A Heuristic Approach To Monitor Attendance Using Machine Learning and Facial Recognition

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Abstract : In evolving world, Image processing plays a vital role to extract important data from the images. The ultimate aim in a large number of image processing application is to extract important features from image data, from which a description, interpretation, or understanding of the scene can be provided by the machine. The traditional method of taking attendance is done manually by the teacher, as the students count increases there comes a challenge for institutes to monitor and maintain record. To overcome these issues, biometric feature like facial recognition can be used which involves the phases such as image acquisition, face detection, feature extraction, face classification, face recognition and eventually marking the attendance. The algorithms like Viola- Jones and HOG features along with SVM classifier and deep neural networks are used to acquire the desired results. Neural Networks interpret data through a kind of machine's perception, labeling it or clustering the raw input The Support Vector Machine (SVM) is a supervised learning model which classifies the data into group of binary categories based on analysis of data, thus simplifying comparison of data. Our idea strive to statistically evaluate some aspect of an image and use Deep Neural Networks and conclude with the match of the exact copy of the image.

IndexTerms - **Face Recognition, Deep Neural Network, Face API and Support Vector Machine (SVM).**

INTRODUCTION:

Automatic attendance system is the advancement that has taken place in the field of automation replacing traditional way of marking attendance system.The attendance monitoring system has made the lives of teachers easier by making attendance marking procedure Face detection and recognition is an essential field in many applications, one which is Attendance Management System. This system makes use of image processing for detection of human face through a high definition camera where detection of images is done by using algorithm.

There is rapid development in image processing such as facial recognition, pattern matching, and signature recognition, which is more efficient and consumes less time. Implementing facial recognition for marking attendance will reduce the human efforts. Marking attendance on just one click of the button will make easier for teachers. This system provides marking automated attendance system that carries out face recognition by using camera placed in classrooms. Using camera, image can be captured to detect the students and attendance can be marked automatically. Using database, the students image can be compared and then the attendance can be marked automatically. By implementing this system it requires zero efforts within less time from user.

Problem Defination:

To develop a time efficient and less error prone attendance marking system for the educational institutions by using image processing and applying machine learning techniques. The solution to the problem is classified in four :
a) Choice of suitable data set and identification of training dataset to train the system.
b) Facial Recognition to identify individual students from the captured image.
c) Machine Learning Algorithms are used like SVM and Deep Neural Networks with the help of Face API. To identify region of interest (accuracy in image identification) and classification purpose.

Objectives

- To protect proxy attendance : One can operate and access the attendance monitoring system with ease due to its simple procedures that are facile and easy to lean and implement. In addition to the group photo, the Application developed will provide a centralized control system to control all the students attendance with the single button click.

- To reduce the Faculty Time : This project also aims to save the time consumed by the faculty when he/she takes attendance after the lecture gets over or at start of the lecture. By saving the time consumed in taking attendance faculty may focused on programmed schedules.

- To increase reliability and scalability : This system is reliable as all the faces of students present or connected to the system are controlled with a proper procedural method. New Students can be easily added in the system with minimal efforts, thus making this system scalable as well as durable.

- To develop a dependable and trustworthy system: This system is safe and is under complete control of the faculty. It helps to bridge the gap between digital and physical world bringing the teachers one step closer to Automation.
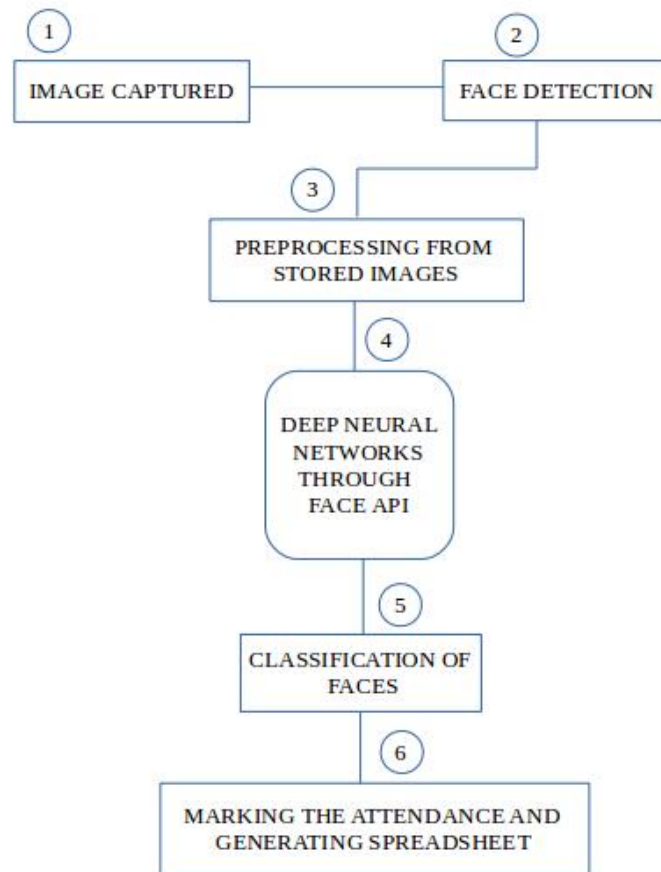
System Architecture:-

Figure 1: System Architecture

Figure 1 is the system architecture. This architecture shows flow of the system. Its show the Step by step activity of the system. The system starts first and select operating system and then directory is changed where we get a working directory where project is present. By running .sh file then user marks attendance by proper verifying the faces.

Face recognition can be used in many different applications, but not all facial recognition libraries are equal in accuracy and performance and most state of the art systems are proprietary black boxes. While OpenFace is been widely adopted because it offers levels of accuracy similar to facial recognition models found in private state of the art systems such as Google's FaceNet or Facebook's DeepFace or Microsoft's Cognitive FaceAPI.

Microsoft Cognitive Face API provides a software oriented service. We require key and endpoint for running application software. We are client in perspective of the Microsoft Cognitive services. Besides Microsoft being an closed source it uses features which are close to or parallel to the OpenFace for the prediction and classification. The development of the model is focused on real-time face recognition on mobile devices, so you can train a model with high accuracy with very little data on the fly.

The captured images are thrown into the a neural net for the feature extraction using designed model. Model relies on a function to compute the accuracy of the neural net for classifying a face and is able to cluster faces because of the resulting measurements on a hypersphere. This trained neural net is used through dlib's face detection model. The faces are normalized through Affine transformation, then are sent through the trained neural net in a single pass. Then the task carried out is the isolation of face from the background of image. The issues like bad lighting, conversion of image to grayscale, normalization of the facial position or any inconsistency is taken care of for the further processes of transformation. The dlib takes care of fiducial points and the OpenCV takes care of normalization of face position. The Histogram of Gradient(HOG) and Support Vector Image(SVM) features are used with combination by the dlib for training on the negative and positive images, less data is required so the HOG has higher accuracy than that of the OpenCV's Haar cascade classifier. The Face API is called and then a successful result is concluded when a universally unique identifier is returned. After the successful call of the Face API the Face is marked by checking the previous stored images. Attendance is marked accordingly either present or absent and the spreadsheet is generated.

Related Works

2.1 Attendance Monitoring System using Facial Recognition with Audio Output and Gender Classification

Introduction: [2.1] Aims to mark attendance automatically by means of face recognition. The teacher can mark the attendance of the students with just the click of a button. The names of the absentees are called out by voice conversion using speech

technology. Hence the teacher can easily mark the attendance of the absentees. Manual entering of attendance in logbooks becomes a difficult task and it can be easily manipulated. Therefore, this paper present's an automated attendance System. This system automatically detects the student in the class room and marks the attendance by recognizing their face. This system is developed by capturing real time human faces in the class. The detected faces are matched against the reference faces in the dataset and marked the attendance for the attendees. Finally the absentee lists are said aloud through voice conversion system for confirmation. Secondly, the system is trained to classify the gender of the students present in the class.

Advantage:-
        It can make the users attendances more easily and effectively without much intervention.
Limitation:-
        Comparitively Poor Time taken for the working and classification purpose.

2.2. Automated Attendance System using Machine Learning Approach

Introduction:- [2.2] attempts to provide an automated attendance system that carries out the face recognition task through an image/video stream to record the attendance in lectures or sections and keeping the database of attendance. After creating the database of the students/ candidates, it requires almost zero efforts from the user side. Thus intrusive nature is absent in this system and makes the system effective. The number of students are increasing day by day, it is a challenging task for universities or colleges to monitor and maintain the record of the students. Automated systems involving use of biometrics like fingerprint and iris recognition are well developed in the recent years however, it is intrusive and cost required for deployment on large scale gets increased substantially. To overcome these issues, biometric feature like facial recognition can be used which involves the phases such as image acquisition, face detection, feature extraction, face classification, face recognition and eventually marking the attendance. The algorithms like Viola- Jones and HOG features along with SVM classifier are used to acquire the desired results. Various real time scenarios need to be considered such as scaling, illumination, occlusions and pose. The problem of redundancy in manual records and keeping attendance is solved by this system. Quantitative analysis is done on the basis of PSNR values.

Advantage:-
        The approach for face detection, minimizes computation time while achieving high detection accuracy.
Limitation:-
        If the eyes are occluded, the detector may generate false working or may fail in marking attendance.

2.3 Face Recognition using DCT

Introduction :- [2.3] discuss a new computational approach to face recognition that, when combined with proper face localization techniques, has proved to be very efficacious. This paper has discussed a face recognition system using the DCT, which included both geometrical and illumination normalization techniques. The survey of the face recognition research has been performed to date. The proposed approach is then presented along with its objectives and the motivations for choosing it. They illustrated that Face recognition by humans is a high level visual task for which it has been extremely difficult to construct detailed neurophysiological and psychophysical models. This is because faces are complex natural stimuli that differ dramatically from the artificially constructed data often used in both human and computer vision research. Thus, developing a computational approach to face recognition proves to be very difficult indeed. Given that recognizing faces is critical for humans in their everyday activities, automating the process would be very useful in a wide range of applications including security, surveillance, criminal identification, and video compression. Finally, they contemplate other enhancements similar to those attempted for the KLT method while moderately enlarging the size of the feature vectors, to likely yield better performance.
Advantage:-
        An accurate and robust face recognition system was developed and tested.
Limitation:-
        The system lacks face localization capabilities.

2.4 Robust real-time face detection

Introduction: [2.4] relates to the biometric attendance management. The automatic attendance management has replaced the manual method, which takes a lot of time consuming and difficult to maintain. There are many biometric processes, in that face recognition is the best method. In this paper we are going to describe the attendance without human interference. In this method the camera is fixed in the classroom and it will capture the image, the faces are detected and then it is recognized with the database and finally the attendance is marked. If the attendance is marked as absent the message about the student's absent is send to their parents. There are various methods for comparing the faces. The Eigen face is the one of the method. Eigen faces is set of Eigen vectors which are used in computer vision problem of face recognition.

Advantage:-
> The approach for face detection, minimizes computation time while achieving high detection accuracy.

Limitation:-
> If the eyes are occluded, the detector will fail.

2.5 A training algorithm for optimal margin classifiers.

Introduction: [2.5] emphases on a training algorithm that maximizes the margin between the training patterns and the decision boundary is presented. The technique is applicable to a wide variety of classification functions including Perceptrons polynomials and Radial Basis Functions. The effective number of parameters is adjusted automatically to match the complexity of the problem. The solution is expressed as a linear combination of supporting patterns. These are the subset of training patterns that are closest to the decision boundary. Bounds on the generalization performance based on the leave one out method and the VC dimension are given. Experimental results on optical character recognition problems demonstrate the good generalization obtained when compared with other learning algorithms. The achieved performance matches that of sophisticated classifers even though no task specific knowledge has been used. The training algorithm is polynomial in the number of training patterns even in cases when the dimension of the solution space. space is exponential or infinite. Lastly, paper illustrated that the training time in all experiments was less than an hour on a workstation.

Advantage:-
> This principle is equivalent to minimizing the maximum loss and has a number of features.

Limitation:-
> Training time may vary as per the experiment and may provide delay.

HYPOTHESIS

- We are developing an application that automatically mark the attendance which reduces the human work.
- This application makes use of Deep Neural networks and SVM basically for the image segmentaion and facial recognition to detect and identify the faces.
- This application reduces the human efforts by automatically marking attendance and providing marked atttendance spreadsheet automatically.
- All the faces for students are stored in the database before the system starts.

DELIMITATION OF THE STUDY

- To overcome the problem of conventionally marking of attendance maunally by the teaacher or administrator which reduces human efforts.
- In this paper we used the correlation between the students faces stored in database and captured image of students.
- Detected faces from the database are marked as present in spreadsheet.

SAMPLE OF THE STUDY

This paper is based on facial recognition and machine learning. As we know conventionally marking attendance is done manually which increases the human efforts, time consuming and errors in marking attendance. Therefore we proposed this concept in which the students faces which stored in database are matched with the captured image using facial recognition techniques and identifying images by using machine learning algorithms.

TOOLS USED

Software Requirement:

- Operating System   : Ubuntu 16.04 LTS
- Language   : Python Programming Language
- Front End   : Python 2.7
- Database   : SQLite 3

Hardware Requirement:

The hardware design of the system includes designing the hardware units and the interface between those units.

- Processor   - Intel Pentium –IV, i3,i5,i7
- RAM   - 1 GB (minimum)
- Speed   - 2.4GHz
- Hard Disk   - 100 GB(minimum)

STATISTICAL TECHNIQUE USED

We have used facial recoginition and machine learning techniques to detect and identify the face image and then compare with database to mark the attendance as present.

Experiment Result:

Results demonstrate that if the captured image of the particular is matched sucessfully with the database stored images ,then the attendance will be marked as present which will be displayed in the spreadsheet.It provides the error free in marking attendance of any student.

Comparision with Existing Methodologies

Parameters	Existing System	Proposed System
Students sample	30	30
Time taken	15 minutes	2-3 minutes
Image to Captured	Every student's photo required	Single group photo required
Complexity of system	Simple	Moderate
Flexibility	No flexibility	More flexible (can add new students)
Cost	Low	Moderate
Computation	Moderate	Fast
Efficiency	Less Efficient	More Efficient
Accuracy	70 percent	95 percent

Table 1: Comparision Table

Future Scope

The experiment results show that this application can be used in future for the purpose of detecting and identifying the faces at airports and railway sations. In order the frauds of ATM's ,which is recommended to prepare database of ATM customers with the bank. All the defense and other important places the face detecting and identifying is required can be deployed for security purpose.

Acknowledgment

It gives us great pleasure in presenting the preliminary project report on 'A Heuristic approach to monitor attendance using machine learning and facial Recognition'.

I would like to take this opportunity to thank my internal guide Prof…. for giving me all the help and guidance I needed I am really grateful to them for their kind support. Their valuable suggestions were very helpful. I am also grateful to Prof..., Head of Computer Engineering Department, Computer Department, Sinhgad Institute of Technology & Science, Pune, for his indispensable support and suggestions.

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Conclusion

We have successfully detected faces and marked attendance for a classroom of BE. In our development we use machine learning for the classification and data boosting of checking of images from a dataset of students. So it is been very perfect combination of two technologies for boosting of the performance for a verry huge dataset. Our system sucessfully marks the attendance via the Face API and using dlib and also uses machine learning algorithms.

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