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Employee Surveillance System Using Face Recognition

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Abstract

Advancement in technology has made face recognition system more prevalent and convenient to identify a person without a manual system which contributes to time consumption. In this system, facial recognition is by the means by which the employees are monitored. Our project addresses the problems present with manual surveillance by automating it in an efficient manner. Machine learning and deep learning have benefited people from all walks of life, and we plan to use machine learning in our surveillance system to build this specific project with the aid of Python and its comprehensive modules. The project involves a real-time detection of faces which are then matched with the corresponding face in the database. An excel sheet stores the time at which the login has taken place when the detection occurs. To achieve the goals, we used a combination of machine learning techniques and various logic-based algorithms.

Keywords: *Face Recognition, Machine Learning, Surveillance, Algorithms*

1. Introduction

The need for a surveillance system has rocketed because of the necessity to know the presence and absence of an individual in their workplace. The manual method of surveillance has had a number of inefficiencies. A surveillance system monitors the employee's working time, resulting in the performance evaluation of an employee. Face recognition is widely implemented in day-to-day life. They seek to provide accurate results with minimal to no human intervention. It is used in multiple fields like the crime department for procuring the details of a criminal or a missing person, attendance system in schools and colleges, unlocking mobile devices and many more.

The project has an interactive interface that takes images with a corresponding ID and names, and then successfully trains the images. In the face detector window, the pre-trained machine recognizes the person with their name, ID and the department they are associated with and generates the login time which is stored in an excel sheet. In case the system fails to recognize the person, it sends an SMTP notification. Deep learning is a branch of the machine learning tree. Most deep learning algorithms are motivated by the human brain's ability to learn vast quantities of data that are complex, unstructured, and interconnected. The computer then uses these algorithms to solve complex problems. Our project covers a wide range of subjects, but it focuses on deep learning through the use of OpenCV and Haar Cascades.

OpenCV is a python library that mainly enables us to achieve objectives like image classification, object detection, face detection and recognition. Computer vision constructs vivid descriptions of physical objects from their image. The input given by the means of Computer Vision gives an appropriate output . It centers around the advancement of constant PC vision applications and interfaces. It has multiple features which can be applied in biometrics, 2D/3D segmentation, surveillance, et cetera. The Haar Cascades Algorithm developed in 2001 was a turning point for any venture pertaining face detection. The Algorithm is a conclusive way of object detection; it trains the machine by the means of positive and negative images. After the training, the machine can successfully detect the trained object in another image. In our project, the specific file which is being used is the Haar cascade frontal face default XML sheet.

The Haar cascades file detects the face appropriately, while the LPBH algorithm or the Local Binary Pattern Histogram algorithm helps in accurate face recognition. It extracts all special facial features from an image or a video. The Histograms are stored as pixelated patterns from each region which are

then bound to form a single enhanced feature. A csv file is used to maintain and keep track of employee presence. This csv file contains the workers' records, which are modified when they check-in and the details are stored in an excel sheet. This serves as a critical element for keeping track of attendance and stands as the main objective of our project. If the person isn't recognized by the system, then there is an SMTP notification generated.

Related Works

Face Recognition has been a space of examination for quite a while. It has bifurcated and given birth to the advancement of various disciplines such as computer vision, machine learning, image processing and neural networks. Since the evolution of technology at such a large scale, face recognition has been implemented into an array of systems like attendance systems, face detection systems, mask detection systems, et cetera.

In, Dhanush Gowda H.L's paper they had implemented an attendance system by the means of OpenCV and recognition through Dlib. In summary, the info picture and the yield is a point in a 128 dimensional space. By checking the distance in this 128 dimensional space, the system can verify if the person is recorded in the database or not. It is determined in Dlib that assuming two face descriptor vectors have a Euclidean distance under 0.6, they are a similar individuals, although the edge shifts as it relies upon the quantity of pictures selected.[1]

In another paper Digital Image Processing is done by the means of PCA, Eigen faces, Microcontroller based on MATLAB. With the help of MATLAB's Image Acquisition Toolbox, the image is captured and processed. This is the part which serves as analyzing face images. Joseph Jomon goes on to highlight the principal component analysis method. They put together this framework with respect to the information theory approach which empowers disintegration of face pictures into a more modest arrangement of trademark include pictures called Eigen faces. These Eigen Faces fill in as the essential parts for preparing the dataset. As another picture is projected into a subspace traversed by Eigen faces, recognition is performed. In the wake of doing as such, the face is ordered by looking at its situation in the face space with those places of the definitely known people.[2]

Nusrat Mubin and her colleagues use the camera system module from Pi to monitor the individuals. She distinguishes the understudies sitting on the last sections advantageously while the histogram evening out of the image is finished. The individual's face discovery will be done through the passed on picture. Their system focused on front images and was an appropriate method to recognize only the frontal view. In the CNN approach for vision-based Student recognition system, they had used NET CNNs and RFID technology which used the monitor camera to scan for information.[3]

Wenxian Zeng in the design of the Classroom attendance system, used a convoluted neural network that uses a system that possesses a multilayer perceptron that helps requirement gathering at a much faster pace. The Automated Attendance System at last aides in expanding the exactness and speed proficiently. It accomplishes high exactness precision for the constant participation issue.[4]

LBPH based enhanced real-time Face Recognition by Farah Deeba and others went into the finer details of feature extraction regarding the Local Binary Pattern Histogram Algorithm. They give a detail outline of how face location, pre-processing, feature extraction and feature coordinating goes about. Farah and her lab mates push through a series of experiments where they receive three different situations. The True Positive happens when the person's information is put away in the dataset and the perceived subject matches that of the prepared dataset, the True Negative happens when the tried information doesn't relate when the subject's information saved in the dataset folder. True Occlusion occurs when the subject's dataset is saved without the occlusion condition and hence cannot recognize the data which has been saved.[5]

Peace Muyambo in their paper on Face Recognition by using LBPH proposes a system to find missing people with the help of Haar Cascade classifier and the LPBH algorithm which is used for detection and recognition of faces while MySQL serves the purpose of a database.[6]

Face Recognition based attendance system by Dhanush Gowda and his peers details their paper by talking about the various aspects of facial recognition by a combination of using both OpenCV and Dlib. Dlib focuses on Euclidean distance and how the input image gives an output by the means of a single point in a 128 dimensional space. However, the bounding box is smaller than the Histogram of orientation gradients' box. It does not detect small faces as the system is trained for minimum face size of 80x80.[1]

Edy Winarno proposed a system which could predict cheating on the basis of facial recognition. They utilized a sound system camera or a double vision camera which produces one picture from every

focal point and in the end half joins the two pictures, one from the left focal point and the other from the correct focal point to deliver one strong picture which goes through extraction utilizing the 3WPCA technique. The method is highly commendable as the accuracy goes up to 98% but the overall point of the objective's face impacts the recognition score massively which could without much of a stretch cut down the productivity of the framework.[7]

ADA Boost algorithm is used by Raj Malik in his Prototype model for an Intelligent Attendance System. A hybrid model of PCA and LDA algorithms is used to eliminate the chances of proxy and fake attendance effectively but this method works only for a single image at a time which gives an unfair disadvantage easily solved by LPBH. [8]

In 2013, Joseph Jomon, in his paper illustrates how Eigen faces with the aid of Principal Component Analysis and MATLAB aim to simplify face recognition but it must be noted that PCA relies heavily on linear assumptions. Both PCA and Eigen faces are very sensitive to scale, which makes it necessary to have a low level pre processing even for scale normalization. Adding to the fact that the recognition rate decreases for recognition under different pose & lighting is an unneeded disadvantage which can be rectified by using LPBH. MATLAB seems more convenient, especially where developing and data presentation is concerned, but OpenCV is much faster in execution [2].

2. Materials And Methods

The proposed system is designed for automating the surveillance over a set of employees. It increases security exponentially by giving face recognition as the method of verification instead of manual administration of employees. The project comprises various layers of security. Only the authorized person has access to the software which is guarded by a username and password. After entering the details, the administrator can access a number of services like employee details, services to train the data, face detection, help desk and an employee database.

Face detection is done by the means of the Haar Cascades classifier by Viola-Jones and face recognition by the LBPH Algorithm. The Local Binary Pattern Histogram is one of the most efficient algorithms to be implemented where face recognition is concerned. LBPH uses several parameters which are detrimental in training the algorithm. After efficiently using a dataset to train images and setting an appropriate ID to each trained image, the calculation will strain through this data to perceive an input picture and give the resultant yield. The Frontend of the System was brought to life by the means of the Tkinter GUI module. With the help of the module, we could establish a login page for the administrator and several other interfaces.

The Employee details page receives information about the employee in a form format where all essential details like his name, phone number et cetera can be filled. After filling in these details, a photo sample of the person is taken with the means of the Viola-Jones Algorithm. The Haar Cascade is an object detection algorithm that is used for identifying a face in an image or a real-time video. OpenCV can read the Haar Cascade XML files and these files include various models for face detection, eye detection, lower body detection, et cetera. All these relevant details are handled and stored with the help of MySQL in a database. Train Data is the other icon available which redirects us to an interface that trains data (Fig 1 & 2). The data is trained by the LBPH algorithm.

Fig: 1

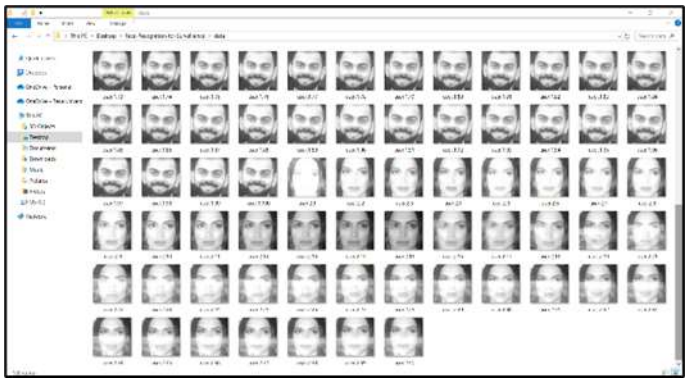

Fig: 2

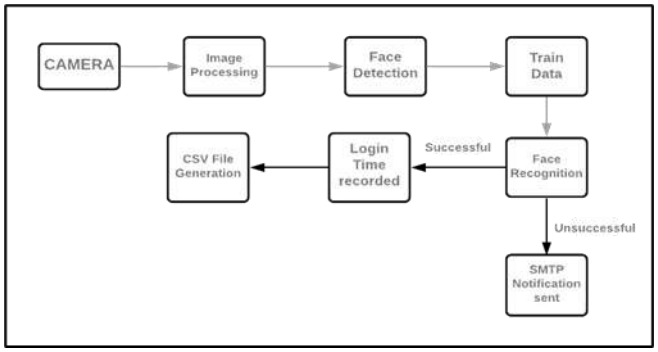

Fig: 3

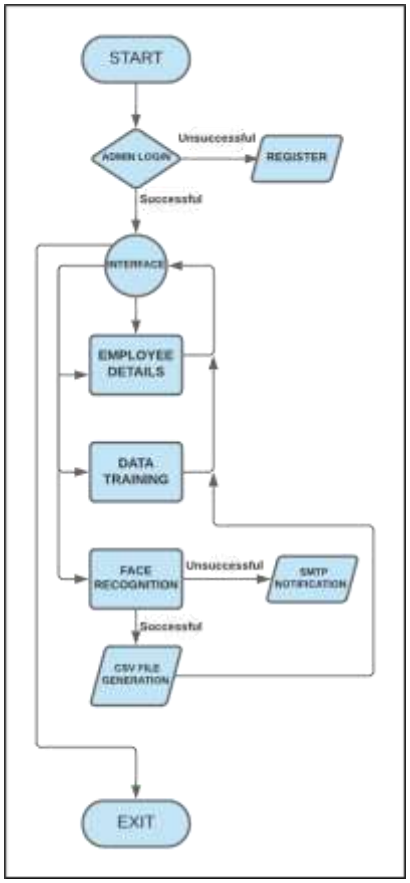

Fig: 4

The Local Binary Pattern Histogram algorithm solves the face recognition problem effectually. It recognizes both the frontal face and the side view as well. LBPH utilizes four factors in particular, they are, range, neighbors, framework X and network Y which typically have a fixed arrangement of qualities. The algorithm is then trained by the means of a dataset. The image is divided into many cells to enable the encoding of features; it is contrasted by using surrounding pixel values which are bearing either clockwise or counter clockwise. Each neighbouring pixel's intensity is compared to the central pixel. The location is assigned to either a 0 or a 1 based on result of the difference. The result

is usually an 8 bit value. If the illumination changes, the result corresponds to the previous result. Each image has an ID associated with it, which aids in training the algorithm. The same procedure is used to classify the input images. After the image has been generated, Histograms of each region are extracted and then concatenated.

Face Detector is the other button present which on clicking, simply opens a window for face recognition. The window recognizes the person if his information is present in the database and gives away his name, department and employee ID which is automatically updated in the employee database. The employee database has the details of the of the employee like the name and the ID with the department they belong to and the time at which they've logged in, down to the second. This enables us to accurately keep a record of the login time in the form of a csv file. If the system cannot recognize a person an SMTP link is sent to the registered email. Fig 3 and 4 gives a detailed block diagram and a flow chart which illustrates the working of the system in an appropriate manner. The developer has the information regarding the developer, and the helpdesk gives the email of the ones who have developed so that any technical difficulties could be managed by the person responsible and could be contacted effortlessly.

4. Conclusion

This project aimed to maintain and archive an employee monitoring system that would act as a failsafe in the workplace. The existing method struggles to do what is necessary, resulting in ineffective procedures. A monitoring device has seen to successfully reduce manual methods and correct any kind of human error. Face recognition monitoring technology effectively resolves these contradictions. The ease of use validates our project as user-friendly. The administration of face recognition prodigiously reduces the time taken and ensures elevated precision to provide the necessities of computerised evaluation in any professional setting.

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