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Face Recognition Based Automated Student Attendance System using Deep Learning

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ABSTRACT

Maintaining the attendance record is a daunting activity with day to day events. The conventional method of calling each student's name is time-consuming and there's always a chance of being a proxy. The following method is focused on face recognition to hold the student's attendance record. Students' regular attendance is reported as being topic wise that is already stored by the administrator. The system automatically starts taking snaps as the time for the corresponding subject arrives and then applies face detection and recognition technique to the given image and the recognized students are marked as present and their attendance update with the appropriate time and subject Id. We used profound learning techniques to build this program, the histogram of directed gradient method is used to detect faces in images, and the method of deep learning is used to compute and compare students' facial features to identify them. Our program is capable of actually recognizing multiple images.

Key words: Attendance, Face Recognition, Deep Learning, Student

1. INTRODUCTION

Face recognition is crucial to identifying family, friends or someone we are familiar with in everyday life. We may not consider that indeed multiple steps have been taken to recognize human faces. Human intelligence enables us to receive information and to interpret the information in the process of recognition. We obtain information in the form of light through the image that is projected through our eyes, specifically through retina. Light is a type of electromagnetic waves that radiate to an object from a source and are projected to human vision. Robinson, G. & Robinson-Riegler, B. [1] stated that after the visual processing of the human visual system, the shape, size, contour and texture of the object are in fact classified to analyze the information. The analyzed information will be compared with other object or face representations that exist to be recognized in our memory. In reality, designing an automated system is a difficult challenge in having the same capacity as a human being to recognize faces. However, in order to identify different faces, we need broad memory, for example, in the universities, there are a lot of students of different races and genders, without making mistakes, it is difficult to remember every single face. Computers with almost unlimited memory, fast processing speed, and control are used in face-recognition systems to solve human limitations.

The human face is a unique portrayal of an individual identity. Face recognition is thus defined as a biometric method in which an individual is identified by comparing the real-time capture image with the images stored in that person's database [2].

Because of its simplicity and awesome results, face recognition system is prevalent nowadays. For example, airport security systems and FBI use face recognition to track offenders, missing children and drug activity for criminal investigations [3]. In addition, Facebook, a common website for social networking, introduces face recognition to allow users to tag their friends for entertainment purposes in the picture [4]. Additionally, Intel Company allows users to access their online account using face recognition. Apple allows users to use face recognition to unlock their mobile phone, iPhone X [5].

In 1960 the work on face recognition started. Woody Bledsoe, Helen Chan Wolf, and Charles Bisson had introduced a system requiring the administrator to locate images of eyes, ears, nose, and mouth. It then measures and compares the distance and the ratios between the identified features and the standard reference points. In 1970, Goldstein, Harmon, and Lesk further enhanced the studies by using other features such as hair color and lip thickness to automate identification.

Kirby and Sirovich first suggested Principle Component Analysis (PCA) in 1988 for solving the problem of face recognition. Many face recognition studies were then continuously conducted to the present day [6].

The aim of this paper is to develop automated student attendance system based on face-recognition. Expected achievements to meet the aims are:

1. To detect the segment of faces from the video frame.
2. To extract the useful features from the detected face.
3. Classify the features to recognize the detected face.
4. To record the student Identified attendance.

2. RELATED WORK

The drawbacks of the RFID (Radio Frequency Identification) card system, fingerprint system, and iris recognition system were stated by Arun Katara et al. [7]. Because of its simplicity RFID card program is introduced. The user, however, tends to help his friends check in as long as they have an ID card from their friend. The fingerprint system is indeed effective but not efficient as it takes time for the verification process so that the user has to align and perform one by one the verification. The human face is still subjected to facial recognition and contains less details compared to iris. Iris recognition system that contains more details could invade user privacy. There is voice recognition available but it is less accurate than other methods. Thus, it is suggested that the face recognition system be implemented in the student attendance system.

There are a few face-detection methods worked on by previous researchers. Most of them, however, used frontal upright facial images that consist of one face only. The face region is fully exposed and free from the spectacles, without obstacles.

P. Akshara Jadhav et al. and Arun Mozhi Devan et al. [8,9] suggested a Viola-Jones Face Detection algorithm for the student attendance system. They concluded that the Viola-Jones algorithm is not only fast and robust from methods such as face-geometry-based methods, feature invariant methods, and machine-based learning methods, but also provides high detection rates and better performance in different lighting conditions. Rahul V. Patil, with S. B. Bangar [10] also accepted that in various lighting conditions, the Viola-Jones algorithm provides better efficiency. In addition, they stated in Mrunmayee Shirodkar et al. 's paper [11] that the Viola-Jones algorithm is capable of eliminating illumination issues, as well as scaling and rotation. Furthermore, Naveed Khan Balcoh [12] suggested that the Viola-Jones algorithm would be the most effective of all algorithms, such as the AdaBoost algorithm, the FloatBoost algorithm, Neural Networks, the S-AdaBoost algorithm, Support Vector Machines (SVM) and the Bayes classification.

In addition to the Viola-Jones algorithm, Varsha Gupta and Dipesh Sharma [13] studied Local Binary Pattern (LBP), Adaboost algorithm, Local Successive Mean Quantization Transform (SMQT) Functions, Sparse Winnows Network (SNOW) Classifier System and Face Detection Methods for Neural Network. They concluded that of all the methods, the Viola-Jones algorithm has the highest speed and the highest precision. Other methods, for example, Local Binary Pattern and SMQT features have simple computation and are able to handle illumination problems, their overall performance is weaker than the Viola-Jones face detection algorithms.

Facial recognition has several drawbacks such as image quality, size, angle facing and processing part. At first, the image quality fundamentally affects the work of facial recognition algorithms. Compared with the digital camera, the quality of the image in video scanning is deficient. The quality of the images has affected the whole process of facial detection. The purpose of face recognition for storage and processing has significant difficulties. The angle face is selected to recognize the person's real image [14]. There have been many forms of angles being used up to get a suitable face using recognition software and this will create a massive problem in the face detection process. In essence, they used photos of the 2D facial type format. Because of this format, the facial recognition currently cannot detect the multiple faces. The person's motion took inaccurate images, and it will cause a problem in the system of facial recognition. The updated software is needed for more accuracy which is very expensive on the market. Sometimes the images become hazy, and the detection process will create a problem. The angle influences within the camera also affect the facial recognition technology process.

Problem Definition:

Computer vision recognition of faces is a challenging problem. The illumination problem [15], the pose problem, variability in scale, low-quality image acquisition, partially occluded faces are some examples of the problems to be addressed. Thus, algorithms for face recognition must exhibit robustness to variations in the parameters above. In cases of different illumination, background or rotation, the existing techniques don't perform well. Thus, the aforementioned disadvantages need to be addressed. The paper aims to design and implement a system that is less Illumination sensitive, invariant in rotation, invariant in scale and robust enough to be implemented in practical applications.

3. PROPOSED METHOD

The attendance system based on face detection algorithm and face recognition algorithm includes following modules as shown in figure 1. The training model is represented in figure 2.

1) Record a video to ensure that every student is appeared in the video.
2) Separate a frame per minute for class attendance.
3) Apply deep learning algorithm CNN for face detection module. Detect all students' faces and output coordinates.

4) Apply deep learning face recognition algorithm for face recognition.
5) Automatic attendance analysis module. The seats of students are fixed so do not contrast their faces' coordinate and determine the identity of each student to achieve automatic attendance.

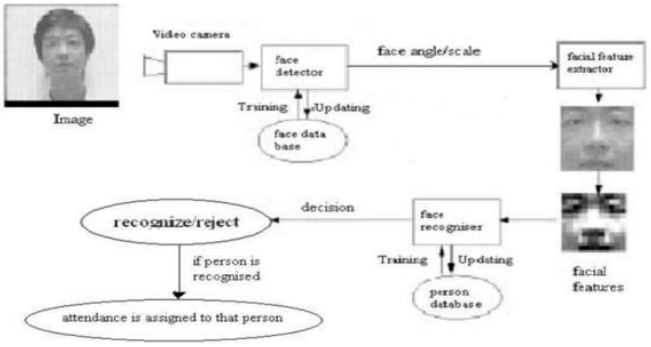

Figure 1: Proposed Method

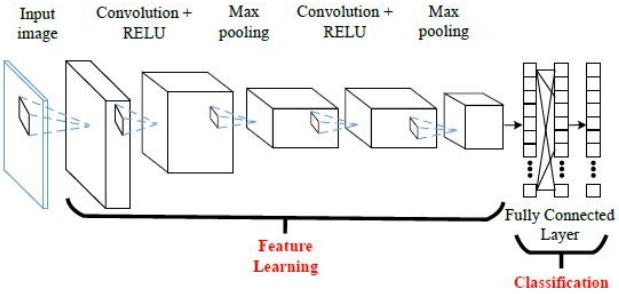

Figure 2: Training Model

4. METHODOLOGY

System design to meet the requirements, some of the interfaces, components, architecture, and database. There are some applications of system design. Users can divide the proposed automated attendance system into few modules.

Image capture:

After capturing the image, the camera will capture the students' image at the top, the next step being to detect the picture that goes to face detection.

Face Detection:

The face detection algorithm will improve facial recognition efficiency. There are some of the algorithms proposed as facial geometry-based performances for face detection. We observed that the algorithm gives better output under different conditions for combining the multiple classifiers for better detection rate. The picture can be observed to an angle of up to 30 degrees.

Database Development:

Enrolment based on biometric system can be chosen in each individual requirement. In this phase we consider the capture as individual features of the image to the way the person is. After identifying we remove the face and store the functions in the database represented in figure 3 and 4.

	A	B	C	D
	Enrollment ID	Name	Date	Time
	60101	Sugandhi	05-11-2019	09:05:45
	41053	Karthik	05-11-2019	09:09:36
	40240	Vijay	05-11-2019	09:10:53
	40677	Bhanu	05-11-2019	09:12:42
	40997	Phani	05-11-2019	09:14:45

Figure 3: Data stored in Excel Sheet

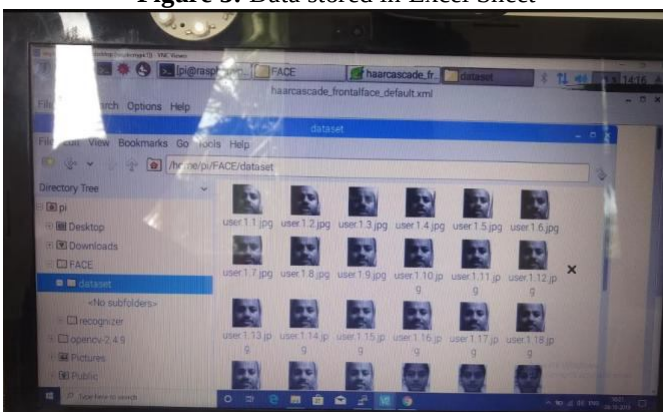

Figure 4: Photos stored in System

Proposed Algorithm:

1. The person's image will be captured.
2. Apply detection algorithms for detecting the face.
3. Face recognition is going to be recognized.
4. Apply pre-processing image.
5. If enrollment phase
   Then store in database
   Else
   Apply feature extraction
   Apply for classification
   End if
6. Post-processing.

5. RESULTS

To order to show the student attendance data, the website of the student attendance system (SAS) was configured to update the student attendance sheet when the student arrives at the college. The student attendance program has an authentication scheme for students who lecturers and can verify their recorded attendance from a cell phone or personal computer. The obtained results are represented in figure 5 and 6.

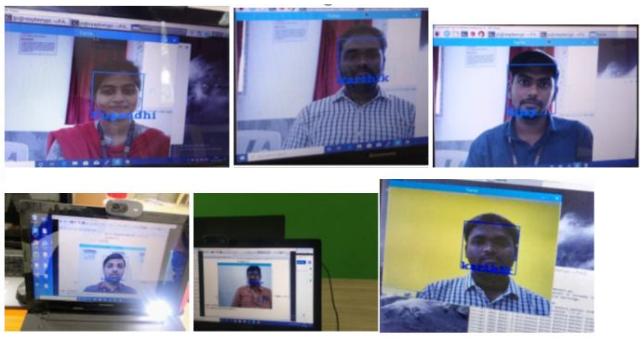

Figure 5: Photos captured during a class

Attendance

Total 11 items.

#	Coursecode	Coursedesc	Ltps	Section	Year	Semester	Fr Date	Total Conducted	Total Attended	Total Absent	Tcbr	Percer
1	15EC4110	Digital Image Processing	L	S-7-MA	2019-2020	Odd Sem	N	29	28	1	0	97%
2	15EC4110	Digital Image Processing	T	S-7-B	2019-2020	Odd Sem	N	22	22	0	0	100%
3	15EC4110	Digital Image Processing	P	S-7-B	2019-2020	Odd Sem	N	28	24	4	0	86%
4	15EC3058	Video Survillance	L	S-2-MA	2019-2020	Odd Sem	N	40	38	2	0	95%
5	15EC4064	Knowledge Based Systems	L	S-1-MA	2019-2020	Odd Sem	N	39	33	5	1	85%

Activate Windows

Figure 6: Studance Attendane in database

6. FUTURE ENHANCEMENTS

Today, security is one of the most-used fields of facial recognition. Facial recognition is a very useful tool that can help law enforcers identify offenders, and software providers are using the technology to help people access their apps. This technology can be further evolved to be used in ways other than ATMs, access to confidential data or other sensitive content. This can make other security measures such as passwords and keys redundant. The current paper can be modified using raspberry pi via an Infrared camera interface that can be used in the Smart Surveillance Security Monitoring System Whichever kind of public security uses live body monitoring or spying, it can also be used with school attendance applications using Raspberry Pi or Arduino UNO platform interfaces like biometric scanner switching, finger t Scientific studies are now under way to allow images to be processed on the GPU of the Raspberry Pi, resulting in better results using specific libraries.

7. CONCLUSION

Twenty faces were detected and recognized in this advanced system; the student attendance was taken hour wise and semester wise percentage of each student was stored in university database and informed to parents and department HOD respectively. The goal of this research paper is to establish a digital attendance system that can generate more accurate results than the manual attendance sheet for use in educational institutions. The machine as hardware is based on Raspberry Pi. The program is designed using both the Python face-recognition system and the SQL attendance management system database. Additionally, a model door is created using servo motor that would open the door to pass the recognized student whenever the recognition succeeds. The attendance will be recorded in MySQL Server, and the data will be accessed from any internet-connected computer web browser. Each lecturer / student had to log in to the SAS website to access his / her attendance sheets. The compact hardware design is critical because the whole device has to be mounted on an electrical door in the classroom with the camera.

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