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Automatic Attendance Management System using Face Recognition

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Abstract: *Face recognition is among the most productive image processing applications and has a pivotal role in the technical field. In the recent time automated face recognition has become a trend and has been developed very much, this is mainly due to two reasons first it is due to availability of modern technologies and second is due to the ability to save time using face recognition in the process of taking attendance of students. Its usage will grow vast in the future as it saves a lot of time. It consumes a lot of time to take attendance manually and few might also fake the attendance, in order to prevent time consumption and avoid faking the attendance. Face recognition is used to identify the person present in the class and mark their attendance , this is done with the help of image or video frame. We proposed an automatic attendance management system using techniques such as PCA algorithm. The face detection and recognition will automatically detect the students in the classroom and mark the attendance by recognizing the person. The traditional process of making attendance and present biometric systems are vulnerable to proxies. This paper is therefore proposed to tackle all these problems. The proposed system makes the use of Haar classifiers, KNN, CNN, SVM, Generative adversarial networks, and Gabor filters. After face recognition attendance reports will be generated and stored in excel format. The system is tested under various conditions like illumination, head movements, the variation of distance between the student and cameras. After vigorous testing overall complexity and accuracy are calculated. The Proposed system proved to be an efficient and robust device for taking attendance in a classroom without any time consumption and manual work. The system developed is cost-efficient and need less installation.*

Keywords: KNN, SVM, VIOLA-JONES, HAAR classifiers, CNN

I. INTRODUCTION

Attendance being a very necessary side of administration may normally become an arduous, redundant activity, pushing itself to inaccuracies. The traditional approach of making roll calls proves itself to be a statute of limitations as it is very difficult to call names and maintain its record especially when the ratio of students is high. Every organization has its way of taking measures for the Attendance of students. Some organizations use document-oriented Approach and others have implemented these digital methods such as biometric fingerprinting techniques and card swapping techniques. however, these methods prove to be a statute of limitations as it subjects students to wait in a time-consuming queue. if the student fails to bring his id card then he will not be able to get attendance. evolving technologies have made many improvements in the changing world. The system of intelligent attendance is generally implemented with biometrics help. Recognition of face is one of the Biometric ways of improving this system. Face recognition proved to be a productive method for taking attendance. The normative face recognition techniques and methodologies fail to tackle challenges like scaling, pose, illumination, variations, rotation, and occlusions. The framework proposed is designed to solve the drawbacks of current systems. there has been a lot of advancement in face recognition but the vital steps are face detection, feature extraction, and face recognition. firstly, two or more cameras depend on the need, and the size of the classroom has to be installed on the ceiling of the classroom from where it covers the entire area. image captured from these cameras will be considered as an input to the system. There may be a possibility of getting image blurred due to movements of students, for better efficacy image can be upgraded using

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Generative Adversarial Networks. A newly generated ameliorated image will be passed to the system for face detection. process of face detection is accompanied by feature extraction and face recognition these process makes the use of Gabor filters. face recognition is done using the K-nearest neighbor algorithm, Convolutional neural networks, and SVM algorithm with their comparative studies. post- completion of face recognition, the system generates the name and identification number of the students who are present and identified in the image. then attendance is marked in front of the student names in the excel format with respective date and subject of a lecture in an institution. It requires very few hardware resources hence it is a cost-friendly system.

II. LITERATURE REVIEW

The primary aim of this paper is to study the different approaches given by authors and to develop a real-time attendance system which overcomes the shortcomings of previous methods and to give the best solution.

In [1] the author used the convolutional neural network (CNN) to obtain low dimensional features as the pre- processed images are too high dimensional for a classifier to take it as input directly. For face detection, they have used the viola and jones algorithm and then used correlation tracker to track face from frame to frame. In this paper, the author has worked on several parameters like pose estimation, sharpness, resolution, and brightness. The head position is determined using three-angle roll, yaw, and pitch. Then approach includes final score calculation named face quality assessment by assigning weights to each of the normalized parameters. In [2] Yohie Kawaguchi et.al proposed a system based on continuous observation and using face recognition. The author presented a system with an active student detecting method (ASD) having two cameras placed on the wall in which one is a sensing camera which is used for estimating seat inside the class and the other is capturing camera which is used for face detection. They have proposed a shooting plan in which one seat is estimated from the seating area obtained by ASD and then directs the capturing camera to the seat and captures an image. The existence of students is estimated using background subtraction and inters frame subtraction. The author has solved the linear sum assignment problem to give the correspondence of students and seats.

In [3] the author presented the system which used the Eigenfaces approach for face recognition. They have performed face detection followed by a cropping of faces then worked on background subtraction for greyscale images and binary images. The author has used the Eigenface method due to its simplicity, speed, and learning capability.

In [4] author studied [6] two-stage hybrid face detection scheme which uses the probability-based Face Mask PreFiltering (PFMPF)and the pixel-based hierarchical Feature Ad boosting (PBHFA) method. This approach is aimed to solve the problem in Haar cascade. The author proposed a system with two phases, training phase, and testing phase. In the training phase, they presented two main steps first is face detection in which they have used the viola jones algorithm. the second step which is feature extraction after detecting faces from a video feature is extracted using the PCA algorithm. in the testing phase, the data set is partitioned into two parts named training dataset and testing dataset.

III. PROPOSED SYSTEM

Principal component analysis (PCA) PCA is a statistical technique for finding patterns in high dimension data such that their similarities and differences are highlighted. It transforms data from their original coordinate system to a new coordinate system, where major distribution of points is along the first principal component. The next largest variation of data is mapped along the second principal component perpendicular to the first principal component axis.

PCA is an effective technique for finding patterns of similarity and dissimilarity in face recognition, mainly because finding patterns in high dimension data is difficult, and images are represented by points in high dimension space. The principle of their algorithm is based on PCA, where gray level images are reduced down to the most variant feature by projecting them to a lower dimension subspace. Recognition between images is performed using distance based matching method. If the distance between the new face and the faces in the training set is small and above a threshold, the new face will be classified as known.

IV. METHDOLOGY

Developing an intelligent attendance management system, some steps need to be followed to achieve this Successful task. The steps are definable as follows:

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Database creation Image amelioration Face detection Feature extraction Face recognition Report generation

4.1 Database Creation

In the first step, the database will be created at the time of enrollment of students. The database will store generic information of students like name, identification number, course, semester subjects. alongside the image of the student is to be captured by the system for training of the proposed system. This system captures single image for a student for training purpose. With the aid of all the pictures the student has stored in the database, facial recognition for all of the students attending a lecture. It can be accomplished.

4.2 Image Amelioration

Due to the movements of a student in a classroom, the image captured by the camera may get blurred. the image can be ameliorated using Generative Adversarial Networks. GANs are known for their ability to retain texture information in images, create solutions similar to the actual range of aspects, and look perceptibly convincing is a distorted image, k(M) is referred to as unknown blur kernels identified by motion field M. is the sharp latent image and * symbolizes convolution whereas N denotes an additive noise.

4.3 Face Detection

Before an image can become part of the training data set, it must first be detected. We used Viola-Jones Haar classifier for face detection, which was trained from face and non-face objects, with the information stored in XML file. To apply the classifier correctly, several factors must be considered. First, it is important to convert color images to gray, since face detection only works on gray scale images. Second, the speed of face detection depends on the size of the input image. Face detection can become very slow for large images, but fast for small images. Third, a low illumination of light can affect the result of a face detection algorithm. Our data set contained images that were all gray level with a reasonable small size of 92 x112 pixels and with a uniform intensity of light. As a result, this data set did not require any pre-processing.

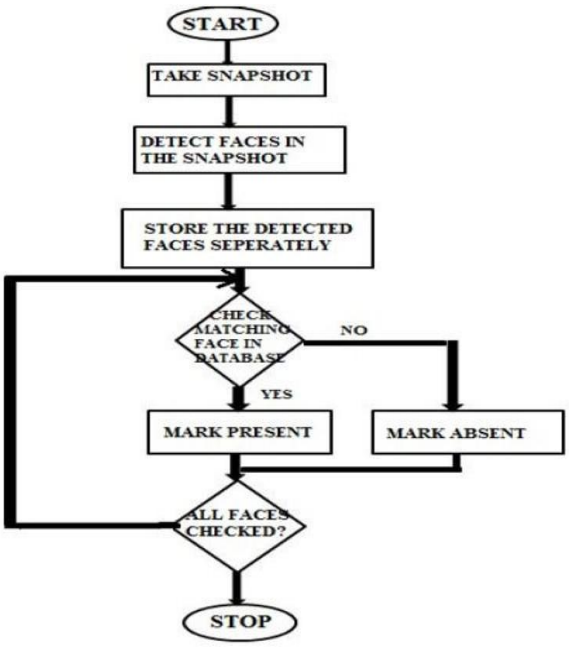

Fig 1. Flow Chart Diagram

4.4 Face Extraction

For extraction of faces 68 landmarks of faces are taken into account. with the help of these landmarks, faces are detected. For face detection, Haar classifiers have been used. It is an approach based on machine learning in which a cascade function is trained from many positive and negative images. This is then used on other images to detect images. These

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classifiers are simply the subtraction of the sum of pixels under the black area from the sum of pixels under the white area. applying 6000 features on each window frame was found to be difficult. features were grouped into stages which are known as cascades of a classifier. AdaBoost is used for removing redundant features and for selecting only appropriate features. These features are known as weak classifiers. A weighted combination of weak classifiers is used to detect faces. using the AdaBoost linear combination of weak classifiers is constructed known as a strong classifier.

4.5 Report Generation

Trailing face recognition reports are generated by marking present in front of the student name and enrollment number in excel format during a lecture.

V. RESULTS

The system was tested on three different algorithms out of which the PCA algorithm proved to be better with the accuracy of 99.27 %. The system was tested on various conditions which include illumination, head movements, expressions, the distance of students from the camera. The system stands up to the expectations even when the image contains faces with beards and spectacles and without beard and spectacles. proposed system evinced to be magnificent to recognize faces having two years of difference. Being tested on these conditions KNN proved to be better by achieving the overall accuracy of 97 %. when tested on conditions listed above CNN achieved the overall accuracy of 95 % and SVM achieved an accuracy of 88 %. viewing the aspect of time complexity, CNN exposed to have low time complexity. It was found that SVM has the highest time complexity among these three listed algorithms. The proposed system is tested on 200 real-time images of a classroom with a maximum strength of 70 students. The proposed system is robust enough to take attendance of 70 students in a classroom.

VI. CONCLUSION

The proposed system meets the objective of achieving high precision and less computational complexity. This system is cost-efficient and less manual work is needed. Using Gabor filters accuracy is highly improved. For face recognition, Three algorithms have been used which are PCA, convolutional neural networks, and support vector machine, among these, the PCA algorithm proved to have the highest accuracy of 99.27 %. Convolutional neural networks evinced to have low computational complexity. SVM algorithm proved to be less efficient.

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