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Face Recognition Based Automated Attendance Management System

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ABSTRACT

At the beginning and end of each session, attendance is an important aspect of the daily classroom evaluation. When using traditional methods such as calling out roll calls or taking a student's signature, managing attendance can be a time-consuming task. The teacher normally checks it, although it's possible that a teacher will miss someone or some students' answers many times. Face recognition-based attendance system is a solution to the problem of recognizing faces for the purpose of collecting attendance by utilizing face recognition technology based on high-definition monitor video and other information technology. Instead of depending on time-consuming approaches, we present a real-time Face Recognition System for tracking student attendance in class in this work. The suggested method included identifying human faces from a webcam using the Viola-Jones technique, resizing the identified face to the desired size, and then processing the resized face using a basic Local Binary Patterns Histogram algorithm. After the recognition is completed, the attendance will be immediately updated in a SQLite database with the relevant information. Many institutions will profit greatly from this endeavor. As a result, the amount of time it takes and the number of human errors it makes are minimized, making it more efficient.

Keywords : Face Detection, Viola-Jones Algorithm, Face Recognition, Attendance, OpenCv.

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I. INTRODUCTION

Many scientific discoveries and technologies have occurred in this modern period of automation to save manpower, improve accuracy, and improve our lives. The breakthrough in the field [1] of automation replacing conventional attendance marking activities is known as an Automated Attendance System. Biometric, smart-card, and web-based Automated Attendance Systems are the most common types. These systems are frequently employed in a variety of businesses. When the strength is greater, the traditional method [2] of attendance marking becomes exceedingly time consuming and cumbersome. Automation of attendance systems has an advantage over traditional methods in that it saves time and can also be used for security [3]. This also aids in the prevention of bogus attendance. A facial recognition system is a computer programme that takes many images of a person and stores the data about that person's face so that when that person appears in front of the camera again, it can verify that person [4].

The face is the physical manifestation of one's individuality. As a result, we've developed a face-recognition-based automatic student attendance system. This technology has a lot of uses in everyday life, especially in security and surveillance systems. Facial recognition technology is a framework or programme that can authenticate an individual's identification by evaluating a photograph or video footage. The major goal of this research is to create an automatic attendance system based on face recognition [5]. To get better results, this project's test and training images are confined to frontal and upright facial photos [6], which only contain a single face. For humans, face recognition is an easy process. Hubel and Torsten Elie Wiesel demonstrated that we have specialized nerve cells for specific native features of a scene, such as lines and edges. Because humans don't perceive the earth as a collection of disparate

objects, our vision should combine the different sources of input into a meaningful and helpful pattern [7]. Automatic face identification entails extracting important options from a photograph, golfing stroke them into a useful representation, and performing some quiet categorization on them. Face recognition, three-dimensional reconstruction, and target recognition are all done with OpenCv, an open source module. This could be used to avoid using a proxy. The problem with this method is that it only catches one image of a student at a time once he enters the classroom.

The suggested system attempts to address the shortcomings of existing systems by including features such as face detection, feature extraction, feature detection, and analysis of student attendance. For feature detection, the system uses techniques such as image contrasts, integral pictures, color features, and a cascading classifier. Due to the usage of a large number of face features (Shape, Color, LBP, wavelet, Auto-Correlation), the method gives higher accuracy. Euclidean distance and k-nearest [8] neighbor techniques are used to recognize faces. Because the system considers the changes that occur in the face over time and utilizes appropriate learning algorithms, the findings are more accurate. The technology has been put through its paces in a variety of scenarios. For the aim of testing the system's accuracy, we consider a specific area such as classroom attendance. The percentage of recognized faces per total number of tested faces of the same person is the parameter used. The system is put to the test in a variety of lighting conditions, with diverse facial expressions, partial faces (in crowded classes), and the presence or absence of a beard and spectacles. In the majority of the cases studied, improved accuracy (almost 100 percent) is reached.

II. RELATED WORK

There are a number of existing systems that are closely analogous to the proposed idea of using official recognition techniques and algorithms to indicate attendance in a class. A literature survey of the proposed systems was conducted to analyse these systems. The proposed case study was built around a few key sources in the field of facial recognition and image processing. Using the other design methodologies, a descriptive framework was created [9]. This type of system makes [10] use of the RFID [11] technology and the SURF algorithm to create a student attendance control system. The SURF directly modifies the scale of box features to implement the scale space using box filter and integral image, similar to how SIFT produces a pyramid scale space and continually smooths the image with Gaussian and then sub samples the image. The authors presented a finger print-based attendance system in [12]. A portable fingerprint device has been developed that may be circulated among students to allow them to lay their finger on the sensor during lecture time without the intervention of the instructor. This technology ensures that attendance is recorded in an error-free manner. The author of [13] is dealt with by the system. The issue with this type of attendance system is that students may lose their ID cards for various reasons, and there will be another opportunity to collect the students' information. It's a lengthy procedure. In addition, when compared to other types of facial recognition algorithms, the algorithm processing is quite slow.

The authors of [14] suggested an Iris recognition system based on Daugman's algorithm. This system employs an iris recognition management system that captures, extracts, stores, and matches iris recognition images. However, laying transmission lines in areas with poor topography is a challenge. The authors of [15] proposed a system based on real-time facial recognition that is reliable, secure, and quick,

although it still has to be improved in varied lighting circumstances. The initiative places a greater emphasis on fingerprint scanning than on face recognition systems. The project will only recognise the student's face in one direction and record the student's attendance [16]. The author is experimenting with a new technology called fingerprint scanning, which comprises of a fingerprint scanner and a camera. The key benefit is that even if the camera does not recognise the student's face correctly after face registration, the student can be declared absent using this fingerprint scanner.

CNN (Convolutional Neural Networks [17]) was used by the authors to detect and extract information from the collected photos that contained the students' faces. They also used CNN to train their model and an SVM (Support Vector Machine) [18] classifier to classify the images after they were trained. They were able to reach a 95 percent accuracy rate [19]. The system implements the attendance system by employing the PCA (Principle Component Analysis) technique to recognise the faces of each and every student. It's a method for minimising the number of variables in face recognition [20]. Every image in the training set is represented by Eigen faces, which are a linear combination of weighted eigenvectors. The covariance matrix of a training image set yields these eigenvectors. When compared to other methods, this algorithm has a significant computational advantage.

III. EXISTING PROBLEM

This project is being carried out due to the concerns that have been highlighted on the methods which lectures use to take attendance during lectures. The use of clickers, ID cards swiping and manually writing down names on a sheet of paper as a method to track student attendants has prompted this project to be carried out. This is not in any way to criticize the various methods used for student attendance, but to build a system that will detect the number of faces present in a classroom as well as recognizing them.

Also, a teacher will be able to tell if a student was honest as these methods mentioned can be used by anyone for attendance records [21], but with the face detection and recognition system in place, it will be easy to tell if a student is actually present in the classroom or not. This system will not only improve classroom control during lectures, it will also possibly detect faces for student attendance purposes.

IV. Requirement

Python is a dynamic, interpreted (byte code-compiled) language. There are no type declarations of variables, parameters, functions, or methods in source code. This makes the code short and flexible, and you lose the compile-time type checking of the source code [22]. Python tracks the types of all values at runtime and flags code that does not make sense as it runs. Python comes with a large standard library that has some handy codes and functions which we can use while writing code in Python. An exception is an event that can occur during program execution and can disrupt the normal flow of program. Python supports exception handling which means we can write less error prone code and can test various scenarios that can cause an exception later on.

Web framework like Django and Flask are based on Python. They help you write server side code which helps you manage database, write backend programming logic, mapping urls etc. There are many machine learning applications written in Python [23]. Machine learning is a way to write logic so that a machine can learn and solve a particular problem on its own. For example, products recommendation in websites like Amazon, Flipkart, eBay etc. is a machine learning [24] algorithm that recognizes user's interest. Face recognition and Voice [25] recognition in your phone is another example of machine learning. Data analysis and data visualization in form of charts can also be developed using Python. Python integrates the Enterprise Application Integration that makes it

easy to develop Web services by invoking COM or COBRA components. It has powerful control capabilities as it calls directly through C, C++ or Java via Python [26]. The Python also processes XML and other markup languages as it can run on all modern operating systems through same byte code.

4.1 Open CV

OpenCV is a large open-source library for image processing, computer vision, and machine learning. Python, C++, Java, and other programming languages are supported by OpenCV.

It can analyse photos and videos to recognise items, faces, and even human handwriting. When it's paired with other libraries, like Numpy, a highly efficient library for numerical operations, the amount of weapons in your arsenal grows, as any operation that Numpy can be merged with OpenCV [27]. OpenCV is a cross-platform library that may be used to create real-time computer vision apps. It mainly focuses on image processing video capture [28] and analysis including features like face detection and object detection. This module covers the basic data structures such as Scalar, Point, Range, etc., that are used to build OpenCV applications. In addition to these, it also includes the multidimensional array Mat, which is used to store the images. In the Java library of OpenCV, this module is included as a package with the name org.opencv.core. This module covers various image processing operations such as image filtering, geometrical image transformations, color space conversion, histograms, etc. In the Java library of OpenCV, this module is included as a package with the name org.opencv.imgproc.

4.2 CSV

CSV (Comma Separated Values) is a simple file format used to store tabular data, such as a spread sheet or database. A CSV file stores tabular data (numbers and text) in plain text. Each line of the file is a data record.

Each record consists of one or more fields, separated by commas. The use of the comma as a field separator is the source of the name for this file format. A Comma Separated Values (CSV) file [29] is a plain text file that contains a list of data. These files are often used for exchanging data between different applications. For example, databases and contact managers often support CSV files. These files may sometimes be called Character Separated Values or Comma Delimited files. They mostly use the comma character to separate (or delimit) data, but sometimes use other characters, like semicolons. The idea is that you can export complex data from one application to a CSV file, and then import the data in that CSV file into another application. A CSV file has a fairly simple structure. It's a list of data separated by commas. For example, let's say you have a few contacts in a contact manager, and you export them as a CSV file [30].

V. System Design

This is a window application developed in Python technology, MySQL is a backend database. This application has two type of users one is Admin user who will upload the files to main storage with annotation details. Another is an end user who is a real beneficiary of this system who can able to search for the file by providing the query keyword. With this system end user can able to get most matching files in short time shown in figure 1. This system uses a Workload which is like a cache area with the help of the Workload space and Annotation technique this system help the end user to get his required file in short time.

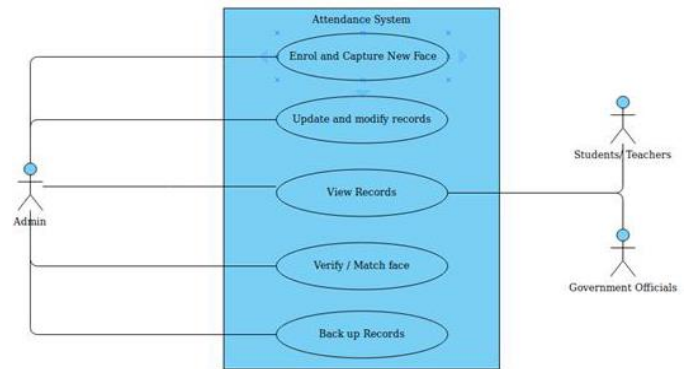


Figure 1 The Use case diagram

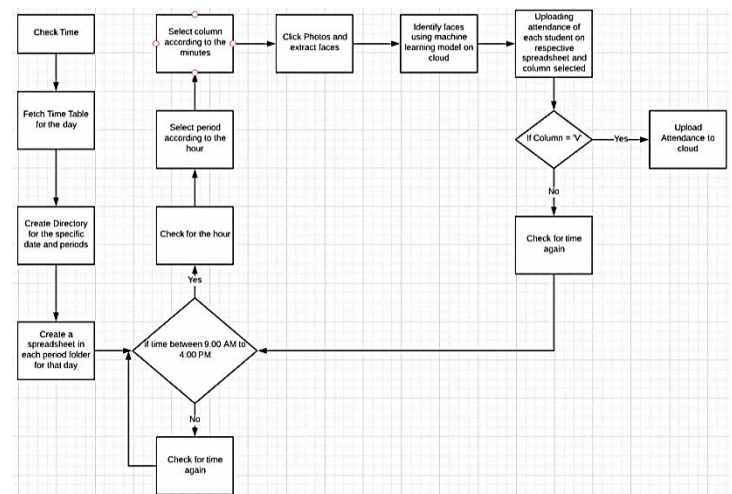


Figure 2 The System Architecture

The usage period of any venture advancement is the most essential stage as it yields the last arrangement, which takes care of the current issue. The usage stage includes the real emergence of the thoughts, which were communicated in the examination report and grew in the configuration stage shown in figure 2. Execution must be an impeccable mapping of the outline record in a suitable programming dialect with a specific end goal to accomplish important last item shown in figure 3. The item may be destroyed because of off base programming dialect decided for usage or unsatisfactory system for programming. The coding stage must be straightforwardly connected to the outline stage in the sense if the configuration is as far as item situated approach then usage ought to be ideally done in the article arranged way. Usage of any product framework is constantly gone before by

essential choice with respect to determination of stage, the dialect utilized and so forth shown in figure 4. These choices are regularly impact by a few variables, for example, environment in which the framework lives up to expectations, the rate that is needed, the security concerns, and other execution points of interest. The real execution choice that has been made before the usage of this venture is determination of the programming dialect for improvement of the application. The venture will be done in java, since it is an adaptable dialect. This dialect has been decided for the execution since it give obliged bundle to the security. The Project work is executed utilizing python. The IDE overshadowing is utilized, which streamlines the development of utilizations. Opencv is utilized to outline the all pages for sender and collector and Opencv code content the Python code at whatever point it obliged element conduct. The Python advancement unit is utilized to actualize all the obliged bundles. The accompanying depictions layout the outcomes or yields that we are going to get once regulated execution of th considerable number of modules of the framework.



Figure 3 The FRBAMS Window I



Figure 4 The FRBAMS Window II

VI. Conclusion

Attendance marking in a class room during a lecture is not only a onerous task but also a time consuming neat that. Due to an unusually high number of students present during the lecture there will always be a probability of proxy attendance. Automatic Face Recognition (AFR) has created a revolution in this changing world. It has ensured us with more safety of our data. Smart attendance using Face Recognition comes handy in day to day activities. It helps reducing the amount of paper and efforts for taking manual attendance. It is a process which uses students face to recognize them. It is done by using face biometrics and some other features of face. It is captured and been stored in the memory and it's been processed on to recognize the student by using various algorithms and techniques. In our attendance system, computer will be able to recognize the student whose data has been stored and it marks attendance of that student. Various algorithms and techniques have been used for improving the performance of face recognition. The concept we are using here is Open CV. We are also using Raspberry Pi and camera module to take image and storing them in database. This way the attendance will be automated. Student's attendance is used to be usually achieved by classical way this means record papers or more novel approaches by hardware tools such as

radio frequency identification (RFID), near field communication (NFC), biometric identification or combination of just presented. But in our proposed system does not require to carry any hardware device or to perform some kind of direct biometric identification. The proposed system an easy way for marking attendance where student is identified by camera, where the faces are matched to the one stored in the database after comparing the trained images. In this way students are automatically and indirectly monitored during classes and lectures, which is a better way for attendance system. Another area of future work is improving our neural network classifier. As mentioned in the previously, it is possible to construct the network to take its input directly from the image data rather from the vector that results from an images projection into face-space. Perhaps learning the face projection function could increase the accuracy of the neural network classifier. Additionally, more experiments are needed to see if there are other ways to tweak the network configuration to produce better results.

VII.Future Work

Face recognition is the most biological features recognition technology, according to the cognitive rule of human beings, its algorithm is ten times more complex than a fingerprint algorithm. The system will do its work even if one is not in touch with it or forget about it. Face recognition is featured by the following advantages compared to fingerprint: Using face recognition accurate and fast identification, industrial leading facial recognition algorithm matches more data than a fingerprint. High usability and security in this context failure to control and acquire rate is less than 0.0001%, fingerprint technology will have problems for enrolment with cold, wet, desquamation, elder, and around 5% people cannot get enrolled with a photo which is captured by the camera, there is no evidence with fingerprint

technology to track the incident and user friendly design.

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