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Smart Attendance Management System

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ABSTRACT
Smart Attendance Management System is an application developed for daily student attendance in colleges or schools. This project attempts to record attendance through face detection. The aim of the project is to create software for attendance management system that can be used by all teachers for their respective courses. The teacher will start the process of taking attendance by clicking a photograph of the class. The algorithm used to detect face is Voila Jones. The software used to detect faces from image is MATLAB. Histogram of Gradients is used to recognize feature. And for classification the algorithm used is Error Correcting Output Coding which uses Support Vector Machine as a binary classifier. The administrator maintains the database. Every day at the end attendance is uploaded to the system and the faculty can generate a list of defaulters.
Keywords:- RFID

I. INTRODUCTION

Attendance is defined as the action or state of going regularly to or being present at a place or event. Attendance of every student is being maintained by schools and colleges. The manual attendance record system is inefficient and more time is required to record as well as calculate the attendance of each student. Hence a system is needed which will solve the issue of manual attendance. While the move towards the digital era is being accelerated every hour, biometrics technologies have started affecting people's daily life at each and every instance. Biometrics technologies use characteristics such as fingerprints, faces irises, retinal patterns, palm prints, voice, hand-written signatures, and so on for authentication. These techniques employing physical data are increasingly seen as an efficient alternative to conventional security methods such as a password or ID cards. The biometric personal authentication uses data taken from measurements. Such data is unique to the individual and remains so throughout one's life. It is important to identify the correct tools to use in commercial and scientific studies. Barcode readers, Radio Frequency Identification (RFID) system, Bluetooth and NFC (Near Field Communication) are just a few of the examples of such tools. However, they are expensive and therefore they had limited use. Hence a system which does not require a special infrastructure is developed using Biometric Facial Detection and Recognition system – Smart Attendance Management System.

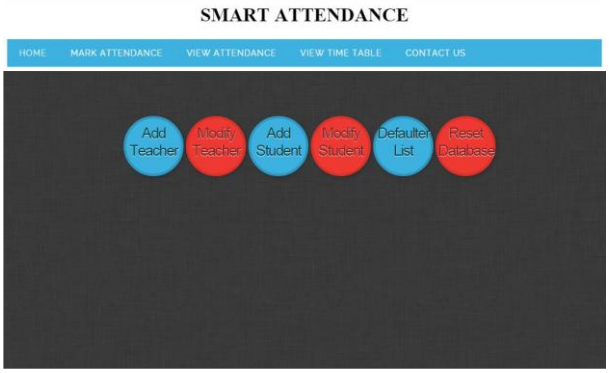


Fig.1 Smart Attendance Management System

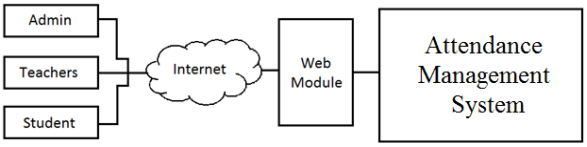
II. OVERVIEW

A. Existing System

The existing system largely consists of physical register where the supervisor manually inputs the attendance record of all students. Other technologies which have been developed to replace this manual system include fingerprint, retina scan, voice recognition etc. The problem with existing system is that the manual system is time consuming and the advanced technologies are too expensive to be implemented on a large scale in any organization.

B. Proposed System

The following system eliminates the tedious task of manually maintaining the attendance records by automating it. The administrator fills up the details of the teachers and students at the start of the semester. Class list is generated automatically. These details can be used for further semesters with little changes.



The system allows easy attendance management using the Face Detection, which is one of the most acceptable techniques. The teacher needs to carry a Digital Image Capturing Devices to the lecture room and take a picture of the class. The teacher then needs to log-in to the computer using his/her login credentials. The web page provides a medium to upload the image to the computer. The system has a copy of MATLAB installed in it. System also consists of database which includes images of all the students and their personal details. The database also keeps record of details of teachers of the respective classes. After the image is uploaded to the system, faces of students are detected from the image using MATLAB software. These images are then compared with the images of students stored in the database using face recognition algorithm and record of attendance is kept. The computer then returns a copy of html page to the teacher with attendance of each student. But, What if only half face of a particular student is seen or his face is not clear in the original image. The teacher can manually mark the attendance of those students. This is how record of attendance is kept in our system.

III. THE PROPOSED SYSYTEM

A. Block diagram

The block diagram of proposed system is as shown below

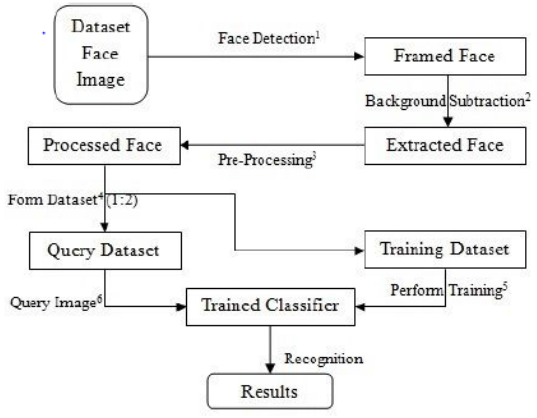


Fig.2 Block diagram

B. Face Detection

The Viola Jones object detection framework to detect faces in the image. The main characteristics of Viola–Jones algorithm which makes it a good detection algorithm are:

- Robust – very high detection rate (true-positive rate) & very low false-positive rate always.
- Real time – Processing must be at least 2 times per second for practical applications.

Face detection but not recognition - The goal is to differentiate faces from non-faces (face detection is the first step in the identification process)

The algorithm has mainly four main stages:

- Haar Features Selection
- Creating Integral image
- Adaboost Training algorithm
- Cascaded Classifiers

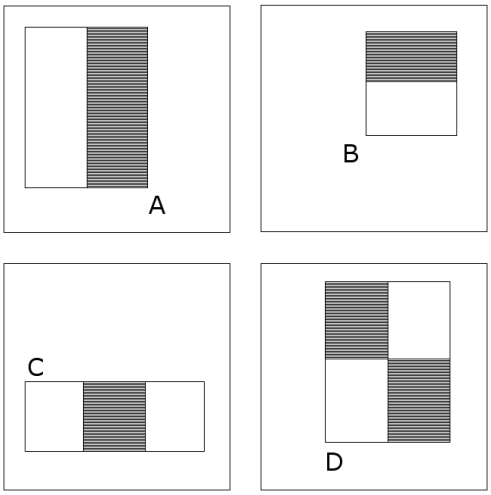


Fig.3 Feature types used by Viola and Jones

Advantages of Viola Jones algorithm:

- Extremely fast feature computation
- Efficient feature selection
- Scale and location invariant detector

Disadvantages of Viola Jones algorithm:

- Detector is most effective only on frontal images of faces
- It can hardly cope with 45° face rotation both around the vertical and horizontal axis.

C. Face Recognition

Histogram of Oriented Gradient (HOG)

The technique counts occurrences of gradient orientation in localized portions of an image. This

method matches with edge orientation histograms, scale-invariant feature transform descriptors, and shape contexts, but it is different in a way that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy[2]. Firstly the face image gets divided into small regions that are connected, called as cells, and the histogram of edge orientation gets computed for each one over the pixels of the cell using discrete derivative masks similar to Sobel masks. Each pixel in the cell will be a parameter for edge orientation and the gradient element is attached to it, thus the computation is performed for orientation bins. The histogram channels are spread in an even manner over 0–180 degree or 0–360 degree, depending on the gradient which is 'unsigned' or 'signed'. The histogram counts are normalized to compensate for illumination. This procedure takes place by accumulating a measure of local histogram energy over the somewhat larger connected regions and thereafter using the results to normalize all cells in the block. The combination of these histograms represents the final HOG descriptor. Invariance to scale and rotation may be also achieved by extracting descriptors from only salient points (key points) in the scale space of the image following rotation normalization. The steps involved are:

- Scale-space extreme detection.
- Orientation assignment.
- Descriptor extraction.

The essential thought behind the Histogram of Oriented Gradient descriptors is that local object appearance and shape within an image can be described by the distribution of intensity gradients or edge directions. The implementation of these descriptors can be achieved by dividing the image into small connected regions, called cells, and for each cell compiling a histogram of gradient directions or edge orientations for the pixels within the cell. The combination of these histograms then represents the descriptor. For improved accuracy, the local histograms can be contrast-normalized by calculating a measure of the intensity across a larger region of the image, called a block, and then using this value to normalize all cells within the block. This normalization results in better invariance to changes in illumination or shadowing.

The HOG descriptor maintains a few key advantages over other descriptor methods. Since the HOG descriptor operates on localized cells, the method upholds invariance to geometric and photometric transformations, except for object orientation. Such changes would only appear in larger spatial regions. Moreover, as per the discovery of Dalal and Triggs, coarse spatial sampling, fine orientation sampling, and strong local photometric normalization permits the individual body movement of pedestrians to be ignored so long as they maintain a roughly upright position. The HOG descriptor is therefore suited for human detection in images.

The final step in object recognition using Histogram of Oriented Gradient descriptors is to feed the descriptors into some recognition system based on supervised learning. The Support Vector Machine classifier is a binary classifier which looks for an optimal hyper plane as a decision function. Once trained on images containing some particular object, the SVM classifier can make decisions regarding the presence of an object, such as a human being, in additional test images

Error-correcting Output Coding (ECOC)

Error-Correcting Output Coding (ECOC)[1] is an ensemble method designed for multi-class classification problem. In multi-class classification problem, the task is the decision of one label from k > 2 possible choices. For example, in digit recognition task, we need to map each hand written digit to one of k = 10 classes. Some algorithms, such as decision tree, naive bayes and neural network, can handle multi-class problem directly. ECOC is a meta method which combines many binary classifiers in order to solve the multi-class problem. It uses the SVM (Support Vector Machine) binary classifier.

In machine learning, support vector machines (SVMs, also support vector networks) are supervised learning models with associated learning algorithms that analyze data and recognize patterns, used for classification and regression analysis. Given a set of training examples, each marked as belonging to one of two categories, an SVM training algorithm builds a model that assigns new examples into one category or the other, making it a non-probabilistic binary linear classifier. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are thereafter mapped into that same space and then predicted to belong to a category based on which side of the gap they fall on.

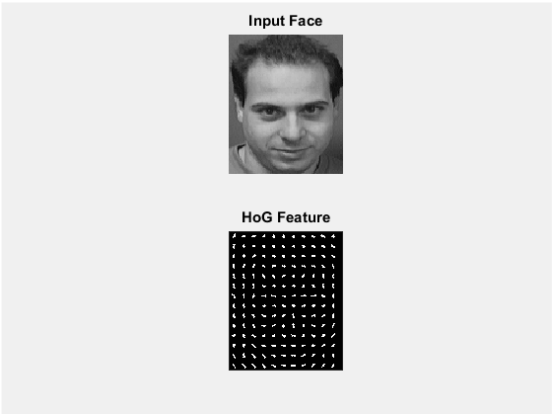


Fig.4 HOG Visualization

A Characteristics of the Proposed System

- User Friendly: The proposed system is very user friendly. The reason is the retrieval and storing of data is fast and data is maintained efficiently. Furthermore the graphical user interface is provided in the proposed system, which provides user to deal with the system very comfortably.
- Reports are easily generated: Defaulter Reports can be generated very comfortably in the proposed system so that user can generate the report as per his/her requirement (monthly) or in the middle of the session. User can provide the notice to the students so as to be regular.
- No paper work: The proposed system does not require much paper work. All the data is fetched into the database immediately and reports can be generated very easily by the teachers. Furthermore work becomes very easy because there is no need to keep data on papers.

B Software Requirements

Operating System - Windows XP or higher (32 or 64 bit)
Programming language – Matlab
Development Kit used – MATLAB R2014b

C Hardware Requirements

Any device which is capable of clicking a photo can be used, and the image can be used to mark the attendance of the class by accessing the online website.

D Steps In Project Development

The following steps were taken during the development of the proposed system:

- Defining the problem.
- Research about existing systems
- Developing the block diagram.
- Software development.
- Testing and debugging the code.
- Testing the entire system.
- Software release
- Documentation.

IV. APPLICATIONS

The proposed system as a wide range of applications, some of them are as follows:

- Time Attendance recording in offices
- Access control at office, Banks
- Canteen management & Food coupon system
- Visitor management
- Members management at event

V. CONCLUSION

This project demonstrates real time attendance marking and management. We have successfully started an application which not only helps the teacher to take attendance but also to check the total attendance of the students. We have built a photo database from scratch for two classes. Database connectivity is done in Java and student attendance database is made in MS Access.

VI. ENHANCEMENTS

The Facial recognition database can be improved by adding more images and variable poses of the students to make recognition full proof. The Web based architecture can be utilized further by maintaining the databases on a remote server and the application will be accessible via the Internet.

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