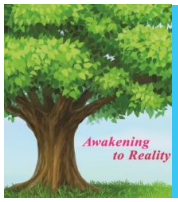

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Efficient Attendance Management Using Multiple Face Recognition

T.Tirupal, EVN Sai Praneeth, P.Srihari, K.Sai Kiran and Md Kaleel Pasha
Department of ECE, G.Pullaiah College of Engineering and Technology, Kurnool, India.

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ABSTRACT

Nowadays, classroom attendance of a student is a 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 waste time, waiting in a queue to detect their thumb, palm, face or iris in front of the scanning device. This paper describes the efficient algorithm that automatically marks attendance without any human intervention and waste of time. The algorithm works with images of multiple faces. Firstly, the images are captured by using a camera placed on the top of the blackboard. The captured images are processed for noise removal using a median filter. Then the faces are detected using the detection algorithm. Lastly, the detected face is recognized by comparing the faces in the database and the attendance is marked. A Graphical User Interface (GUI) is designed for calculating the percentage of the match of faces.

Introduction

In recent years, biometric-based techniques [1, 2, 3, 4] have emerged as the most promising option for recognizing individuals. These techniques examine an individual's physiological and behavioral characteristics to determine and ascertain their identity instead of authenticating people and granting them access to physical domains by using passwords, PINs, smart cards, plastic cards, tokens or keys. Passwords and PINs are hard to remember and can be stolen or guessed easily; cards, tokens, keys and the like can be misplaced, forgotten, purloined or duplicated; magnetic cards can become corrupted and unreadable. However, an individual's biological traits cannot be misplaced, forgotten, stolen or forged. Face recognition is one of the least intrusive and fastest biometrics compared with other techniques such as finger print [5, 6] and iris recognition. For example, in surveillance systems [7], instead of requiring people to place their hands on a reader (finger printing) or precisely position their eyes in front of a scanner (iris recognition), face recognition systems [8, 9] unobtrusively take pictures of people's faces as they enter a defined area. There is no intrusion or capture delay, and in most cases, the subjects are entirely unaware of the process. People do not necessarily feel under surveillance or their privacy being invaded.

Owing to its use in several applications, face recognition has received substantial attention from both research communities and the market, and there has been an emerging demand for robust face recognition algorithms that can deal with real-world facial images. A general statement of the automatic face recognition problem is simply formulated as follows: given still or video images of a scene, identify or verify one or more persons in the scene using a stored database of faces.

In other words, the face recognition system generally operates under one of two scenarios: verification (one-to-one) or identification (one-to-many), wherein the verification scenario, the similarity between two face images is measured and a determination of either match or non-match is made. Although, in the identification scenario, the similarity between a given face image (i.e. probe) and all the face images in a large database (i.e. gallery) is computed.

Literature Review

Maintaining attendance is very important in all the institutes for checking the performance of students. Every institute has its method in this regard. Some are taking attendance manually using the old paper 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 a long time in making a queue at the time they enter the classroom. Many biometric systems are available but the key authentication is the same is all the techniques. Every biometric system consists of the enrolment process in which unique features of a person are stored in the database and then there are processes of identification and verification. These two processes compare the biometric feature of a person with a 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. Several methods have been proposed for face detection i.e. AdaBoost algorithm, the Float Boost algorithm, Neural Networks [10], the S-AdaBoost algorithm, Support Vector Machines (SVM) [11], and the Bayes.

Existing Methods for Face Detection [12]

During the last decade, several promising face detection algorithms have been developed and published. Among these three stands out because they are often referred to when performance figures etc. are compared. This section briefly presents the outline and main points of each of these algorithms.

Tele: +919491236447
E-mail address: tirutalari@gmail.com

1. Robust Real-Time Object Detection: By Paul Viola and Michael J. Jones [8, 12]. This seems to be the first article where Viola-Jones presents the coherent set of ideas that constitute the fundamentals of their face detection algorithm. This algorithm only finds frontal upright faces but is in 2003 presented in a variant that also detects profile and rotated views.

2. Neural Network-Based Face Detection: An image pyramid is calculated to detect faces at multiple scales. A fixed-size sub-window is moved through each image in the pyramid. The content of a sub- window is corrected for non-uniform lightning and subjected to histogram equalization. The processed content is fed to several parallel neural networks [10] that carry out the actual face detection. The outputs are combined using logical AND, thus reducing the number of false detections. In its first form this algorithm also only detects frontal upright faces.

3. A Statistical method for 3d Object Detection [11] applied to Faces and Cars: The basic mechanics of this algorithm is also to calculate an image pyramid and scan a fixed size sub-window through each layer of this pyramid. The content of the sub- window is subjected to a wavelet analysis [12, 13, 14, 15, 16, 17, 18, 19, 20] and histograms are made for the different wavelet coefficients. These coefficients are fed to differently train parallel detectors that are sensitive to various orientations of the object. The orientation of the object is determined by the detector that yields the highest output. Opposed to the basic Viola-Jones algorithm and the algorithm presented by Rowley et al. this algorithm also detects profile views.

Existing Methods for Recognition [21, 22]

1. Introduction to Biometrics: Biometrics is an automated method of identifying a person or verifying the identity of a person based on a physiological or behavioral characteristic. Examples of physiological characteristics include hand or finger images, facial characteristics. Biometric authentication requires comparing a registered or enrolled biometric sample (biometric template or identifier) against a newly captured biometric sample (for example, captured image during a login). During Enrollment, as shown in the picture below, a sample of the biometric trait is captured, processed by a computer, and store for later comparison.

2. Biometric Authentication Technology:

Biometric recognition can be used in Identification mode, where the biometric system identifies a person [23] from the entire enrolled population by searching a database for a match based solely on the biometric. Sometimes identification is called "one-to-many" matching. A system can also be used in Verification mode, where the biometric system [24, 25, 26] authenticates a person's claimed identity from their previously enrolled pattern. This is also called "one-to-one" matching. In most computer access or network access environments, verification mode would be used.

3. Types of Biometrics: There are various types of biometric techniques [27] that we observe in our daily life. Some of them are shown below

Face Recognition

The identification of a person by their facial image can be done in many different ways such as by capturing an image of the face in the visible spectrum using an inexpensive camera or by using the infrared patterns of facial heat emission. Facial recognition [28, 29, 30, 31] in visible light typically model key features from the central portion of a facial image. Using a wide assortment of cameras, the visible light systems extract features from the captured images that do not change over time while avoiding superficial features such as facial expressions or hair. Several approaches to modeling facial images in the visible spectrum are Principal Component Analysis, Local Feature Analysis, neural networks, elastic graph theory, and multi-resolution analysis.

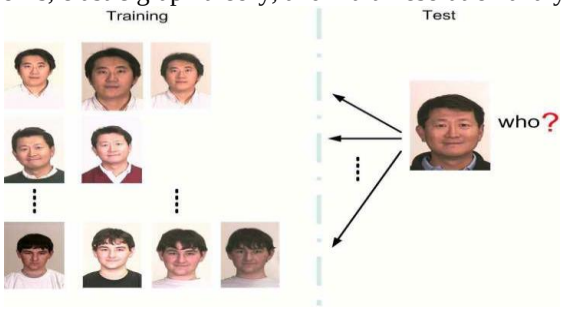


Figure 1. Face Recognition

Fingerprint Recognition

Fingerprints are unique for each finger of a person including identical twins. One of the most commercially available biometric technologies, fingerprint recognition devices for desktop and laptop access are now widely available from many different vendors at a low cost. With these devices, users no longer need to type passwords – instead, only a touch provides instant access. Fingerprint systems can also be used in identification mode. Several states check fingerprints for new applicants to social services benefits to ensure recipients do not fraudulently obtain benefits under fake names.

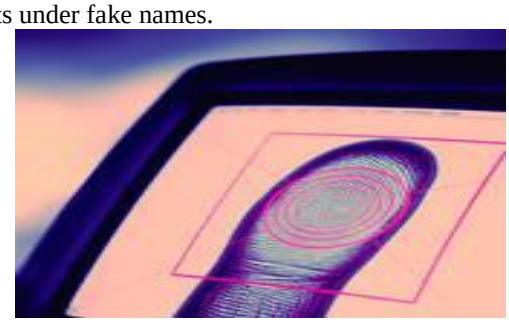


Figure 2. Fingerprint Recognition

Palm Recognition

Palm print recognition is a biometric authentication method based on the unique patterns of various characteristics in the palms of people's hands. Palm prints and fingerprints are often used together to enhance the accuracy of identification.

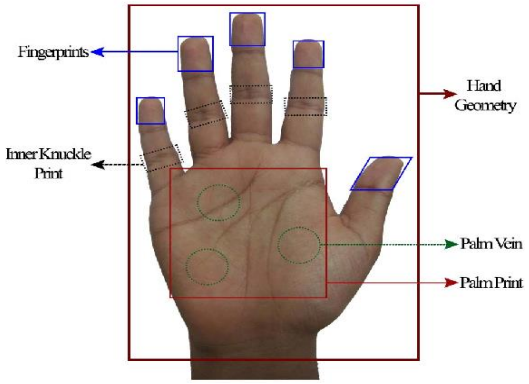


Figure 3. Palm Recognition

Gait Recognition

The Machine Visions approach to gait recognition entails the acquisition of gait signals using one or more video-cameras from a distance. Therefore, it requires an ambient

set-up. As a first common step, systems in this category use techniques for video and image processing to detect the user's image in a scene, to track the user's walk, and to extract gait features for user recognition.

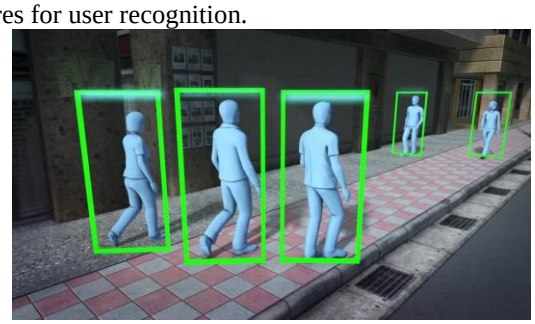


Figure 4. Gait Recognition

Voice Recognition

Voice recognition is "the technology by which sounds, words or phrases spoken by humans are converted into electrical signals, and these signals are transformed into coding patterns to which meaning has been assigned". While the concept could more generally be called "sound recognition", we focus here on the human voice because we most often and most naturally use our voices to communicate our ideas to others in our immediate surroundings. The difficulty in using voice as an input to a computer simulation lies in the fundamental differences between human speech and the more traditional forms of computer input. While computer programs are commonly designed to produce a precise and well-defined response upon receiving the proper (and equally precise) input, the human voice and spoken words are anything but precise. Each human voice is different, and identical words can have different meanings if spoken with different inflections or in different contexts.

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.

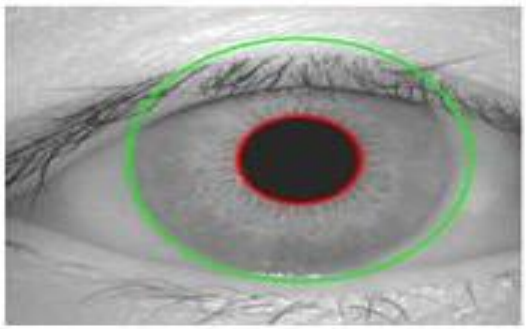


Figure 5. Iris Recognition

DNA Recognition

Deoxyribonucleic acid (DNA) is the genetic material found in most organisms, including humans. DNA serves as a genetic code that is unique to every organism, no two being exactly alike; only identical twins are an exact DNA match. In the case of human beings, there are about 3 million bases, 99% of which are the same from person to person. The variations found in the final 1% are how DNA becomes unique to each individual. The final 1% also serves as the foundation for DNA biometrics, being the location of the unique traits by which DNA recognition can identify or verify the identification of a person.

The cells that contain DNA share genetic material (information) through chromosomes. Humans have 23 chromosomes that house a person's DNA and their genes. Of the 46 total chromosomes, 23 come from each parent of an offspring. 99.7% of an offspring's DNA is shared with their parents. The remaining .3% of an individual's DNA is variable repetitive coding unique to an individual. This repetitive coding is the basis of DNA biometrics. DNA recognition uses genetic profiling, also called genetic fingerprinting, to isolate and identify these repetitive DNA regions that are unique to each individual to either identify or verify a person's identity.

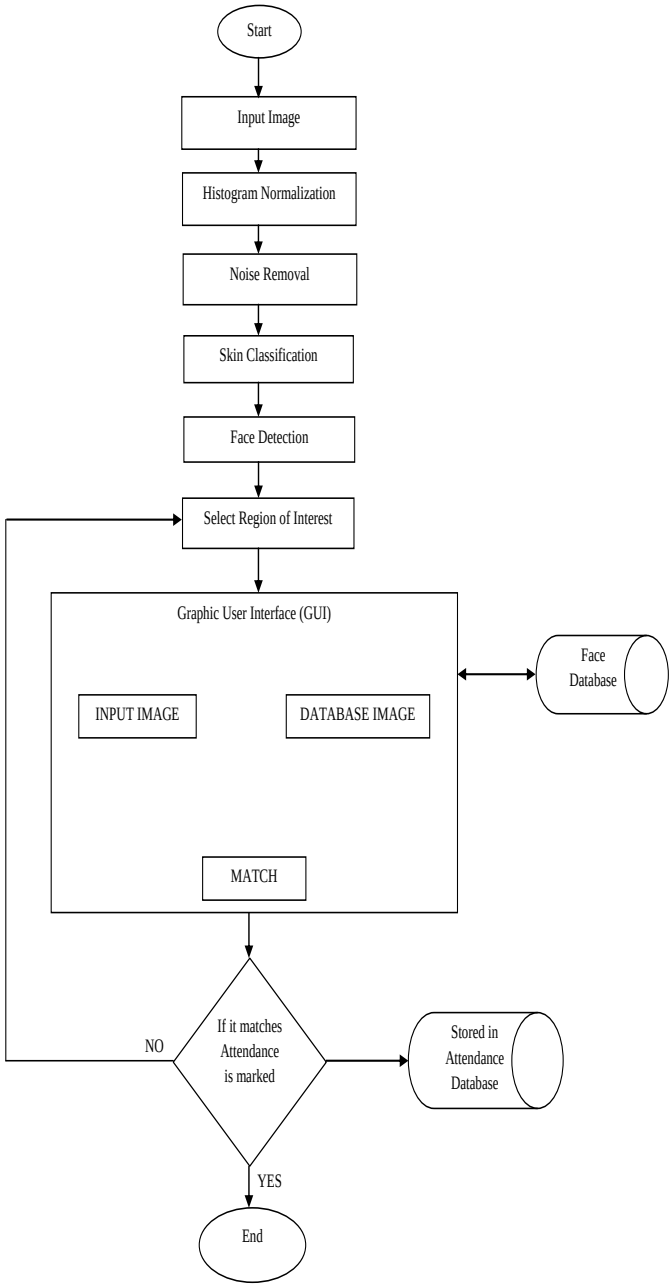


Figure 6. Schematic diagram of the proposed method

Proposed Method

Attendance Management System is software developed for daily student attendance in schools, colleges, and

institutes. If facilitates to access the attendance information of a particular student in a particular class.

The information is sorted by the operators, which will be provided by the teacher for a particular class. This system will also help in evaluating the attendance eligibility criteria of a student. The proposed method for effective attendance management using multiple face recognition is shown in figure 6 and its explanation is given below. For each step, an independent image is acquired that is shown in figure 7.

Image Acquisition

Image is acquired from a high definition camera that is connected above the blackboard.

Histogram Normalization

The captured images sometimes have brightness or darkness in it which should be removed for good results. First, the RGB image is converted to the grayscale image for enhancement.

Noise Filtering

Many sources of noise may exist in the input image when captured from the camera. There are many techniques for noise removal. Low pass filtering in the frequency domain may be a good choice but this also removes some important information in the image. In our system median filtering is used for noise removal in the histogram normalized image.

Skin Classification

This is used to increase the efficiency of the face detection algorithm. Voila and Jones is used for detection and its accuracy can be increased if the skin is classified before the scanning procedure of faces.

Face Detection

In this section, faces are detected and shown in figure 7 by marking circles on the faces of students.

Region of Interest:

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 image. This is called the selection of a region of interest. In this way faces of students are verified one by one with the face database using the Eigen Face method.

Graphical User Interface (GUI)

In this proposed method, we use the Graphical User Interface (GUI) for accurate verification of detected faces. Here, the detected face images are compared with database images and matched for recognition. If both the faces are matched then attendance is marked to that detected face otherwise it selects other image and the process is repeated.

Experimental Results

Figure 8 represents the Graphic User Interface for recognition of captured images with matched and unmatched tabs. If the input image is matched with the already existing image in the database then the image is said to be recognized and attendance will be given to that particular face. If the image is not matched with the database image then it is displayed as unmatched and attendance will not be given to that face image.

Conclusion

This paper presents an efficient and accurate method of attendance management in the classroom environment that can replace the old manual methods. This method is secure enough, reliable and available for use. There is a need to use some algorithms that can recognize the faces in a veil to improve the system performance. This proposed algorithm works with images of multiple faces. The paper is described in the following steps: Firstly, the images are captured by using a camera placed on the top of the blackboard. The captured images are processed for noise removal using a median filter. Then the faces are detected using the detection algorithm. Lastly, the detected face is recognized by comparing the faces in the database and the attendance is marked. A Graphical User Interface (GUI) is designed for calculating the percentage of the match of faces.

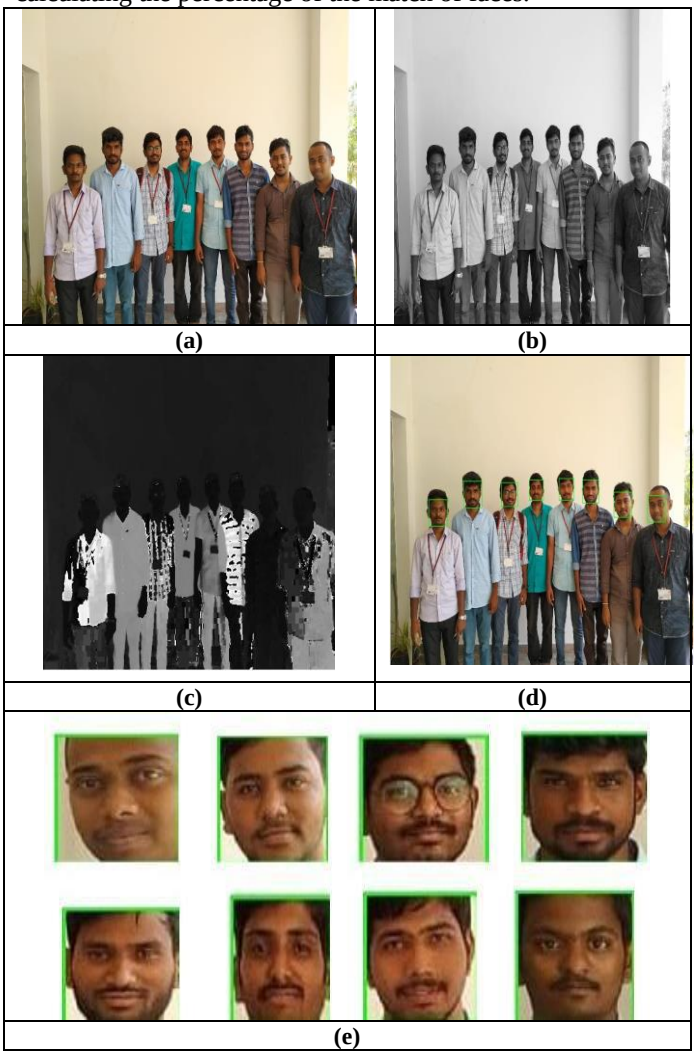
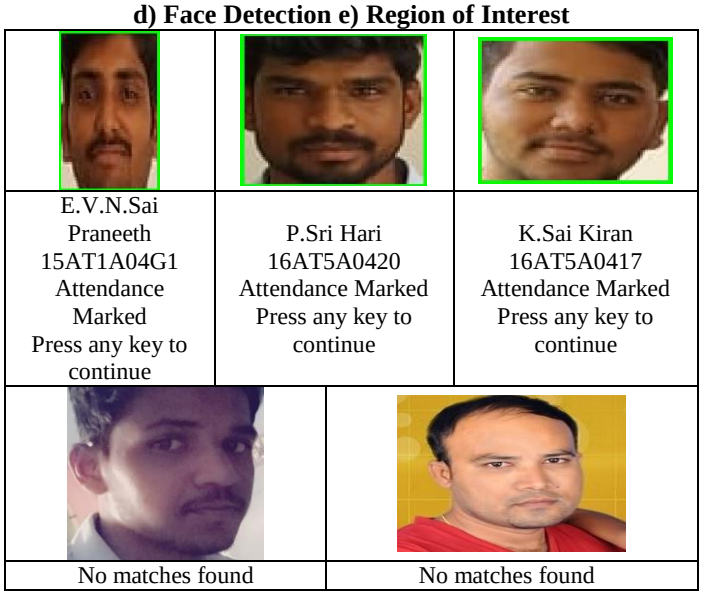


Figure 6. Output images for the steps in proposed method a) Input Image b) Gray-scale Image c) Skin Classification d) Face Detection e) Region of Interest



Press any key to continue	Press any key to continue

Figure 7. Different images stored in database.

(a) (b)

Figure 8. Graphic User Interface for recognition of captured images a) Matched Recognition b) Unmatched Recognition.

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