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Implementation of Face Recognition in Cloud Vision Using Eigen Faces

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Abstract
Cloud computing comes in several different forms and this article documents how service, Face is a complex multidimensional visual model and developing a computational model for face recognition is difficult. The papers discuss a methodology for face recognition based on information theory approach of coding and decoding the face image. Proposed System is connection of two stages – Feature extraction using principle component analysis and recognition using the back propagation Network. This paper also discusses our work with the design and implementation of face recognition applications using our mobile-cloudlet-cloud architecture named MOCHA and its initial performance results. The dispute lies with how to performance task partitioning from mobile devices to cloud and distribute compute load among cloud servers to minimize the response time given diverse communication latencies and server compute powers

Key Words: Face recognition, Principal component analysis (PCA), Artificial Neural network (ANN), Eigenvector, Eigenfaces.

I. INTRODUCTION

The face is the primary focus of attention in the society, playing a major role in conveying identity and emotion. The ability to infer intelligence. Face recognition has become an important issue in many applications such as criminal identification security systems, Debit card verification, etc., as opposed to recognizing them, cane important. A human can recognize thousands of faces learned throughout the lifetime and identify familiar faces at a glance even after years of separation although it is clear that people are good at face recognition, it is not at all obvious how faces are encode or decode by a human brain. Human face recognition has been studied for more than no of years. Implementing a computational model of face recognition is slightly difficult, because faces are complex, dimensional visual stimuli. This skill is quite robust, despite of large changes in the visual stimulus due to viewing methods.[2]

II. RELATED WORK

There are two basic types for face recognition. The first type is based on extracting feature vectors from the basic parts of a face such as eyes, nose, mouth, and chin, with the help of deformable templates and extensive mathematics. Then key information from the basic parts of face is gathered and converted into a feature vector. Yullie and Cohen [1] used deformable templates in contour extraction of face images. Recognition system is implemented based on Eigenfaces; PCA and ANN. Principal Component analysis for face recognition is based on the information theory approach in which the relevant information in a face image is extracted as efficiently

as possible. Another method is based on the information theory. In this method, information that best describes a face is derived from the entire face image. Based on the expansion in pattern recognition, Kirby and Sirovich [5], [6] have shown that any particular face can be represented in terms of a best coordinate system termed as "eigenfaces". Later, Turk and Pentland [7] proposed a face recognition method based on the Eigenfaces approach. An unsupervised pattern recognition scheme is proposed in this paper which is independent of excessive geometry and computation. Further Artificial Neural Network was used for classification. Artificial Neural Network concept is used because of its ability to learn ' from observed data.[2]

III. PROPOSED SYSTEM

The proposed System is coding and decoding of face images, emphasizing the significant features.

In the relevant information language of information theory and In the image face is extracted, encoded and then compared with a database of models. The proposed method is independent of any judgment of features (open/closed eyes, different facial expressions, with and without Glasses). The face recognition system is as follows:
Since the number of network methods is equal to the number of people in the database, therefore forty networks, one for each person was created.. PCA is a statistical method under the broad title of factor

analysis. The purpose of PCA is to reduce the large dimensionality of the image space (observed variables) to the smaller intrinsic dimensionality of feature space (independent variables), which are needed to describe the image data economically. A face recognition system usually has a sequential configuration of processing steps: face detection, pre-processing, feature detection, feature extraction and classification. Early research of facial expression recognition needs the help of markers for facial feature point detection. The first important factor in facial recognition systems is its ability to differentiate between the background and the face PCA algorithm extracts orthonormal linear projections, called eigenvectors that maximize the scatter of all projected samples. It enables one to represent an image as linear combination of orthonormal vectors, called eigen pictures.[1]&[2]

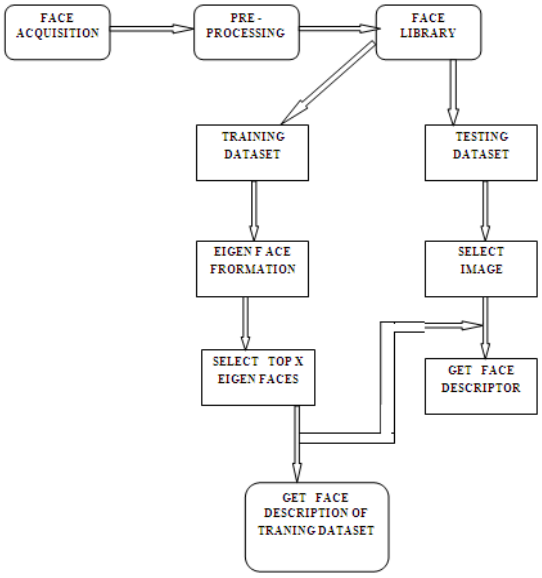

Fig. 1 – Face Formation and getting face descriptor

A. Processing of Face Library Formation

Face images are stored in a face library in the system. Every action such as training set or Eigen face formation is performed on this face library. Image size normalization, histogram equalization and conversion into gray scale are used for preprocessing of the image. The face library is further divided into two sets – training dataset (60% of individual image) and testing dataset (rest 40% images). The process is described in Fig. 1.

This module automatically reduce every face image to X*Y pixels(based on user request), can distribute the intensity of face images (histogram equalization) in order to improve face recognition performance.[2]

B. Calculating Eigenfaces Library Formation

The face can also be approximated using only the best M Eigenfaces, which have the largest eigenvalues. It accounts for the most variance within the set of face images. The face library entries are normalized. For calculating the Eigenfaces PCA algorithm [5], [8], was used.

Let a face image I(x, y) be a two-dimensional N x N array. An image may also be considered as a vector of dimension N2, so that a typical image of size 92 x 112.

An group of images, then, a collection of points in this huge space. Eigenfaces are calculated from the training set An separate face can be entitled exactly in terms of a linear combination of Eigenfaces. Best M Eigenfaces span an M-dimensional subspace which is called the "face space" of all possible images.[2]

Images of faces, being similar in overall Information, will not be distributed in this huge image space and thus can be described by a relatively low dimensional subspace. The main aim of the principal component analysis.

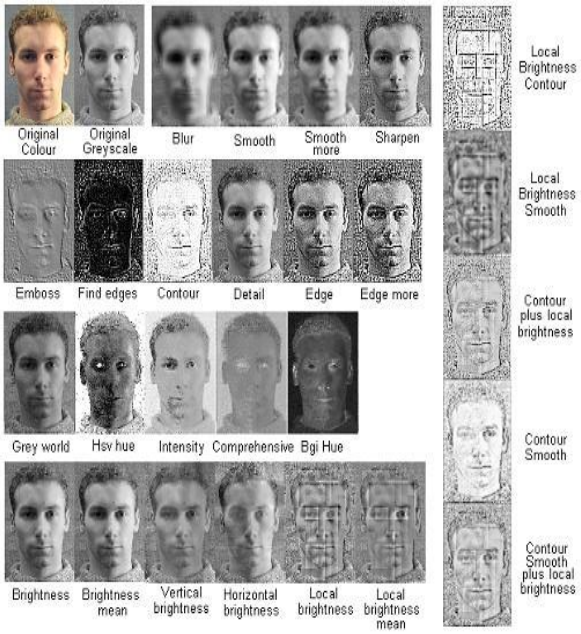

Fig – 2 Eigen Faces and their mean Image

These vectors define the subspace of face images, which we call "face space". The vector is of length N2, and is a linear combination of the existing face images. the covariance matrix corresponding to

the existing face images, and because they are used as face-like in appearance in different images, we refer to them as "Eigenfaces"..

Let the training set of face images be Γ1, Γ2, Γ3... ΓM then the average of the set is defined by

$$\Psi = \frac{1}{M}\sum_{n-1}^{M}\Gamma_n \quad (1)$$

The face different from the avg by the vector

$$\Phi i = \Gamma i - \Psi \quad (2)$$

An above training set is shown in Fig 2, with the average face Ψ.

This set of very large vectors is then subject to method of PCA, which attempt a set of M orthonormal vectors, un , which best describes the distribution of the data. The kth vector, uk , is chosen such thatis a maximum, subject toFace vectors.

$$u_l u_k = \delta_{lk} = \begin{cases} 1, & if\ l = k \\ 0, & otherwise \end{cases}$$

The vectors u_k and scalar δ_{lk} are the eigenvectors and eigen values, respectively of the covariance matrix.

C. Artificial Neural Networks

Artificial Neural networks have been perform to complex functions in various fields of application including pattern recognition, identification, classification, speech, vision and control systems.

D. Eigenfaces Simulation of ANN for Recognition

These new descriptors are given as an input to every network; further these networks are simulated. Compare the simulated results and if the maximum output exceeds the predefined threshold level, then it is confirmed that this new face belongs to the recognized person with the maximum output (fig. 3).

New test image is taken for recognition (from test dataset and its face descriptor is calculated from the eigenfaces .

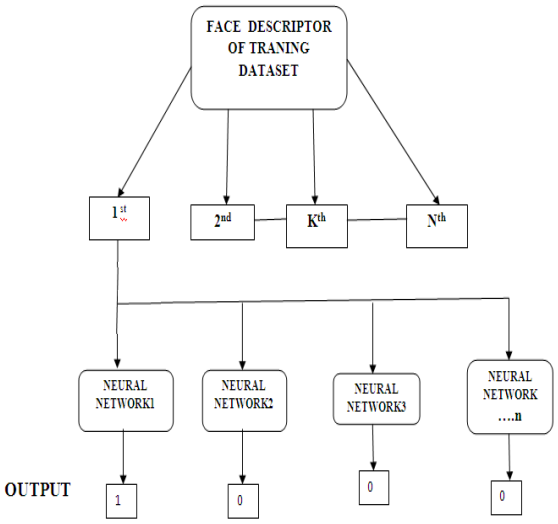

Fig. 3 – Testing of Neural Network

IV. IMPLEMENTATAION

Eigenfaces are calculated by using PCA algorithm and experiment is performed by varying the number of Eigenfaces used in face space to calculate the face descriptors of the images. (expression, illumination, etc.) The proposed method is tested on ORL face database. Database has more than one image of an individual's face with different conditions. There are ten different images of each of 40 distinct subjects. Each image has the size of 112 x 92 pixels with 256 levels of grey. For some subjects, the images were taken at different methods, varying the lighting, affecting face expressions (open / closed eyes, smiling / not smiling) and facial details. Homogeneous background with the subjects in an upright, frontal position. A display image of the Database of the Faces is available (Fig. 4). The original pictures of 112 x 92 pixels have been resized to 6 x 46 so that the input space has the dimension of 2576.

The numbers of network used are equal to number of subjects in the database. The initial parameters of the Neural Network used in the experiment are given below:

- Method: Forward back propagation network
- Number of layers: 3 (input, one hidden, output layer)
- Transfer the no of function of the ith layer: Tansig
- Training Function: Trainlm

Since the number of networks is equal to the number of people in the database, therefore forty networks, one for each person was created. Among the ten images, The proposed technique is analyzed by varying the number of eigenfaces used for feature extraction.

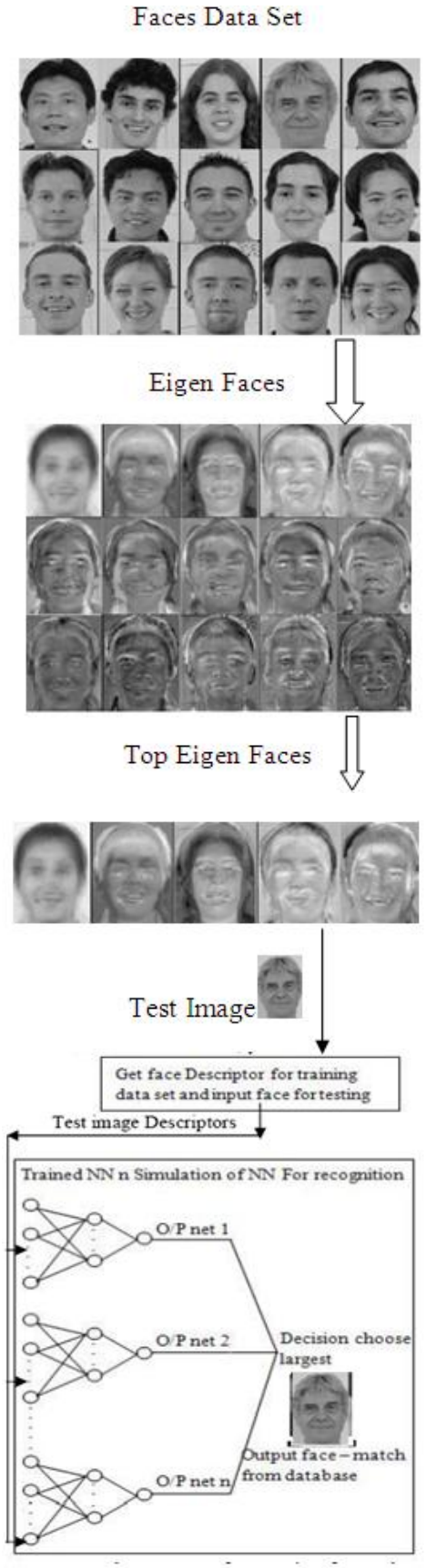

Fig. 4 – A complete process of PCA, Eigenfaces and ANN based faced recognition system

V. ANALYSIS

The proposed System is analyzed by varying the number of Eigenfaces used for aspect of something. The recognition performance is shown in Table I.

Recognition Score of Face Recognition Using PCA and ANN			
No Of Eigenfaces	**Recognition Result1**	**Recognition Result2**	**Average of Result 1-2**
20	98.327	96.425	97.376
40	95.506	96.581	96.0435
60	94.006	94.987	94.4965
80	94.950	94.837	94.8935
100	95.250	93.993	94.6215

Table I. Recognition Score of Face Recognition Using PCA and ANN

The result derived from proposed method is compared with the other techniques which are 1. K-means [2], 2. Fuzzy Ant with fuzzy C-means.[2] Comparison of the result has been tabulated in Table II.

Method	Recognition Rate
K-Means	86.75
Fuzzy Ant With Fuzzy	94.82
Proposed	97.08

Table II. Comparison of the Result

VI. CONCLUSIONS

In this paper, we have discussed a face recognition approach using PCA and Neural Network techniques. The result is compared with K-means, Fuzzy Ant with fuzzy C-means and proposed technique gives a better recognition rate then the other two.

In the Table I one can see the recognition rate by varying the Eigenfaces and the maximum recognition. Eigenfaces of highest eigenvalues are actually needed to produce a complete basis for the face space, As shown in Table I, maximum recognition rate is for M =50. The Eigenfaces method is very sensitive

In the Table II one can see the advantage of using the proposed face recognition over K-means method and Fuzzy Ant with fuzzy C-means based algorithm.

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