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Facial Recognition-Based Classroom Attendance System

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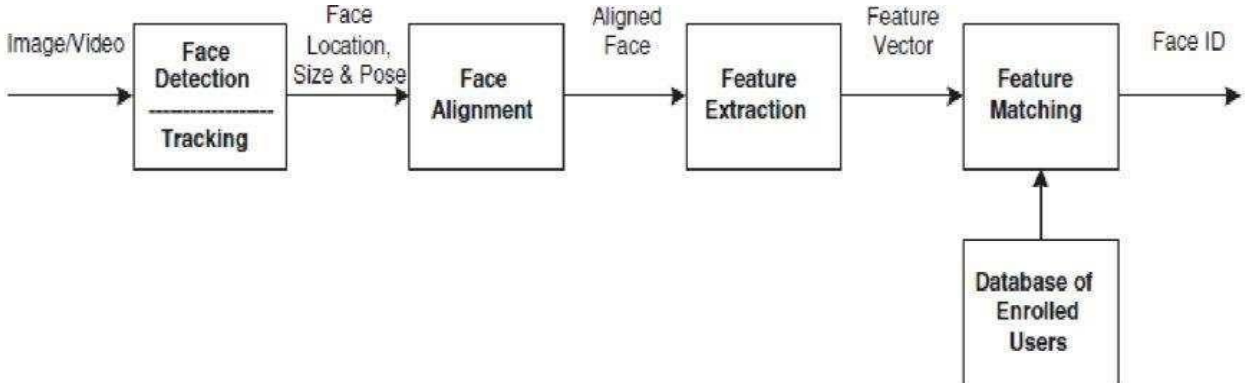
Abstract **–**A person's face is their unique identifier. Since the development of image processing techniques, there has been a lot of innovation in methods to use this physical feature for various purposes. The main goal of a face recognition system is to accurately recognize a person so that they can be further processed. While traditional face recognition systems use input to identify a face, the results aren't always as accurate and precise as desired. In this paper, we describe a system that aims to break away from this trend and introduce a new approach to using face recognition—specifically, the generation of a 3D facial model—to accurately identify students. The system is designed to function as an automated attendance system in a classroom setting.

Keywords- Image Processing; Face Recognition; Pattern Recognition; Identification.

I. INTRODUCTION

The relevance of using pattern recognition technology across big enterprises is growing as the field continues to make tremendous strides and find applications in other domains, such as signature and face recognition. This is mostly due to the fact that these apps facilitate decision-making by upper-level management, which in turn boosts the efficiency and productivity of the business. However, a reliable and quick system for keeping track of employee performance is essential for any firm that wants to succeed.

Fig 1: Face recognition processing flow



Many identification systems used to evaluate employees' performance in the workplace may soon include biometric recognition as an essential component. The promise of biometric technology to ensure automated human recognition has not been fulfilled, despite their widespread use.
Biometric recognition methods include face recognition. The high level of interest in it over the last few years is largely attributable to the fact that it is among the most effective uses of image analysis and processing. Conferences like the International Conference on Automatic Face and Gesture Recognition (AFGR) and the International Conference on Audio and Video-Based Person Authentication (AVBPA) have emerged specifically to address facial recognition research, demonstrating this focus.
Similar to other biometric identification methods, face-base biometric systems use detection, alignment, feature extraction, and matching to complete the facial recognition process.
You may think of face recognition as having two primary phases: the pre-detection processing that involves localization and normalization to locate and align faces, and the post-detection recognition phase that involves feature extraction and matching.

A. Face Detection

This process separates the facial area from the rest of the background image. In the case of video streams, faces can be tracked using a face tracking component.

B. Face Alignment

This process focus on finding the best localization and normalization of the face; where the detection step roughly estimates the position of the face, this step outlines the facial components, such as face outline, eyes, nose, ears and mouth. Afterwards normalization with respect to geometrical transforms such as size and pose, in addition to photometrical properties such as illumination and grey scale take place.

C. Feature Extraction

After the previous two steps, feature extraction is performed resulting in effective information that is useful for distinguishing between faces of different persons and stable with respect to the geometrical and photometrical variations.

D. Face Matching

The extracted features are compared to those stored in the database, and decisions are made according to the sufficient confidence in the match score.

Automatic face recognition techniques have been utilized in many applications over the past years.

- Human-Computer Interaction:
  Video Gaming, virtual reality training programs, proactive computing.
- Smart Cards and Face ID:
  user authentication- stored value security, drivers' license, national ID, passports, voters' registration.
- Security :
  TV Parental control, Device logon, application security, database security, file encryption, secure trading terminals, medical records, internet and intranet security, terrorist alert.
- Law and video surveillance:
  Crime stopping and suspect alert, suspect tracking and investigation, suspect background check, post event analysis, shoplifter recognition.
- Others:
  time attendance and monitoring.

The incorporation of biometric recognition into various identification systems used for performance evaluations by workers in the workplace is imminent. Although biometric technologies have been widely used, its promise of ensuring automatic human recognition has not been delivered. One kind of biometric identification is facial recognition. Its prominence as one of the most efficient applications of image processing and analysis explains in large part the surge in interest in it in recent years. Expos like AVBPA and AFGR—the International Conference on Audio and Video-Based Person Authentication—have arisen to discuss face recognition research in particular, indicating this concentration.
The four steps of face-base biometric systems—detection, alignment, feature extraction, and matching—are similar to those of other biometric identification approaches.

Before detecting a face, there is pre-detection processing that uses normalization and localization to find and align faces; after detection, there is recognition, which uses feature extraction and matching. This is one way of looking at face recognition.

PROBLEM DEFINITION

The instructor or TA always stops what they're doing to take attendance before a class, lab, or section begins. This is a laborious procedure that demands a great deal of energy and time, particularly when dealing with a large class size. Additionally, it creates a great deal of chaos and disruption during test times. While being handed from one student to another or from one member of the teaching staff to another, the attendance sheet is also vulnerable to loss or damage.

Plus, it's not fair for students since when there are a lot of people registered in a class, the professors usually just choose a few names at random to give out grades. Lastly, the staff uses these attendance data to track the students' attendance rates. Dealing with the records of a big number of students often results in human mistake, even if this procedure might be simple and successful with a small number of students.

PROPOSED SYSTEM

We proposes solutions to all the above mentioned problems by providing an automated attendance system for all the students that attend a certain lecture, section, laboratory or exam at its specific time, thus saving time, effort and reducing distractions and disturbance. Another advantage concerning exams, is when the lecturer or the advisor accidentally losses an exam paper or the student lies about attending the exam, there will be a record of the students' attendance for the exam at that time, thus protecting both lecturer's and students' rights. In addition, an automated performance evaluation would provide more accurate and reliable results avoiding human error.

The main objective of the system is to provide an automated attendance system that is practical, reliable and eliminates disturbance and time loss in traditional attendance systems. A further objective is to present a system that can accurately evaluate students' performances depending on their recorded attendance rate.

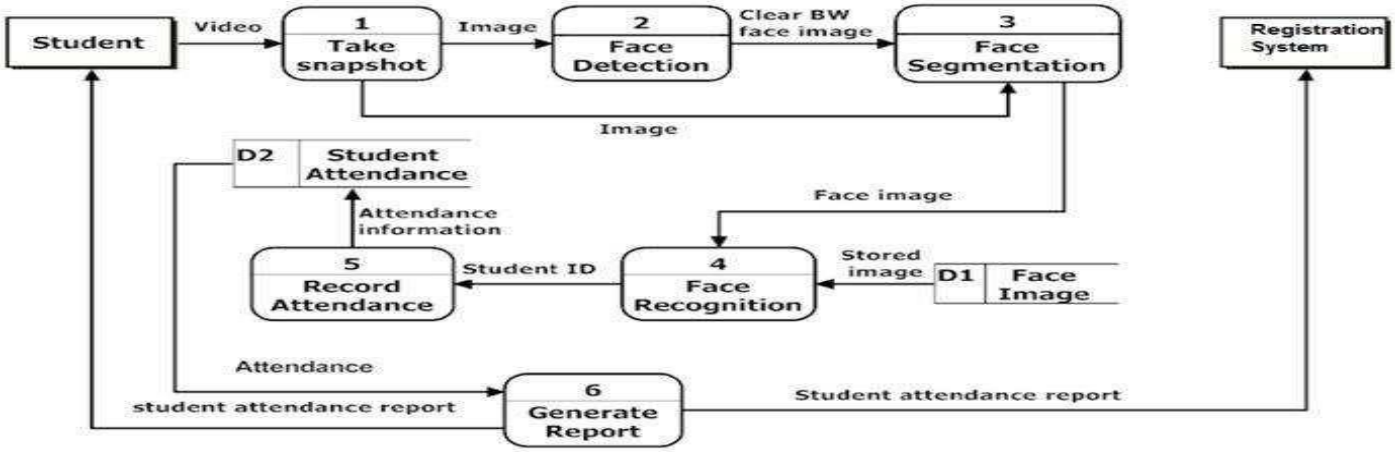


Fig 2: Steps for Automated Facial Recognition Attendance System

II. SYSTEM REQUIREMENTS

Analyzing user requirements and needs is a vital task in any system development process. End users must be the main concern of the system designer in order to produce a valid, useful and user-satisfying system. This section examines and analyzes the requirements and needs of the possible different system end users.

A. Student requirements

The student needs to keep track of his attendance. This would require him to login using his ID and password to the system. The system will accept him if his ID and password are the same as the ones saved in the database and a page will appear according to the student's privileges which are viewing his progress, course and result.

B. Teaching Staff Requirement

The teaching staff needs an efficient and reliable automated system for recording the student's attendance during lectures, sections, labs and exams. This system should be able to calculate and process the performance of students according to their attendance rates.

The teaching staff needs to keep track of their courses and the students' attendance in these courses. This would require them to inserts their ID and password to the system then the system will accept them if the ID and password entered are the same as the ones saved in the database and a page will appear according to their privileges which are viewing their student's progress, course and attendance reports.

If the information entered does not match the ones in the database an error page will appear and they will be asked to enter the ID and password again.

On the event of forgetting the password the system will display a message asking them to go to the administration department to acquire a new password or receive it on his personal email.

C. Administrator requirements

The administrator should be able to enter the all the users' (students, lecturer and teaching assistants) information and creates IDs and passwords for them to access the system. Assigns lecturers and teaching assistance to the courses when adding new lecturers to the system.

Responsible to provide a new password on the event of the users forgetting their login details. Adding new courses ever y semester for the students to register to.

III. IMPLEMENTATION

We have taken different techniques like color based detection and Principle Component Analysis (PCA) for face detection and for feature extraction, PCA and Linear Discriminate Analysis (LDA). For detection, Color based technique was implemented, which depends on the detection of the human skin color with all its different variations in the image. The skin area of the image is then segmented and passed to the recognition process. For recognition, PCA technique has been implemented which is a statistical approach that deals with pure mathematical matrixes not image processing like the color based technique used for detection. PCA can also be used for detection.

IV. CONCLUSION

The system allows the instructor or TA to track each student's presence in class, whether it's a whole class, a specific portion, or a lab. In a lecture with a large number of students, this is really helpful since it saves time and effort. Every part of the system is coded in MATLAB. Using face recognition methods, this attendance system takes students' actual presence in class; later on, this data might be useful for handling concerns pertaining to tests.

REFERENCES

[1] In the proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, M. A. Turk and A. P. Pentland published an article titled "Face Recognition Using Eigenfaces" (pp. 586-591). [2] In the 1991 edition of the Handbook of Combinatorial Optimization, edited by Du Z and Pardalos P, R.E. Burkard and E. C¸ ela provide an introduction to linear assignment problems and extensions. Pages 75–149, published 1999 by Kluwer Academic Publishers, Dordreck. Using kernel eigenfaces for face recognition was discussed in a paper by M. H. Yang, N. Ahuja, and D. Kriegmao published at the 2000 IEEE International Conference on Image Processing (Volume 1, pages 10–13). In their 2002 paper "Face recognition using kemel principal component analysis and genetic algorithms," Zhang and Liu presented their work at the IEEE Workshop on Neural Networks for Signal Processing. The paper was published on pages 4–6 on September 4th.
(5) "Face recognition: A literature survey" by W. Zhao, R. Chellappa, P. J. Phillips, and A. Rosenfeld was published in 2003 in the ACM Computing Surveys, volume 35, issue 4, pages 399-458. Source: "3D Facial Recognition: A Quantitative Analysis" presented at the 38th Annual 2004 International Carnahan Conference on Security Technology by T. D. Russ, M. W. Koch, and C. Q. Little in 2004. "Effective Teaching for Large Classes with Rental PCs by Web System WTS," in Proc. [7] K. Cheng, L. Xiang, T. Hirota and K. Ushijima. "Face Recognition by Humans: Nineteen Results All Computer Vision Researchers Should Know About," in Proceedings of the IEEE, vol. 94, Issue 11, 2006, by P. Sinha, B. Balas, Y. Ostrovsky, and R. Russell, 1D-d3 data engineering workshop, 2005.
Kao, Y.-W., Gu, H.-Z., and Yuan, S.-M. [9] Proceedings of the 2008 Fourth International Conference on Networked Computing and Advanced Information Management, "Personal based authentication by face recognition," pages 81–85. Digital Image Processing, by Rafael.C. Gonzalez, published by Pearson Publications, [10]