.3 Flowchart for Subpattern technique

SpPCA includes two steps. In the first step, an original whole pattern denoted by a vector is partitioned into a set of equally-sized subpatterns in non-overlapping ways and then all those subpatterns sharing the same original feature components are respectively collected from the training set to compose Corresponding training subpattern setsas shown in "Fig1". Secondly, PCA is performed on each of such subpattern sets. More specifically, we are given a set of training patterns X={X1 ,X2 , …XN, } with each column vector *Xi* for (*i*=1, 2, … , *N*) having *m* dimensions. Now according to the first step, an original whole pattern is first partitioned into *K d*- dimensional subpatterns in a non overlapping way and reshaped into a *d*-by-*K* matrix Xi=(Xi1,Xi2……Xik) , with Xij being the *j*th subpattern of *Xi* and *i*=1,2,…, *N* and *j*=1,2,…,*K*. And then according to the second step, we construct PCA for the *j*th subpattern set *SPj= Xij,i=1,2….,N) to* seek its projection vectors Φj =(¢j1,¢j2,..¢jl) Here it is easy to prove that all total sub-scatter matrices are positive semi-definite and their scales are all *dxd*. And then find independently each set of projection sub-vectors by means of the following eigen value-eigenvector system under the constraints. After obtaining all individual projection sub-vectors from the partitioned subpattern sets, we can extract corresponding sub-features from any subpattern of a given whole pattern Then synthesize them into a global feature . Now on the basis of the synthesized global features, we can use the nearest neighbor (NN) rule [3] to perform pattern classification.

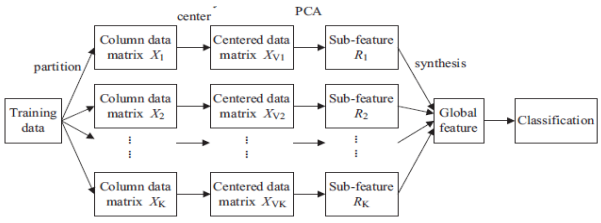

Fig. 1. Illustration of the overall procedure of the Sp-PCA I.

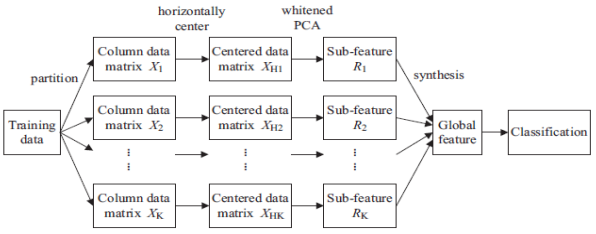

Fig. 2. Illustration of the overall procedure of the Sp-PCA II.

Fig42 . Block Diagram for Hybrid Implementation

A) Algorithm for proposed Hybrid Scheme

Step 1: Create database from input image
Step 2: Read Train and Test image
Step 3: Perform SpPCA I and SpPCA II
Step 4: Calculate The Recognition Rates
Step5.Calculatetheoveralldistance Computation and classification.
Step 6. Calculate the Recognition rate for Hybrid method

IV. EXPERIMENTAL RESULTS

In this paper, experiments are based on ORL face database, which can be used freely for academic research [7]. ORL face database contains 40 distinct persons, each person having ten different face images. There are 400 face images in total, with 256 gray degrees and the resolution of 92112×. These face images are attained in different situations, such as different time, different angles, different expression (closed eyes/open eyes, smile/surprise/angry/happy etc.) and different face details (glasses/no glasses, beard/no beard, different hair style etc.). Some images are shown in Fig.2.

Fig5 .ORL DATABASE

A) Graphical Result Of Algorithms Implemented

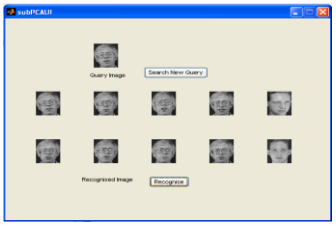

Fig6. Train & Query Image

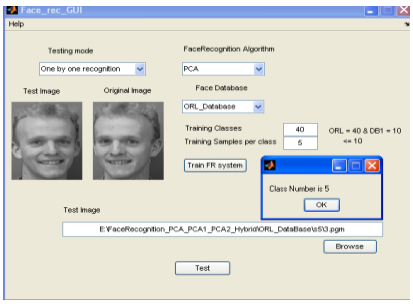

Fig7. PCA

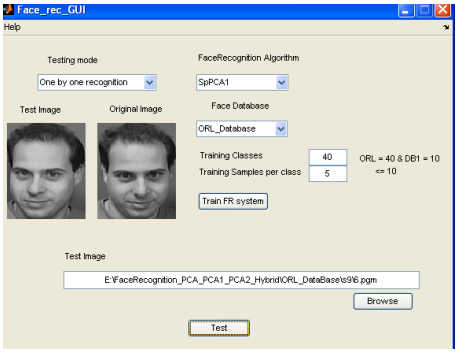

Fig 8 . SpPCA I

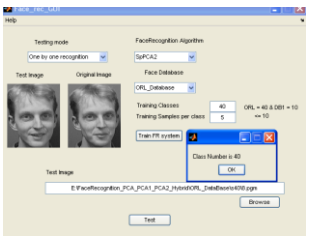

Fig.9 SpPCAII

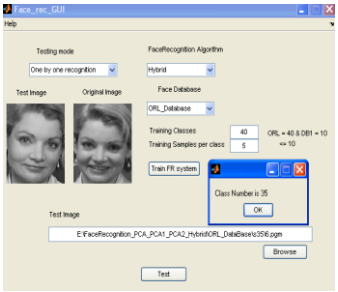

Fig10.hybrid

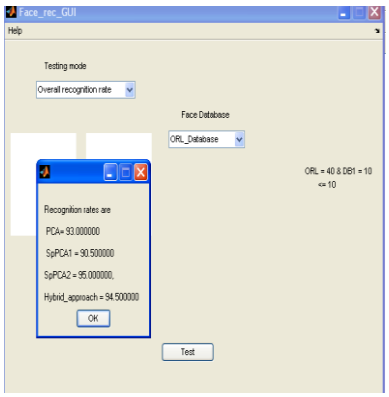

Fig11.Overall Recognition accuracy

B) Table.1 Recognition Accuracy Comparision

METHODS	RECOGNITION RATE %
PCA	93
SPPCAI	90.5
SPPCAII	95
Hybrid	94.5

C) Algorithm Comparision Chart

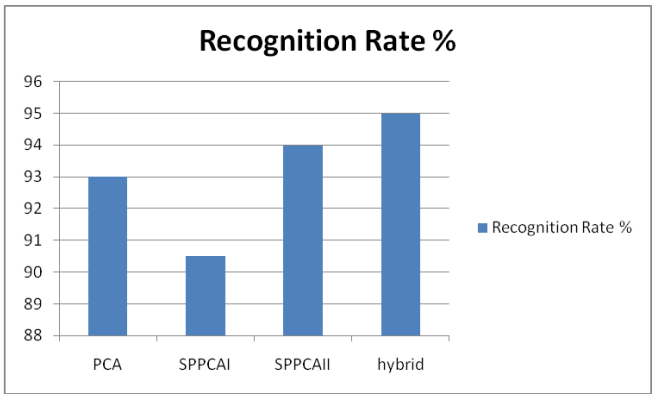

Fig.12 Recognition Rate

V. CONCLUSION

A Hybrid Approach for face Recognition using Subpattern Technique is implemented. In this paper facial expression recognition using PCA, SpPCA approaches were done and compared...The results of experiments demonstrate SpPCA overcome PCA.. Therefore integration of SpPCA with PCA was done and found recognition accuracy to be improved. We can therefore say that our novel hybrid approach is robust and competitive.

FUTURE SCOPE

Face recognition has recently become a very active and interesting research area. Vigorous research has been conducted in this area for the past four decades and huge progress with encouraging results has been obtained. The goal of this paper is to provide a survey of recent holistic and feature based approaches that complement previous surveys. Current face recognition systems have already reached a certain level of maturity when operating under constrained conditions. However, we are still far from achieving the ideal and adequate results in all the various situations. Still more advances need to be done in the technology regarding the sensitivity of the face images to environmental conditions like illumination, occlusion, time-delays, pose orientations, facial expressions. Furthermore, research work on 3 D face recognition and face recognition in videos is also pacing parallel. However, the error rates of current face recognition systems are still too high for many of the applications. So, the researchers still need to go far to get accurate face recognitions.

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