Automated Attendance Monitoring system using discriminative Local Binary Histograms and PostgreSQL

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Abstract: ***The aim of this project is to design and implement an attendance monitoring system using Facial Recognition. The automatic attendance management will replace the manual method, which is time consuming. There are many biometric processes, in that face recognition is the best method. In this paper, an attendance monitoring system for administrative purposes is created. In this method the USB camera is fixed at a place and it will capture the image, the face of the person is detected, trained and then it is recognized with the database and finally the attendance is marked. There are various methods for comparing the faces. OpenCV (Open Source Computer Vision) is a popular computer vision library which works on the concept of real time image processing and is supported with various open source implementations of the latest computer vision algorithms. OpenCV 2.7 comes with a pre-defined programming interface with Python. The Linear Binary Pattern Histograms (LBPH) Algorithm has been used in the proposed system for facial recognition. The database which records attendance is created using PostgreSQL.***

I. INTRODUCTION

Face recognition is generally an uncomplicated task for us humans. According to various experiments young babies of even a few days old are able to distinguish between faces. Shouldn't be that complicated of a procedure for a machine then? Surprisingly, little is known about facial recognition till now. For a successful recognition, are the features within like eyes, nose etc or are outer features like hairline, head shape more pertinent towards this? The question of how this was analyzed or how the brain encodes this in general is rather interesting.

There are specialized nerve cells within the brain which correspond to specific localized features of an image, angle and even movement, as shown by neurophysiologist David Hubel. The visual cortex of the brain should inherently combine the various sources of information to meaningful patterns, since what is seen is not a scattered reflection.

The main aim of automated facial recognition is to extract the valuable pieces of an image, arrange it into a useful representation and classify them into distinguishable categories.

The LBPH face recognizer does a similar kind of work. Local Binary Histogram Patterns labels the pixels of an image by thresholding the surrounding of each pixel and takes into consideration the result as a binary number which is in turn extremely simple but efficient.

LITERATURE SURVEY

Multiple Face Recognition algorithms are currently existent each of which follow a different approach or methodology and thereby have different levels of accuracy and different success rates. Role of machine learning algorithms is vital nowadays for handling the huge data and related accurate and fast classification and recognition [12-17].Although multiple algorithms might exist to serve this purpose, the algorithm that forms the basis of research and further development in this field is the Principle Component Analysis (PCA) based on Eigenvalues. This algorithm although being the most inefficient among the rest, formed the basis of research and led to the development of more efficient and accurate algorithms leading to higher quality results. But as more and more algorithms were developed that yielded results with higher efficiency PCA was not used further for the applications of this domain. The Linear Binary Pattern Histograms Algorithm has been used in the proposed system. The system follows a simple chronological execution of various steps that defines the capability and the efficiency of the system which includes determining, detecting, capturing of the image in initial stages which is followed by processing and training the image and finally taking the real-time snapshot and comparing this image with the previously

processed and trained set of images. After recognizing the face, the attendance of the particular individual is marked. To probe into deep, the actual working of the system which focuses mainly on Local Binary Pattern Histograms (LBPH) Algorithm proves to be a key aspect that forms the basis of the face recognition part of the system[7].

II. PROPOSED WORK

A. Image Acquisition

Scanning a photograph or using an optical camera to capture a live picture of the subject in question are a few ways an image can be acquired. Another source of face images can also be video which is a multiple images in quick succession. When the images are particularly of low quality which are in the case of low lighting, various poses, awkward expressions or illumination, the rate of recognition can be adversely affected in the process.

B. Image Preprocessing

The significant amount of variations in illumination and lighting between gallery and probe pictures is majorly dealt with various face recognition algorithms. The image pre-processing algorithms that are used to compensate for such variations in images before the actual recognition is used for the same reason.
The aim of digital image processing is to improve the image data (features) by suppressing unwanted distortions and/or enhancement of some important image features so that our **AI-Computer Vision** models can benefit from this improved data to work on.

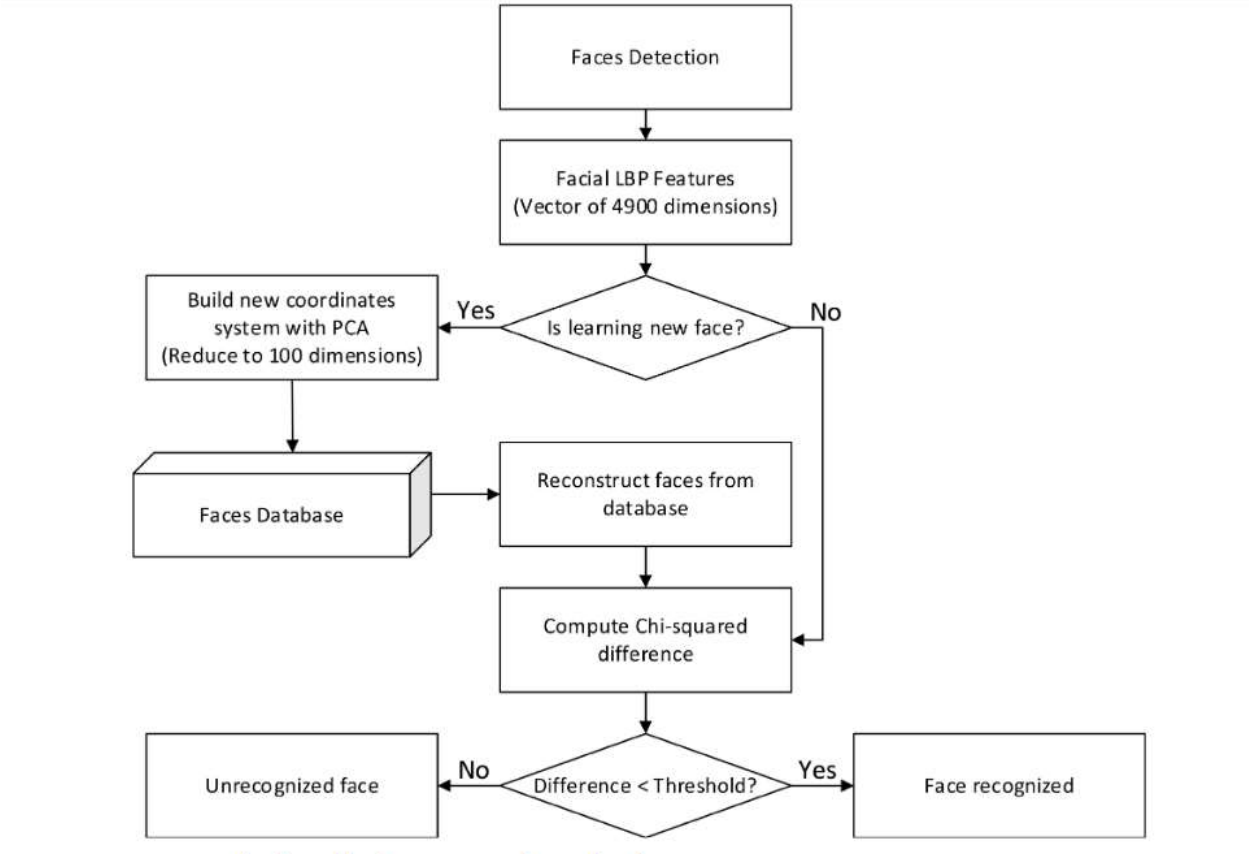

Fig. 3.1: The Face recognition overview diagram of our approach.

C. Face Detection

Face detection is a technology used in computer vision to understand faces and their location in a 2-Dimension image. It focuses on the features like eyes, eye-brows, nose, lips and jaw of the face and ignores the rest. Face detection can be thought of as synonymous to object detection with a particular class in consideration. Object detection itself is a major task in computer vision which makes face detection a competitive problem to solve. The coordinates of the faces in the frame are to be extracted from an image with the use of a synthesized, algorithmic computer program. An overall notion of how a face looks like is used by the program to detect faces from a given frame.

D. Face Extraction

This module takes care of extracting meaningful information regarding a detected face and devises a feature vector for the same. Aim of Face extraction is to draw out the relevant information from the provided image. Holistic feature category and the local features category can be the two classifications in which feature extraction can be categorized into. The descriptor local binary pattern is used to compare all the pixels including the center pixel with the neighboring pixels in the kernel to improve the robustness against the illumination variation [6]. While the holistic feature category comprises of taking the whole face into consideration, Local feature based techniques try to locate facial features like eyes, nose and mouth which are special to a human face and the known distances between them are analyzed.

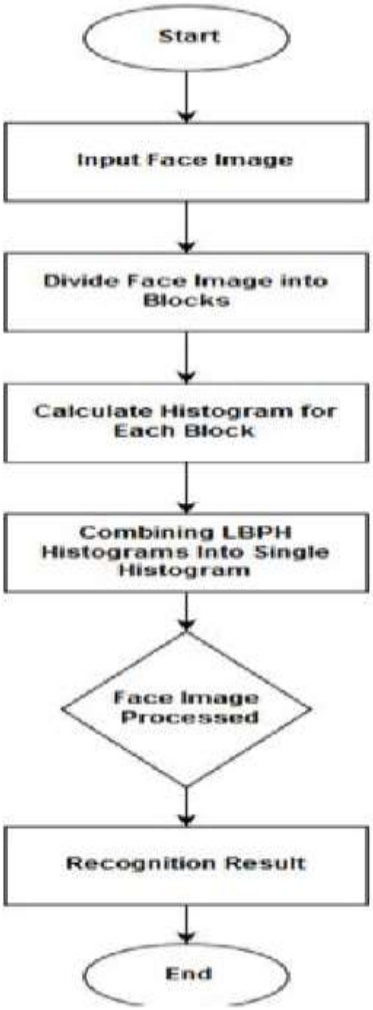

Fig. 3.2: The Face analysis flowchart.

E. Training Database and declaring a match

It is required to train the neural network by passing various data sets and creating a large trained database for high efficiency. After the neural network is trained, it is used on a testing data set to check the accuracy of the NN. After numerous such iterations, the final model is used in the testing environment of new faces. A database of known faces is stored and keeps updating regularly. Finally compare the results of the neural network with those in a database of known faces.

In the attendance monitoring scenario, the detected face is checked and compared against each entry in the database to find out a match. This will result in the correct face recognition of the students in the classes.

IV. RESULTS AND ANALYSIS

Fig. 4.1: Our System sample screen.

Figure 4.1 shows a sample screen of the proposed attendance monitoring system. The student is automatically marked absent or present and the status is displayed in real time. Manual marking feature is also provided which may be used to resolve emergency discrepancies. The marked students are automatically put in the live database making the system highly automatic. The live class capacity and students who are absent/present for a certain number of lectures can be viewed by executing simple queries.

The face recognition model correctly detects all the student faces according to the algorithm with an accuracy of 73% achieved on a validation dataset of 800 students from the institution.

The model was also tested on adverse light conditions where ambient light was not sufficient. In such cases the model performed well with an accuracy of 57%. Figure 4.2 illustrates the obtained results in dim light outside the classrooms.

The scale of the system was also tested with around 800 students at the same time with 10 simultaneous attendance systems working concurrently to ingest data of 800 students into the database with an average latency of 50ms. The live database was tested with complex join queries and the maximum latency observed was 102 ms.

Fig. 4.2: Results of our model in dim light.

The attendance system proved to recognize images of indifferent angle and light conditions. The faces which are not in our training dataset are marked as unknown. The Attendance of recognizing images of students is marked in real time. And import to excel sheet and save by the system automatically. The accuracy of 73% was achieved through disruptive local binary histogram patterns and the result has been varying with distance and different lighting conditions.

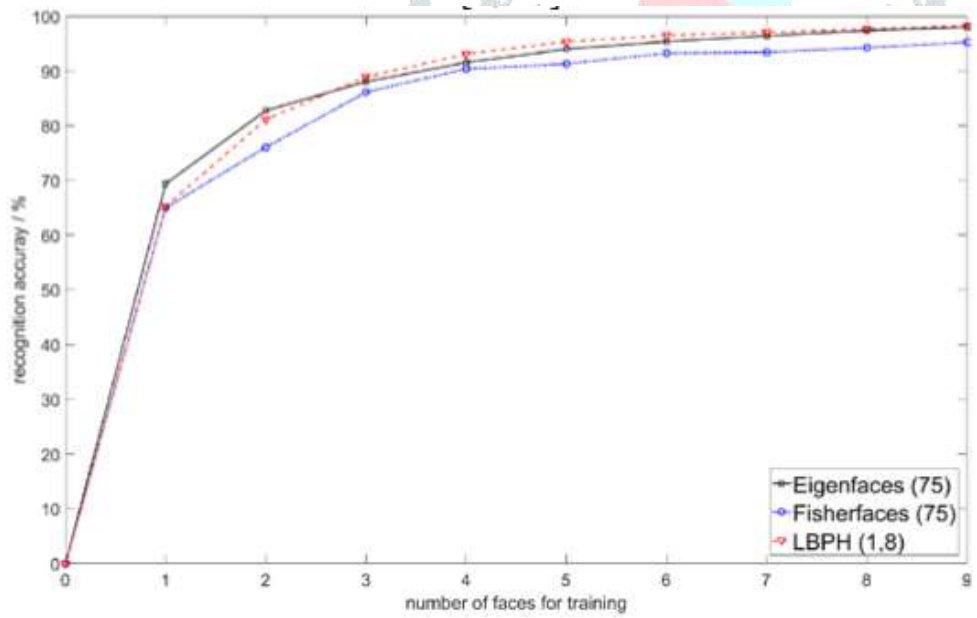

Fig. 4.3: Plot of Model Accuracy on Train Datasets.

The results of accuracy comparison for EigenFaces, Fisherfaces and LBPH were important in deciding which technique to use in the implementation of the attendance management system. Figure 4.3 shows accuracy vs number of training faces plot results which gave a clear direction and validation for the decision to choose LBPH for facial analysis. The eigenface algorithm, another method which primarily focuses on linearly projecting the image space to a low dimensional subspace, which has relatively equal computational requirements. Although, incisive experimental results show that the other fisherface method has error rates that are significantly lower than those of the eigenface technique for the comparative assessments done on the Harvard and Yale face

databases [4]. For the mentioned reasons LBPH provides a substantial method to use in terms of extraction of features is concerned.

V. CONCLUSION

The proposed application of face recognition using LBPH proved to be very successful in developing an attendance management system. Smart attendance management system is designed to solve the issues of existing manual systems. Face recognition concepts are used to mark the attendance of students and make the system better. The system performs satisfactorily with an overall accuracy of 73% in different poses and variations. The database performance was also tested which resulted in good latency and a scalable solution. The system was tested in a real-life environment in PICT on a total of 800 students. Since the tests are taken in general uncontrolled environments, the illumination and pose could, to a quite an extent, affect the accuracy rate. The filtering system introduced reduced these effects. To increase accuracy, a pose tolerant face recognition approach may also be used [11].

For further improvement in the coming times, the system often faces difficulty in recognizing subjects from a distance which is compounded with limitations in process power. Better processing provides a more efficient and effective performance. Although, with the limitations on one side of recognizing a large amount of facial structures, there is a lot of scope for further improvement. As in this project, a model based approach has been used, given the opportunity to improve various other models till a required detection and desirable recognition efficiency is achieved. Enhancement can be in terms of rate of detection, efficiency, precision to more number of students for an auditorium than a class of 40 students, for which various improvements in algorithms can be made.

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