EFFICIENT ATTENDANCE MANAGEMENT SYSTEM USING FACE DETECTION AND RECOGNITION

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Abstract:Students attendance in the classroom is very important task and if taken manually wastes a lot of time. There are many automatic methods available for this purpose i.e. biometric attendance. All These methods also waste time because students have to make a queue to touch their thumb on the scanning device. This work describes the efficient algorithm that automatically marks the attendance without human intervention. This attendance is recorded by using a camera attached in front of classroom that is continuously capturing images of students, detect the faces in images and compare the detected faces with the database and mark the attendance. We propose using real time face detection algorithms integrated on an existing Learning Management System (LMS), which automatically detects and registers students attending the lecture. The system represents a supplemental tool for instructors, to track facial changes during a longer period of time. This new system aims to be less time consuming than traditional methods, at the same time being non intrusive and not interfere with the regular teaching process. The tool promises to offer accurate results and a more detailed reporting system which shows student attendance in a classroom.

Keywords:

Automatic Attendance, Face Detection, Face Recognition, Image Enhancement, Enrollment, Verification.

Introduction:

Maintaining the attendance is very important in all the institutes for checking the performance of students. Every institute has its own method in this regard. Some are taking attendance manually using attendance registers, marking attendance sheets or file based approach and some have adopted methods of automatic attendance using some biometric techniques. But in these methods students have to wait for long time in making a queue at time they enter the classroom. Many biometric systems are available but the key authentications are same is all the techniques. Every biometric system consists of enrolment process in which unique features of a person is stored in the database and then there are processes of identification and verification. These two processes compare the biometric feature of a person with previously stored template captured at the time of enrollment. Biometric templates can be of many types like Fingerprints, Eye Iris, Face, Hand Geometry, Signature, Gait and voice. Our system uses the face recognition approach for the automatic attendance of students in the classroom environment without students

intervention. Face recognition consists of two steps, in first step faces are detected in the image and then these detected faces are compared with the database for verification. The efficiency of face recognition algorithm can be increased with the fast face detection algorithm. Face recognition techniques can be divided into two types, Appearance based which use texture features that is applied to whole face or some specific regions, other is Feature based which uses geometric features like mouth, nose, eyes, eye brows, cheeks and relation between them. Illumination invariant algorithm is utilized for removing the lighting effect inside the classroom.

Organization:

The paper is organized as follows: in Section I we present System Modules, in Section II we present a System Description, in Section III we describe System Algorithms, and in section IV we conclude our paper.

I. System modules:

1) STUDENT ENROLLEMENT
2) FACE DETECTION
3) FACE RECOGNITION
4) ATTENDANCE MANADEMENT

STUDENT ENROLLEMENT:

In this module we are going to maintain person details in the database which include information like Branch, SEM, Name, USN etc. and we also store the image of a many persons in the database for further process. These unique features are then stored in the face database with certain id of that person. At the time of enrollment templates of face images of individual students are stored in the Face database. This will help us to give the details of a person when his face is detected and recognized in given group image. In case person face in the group image is not stored in the databases then it will gives an error message like "this person details is not stored in the database".

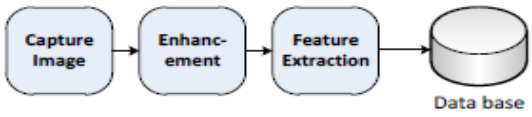


Fig 1. Enrollment Process

Face detection:

Detecting a face is in essence an object detection task, where the object of interest in this case is the face. However, many factors can interfere with the face detection algorithms, factors such as face pose, scale, position, rotation, light, image colors etc. The same problems arise when one wants to identify (recognize) a face. There are plenty face detection algorithms which can effectively detect a face (or any other specific object) in a picture. In the system presented here, most students face the camera frontally hence we chose to use the HAAR classifier for face detection. The classifier works by training a model using *positive face images* and *negative face images*. A positive image is an image that contains the desired object to be detected, in our case this object is a face. A negative image is an image that does not contain the desired object. Problem faced during this process was the large number of false-positives: objects mistakenly detected as faces. This was not such a big issue for us, since a false-positive does not result in a positive identification during the recognition phase. Because of this, we lowered the detection threshold, so all faces could be detected. After a face has been detected, the rectangle enclosing this face is cropped and processed later by the face recognition module. This rectangle represents a single face, and after being cropped as an image is transferred on server. Each file transferred is renamed to have a unique ID.

Face recognition:

Face detection is defined as the process of extracting faces from scenes. So the system positively identifies a certain image region as a face. This procedure has many applications like face tracking, pose estimation or compression.
The next step -feature extraction- involves obtaining relevant facial features from the data. These features could be certain face regions, variations, angles or measures, which can be human relevant (e.g. eyes spacing) or not. This

phase has other applications like facial feature tracking or emotion recognition.

Finally, the system does recognize the face. In an identification task, the system would report an identity from a database. This phase involves a comparison method, a classification algorithm and an accuracy measure. Recognizing a face means to identify that particular face from a list of faces on a database.

Whenever we successfully identify a face, a copy of that face is stored in the database of faces for that student. This way even if a student gradually changes his appearance (e.g., grows a beard) the system is still capable to identify him, since it has multiple images of the same person. On each consequent scan for a student, the recognition module starts comparing images from this database, sorted by date in descending order. This approach was chosen since the latest image of a student on our database is most likely to be more similar to the current captured image. Of course, a drastic change on a student's look causes the system to not identify that particular student. To solve this issue, we have included a module, which lists all unidentified faces and the teacher is able to manually connect a captured face with a student from the list. This image is also stored on our database, as an updated picture of this particular student. This manual recognition process is performed only once. In a subsequent scan, this student is identified automatically by our system.

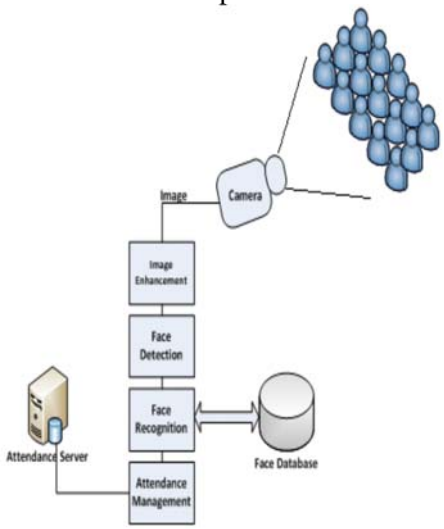
To speed up the face recognition process we only compare images captured in a classroom, with the database of students enrolled for that course only. This ensures that we process only a small subset of images available on our server.

Attendance management:

This module can be used to view the attendance status of the student. After the face detection and recognition method attendance is marked on the server. This system uses a protocol for attendance. A time table module is also attached with the system which automatically gets the subject, class, date and time. Teachers come in the class and just press a button to start the attendance process and the system automatically gets the attendance without even the intensions of students and teacher. In this way a lot of time is saved and this is highly securing process no one can mark the attendance of other. Attendance is maintained on the server so anyone can access it for it purposes like administration, parents and students themselves.

II. System description:

The system consists of a camera that captures the images of the classroom and sends it to the image enhancement module. After enhancement the image comes in the Face Detection and Recognition modules and then the attendance is marked on the database server. At the time of enrollment templates of face images of individual students are stored in with the face database. If any face is recognized the attendance is marked on the server from where anyone can access and use it for different purposes. This system uses a protocol for attendance. Camera takes the images continuously to detect and recognize all the students in the classroom. In order to avoid the false detection we are using the skin classification technique .



Experimental Setup

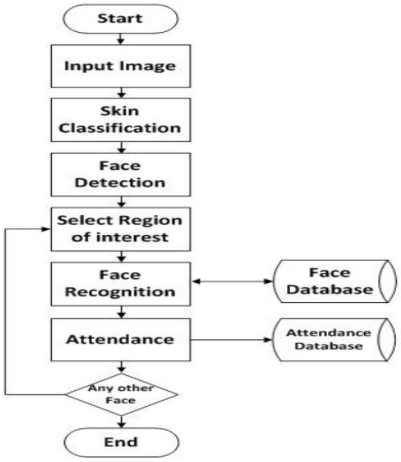
Using this technique enhance the efficiency and accuracy of the detection process. In this process first the skin is classified and then only skin pixels remains and all other pixels in the image are set to black, this greatly enhance the accuracy of face detection process. Two databases are displayed in the experimental setup . Face Database is the collection of face images and extracted features at the time of enrollment process and the second attendance

database contains the information about the teachers and students and also use to mark attendance.

III. System Algorithm:

This section describes the software algorithm for the system. The algorithm consists of the following steps

- Image acquisition
- Upgrade Contrast
- Skin classification
- Connected Region Analysis
- Face detection
- Face recognition
- Attendance



Data Flow Diagram

Image Acquisition:

Image is acquired from a high definition camera that is connected above the white board. This camera is connected to the computer. It captures images after every 2 minutes and sends these images to the computer for processing.

Input image

Upgrade Contrast:

In this stage we convert RGB image into binary image. For this process, we calculate the average value of RGB for each pixel and if the average value is below than 110, we replace it by black pixel and otherwise we replace it by white pixel. By this method, we get a binary image from RGB image.

Histogram normalization is good technique for contrast enhancement in the spatial domain.

Histogram Equalized Image

This can be easily seen that the students sitting on the back rows are now clearly seen and in this way they can be easily recognized

.

Noise Filtering:

Many sources of noise may exist in the input image when captured from the camera. There are many techniques for noise removal. In our system median filtering in is used for the purpose of noise removal in the histogram normalized image.

Skin classification:

This is used to increase the efficiency of the face detection Algorithm. As can be shown in the above Figure pixel those are closely related to the skin becomes white and all other are black. This binary image uses the threshold of skin colors.

Connected Region Analysis:

The image output by morphological processing still contains quite a few non-face regions. Most of these are hands, arms, regions of dress that match skin color and some portions of background.

In connected region analysis, image statistics from the training set are used to classify each connected region in the image.

Face Detection:

In this section faces are detected by marking circles on the faces of students. Haar classifiers have been used for detection. Initially face detection algorithm was tested on variety of images with different face positions and lighting

conditions and then algorithm was applied to detect faces in real time video.

Face Detection

After the detection of faces from the images next step is cropping of each detected face. The algorithm uses the technique of threading to enhance the speed of algorithm. Each cropped image is assigned to a separate thread for the recognition purposes.

Cropped Faces

Face Recognition and Attendance:

After the face detection step the next is face recognition. This can be achieved by cropping the first detected face from the image and compare it with the database. This is called the selection of region of interest. In this way faces of students are verified one by one with the face database using the Eigen Face method and attendance is marked on the server. Face Recognition techniques are used in our system.

The faces which are recognized will be marked as present and the other faces which are remaining will be marked as absent.

SMS option will be provided so that is student present or absent status will be sent. And Export to EXCEL sheet is provided to take the print out of attendance status.

IV. Conclusion:

This paper introduces the efficient and accurate method of attendance in the classroom environment that can replace the old manual methods. This method is secure enough, reliable and available for use. No need for specialized hardware for installing the system in the classroom. It can be constructed using a camera and computer. There is a need to use some algorithms that can recognize the faces in veil to improve the system performance.

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