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Smart Attendance using Face Recognition with Percentage Analyzer

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Abstract: Smart Attendance system is a smart way of marking attendance. It replaces the old hectic and time consuming methods of marking attendance by a smart way which makes use of face recognition technique for marking attendance. In our work we have introduced a new method which uses PCA with Artificial Neural Network for the purpose of face recognition in Attendance management. Additional to it we also introduce a function which will analyze the percentage of attendance for a student and help him manage his leaves.

Keywords: Face recognition, Feature extraction, Principal component Analysis (PCA), Artificial Neural networks (ANN), Back propagation algorithm.

I. INTRODUCTION

Face recognition technology have improved dramatically in their performance over the past few years, and this technology is now widely used for various purposes such as for security and for commercial applications. Face recognition is an active area of research which is a computer based digital technology. Use of face recognition for the purpose of attendance marking is a smart way of attendance management system.

In this paper we present a new way for automated attendance system which makes use of Principal component Analysis (PCA) along with Artificial Neural networks (ANN). As human brain has the learning ability to recognize the persons by their faces even the feature characteristics change with time because the neurons of human brain are trained by reading or learning the face of a person and can identify that face even after several years. Similarly this ability of training and identifying is converted into machine system using Artificial Neural networks (ANN). The basic function for the face recognition system is to compare the face of a person which is to be recognized with the faces already trained in the Artificial Neural Networks and it recognized the best matching face as output even at different lightening conditions, viewing conditions and facial expressions.

In our work, the features of the face images are extracted by creating the feature vectors of maximum varied face points and computing its Covariance column matrix using PCA. These faces are projected onto the face space that spans the significant variations in the face images stored in the database [5]. These feature vectors are the eigenvectors of covariance matrix and having the face like appearance so that we call them eigenfaces which are used as input to train the Artificial Neural Networks. The learning of the correlated patterns between the input face images is one of the useful properties of Artificial Neural Networks. After training the Artificial Neural Networks, we tested it with known and unknown face images for success and rejection rate analysis.

Along with this we have added a feature which will calculate the percentage of attendance for each student and will help the student to monitor his leaves. As in many institutions there is a criteria of maintaining at least 75% of attendance otherwise the student is debarred. This feature will help student to regularly check weather his attendance is up to mark or falling below 75%.

II. RELATED WORK

An Automated attendance management is a very active topic of research. A lot of work has been done in this field and there is a lot to improve. In recent years many authors have introduced their work in this field. Jomon joseph and K.P. Zacharia has proposed a system for automated attendance management using face recognition [2] in which they have used only PCA. J.G Roshan Tharanga et al has proposed in their work a smart way for attendance marking [3]. K.Senthamil Selvi et al have discussed in their paper the recent advancement in the topic[4]. Shireesha Chintalapati et al have discussed PCA, LDA, and LBPH for face recognition in their research [8].

III. PROPOSED WORK

The existing system is designed for frontal views of face images. In our proposed work we will implement an artificial neural network architecture which will determine the orientation of the face and then recognize the face. Thus the system which we will design will recognize those faces also in which side view of face is visible. Also we have added percentage analyzer feature which will help the students to monitor their attendance. The proposed system will also increase the accuracy of face recognition.

The proposed system will work in the following four phases:

1. Database Making
2. Feature Extraction
3. Face Recognition
4. Attendance Marking
5. View Attendance

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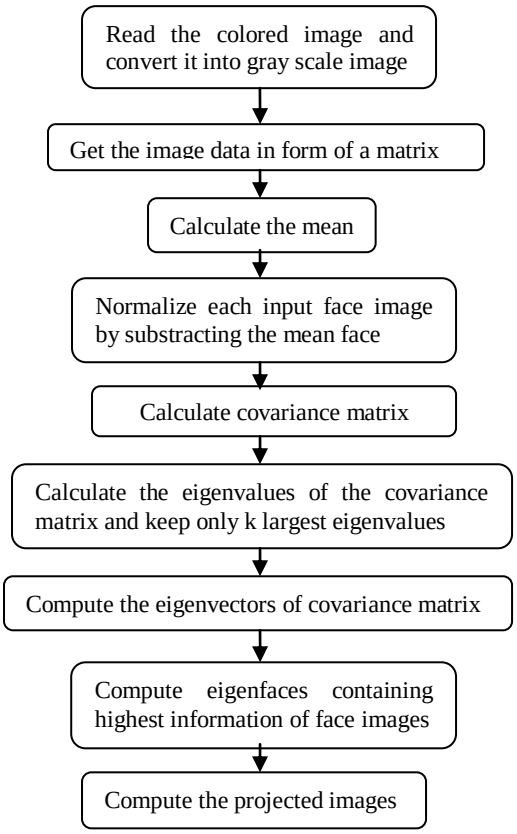
3.1 Database Making

This is the first step in which we add information in the database. Details of student such as students id, roll no, department etc are added in database along with their photos. The database was made using SQL server.

3.2 Feature Extraction

In Proposed algorithm features of the face image are extracted using Principal Component Analysis (PCA). PCA is dimensionality reduction method which retain majority of the variations present in the data set. PCA is a way of identifying patterns in data and expressing the data in such a way as to highlight their similarities and differences.



Steps involved in PCA are:

- Step 1: Get image data in form of matrix as A1,A2….Am.
- Step 2: Calculate the mean Ø as Σ Al /M.
- Step 3: Substract mean from original data (image data) A1- Ø.
- Step 4: Calculate covariance matrix C= **ATA .**
- Step 5: Calculate eigenvalues of the covariance matrix.
- Step 6: Choose components with highest information and form a feature vector.
- Step 7: Derive new data set and project the eigenface image.

3.3 Face Recognition

The next step makes use of Artificial neural networks. As the human brain consist of complex interconnected neurons to process the different task. They can resolve the complex and noisy data problems. Artificial Neural Networks (ANN) learns the correlated patterns of input and target values. ANN is inspired by the human biological nervous system.

For Face Recognition purpose, the learning process of ANN is used with back propagation algorithm. Back Propagation is a feed forward supervised learning network. There are many types of ANN like Multilayered Perceptron, Kohonen networks and Radial Basis Function. The multilayered feed forward neural networks consist of the three layers as input layer, hidden layer and output layer as shown in Fig. 1. These layers of processing elements make independent computation of data and pass it to another layer. The computation of processing elements is completed on the basis of weighted sum of the inputs. The output is compared with the target value and the mean square error is calculated which is processed back to the hidden layer to adjust its weights. This process performs iteration for each layer to minimize the error by repeatedly adjusting the weight of each layer. Hence, it is called the back propagation. The iteration process carried on until the error falls below the tolerance level.

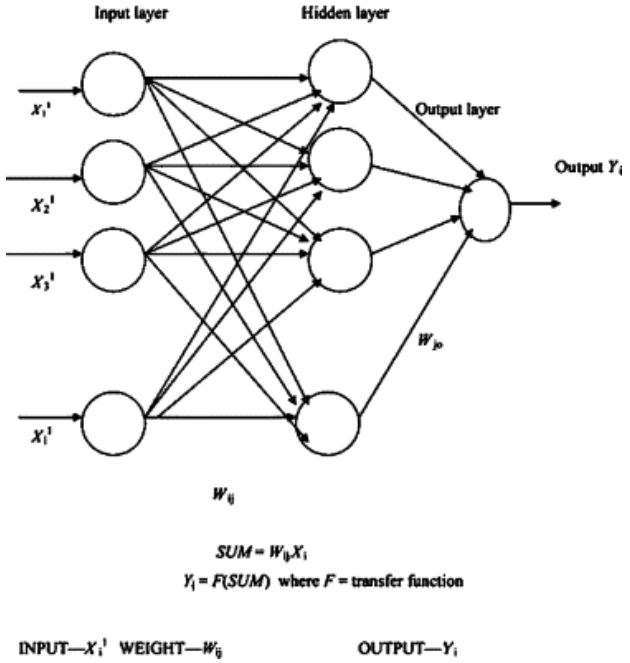


Fig.1. The basic architecture of multilayered ANN

The multilayered ANN has the different layers of processing elements. In face recognition system using ANN, the model works in the following frames:-

- **Input to Feed Forward Network**: - First, the parameters are selected for required Neural Networks operation i.e. the number of input layers, hidden layers and output layers. These input neurons receive the inputs signal from the training data of face images. Each input has its own weights.
- **Back Propagation and weight Adjustment**: - The input layer processes the data to the hidden layer which computes the data further and passes it to the output layer. Output layer compare it with the target value and obtain the error signals. These errors are sent back for

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adjusting the weights of each layer to minimize the error as shown in Fig. 2.

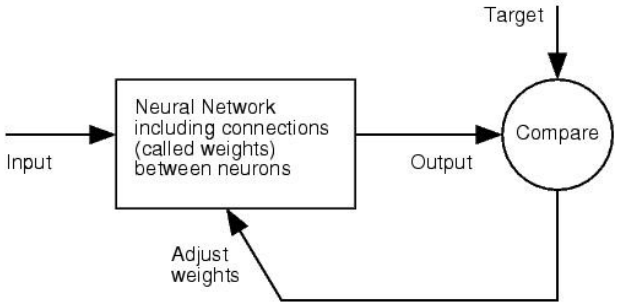


Fig.2. Back Propagation of multilayered ANN

- **Mathematical Function**: - It performs the mathematical operation on the output signal. The functions can be threshold function, log-sigmoid and Tangent hyperbolic function. If the output values of the function are similar to the output values of the Tested face, the face is detected. Hence, the Neural Networks provides the response to the input which is similar to the training data.

3.4 Attendance Marking

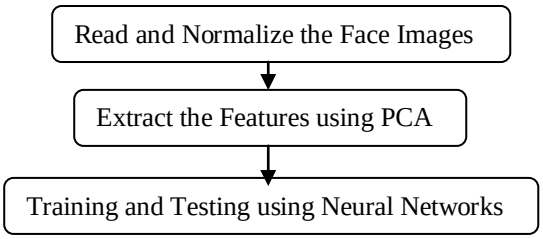
As soon as a face is recognized, attendance is marked in the database corresponding to the matched face as the information is already stored in database in the first step. If an unknown face is tested the result shows no match found.

3.5 View Attendance

This option will let the user to view his attendance in the database. By entering the value in the option given for dates the student can see his attendance for that period of time. On clicking on the name of a student his attendance percentage can be seen. If the percentage is less than 75% then a message will be displayed that his attendance is short.

IV. IMPLEMENTATION AND RESULT

In this work, the features of the face images are extracted using PCA which extracts the variations in the features of face images which contains the highest information with decomposed dimensions. Extracted features compute the eigenfaces which are taken as input to the Artificial Neural Networks to train the neural networks. For testing purpose, the eigenface of the tested image is provided as input to the trained neural networks and it finds the best match considering the threshold value for rejecting the non-human and unknown face images.



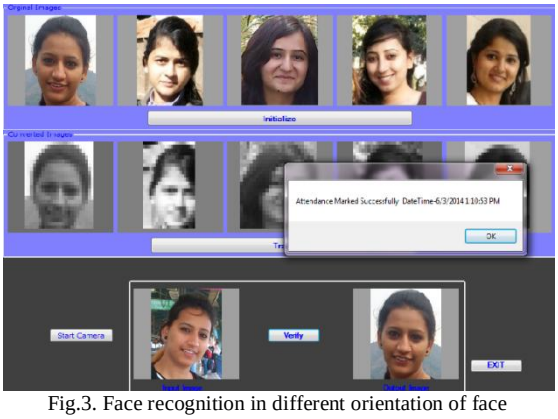


Fig.3. Face recognition in different orientation of face

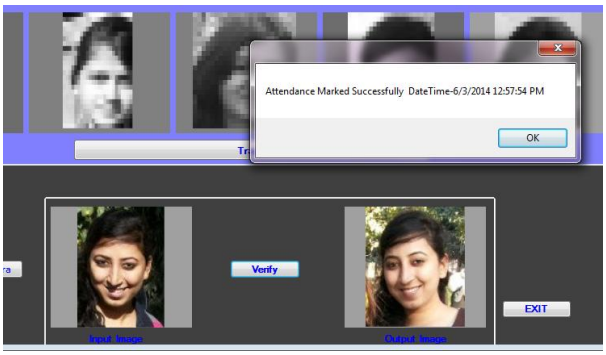


Fig.4. Attendance marked successfully for recognized student

Results show that face is recognized in different orientation also and the attendance is marked successfully when a match is found.

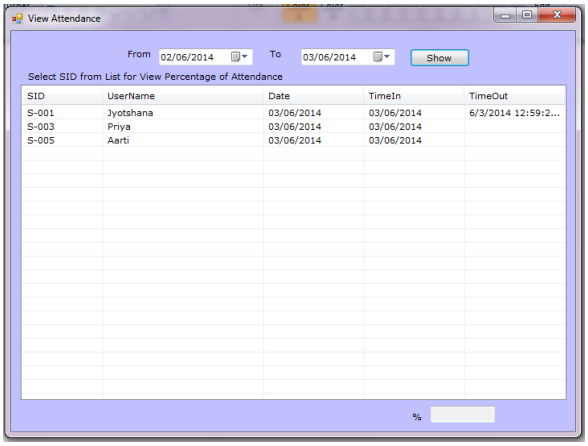


Fig.5. Attendance marked for Jyotshana, Priya and Arti

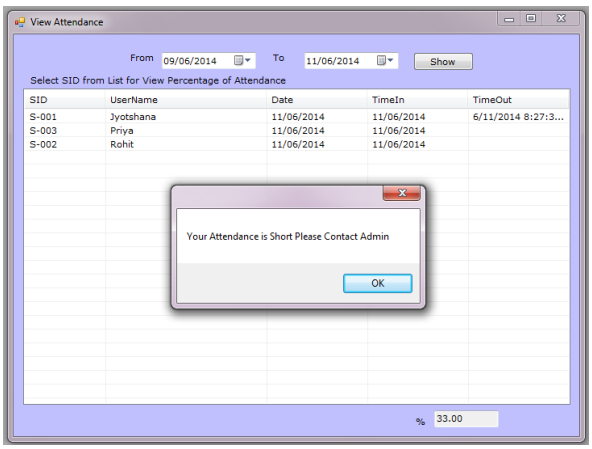


Fig.6. Showing short attendance for jyotshana

V. CONCLUSION

From the results we can conclude that the proposed system shows better results as faces in different orientation and environment are also recognized. Also the automated attendance system is a smarter way for marking attendance.

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BIOGRAPHY

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