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Face Recognition Based Student Attendance System with OpenCV

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Abstract: In this paper we introduce a system for student attendance in Classes and any Lecture hall by using the openCV(Open source Computer Vision) with some face detection and face recognition algorithms. The aim is to take the number of people present in the class and take attendance to each of them using face detection algorithms and face recognition algorithms to determine the actual identification of persons which of them are present. This approach can use in different situations like security purpose, Authentication etc. But here in this paper it is implemented to take attendance to the students in a class room or in a Seminar hall. It may be also used for the prevention of unauthorized persons in a system and in security issues for security or in any illegal activities.

Keywords: OpenCV, Eigen Faces Algorithm, Principle Component Analyzer (PCA).

I. INTRODUCTION

A facial recognition system is a computer application which is capable of identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database Face recognition system 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 system. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems. Recently, it has also become popular as a commercial identification and marketing tool. As the number of students in a college or employees at an organization are increasing the requirements for lecturers or to the organization is increase the complexity of attendance monitoring and number of persons present. The solution for this kind of problems this paper may useful. Monitor the number of students present in a particular area (case or lecture attendance in a fixed hall), recognize each person within this area and then provide information about the fixed area. Often might happen that some room is not being utilized, e.g. when specific room is assigned to some study group and lecturer is absent. This may result in vacant room while other lecturers are unaware of its status. Using proposed system we eliminate this disadvantage and propose solution that will inform other lecturers that room is still vacant. Overall statics of room utilization may be eventually stored in database and used in future for statistical purposes.

II. RELATED WORK

Automated attendance management of students or employees in an organization is a very emerging issues in research. The first automated face recognition system was developed by Takeo Kanade in his Ph.D. thesis work in 1973. There was a dormant period in automatic face recognition until the work by Sirovich and Kirby on face recognition with low accuracy of dimensionalities, those are derived from the Karhunen-Loeve Principal Component Analysis (PCA)also called as transform. For the approach of detection we took a method that utilize training and features extraction techniques. In the process of detection human being in the it is not need to implement some descriptor for feature extraction. In this the other kind of works are is artificial neural networks (ANN), e.g. Kohail was used the Active Appearance Model (AAM) to extract the features of the faces and also using this inputs trained Multi-layer perceptron neural networks (MPL).

III. SYSTEM DESIGN

The main role of proposed is a facial recognition based attendance system. The above mentioned studies are not give a deeper solution for this kind facial recognition .Our proposed system will give a better performance for this kind of problems. It was implemented using the OpenCV [1] .With the help if the opencv we are used Eigen object detector algorithms.

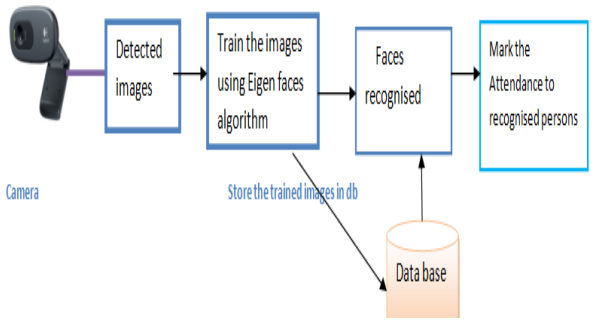

Fig.1. Block Diagram for Face Recognition and Marking Attendance

The block diagram explains the system design and working. First from the camera the input of images are taken and then the faces and the eyes are detected using haarcascades after that trained using the Eigen object recogniser algorithm , for this training of images we will take different images of the same person with different expressions this is because when there are number of trained images are there we can recognise easily when the image of that particular person is detected and then they are stored in the Database for comparing when the image is detected. After the training of the images is completed .we will make the system ready for recognition and marking the attendance, when the images are detected then the system will compare the image with the trained images in the Database after that for the recognised faces it will mark the Attendance.

IV. IMPLEMENTATION OF THE PROJECT

In our proposed system we will detect and recognize the faces by using Eigen object detector algorithm. This can be done with the help of OpenCV with haar cascades which are present in the OpenCV inbuilt. We will design an attendance system for the students with the help of this OpenCV, for this the system will need a HD webcam to take the input images in a fixed area where the camera is located. The images which are taken from the camera are detected with haarcascade frontal faces and eyes then trained with Eigen algorithm, the trained faces are stored in a database first and compared to the trained images (the trained images are initially present in the database means the related persons to the particular college or organization) after comparing it will make attendance to the recognized persons.

A. Microsoft Visual C#

The proposed system is implementing with this visual studio to build this system as an application .Visual Studio is a fully set of development tools to build ASP.NET Web applications, XML Web Services, desktop applications, and mobile applications. Visual Basic, Visual C#, and Visual C++ all use the same integrated development environment (IDE). For more convenient way to this system we are using the OpenCV[open source Computer vision]

B. Open CV

The OpenCV is an open source [1] computer vision library. This library was written in C and C++ and runs under different operating systems like windows, Mac OS and Mac OS. The main goal of the opencv is to provide an easy way of computer vision infrastructure which helps to build the applications easily based on vision One of OpenCV's goals is to provide a simple-to-use computer vision infrastructure that helps people build fairly sophisticated vision applications quickly. Here we are using different libraries of opencv the used libraries are as fallows They are different algorithms are there to do this kind of tasks, but here we are using the Eigen face recognizer. This is better than some of the emerging algorithms. To get more accuracy the output we are designing with some modifications are added to the previous existing algorithm

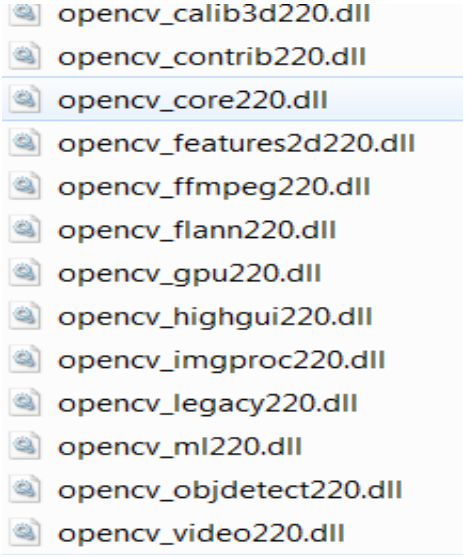

Fig.2.

The above libraries are used here to build this application.

C. Overview of Eigen Face Algorithm

The basic idea is to use the Principle Component analysis PSA[5]. Here we are implementing the Recognition of faces with the Eigen faces .The algorithm [2] for the facial recognition using eigenfaces is basically described that in this first, the original images of the training set are transformed into a set of eigenfaces E. Afterwards, the weights are calculated for each image of the training set and stored in the set W. Upon observing an unknown image X, the weights are calculated for that particular image and stored in the vector W_X. Afterwards, W_X is compared with the weights of images, of which one knows for certain that they are faces (the weights of the training set W). One way to do it would be to regard each weight vector as a point in space and calculate an average distance D between the weight vectors from W_X and the weight vector of the unknown image W_X. If this average distance exceeds some threshold value , then the weight vector of the unknown image W_X lies too "far apart" from the weights of the faces. In this case, the unknown X is considered as not a face. Otherwise (if X is actualy a face), its weight vector W_X is stored for later classification. The optimal threshold value has to be determined empirically.

D. Calculation of Eigen Faces with PCA

In this section, the original scheme for determination of the eigenfaces using PCA will be presented. The algorithm described in scope of this paper is a variation of the one outlined here.

1. Step 1: Prepare the Data

In this step, the faces constituting the training set should be prepared for processing.

2. Step 2: Subtract the Mean

The average matrix has to be calculated, then subtracted from the original faces and the result stored in the variable

3. Step 3: Calculate the Covariance Matrix

In the next step the covariance matrix C is calculated according to eigenvectors

4. Step 4: Calculate the Eigenvectors and Eigen Values of the Covariance Matrix

In this step, the eigenvectors (eigenfaces) u_i and the corresponding eigenvalues $_i$ should be calculated. The eigenvectors (eigenfaces) must be normalised so that they are unit vectors, i.e. of length 1. The description of the exact algorithm for determination of eigenvectors and eigenvalues is omitted here, as it belongs to the standard arsenal of most math programming libraries.

5. Step 5: Select the Principal Components

From M eigenvectors (eigenfaces) u_i, only M' should be chosen, which have the highest eigenvalues. The higher the eigenvalue, the more characteristic features of a face does the particular eigenvector describe. Eigenfaces with low eigenvalues can be omitted, as they explain only a small part of characteristic features of the faces. After M' eigenfaces u_i are determined, the training phase of the algorithm is finished.

6. Step6: **Improvement of the Original Algorithm**

There is a problem with the algorithm described in section 4. The covariance matrix C in step 3 has a dimensionality of N2 × N2, so one would have N2 eigenfaces and eigenvalues. For a 256 × 256 image that means that one must compute a 65,536 × 65,536 matrix and calculate 65,536 eigenfaces. Computationally, this is not very efficient as most of those eigenfaces are not useful for our task. So, the step 3 and 4 is replaced by the scheme. Note that the covariance matrix C is calculated using the formula $C = AA^T$, the original (inefficient) formula is given only for the sake of explanation of A. The advantage of this method is that one has to evaluate only M numbers and not N^2. Usually, M « N^2 as only a few principal components (eigenfaces) will be relevant. The amount of calculations to be performed is reduced from the number of prixels (N^2 × N^2) to the number of images in the training set (M). In the step 5, the associated eigenvalues allow one to rank the eigenfaces according to their usefulness. Usually, we will use only a subset of M eigenfaces, the M' eigenfaces with the largest eigenvalues.

7. Step7 Classifying the Faces

The process of classification of a new (unknown) face new to one of the classes (known faces) proceeds in two steps. First, the new image is transformed into its eigenface components. The resulting weights form the weight vector newt

The Euclidean distance between two weight vectors d (i,j) provides a measure of similarity between the corresponding images i and j. If the Euclidean distance between new and other faces exceeds - on average - some threshold value, one can assume that new is no face at all. d(i j) also allows one to construct ”clusters” of faces such that similar faces are assigned to one cluster.

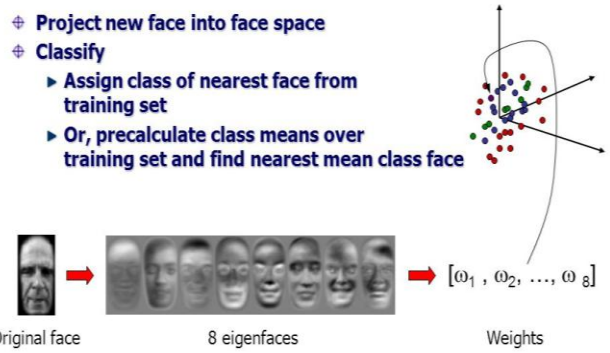

Fig.3. Training Eigen faces

E. Working Process of the Proposed System

Working process of the system is started from the first module of the program i.e detect and recognize. Then the system will take the input of images from the video camera. The flow of working is as follows.

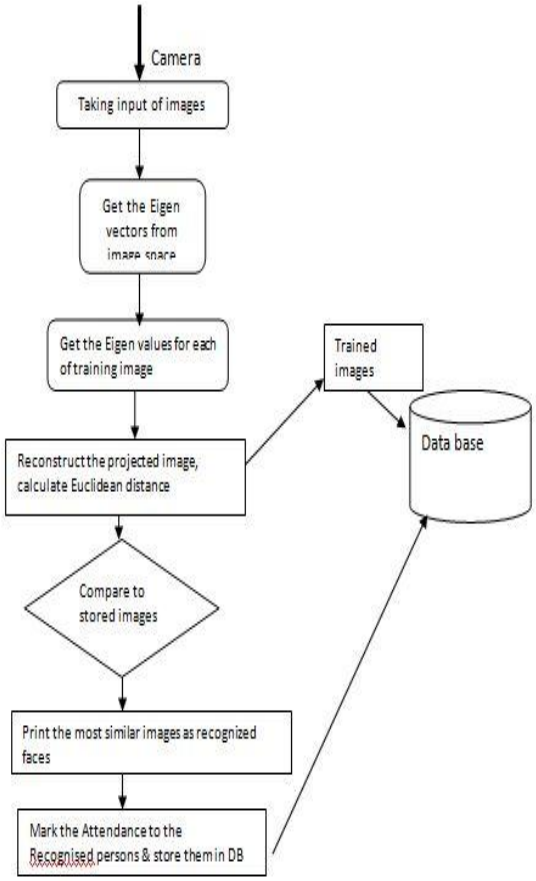

Fig.4. Work Flow of the System

V. EXPERIMENTAL RESULTS

The implementation of the “Face recognition based Attendance system using with OpenCV” is done Successfully. The Attendance system for students is done without any errors in the system. In this OpenCV and Eigen faces algorithm plays an important role in the paper as it is a platform. The proposed system outputs are shown below.

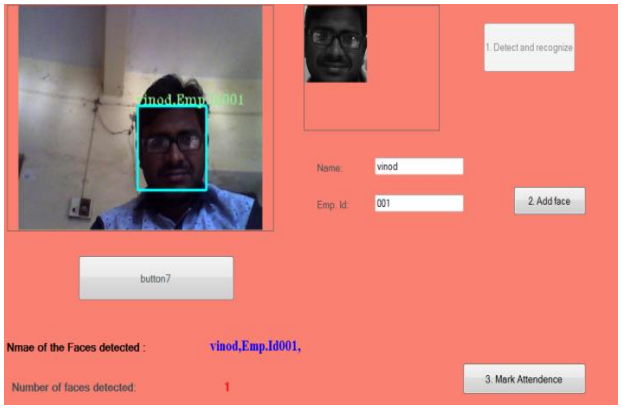

Fig.5. Taking Input from the Camera for the Training of Images.

The above fig is showing the result of a face is detected and added to the database.

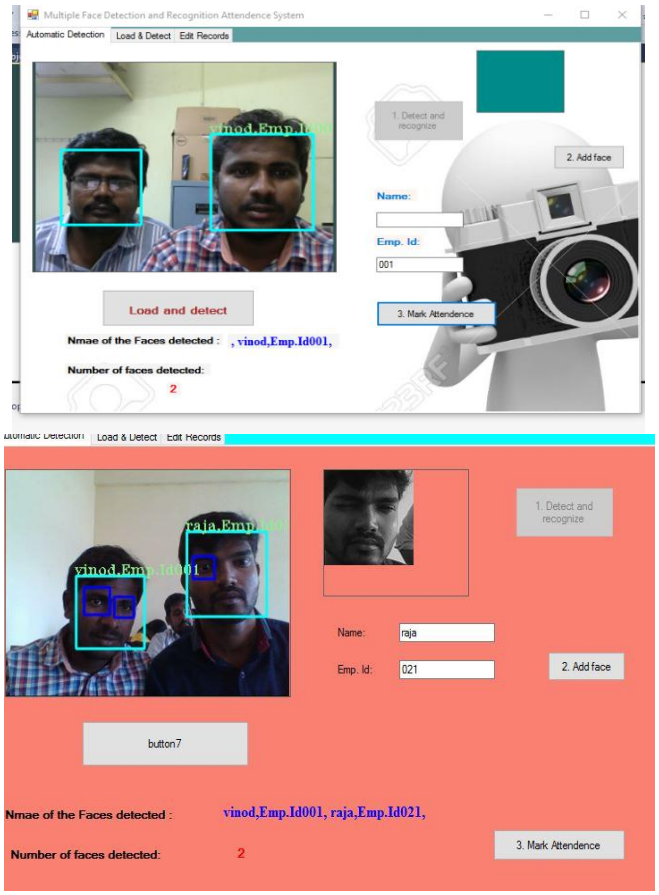

Fig.6. Results for Trained Data and Untrained Data I.E The Detected And Recognized Image is the Trained One and Just Detected Image is the Untrained Image.

Fig.7. These are the Set of Some Trained Images from The Database

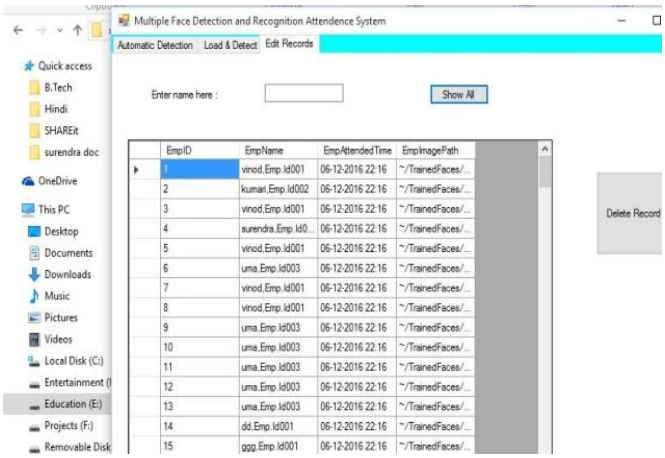

Fig.8. The Above Figure is Showing the Records of the Students or Employees & Editing of the Attendances of the Recognized Persons

VI. CONCLUSION & FUTURE SCOPE

Students attendance is used to be usually achieved by classical way-this means record papers or more novel approaches by hardware tools such as radiofrequency identification (RFID),near near field communication (NFC), biometric identification or combination of just presented. But in our proposed system does not require to carry any hardware device nor to perform some kind of direct biometric identification. The proposed system an easy way for marking attendance where student is identified by camera, where the faces are matched to the one stored in the database after comparing the trained images. In this way students are automatically and indirectly monitored during classes and lectures, Which is a better way for attendance system. Another area of future work is improving our neural network classifier. As mentioned in the previously, it is possible to construct the network to take its input directly from the image data rather from the vector that results from an images projection into face-space. Perhaps learning the face projection function could increase the accuracy of the neural network classifier. Additionally, more experiments are needed to see if there are other ways to tweak the network configuration to produce better results.

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