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Monitor Student's Presence in Classroom

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Abstract - The real time face detection and recognition is now a days a subject of interest in various daily applications like crowd identification, video conference ,security measure, image analysis etc. This topic has brought attention of researchers because the human face is a dynamic object and has a high degree of variability in its appearance, which make face detection a difficult problem in computer vision. Many technique are being proposed, ranging from simple edge based algorithm to composite high level approaches utilizing advanced pattern recognition methods. The algorithms presented in this paper are Viola-Jones algorithm(Haar Cascade Classifier) and PCA(classified as either feature based and image based) and are discussed in terms of technical approach and performance. The objective of this paper is to find out away to monitor student's presence in classroom using EmguCV(Computer vision Library and wrapper class of OpenCV) and send important notification to parents to keep track of their child from remote location.

Keywords **– EmguCV, Camera, Face Detection, Face Recognition System, PCA Eigen Faces.**

1. Introduction

Today, we see an incremental growth in education percentage compared to the last decade because of awareness within folks and significant benefits of proper education for self and carrier development. The admissions of students are increasing day by day in schools and colleges which in turn increasing no. of students in the classroom. And, teachers/professors are finding difficulty to keep track of presence of all the students in the classroom that takes substantial time to take attendance as well. Therefore, to get rid of this, all are seeking for various alternatives of which 'Online Attendance' is an alternative.

In many institutions, Colleges and organization the attendance is very important criteria for students and organization Employees. The previous method in which manually taking and maintains the attendance records was very inconvenient work for teacher/faculty. Traditionally, students present or absent are taken manually by using attendance sheet given by the faculty members in class, which is a time consuming task. Moreover, it is very difficult event to verify one by one student in a big classroom whether the authenticated students are actually present or not. The ability to compute the attendance percentage becomes a major task as manual computation produces errors, and also wastes a lot of time. If an automatic detect and recognize system is developed for college, it eliminates the need for sheet of paper and personnel for the keeping of student records. Identifying students early on who show signs of absenteeism is a predicator of warning signs of students dropping out. Even though truancy is a major issue in middle school and high school, perhaps students should be identified and monitored early on in elementary school.

Educators need to continue to find innovative ways to bridge the gap between home and school to communicate with parents the need for a strong partnership so students can find success. Students need to know that coming to school on time, everyday is important. Educators, when faced with schools that have attendance problems may need to venture out beyond the wall of the school, into the community to involve families and work together. An automatic attendance management system using biometrics would provide the needed solution. The project – Monitor Student's Presence in Classroom will have a smart and real time attendance application that monitor and detect the exact presence of a student in classroom. This desktop camera authenticate student after

recognizing face of that student and at the same time save record with details like student name, roll number, date, time etc. of present student in classroom.

Here, the application is using visual studio 2010, OpenCV library(EmguCV).Using this software, system perform multiple face detection, recognition, tracking of a position of student and provides the exact attendance of student is mark in the access database.

2. Literature Survey

Development of automated face recognition started in the 1960s, the first semi-automated system for face recognition required the user to locate features (such as eyes, ears, nose and mouth) on the photographs before it calculated distances and ratios to a common reference point, which were then compared to reference data. In the 1970s, Goldstein, Harmon and Lesk used 21 specific subjective markers such as hair colour and lip thickness to automate the recognition. The problem with both of these early solutions was that the measurements and locations were manually computed. In 1988, Kirby and Sirovich applied principle component analysis, a standard linear algebra technique, to the face recognition problem. This was considered somewhat of a milestone as it showed that less than one hundred values were required to accurately code a suitably aligned and normalized face image. In eigenfaces techniques, the residual error could be used to detect faces in images- a discovery that enabled reliable real-time automated face recognition systems.

2.1 Survey on Previous Paper

In [1] A portable fingerprint device has been developed which can be passed among the students to place their finger on the sensor during the lecture time without the instructor's intervention. This system guarantees a fool-proof method for marking the attendance. The problem with this approach is that passing of the device during the lecture time may distract the attention of the students. A number of works related to Radio Frequency Identification (RFID) based Attendance Systems exist in the literature. In [2] the authors have proposed RFID based system in which students carry a RFID tag type ID card and they need to place that on the card reader to record their attendance. RS232 is used to connect the system to the computer and save the recorded attendance from the database. This system may give rise to the problem of fraudulent access. An unauthorized person may make use of authorized ID card and enter into the organization. Iris is the another bio-metric that can be used for Attendance Systems.

In [3] the authors have proposed Daugman's algorithm based Iris recognition system. This system uses iris recognition management system that does capturing the image of iris recognition, extraction, storing and matching. But the difficulty occurs to lay the transmission lines in the places where the topography is bad.

In [4] authors have proposed a system based on real time face recognition which is reliable, secure and fast which needs improvement in different lighting conditions.

3. Proposed System

The feasibility analysis was timely performed to determine whether the system is capable of performing the intended job. The pilot project is executed, successfully implemented and achieved desired output from the system. The results improved performance over manual attendance management system. This proposed system in school or college can easily be implemented, as this is based on Emgucv coding. The resources that are required to implement/install these are easily available from open sources. The personal of the organization have enough exposure to computers so the project is operationally feasible. This technology supports the modern trends of face detection and recognition technology and easily accessible, more secure. In this project, all the soft tools required to perform the job are open source. In the hardware section, in-build desktop CAMERA i.e. Windows Form Application which will be used to capture images. As numbers of students are increasing day by day in turn increasing schools/colleges counts. Therefore, giving a good potential forecast for the product or services to be opted by various schools/colleges to monitor student's presence or attendance in the classroom. The Real-Time monitoring accelerates time to delivery. The main aim of our project is to monitor student behavior and hence provides security to students. It also aims to provide ease to teachers by providing them with real time and smart monitor system facilities which reduces their manual work and save time.

and flushed right. Equations should be referred to as Eq. (X) in the text where X is the equation number. In multiple-line equations, the number should be given on the last line.

$$y_i(N) = \sum_{n=0}^{m-1} w_n(N) b_n(N)$$

$$= \sum_{n=0}^{m-1} \overline{b_n^*(N) r_i(N)} \cdot b_n(N) \qquad (1)$$

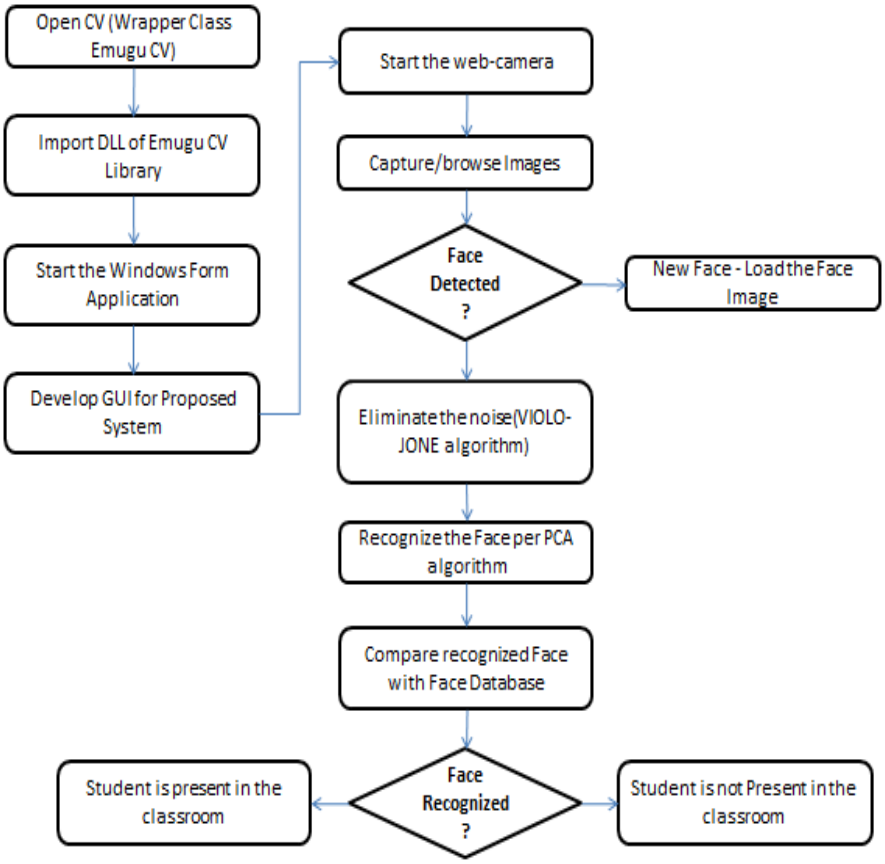


Fig. 1 System Architecture

4. Implementation of system

Open CV

It stands for Open Source Computer Vision, it was designed especially for computational efficiency with strong focus on real time applications. It is written in optimized C/C++, and can take advantage of multi-core processing. In Image processing it has been a great boon for the developers.

Emgu CV

1. Emgu CV is a cross platform .Net wrapper to the OpenCV image processing library. Allowing OpenCV functions to be called from .NET compatible languages such as C#, VB, VC++ etc. The wrapper can be compiled in Mono and run on Windows, Linux, Mac OS X, iPhone, and Android devices.

2. Add the OpenCV .dll files required for Emgucv functions to work in project.

3. Its is essentially a huge library of "wrapper" functions that allows calling OpenCV funtions from Visual Studio Windows Form Application. It is necessary because Visual Studio/.NET is an "interpreted" environment that cannot directly call functions written in native C/C++.

A. Camera Capture Application:

The in-build camera (Desktop Application) is used to capture the images. It should following steps,

1. Desktop camera is ON, capturing images continuously
2. An Image should be displayed in an EmguCV Image box
3. The application should start when "Start" button is pressed and pause when it is again pressed and vice versa.

B. Face Detection

Face detection is a computer vision technology that determines the locations and sizes of human faces in arbitrary digital images. It detects facial features and ignores anything else, such as buildings, trees, background and bodies. Face detection can be considered as a object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in a digital image that belong to a given class. Examples are video for classroom, student images/database .

There are many methods to detect a face in a real time application. Some ways are easier and some are harder. Face detection approaches:

•Finding faces in images with controlled background.
•Finding faces by color.
•Finding faces by motion.
•Using a mixture of the color and motion.
•Finding faces in unconstrained scenes:
Neural Net approach
Neural Nets using statistical cluster information
Model-based Face Tracking
Weak classifier cascades

The Viola Jones method is best model for Face detection. 'Haar Cascade Classifier' is used for detect faces from live desktop camera.

C. Extract the Detected Faces From Input Image

Each extracted face added to the Extracted Faces array. Then display each extracted face in the array to the picture box. Code behind the added buttons to navigate through the extracted faces array to display previous or next extracted face.

D. FACE RECOGNITION

"Face recognition is the task of identifying an already detected object as a KNOWN or UNKNOWN face, and in more advanced cases, telling EXACTLY WHO'S face it is!" Face detection is to identify an object as a "face" and locate it in the input image.

Face Recognition nothing but is to decide if this "face" is someone KNOWN, or UNKNOWN, basing on the database of faces it uses to validate this input face.so face detection's output (the face) is in fact recognition's input and recognition's output is the final decision: face known/face unknown! Recognition algorithms can be divided into two main approaches:

1- Geometric: which looks at distinguishing features?
2- Photometric: which is a statistical approach that distills an image into values and comparing the values with templates to eliminate variances?

Recognition algorithms include
1. Principal Component Analysis using Eigenfaces
2. Linear Discriminate Analysis,
3. Elastic Bunch Graph Matching using the Fisherface algorithm,
4. The Hidden Markov model, and
5. The neuronal motivated dynamic link matching.

PCA based Eigenface method is at the most primary level and simplest of efficient face recognition algorithms and is therefore a great place for beginners to start learning face recognition! PCA based Eigenfaces method for recognition is as supported by EmguCV library as is Viola-Jones method for detection is!

E. Collect Face images for training set Database

Face Recognition results HIGHLY depend on the faces you store in the training Set. The faces try to recognize. Project task is to ENSURE that training set (faces database) is WELL made.

5. Mathematical Model

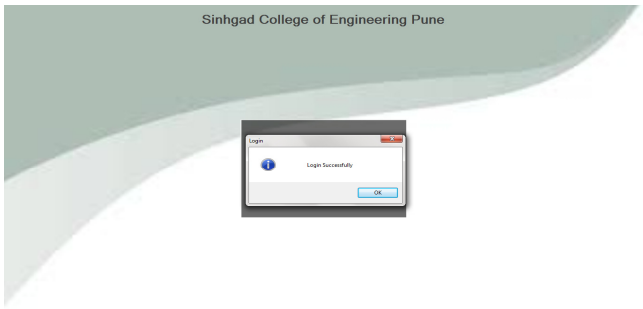
The model of Monitor Student's Presence in Classroom System as a Finite State Machine MSPCS is defined as a five tuples relationship

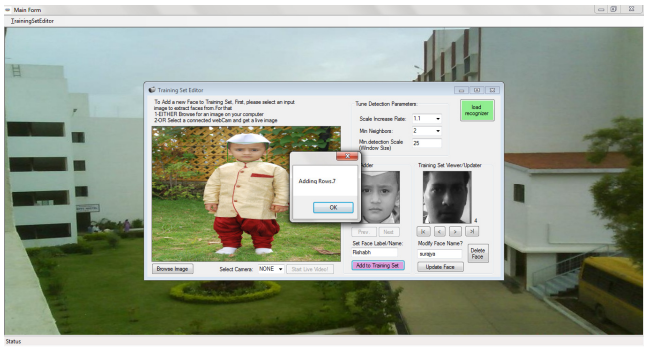
$$MSPCS \mid\mid (S, \Sigma, s, F, \delta)$$

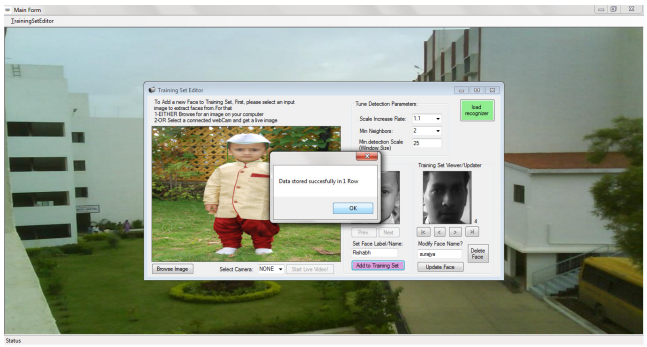
Where S is a set of valid states that forms the domain of the MSPCS, S = {s0, s1, …, s8} where the states are: s0 – Teacher Registration System, s1 – Student Images capture by camera, s2 – Database student Image, s3 –Result of Image Compare, s4 – Parents Registration , s5 –Login and child Status checked s6 - Attendance is taken s7 - Entry is granted, s8 – Entry denied s9 – Exit

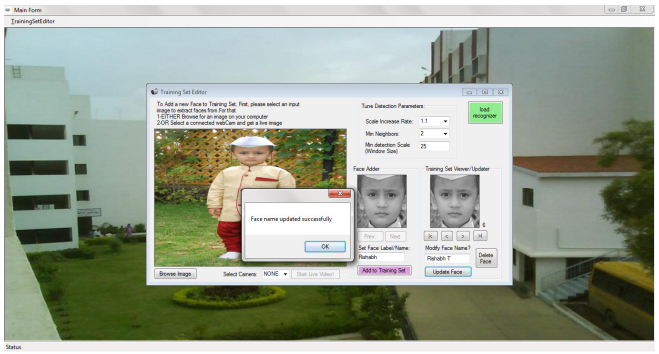
Σ is a set of events that the Software may accept and process, Σ = {e0, e1, …, e12} where: e0 - Start, e1- Face Detection, e2 – Face Recognition Data, e3 – Check for Student Image Match, e4 – Match Found, e5 – Match not found, e6 –Status confirmed, e7 – status not confirmed, e8-Attendance Marked.

6. Results and Snapshot









7. Conclusion

The aim of project to introduce new face recognition method. This face recognition technology used for many purposes. Pilot phase of this project would be to monitor the movement/behavior of children in the classroom. Parents can monitor presence/absence of their children from remote location without physically visiting to the college or school. However, after successful implantation of pilot, same concept might be implemented in various areas like institute, police department, constitution, organization etc.

Acknowledgments

A project of this magnitude has been a journey with various ups and downs.

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