International Journal of Electronics, Communication & Soft Computing Science and Engineering
ISSN: 2277-9477, Volume 2, Issue 2

Student Monitoring By Face Recognition System

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***Abstract* - Image processing is widely used in many applications, including medical imaging, industrial manufacturing, and security systems. Often the size of image is very large, the processing time has to be small and usually real time constrains have to be met. Therefore, during the last decades their has been an increasing interest in the development and use of parallel algorithms in image processing.In this paper, we propose a system that takes the attendance of students in classroom automatically using face detection and face recognition. However, it is difficult to estimate the attendance precisely using each result of face recognition independently because the face detection rate is not sufficiently high. In this paper, we propose a method for estimating the attendance precisely using all the results of face recognition obtained by continuous observation. Continuous observation improves the performance for the estimation of the attendance.We constructed the lecture attendance system based on face recognition, and applied the system to classroom lecture. This paper first review the related works in the field of attendance management and face recognition. Then, it introduces our system structure and plan. Finally, experiments are implemented to provide as evidence to support our plan. The result shows that continuous observation improved the performance for the estimation of the attendance.**

***Key Words* — Face detection, Face Recognition, Eigenfaces**

I. INTRODUCTION

We are developing the Student monitoring system using face recognition technique. Facial scan systems can range from software-only solutions that process images processed through existing closed-circuit television cameras and processing systems with facial recognition technology, a web camera image is used to analyze facial characteristics such as the distance between eyes, mouth or nose. These measurements are stored in a database and used to compare with a subject standing before a camera.

In this system the standard images of the students in that class are stored in the database. The stored image has the Students information such as the student's seat number, mobile number, class, branch, year etc. that are the reference template which is used for comparison. The face images are detected from the captured image, archived and recognized. Every teacher gets an username and password to login into the system and then they can take the attendance for that subjects which are allocated to them.

When the captured image which is taken from the Webcam is matched with the reference image, it marks the attendance and send SMS to that student and there parents.

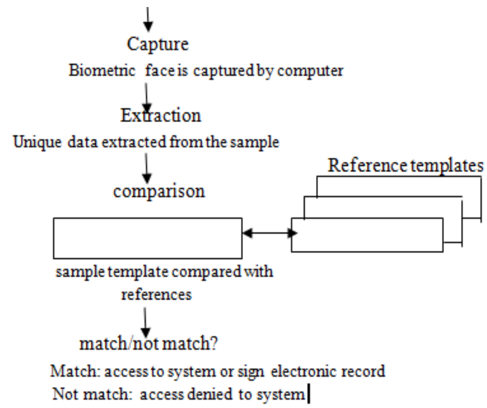

Fig.1 Process of the System

Advantage of this system is that it is a Web based Software and Database of all students is located on Central Server. If we connect the server to private network i.e. LAN then we can use it from anywhere in that Network area. Only a need of one web camera is to be connected to accessing PC. The procedure is repeated during lecture, and estimated the attendance of the students in real time.

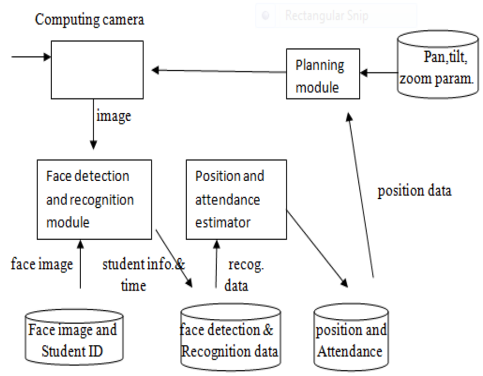

Fig.2 System Architecture

II. METHODOLOGY

The algorithm has two stages. First web camera takes image, detect the face and then compare with the stored or reference images. And second stage is if image will matched the attendance of student is marked then SMS is send to the student and their parents.

Face detection and recognition module detects faces from the image captured by the web camera, and the image of the face is cropped and stored. The module recognizes the images of student's face, which have been registered manually with their names and Seat No. in the database.

A. Face Detection

Face detection has been regarded as the most complex and challenging problem in the field of computer vision, due to the large intra-class variations caused by the changes in facial appearance, lighting, and expression.

Such variations result in the face distribution to be highly nonlinear and complex in any space which is linear to the original image space. Moreover, in the applications of real life surveillance and biometric, the camera limitations and pose variations make the distribution of human faces in feature space more dispersed and complicated than that of frontal faces. It further complicates the problem of robust face detection. Face detection techniques have been researched for years and much progress has been proposed in literature.

Most of the face detection methods focus on detecting frontal faces with good lighting conditions. According to Yang's survey [Yang, 1996], these methods can be categorized into four types: knowledge-based, feature invariant, template matching and appearance-based Any of the methods can involve color segmentation, pattern matching, statistical analysis and complex transforms, where the common goal is classification with least amount of error. Bounds on the classification accuracy change from method to method yet the best techniques are found in areas where the models or rules for classification are dynamic and produced from machine.

Fig.3 Face Detection

Face detection is a computer technology that determines the locations and sizes of human faces in arbitrary (digital) images. It detects facial features and ignores anything else, such as buildings, trees and bodies.

Now we have ability to implement this feature on client-side by using jQuery Plugin which detects faces in pictures and returns theirs Co-ordinate. This Plugin uses an algorithm by Liu Liu.

B. Face Recognition

It includes feature extraction, where important information for discrimination is saved, and the matching, where the recognition result is given with the aid of a face database. Among the different biometric techniques facial recognition may not be the most reliable and efficient but it has several advantages over the others: it is natural, easy to use and does not require aid from the test subject. Because the face detection and recognition database is a collection of images and automatic face recognition system should work with these images, which can hold large volumes of computer memory that is way it's necessary to investigate and develop a method / tool for optimal using volume of computer memory (that decrease image database volume) and implement quick face detection within database.

There are three main contenders for improving face recognition algorithms: high resolution images, three-dimensional (3D) face recognition, and new preprocessing techniques. The FRGC is simultaneously pursuing and will assess the merit of all three techniques. Current face recognition systems are designed to work on relatively small still facial images. The traditional method for measuring the size of a face is the number of pixels between the centers of the eyes. In current images there are 40 to 60 pixels between the centers of the eyes (10,000 to 20,000 pixels on the face). In the FRGC, high resolution images consist of facial images with 250 pixels between the centers of the eyes on average. The FRGC will facilitate the development of new algorithms that take advantage of the additional information inherent in high resolution images. In the last couple years there have been advances in computer graphics and computer vision on modeling lighting and pose changes in facial imagery. These advances have led to the development of new computer algorithms that can automatically correct for lighting and pose changes in facial imagery. These new algorithms work by preprocessing a facial image to correct for lighting and pose prior to being processed through a face recognition system. The preprocessing portion of the FRGC will measure the impact of new preprocessing algorithms on recognition performance.

The FRGC improved the capabilities of automatic face recognition systems through experimentation with clearly stated goals and challenge problems. Researchers and developers can develop new algorithms and systems that meet the FRGC goals. The development of the new algorithms and systems is facilitated by the FRGC challenge problems.

C. Eigenface

Eigenfaces are a set of Eigen vectors used in the computer vision problem of human face recognition. The approach of using eigenfaces for recognition was developed by Sirovich and Kirby (1987) and used by Matthew Turk and Alex Pentland in face classification. It is considered the first successful example of facial recognition technology. These eigenvectors are derived from the covariance matrix of the probability distribution of the high-dimensional vector space of possible faces of human beings

Eigenface generation

A set of eigenfaces, that are created will appear as light and dark areas that are arranged in a specific pattern. This pattern is how different features of a face are singled out to be evaluated and scored. There will be a pattern to evaluate symmetry, if there is any style of facial hair, where the hairline is, or evaluate the size of the nose or mouth. Other eigenfaces have patterns that are less simple to identify, and the image of the Eigenface may look very little like a face.

To create a set of eigenfaces, one must:

1. Prepare a training set of face images. The pictures constituting the training set should have been taken under the same lighting conditions, and must be normalized to have the eyes and mouths aligned across all images. They must also be all resample to a common pixel resolution (r × c). Each image is treated as one vector, simply by concatenating the rows of pixels in the original image, resulting in a single row with r × c elements. For this implementation, it is assumed that all images of the training set are stored in a single matrix T, where each row of the matrix is an image.

2. Subtract the mean. The average image a has to be calculated and then subtracted from each original image in T.

3. Calculate the eigenvectors and Eigen values of the covariance matrix S. Each eigenvector has the same dimensionality (number of components) as the original images, and thus can itself be seen as an image. The eigenvectors of this covariance matrix are therefore called eigenfaces. They are the directions in which the images differ from the mean image. Usually this will be a computationally expensive step (if at all possible), but the practical applicability of eigenfaces stems from the possibility to compute the eigenvectors of S efficiently, without ever computing S explicitly, as detailed below.
4. Choose the principal components. The D x D covariance matrix will result in D eigenvectors, each representing a direction in the r × c -dimensional image space. The eigenvectors (eigenfaces) with largest associated Eigen value are kept.

Facial recognition was the source of motivation behind the creation of eigenfaces. For this use, eigenfaces have advantages over other techniques available, such as the system's speed and efficiency. Using eigenfaces is very fast, and able to functionally operate on lots of faces in very little time. Unfortunately, this type of facial recognition does have a drawback to consider: trouble recognizing faces when they are viewed with different levels of light or angles. For the system to work well, the faces need to be seen from a frontal view under similar lighting. Face recognition using eigenfaces has been shown to be quite accurate.

By experimenting with the system to test it under variations of certain conditions, the following correct recognitions were found: an average of 96% with light variation, 85% with orientation variation, and 64% with size variation.

To complement eigenfaces, another approach has been developed called Eigen features. This combines facial metrics (measuring distance between facial features) with the Eigenface approach. Another method, which is competing with the Eigenface technique, uses 'fisher faces'. This method for facial recognition is less sensitive to variation in lighting and pose of the face than the method using eigenfaces.

A more modern alternative to eigenfaces and fisher faces is the active appearance model, which decouples the face's shape from its texture: it does an Eigenface decomposition of the face after warping it to mean shape. This allows it to perform better on different projections of the face, and when the face is tilted.

Matching

The newly acquired facial data is compared to the stored data and (ideally) linked to at least one stored facial representation. It facial recognition system is the Local Feature Analysis (LFA) algorithm. This is the mathematical technique the system uses to encode faces. The system maps the face and creates a faceprint, a unique numerical code for that face. Once the system has stored a faceprint, it can compare it to the thousands or millions of faceprints stored in a database. Each faceprint is stored as an 84-byte file.

The system can match multiple faceprints at a rate of 60 million per minute from memory or 15 million per minute from hard disk. As comparisons are made, the system assigns a value to the comparison using a scale of one to 10. If a score is above a predetermined threshold, a match is declared. The operator then views the two photos that have been declared a match to be certain that the computer is accurate.

Facial recognition, like other forms of biometrics, is considered a technology that will have many uses in the near future. In the next section, we will look how it is being used right now.

III. Result And Discussion

Some results of the Eigenface are shown below which are produce during the recognition and after that will compare with the reference image, and if the captured image is match then the attendance will marked at that time and student get message.

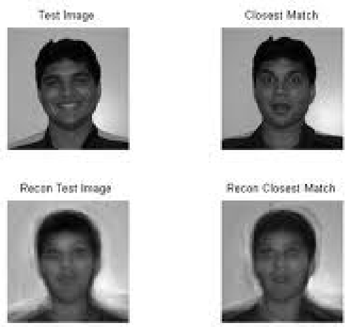

Fig.4 Results of Captured Image 1

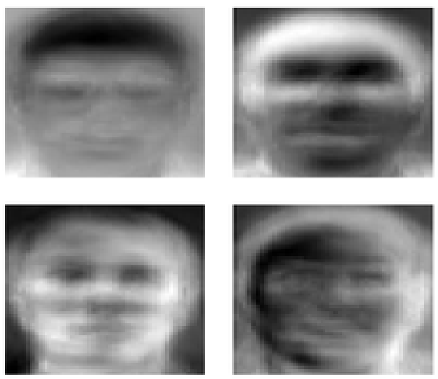

Fig.5 Results of Captured Image 2

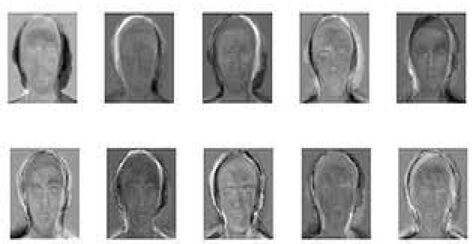

Fig.6 Results of Captured Image 3

IV. FUTURE WORK

In the future work, we can develop the advanced program so some important information of the student can be stored, and can be send to the parents. And for the matching images the background should be plane, proper lightning should be there, can work on these problems.

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