AUTOMATED ATTENDANCE SYSTEM USING IMAGE PROCESSING

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ABSTRACT: Automated attendance system is a system which will record the status of the student; whether he/she is present in the class.In this paper we propose an automated attendance management system. This system, which is based on face detection and recognition algorithms, automatically detects the student using web cam when he enters the class room and marks the attendance by recognizing him. The system architecture and algorithms used in each stage are described in this paper. Different real time scenarios are considered to evaluate the performance of various face recognition systems. This paper also proposes the techniques to be used in order to handle the threats like spoofing. When compared to traditional attendance marking this system saves the time and also helps to monitor the students.

Index Terms—Face detection, Web cam, Automatic attendance, Performance.

I. INTRODUCTION

Time is gold as the famous line goes, time is very precious thing in today's fast changing, fast developing environment, through the different stages of civilizations man always tried to look for ways to make his work easier. Man was never satisfied, so the concept of automation came into existence. Automated attendance system is the advancement that has taken place in the field of automation replacing traditional marking attendance system. [1] The attendance monitoring system has made the lives of teachers easier by making attendance marking procedure a piece of cake. Face detection and recognition is an essential field in many applications, one which is Attendance Management System. This system includes detection of human face through a high definition camera where detection of images is done using a well-known algorithm called Viola Jones Algorithm [10].Feature Extraction is a method of capturing visual content of images for indexing & retrieval. Primitive or low level image features can be either general features, such as extraction of color, texture and shape or domain specific features. This paper presents an application of gray level co-occurrence matrix (GLCM) to extract statistical texture features for estimation of images. An automated attendance system which is developed using web cam consists of Image capture, face detection, database development, pre-processing, feature extraction, post-processing stages. This type of system can be ported in any academic environment.

II LITERATURE SURVEY

Normally in schools and colleges, the average student's count will be 50-80.Teacher has to mark student's presence for every hour. Traditionally, student's attendances are taken manually by using attendance sheet given by the faculty members in class, which is a time consuming event. Moreover, it is very difficult to verify one by one student in a large classroom environment with distributed branches whether the authenticated students are actually responding or not. Using conventional method of calling out names [5]takes approximately 5-10 minutes for marking attendance of entire class. It becomes complicated when strength is more. To overcome the traditional method, a finger print based attendance system came into existence.

Firstly employees fingerprint are scanned by software and an identity number is allotted as their enrollment .During the attendance time when employees impress their fingerprints against the scanner ,the system compares the new fingerprint patterns and connections between various points in the fingerprint with the enrollment database .A match is recorded as a knock exercising acquisition, processing, transmission, matching. Through this automatic system, time and manpower is reduced to great extent. In [6] a portable fingerprint device which can be passed among the students to place their finger on the sensor during the lecture time. The problem with this approach is that passing of the device may distract the attention of the students. A number of works related to Radio Frequency Identification [7] (RFID) based Attendance Systems exist in the literature. In RFID based system, students carry a RFID tag type ID card and they need to place that on the card reader to record their attendance. RS232 is used to connect the system to the computer and save the recorded attendance from the database. This system may give rise to the problem of fraudulent access. Iris [8] is the biometric that can be used for Attendance Systems. Iris Recognition: This recognition method uses the iris of the eye which is the colored area that surrounds the pupil. Iris patterns are thought unique. The iris patterns are obtained through a

video-based image acquisition system. Iris scanning devices have been used in personal authentication applications for several years. Systems based on iris recognition have substantially decreased in price and this trend is expected to continue. The technology works well in both verification and identification modes. This system uses iris recognition system that does capturing the image, iris recognition, extraction, storing and matching. The difficulty occurs to lay the transmission lines in the places where the topography is bad. To overcome all these problems, a real time face recognition system using web cam is proposed in which web cam is connected to computer, which will capture the faces of group of students. Using face detection technique, faces are extracted and processed using standard algorithms which is reliable, secure and fast.

III. METHODOLOGY

Viola Jones Framework Algorithm

This is a Paradigmatic method for Real time Face detection. Training is slow, but detection is very fast. The task of face detection in Viola Jones algorithm uses a 24x24 window as the base window size to start evaluating these features in any given image.

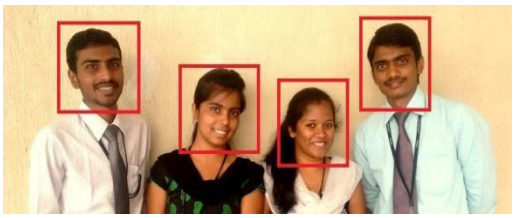


Fig.1 24 x 24 Base Window used by algorithm to crop face in given input image

Detection process has three key ideas

- The first is usage of **Haar Features** for the detection of features in the input image.
- The second is the introduction of a new image illustration called the **—Integral Image** which allows the features used by our detector to be computed very quickly.
- The third is an easy and efficient classifier which is built using the **AdaBoost learning algorithm** to select a small number of critical visual features from a very large set of potential features.
- The fourth contribution is a process for combining classifiers in a **—cascade** which allows background regions of the image to be quickly discarded while spending more computation on promising face-like regions.

Advantages:

- It is the most admired algorithms for face detection in real time.
- The main advantage of this approach is uncompetitive detection speed while relatively high detection accuracy, comparable to much slower algorithms.
- High accuracy, Viola Jones gives accurate face detection.
- Constructing a cascade of classifiers which totally reduces computation time while improving detection accuracy.
- The Viola and Jones technique for face detection is an especially successful method as it has a very low false positive rate.

Disadvantages:

- Extremely long training time.
- Limited head poses.
- Not detect black Faces.

Haar features

Haar features are similar to this convolution kernel which is used to detect the presence of that feature in the given image. Each feature results in a single value which is calculated by subtracting the sum of pixels under white rectangle from the sum of pixels under black rectangle

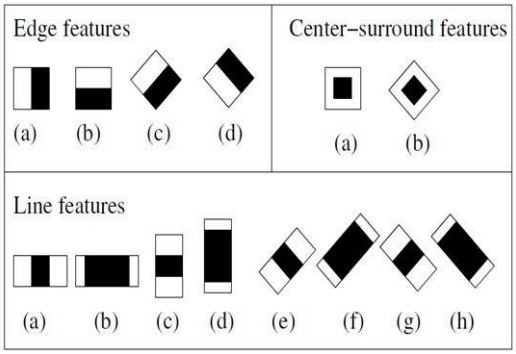


Fig.2 Different types of Haar Features

- If we consider all possible parameters of the Haar features like position, scale and type we end up calculating about 160000+ features in this window.

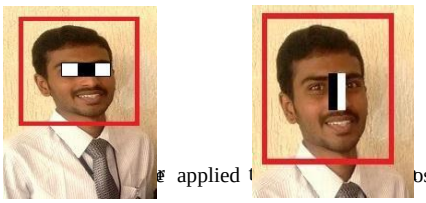


Fig.3 Line ¢ applied t ose regions

Above images show use of different Haar features applied to eye regions, which cause redundancy in choosing Haar features.

Adaboost

It is used both to select the features and train the classifier. Weak learner is a single rectangle feature that best separates positive and negative examples; so weak classifier is a threshold single feature.

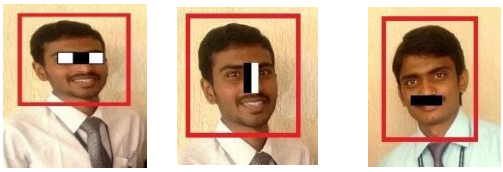
Initially, give equal weight to each training example. Iterative procedure to find the best weak learner for the current weighted training set and raise the weights of training examples misclassified by current weak learner. Compute final classifier as linear combination of all weak learners.

Advantages:

- AdaBoost is an algorithm which only needs two inputs: a training dataset and a set of features (classification functions). There is no need to have any a prior knowledge about face structure.
- Adaptive algorithm with relevant features under weak classifier, which is successively summed up to form strong classifier.
- Very simple to implement and program.

Disadvantages:

- The result depends on the data and weak classifiers.
- Quite slow training.
- Weak classifiers too complex leads to over fitting.
- Weak classifiers too weak can lead to low margins, and can also lead to over fitting.



Relevant features Relevant features Irrelevant features

Fig.4 Shows only selection of relevant features for weak classier

$$F(x) = \alpha_1 f_1(X) + \alpha_2 f_2(x) + \alpha_3 f_3(x) + ...$$

Cascading

The basic principle of the Viola Jones face detection algorithm is to scan the detector many times through the same image, each time with a new size. Even if an image should contain one or more faces it is obvious that an excessive large amount of the evaluated sub-windows would still be negatives (non-faces). This realization leads to a different formulation of the problem:

Detection of eyes

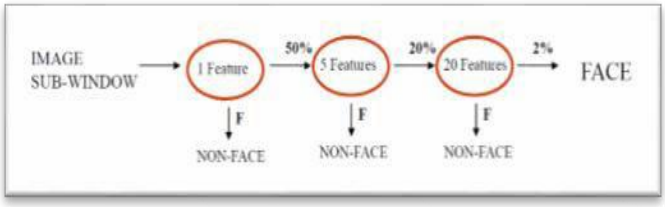


Fig.5 Instead of finding faces, the algorithm should discard non-faces.

The cascaded classifier is composed of stages each containing a strong classifier. The job of each stage is to determine whether a given sub-window is definitely not a face or maybe a face. When a sub-window is classified to be a non-face by a given stage it is immediately discarded. Conversely a sub-window classified as a maybe-face is passed on to the next stage in the cascade. It follows that the more stages a given sub-window passes, the higher the chance the sub-window actually contains a face.

Texture Analysis Based on Gray level co-occurrence Matrix (GLCM)

Texture is a property that represents the surface and structure of an image or it can be defined as a regular repetition of an element or pattern on a surface. Textures of an image are complex visual patterns that are composed of entities or regions with sub-patterns with the characteristics of brightness, color, shape, size, etc.

Texture analysis characterizes the spatial variation of image pattern based on some mathematical procedures and models to extract information from it. One of the methods used for texture feature extraction was proposed by Haralick et al. known as **Gray-Level Co-occurrence Matrix (GLCM)**.

GLCM estimates image properties related to second-order statistics which considers the relationship among pixels or groups of pixels (usually two). A simple one-dimensional histogram may not be useful in characterizing texture features as it is a spatial property. Hence, this two-dimensional GLCM matrix is extensively used in texture analysis.

Gray-Level Co-occurrence Matrix (GLCM)

The GLCM, which is a square matrix, can reveal certain properties about the spatial distribution of the gray-levels in the texture image. It was defined by Haralick et al. in 1973. It shows how often a pixel value known as the reference pixel with the intensity value _i‘ occur in a specific relationship to a pixel value known as the neighbor pixel with the intensity value j. So, each element (i, j) of the matrix is the number of occurrences of the pair of pixel with value _i‘ and a pixel with value _j‘ which are at a distance d relative to each other. The spatial relationship between two neighboring pixels can be

specified in many ways with different offsets and angles, the default one being between a pixel and its immediate neighbor to its right.

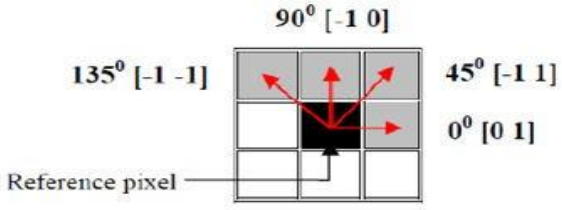


Fig.6 GLCM directions

There are 4 possible spatial relationships (0°; 45°; 90° and 135°).**Each element of the GLCM is the number of times that two pixels with gray tone i and j are neighborhood in distance d and direction θ.**

For 0° co-occurrence matrix, there are 2 occurrences of the pixel intensity value 1 and pixel intensity value 3 adjacent to each other (i.e. 1, 3) in the input image. Also, the occurrence of pixel intensity value 3 and pixel intensity value 1 adjacent to each other (i.e. 3, 1) is 2 times. Hence, these matrices are symmetric in nature and the co-occurring pairs obtained by choosing θ equal to 0° would be similar to those obtained by choosing θ equal to 180°. This concept extends to 45°, 90° and 135° as well with all these considerations, the GLCM matrix is calculated for each of the four possible angles and shown in fig.7.

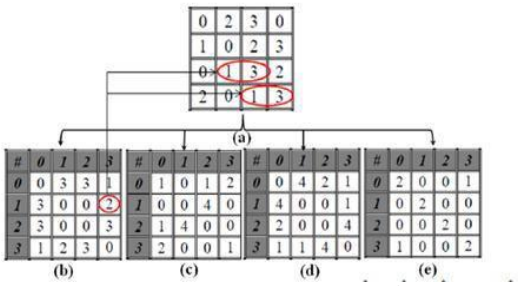


Fig.7 GLCM construction based on a (a) test image along four possible direction (b)0 (c) 45 (d) 90 and (e) 135 with a distance d=1. Here # represents the number of times.

IV RESULT AND DISCUSSION

DATABASE TESTING

The enrolment of the new student can be done in this stage. The images of the students are uploaded successfully.

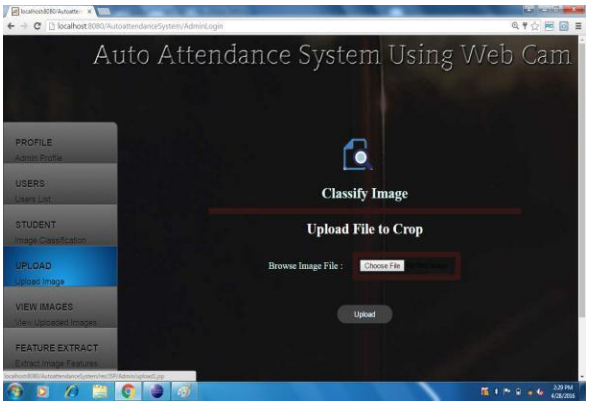


Fig.7 uploading of an image

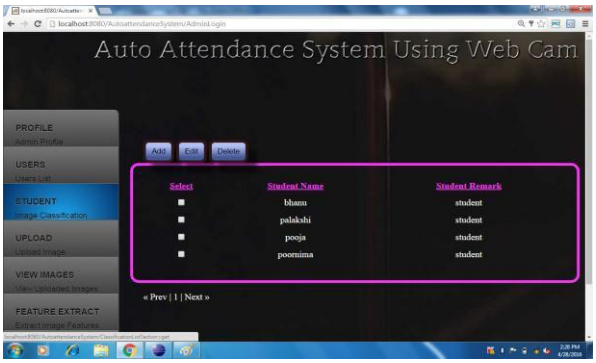


Fig.8 Student list stored in database

ATTENDANCE LIST

The list of the students who attended the class are marked present

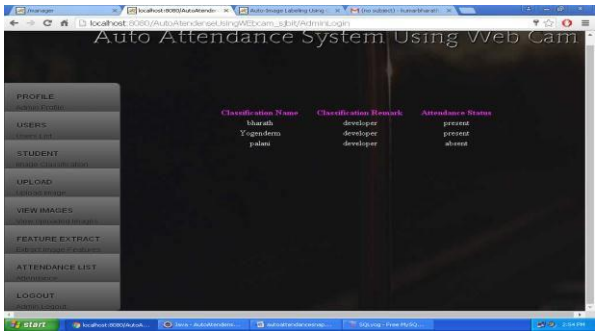


Fig.9 Student‘s attendance list

TABLE I: Performance analysis

Distance of object for correct recognition	5feet
Training time	670ms
Detection rate	90%
Recognition	80%

V CONCLUSION AND FUTURE WORK

An automatic attendance management system is a necessary tool for any learning management schools. Most of the existing systems are time consuming and require a semi manual work from the teacher or students. Our approach aims to solve the issues by integrating face recognition in the process. Even though this system has disadvantages like detecting large number of faces, there is much more room for improvement. Since we implement a modular approach we can improve different modules until we reach an acceptable detection and identification rate. The system can be enhanced in such a way that the accuracy, detection rate and recognition rate can be increased so that more number of students can be detected and recognized for those who are present in the class.

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