Attendance Monitoring System based on Face Recognition

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Abstract

Attendance monitoring of a college student in an academic institute plays a crucial role in analysing student's performance. As physical labour is a major part of this process and it is very time extensive process, an automated Attendance Monitoring System (AMS) built on face detection, feature extraction and face recognition is proposed in this paper. The system uses PCA (Principal Component Analysis) algorithm for face detection, face recognition. After successful recognition of a student, the system automatically logs the attendance in the central database. The proposed system amplifies the performance of existing attendance monitoring systems by removing teacher's calling, marking and insertion of attendance in institutional websites.

Keywords: Face Detection, Face Recognition, Attendance Management Systems, Feature Extraction.

I.   Introduction

Every organization has taken on its own method for Automated Attendance Monitoring System. A few still uses the manual attendance taking method while some have taken on the bio-metric methods. The conventional method makes it complicated to verify students' attendance one-by-one in a whole classroom. Moreover, the labour involved in calculating the percentage of attendance becomes a major task. The Radio Frequency Identification (RFID) technique uses radio waves to recognize a big crowd. It has hands-free access control and high efficiency. But it has the potential to be misused. An automatic bio-metric technique would actually provide the solution. These systems include eye retina, fingerprints, voice etc. However, each one of the bio-metric technique has their own perks and disadvantages.

The main motivation behind the development of this project is ineffective and slow traditional manual attendance systems. This made us think why not make it automated fast and much efficient. Human face recognition has been used in numerous real-life scenarios such as computer graphics, interactive computer designs/simulations, security systems, psychology, and computer vision. Also, various face detection methods are used in crime investigation for comparing the images in criminal database with the images obtained from the crime scene by detecting faces from those images. Facebook also uses an algorithm called deep face whose accuracy to recognize faces is 97.25%, which is as close as what humans have that is 97.53%.

II.   Literature Survey

The main purpose of this review paper was to understand the solutions provided by other authors and find the limitations of their proposed methods. The best solution then proposed after reviewing all methods.

In [1], This paper contains the description of a face detection framework. This framework is capable of processing images very quickly all the while, also attaining high detection rates. Three key contributions has been given in this paper. The first one is the introduction "Integral Image", a new image representation, which allows quick computation of the features. The second one is a simple yet effective classifier which is built such that it can select a small number of important visual features from a very large collection of prospective features. the classifier has been built using AdaBoost learning algorithm. The third one is a way for fusing classifiers in a "cascade", which helps swiftly discarded the background regions of the image. And this helps in spending more computation on promising face-like regions.

In [2], In this paper for locating the region of face, rather than locating the face region's fiducial points, they propose a framework(end-to-end), in which network of spatial trans-former is applied for learning face alignment parameters. The spatial transformer network learns spatial transformation for an image or a feature map. The transformation includes cropping, rotation, scaling, and non-rigid deformation. Every input sample is converted before being classified. This is done by adding a new transformation layer between the classification layers and the input layer, called the spatial transformer. For example, face regions at the edge of images are transformed to the centre area, and plane rotated images are transformed to frontal face images.

In [3], This paper uses a technique for Students' Attendance Monitoring System which will be integrated with the face recognition technology using PCA algorithm. The system will document the student's attendance in classroom automatically. And it will give the faculty the chance to access the attendance data of the students easily. This is achieved by keeping a log for clock-in and clock-out time. This paper uses PCA (Principle Component Analysis) method for recognition of faces and compression of images. In this project OpenCV libraries are used for face detection and other processing. PCA technique has been widely used in use cases such as recognition of faces and compression of images. PCA is a common method for pattern finding in data, and eigenvector presentation of data to highlight the likeness and dissimilarity between various data. Then the implementation of system is divided into three major processes Detection of Faces and Extraction, Learning and Training Face Images, Identification and Recognition. Implementation of system is performed using libraries of OpenCV which is open source and cross platform.

In [4], This paper uses Viola and Jones algorithm for face detection and for face recognition correlation formulas. Viola and Jones algorithm is used for process of face detection. Where it is used in both creating the database and the face recognition process. In case of creating database, it takes image as an input from a web camera consistently. captured image undergoes in the process of face detection. Detected face will be saved in database. And in case of face recognition the moving object will be detected using video surveillance. The image is captured and the captured image goes through the process of face detection and other processing is done by face recognition technique.

In [5], The attendance management system estimates the attendance of each student by continuous clicking of images for some time period and finds the best localized image for processing. The system allows the teacher to check student's attendance automatically without any extra cost and effort whereas the proposed system needs very elementary things such as; camera, a computer system and local net-work. This method is secure, reliable and easy to use. The overall system is implemented in MATLAB.

In [6], This system records and analyses the attendance students using three stages of operations. In first stage the system scans the Wi-Fi devices present in the range which is classroom. The system scans only preregistered devices and remove other Wi-Fi devices present in the range. The data is then matched with the data received from the counter installed at the gate. In case of mismatch the Wi-Fi devices are scanned again. And in case of no mismatch the data is stored on the server for further processing. In second stage the image processing and face recognition is utilized to completely eliminate the chances of proxy attendance and log the attendance of authorized person only. In third stage the system is using the API of Facebook the social media platform to tag the person present in the picture captured. And this method is also useful in increasing the face recognition accuracy because of the API used.

In [7], Here primary concern is the manner by which you will utilize and use the innovation in everyday life. In the above talk we have utilized the RFID and IOT in the participation observing framework. By utilizing above we are doing heaps of work naturally rather than doing physically, which is the best piece of that. We are utilizing cloud as back end stockpiling. Utilizing IOT we are making it adaptable so that can be found from anyplace.

In [8], This framework consequently distinguishes the understudy in the class room. Then marks the participation by perceiving their face. This framework is created by catching constant human faces in the class. The distinguished appearances are coordinated against the reference faces in the data-set and denoted the participation for the participants. At long last the truant records are said so anyone might hear through voice transformation framework for affirmation. Also, the framework is prepared to arrange the sex of the understudies present in the class.

In [9], The hardware and software design here are user friendly. The real time data point in term of voltages is stored in the text file. These are used as boundary condition for generation of meshes, nodes and equations automatically for any length of boundary conditions. The software also has a capability to solve these equations which represent the pixel intensity in term of conductivity distribution inside the closed object. The algorithm has very wide application in bio-medical area especially in the field of electrical impedance tomography. The technology developed here was validated as an experiment's series done in the phantom and other mechanical model of almost identical conditions. Results showed clearly that the profiling and detection of similar bio-physiological parameters of fetus and mother growing inside the gravid uterus can be done through the electrical impedance tomography. The EIT has been used for as an imaging modality for last many years for human like, lungs, GI, CVS, brain and in breast cancer detection. This is for the first time this method has been suitably modified including the instrumentation as well as the post processing of the raw data for another application i.e. fatal monitoring. The Signal generated from the tissues within the closed system as an alternative/complementary to the known available fetomaternal monitoring techniques such as US and CTG. We except that the technology and methodology developed can be used as a mass health care affordable tool for base line screening as well as monitoring fatal and maternal parameters.

Though the image resolution of in-vivo studies is continuously increasing, it will theoretically remain lower than that of ultrasound. This low resolution will limit its uses to that of only monitoring, rather than to correct anatomical imaging uses. The main objective here is to use this technique for fetomaternal wellbeing as a scaling down technology as mass health care tool for screening and monitoring purpose as an alternative system in the absence of known conventional monitoring technology.

In [10], Another profound learning-based face acknowledgement participation framework is proposed. The whole method of building up a face acknowledgment part by joining state of-the-craftsmanship techniques and advances in profound learning is portrayed. It is resolved that with the more modest number of face pictures alongside the proposed technique for increase high exactness can be accomplished, 95.02 percent in generally. These outcomes are empowering further research for the reason of acquiring significantly higher exactness on littler data-sets, which is urgent for making this arrangement creation prepared. The future work could include investigating new expansion forms and misusing recently assembled pictures in run-time for programmed retraining of the installing CNN. One of the unexplored territories of this exploration is the investigation of extra answers for grouping face inserting vectors. Creating a particular ordering answer for this undertaking could possibly prompt accomplishing higher exactness on a littler data-set. This profound learning constructed arrangement does not depend with respect to GPU in run-time. Along these lines, it could be material in numerous different frameworks as a primary or a side part that could keep running on a less expensive and low-limit equipment, even as a universally useful Internet of things (IoT) gadget.

III. Implementations

A. Eclipse

Eclipse is an open source, integrated development environment (IDE) for developing computer programming work products. It comprises an extensible plugin system and a base work space for customizing the environment. Mostly eclipse is written in Java and is used primarily for developing Java applications, but it also supports development of applications using other programming languages by using different available plug-ins, such as C, Clojure, NATURAL, COBOL, PROLOG, D, Erlang, Rust, Fortran, Groovy, Haskell, JavaScript, Julia, C++, Lua, PHP, Python, R, Ruby, Perl, Scala. Eclipse provide different development environments such as CDT for C and C++, Java development tools (JDT) for Java, and PDT for PHP, among others. Eclipse includes a code editor, Intelligence and support for code refactoring. The integrated debugger can get applied for source-level debugging and a machine-level debugging as well. Other built-in tools include a class designer, forms designer for building GUI applications, code profiler, web designer, and schema designer of database. Different plugins can be used to improve the applicability at almost every level, from adding source control

systems support (like Subversion) to adding new tool-sets like visual designers and editors or tool-sets for other aspects of the SDLC.

B. Algorithm Mathematical Formulation

Principal Component Analysis is a statistical method which uses an orthogonal transformation to convert a set of observations of potentially correlated variables (entities each taking on different numerical values) into a set of values of linearly uncorrelated variables called principal components. If there are n observations with variables p, the number of separate main components is (n-1, p) (n-1, p). This transformation is defined in such a way that the first main component has the greatest possible variance (that is, accounts for the greatest possible variability in the data) and each successor in turn, the component has the highest possible variance under the orthogonal constraint of the previous components. The resulting vectors (each of which is a linear combination of the variables with n observations) are an uncorrelated orthogonal base. PCA is susceptible to the relative scale of the original variables.

C. Algorithm

- Get set of images from the database and then find mean of the images.
- Find the difference between mean image and each of database images.
- Find co-variance matrix of the matrix obtained from step 2.
- For this co-variance matrix find Eigen values and Eigen vectors, and then find the Eigen faces with larger Eigen values.
- Find out weight vector using these Eigen faces.
- For any new/unknown image repeat steps 1 to 3 and then find out weight vector for the test image.
- Find Euclidean distance between weight vectors of unknown image and database images.
- If this calculated distance is less than the threshold then test image is considered to be a match from the image
  in the database and hence authorized, otherwise, unauthorized.

IV. Benefits of Automating ERP System

The objective of this system is to present an automated system for human face recognition in a real time for an organization to mark the attendance of their employees or student. Build an automated system to increase the accuracy of existing system.

A. Advantages

- We don't need to use the traditional method of taking the attendance manually.
- Traditionally, students' attendance is taken manually by the use of attendance sheets in the class, which is a time-consuming event. Moreover, it is exceptionally tough to confirm each student's presence one by one in a large classroom environment. And to determine whether there has been any proxy attendance or not.
- Computing the percentages of attendance is a major task and also not error free because the manual calculation may compute the errors and this is even time-consuming process so we can avoid it using automated attendance monitoring system.
- In the previous traditional approach, there is a probability of impersonation and also the attendance sheet may get stolen or it may lose.
- In traditional method there is a possibility of proxy attendance so it can be completely avoided in automated attendance monitoring system.
- In this technique we can generate real time report without any manual intervention.
- Bio-metric-based techniques have appeared as the most promising option for recognizing people in the recent years since, instead of authenticating them using passwords, Pin's, smart cards, plastic cards, tokens, etc. Biometric methods examine an individual's physiological and/or behavioural characteristic in order to determine his identity.
- Technologies based on bio-metrics include recognition based on physiological characteristics (such as finger-prints, face, finger geometry, palm, retina, iris) and behavioural traits (like signature, gait and keystroke dynamics).
- Face recognition offers a lot of advantages over other bio-metric methods, a few of which are mentioned here: Almost in all of these technologies' user need to perform some action, like, in fingerprinting or

hand geometry detection, the user needs to place his/her hand on a hand-rest and in iris or retina biometric identification user needs to stand in a static position in front of a camera. However, in face detection and recognition technique it can be done passively without any explicit action or participation from the user.

V. Scope and Conclusion

To eliminate the manpower involved in taking the attendance, an Automated Attendance Monitoring System (AMS) built on face detection technique and face recognition technique is proposed. Principal Component Analysis (PCA) algorithm is used for detection and recognition of faces. The proposed system increases the performance ability of existing attendance monitoring systems in the following ways:

- Automatic logging of the attendance of the students.
- Reducing the pressure and manual labour on the teachers for accurate marking of the student attendance.
- Eliminating the time required for taking attendance and maximizing the actual time for actual teaching process.
- Improve the accuracy of the overall system. Increasing the security.

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