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Development of Home Security Surveillance System by Face Recognition using HAAR Cascade

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ABSTRACT: Security is a most important factor today. Technology develops day by day in the world. So, the technology of security should be modern with time to protect. Face recognition play a vital role in variety of applications from biometrics, surveillance, security, identification to the authentication. It is the ability to detect and recognize a person by their facial characteristics. Face is a multidimensional and hence requires a lot of mathematical computations. Face recognition system is very essential and important for providing security, mug shot matching, law enforcement applications, user verification, ser access control.
We proposed asmart security system for restricted area where access is limited to people whose faces are available in the database. This is a real time system for surveillance using cameras. The process is of 2 steps. Face Detection (FD) and Face Recognition (FR) to identify a particular person. For FD the system tracks and selects the faces of the detected person through Haar Cascade algorithm and an efficient LBPH Face Recognizer algorithm is then used to recognize detected faces with a known database.

KEYWORDS: Face Detection; Face Recognition; Haar Cascade Algorithm; LBPH Face Recognizer;

I. INTRODUCTION

The advent of technologies like Internet of Things, Ubiquitous computing, Autonomous computing etc. have turned a number of unimaginable concepts and theories into reality. Earlier a major setback in the realization of any concept or a theory was the lack of availability of computing resources but now, with the introduction of these new technologies we are able to introduce our concepts to the future world in no time. Internet of Things (IoT) is a highly proliferating paradigm of modern wireless telecommunications as it consists of many novel networking techniques. With the aid and assist of sensors and actuators, IoT has found its place in wide range industrial automation devices, mobile object locating systems, ecological supervising etc. A huge variety of IoT systems such as smart grids, intelligent transportation, smart cities and virtual power plants are fully functional in the current era.

Surveillance is the monitoring of behaviour, activities, or information for the purpose of influencing, managing or directing. This can include observation from a distance by means of electronic equipment, such as closed-circuit television (CCTV), or interception of electronically transmitted information, such as Internet traffic. It can also include simple technical methods, such as human intelligence gathering and postal interception. Surveillance cameras are video cameras used for the purpose of observing an area. They are often connected to a recording device or IP network, and may be watched by a security guard or law enforcement officer. Cameras and recording equipment used to be relatively expensive and required human personnel to monitor camera footage, but analysis of footage has been made easier by automated software that organizes digital video footage into a searchable database, and by video analysis software (such as VIRAT and HumanID). The amount of footage is also drastically reduced by motion sensors which only record when motion is detected. With cheaper production techniques, surveillance cameras are simple and inexpensive enough to be used in home security systems, and for everyday surveillance. The advent of 360o cameras equipped with video de-warping technology is eliminating the need to deploy 3 to 4 PTZ (or the standard CCTV) cameras to cover a single region, as a single device can now effectively do the same. It has also reduced the post-deployment costs for businesses since a single video feed generated by such devices consumes lower network bandwidth and storage space.

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II. RELATED WORK

In [1] the proposed video surveillance system, unlike other aforementioned algorithms instead of a wide-angle camera, a pair of static cameras monitor the surveillance area, detect and track people (pedestrian) in the area, to obtain 3D information and analyses their activities in order to accurately and reliably drive the PTZ camera. The high-resolution images/video generated from PTZ camera could be used further to control the tracking itself or in forensic investigation later to obtain the 3D information, the canonical stereo configuration is used by special arrangement of the pair of cameras with same intrinsic parameters in the proposed system. One or two or even to obtain the 3D information, the canonical stereo configuration is used by special arrangement of the pair of cameras with same intrinsic parameters in the proposed system. One or two or even the experimental results presented here use two sequences of image taken with stationary cameras to test the proposed novel moving object detection, tracking and analysis method. The image sequences were processed and the object motion detection and tracking were simulated.

In [2] the faces are detected using Histograms of oriented Gradients (HoG) algorithm proposed in using python implementation. For each detected face, an algorithm for landmarks detection based on regression tree is then used for face landmarks detection.

In [3] a system is devised for live video feed based facial recognition. This basically focuses on how we can have better and more efficient surveillance and security assurance as and when needed by organizations or government agencies to firstly increase their authentication procedure to avoid crimes and secondly it will help catch criminals and frauds on the basis of highly efficient live video-based face recognition. PCA (Principle component analysis) and SVD (single value decomposition)-based algorithm and tells how feature extraction is done by projections and how these algorithms work as a whole. A novel model is proposed so as to improve precision and accuracy of recognition. There are several conditions which obstruct obtaining efficient face recognition like illumination, translation, angle of the photo, rotation, hairstyle, spectacles, makeup, background, distortion etc. These are the complications which mainly need to be tackled. , in this paper the combination of the PCA model along with fisher face method and SVD projections has been used to gain results for better and higher efficiency and accuracy. The efficiency is indeed improved and recognition rates are increased but still there is still need and scope for better creations of training sets and the way changes in the face affects the efficiency.

In [4] proposes solutions for a faster face recognition process with accurate results. The proposed face recognition process was done using a hybrid process of Haar Cascades and Eigenface methods, which can detect multiple faces (55 faces) in a single detection process. There are two major approaches for feature extraction, typically holistic feature and local feature. Facial recognition systems have been used in small mobile environments as well, to recognize images and video. It uses multiple object detection using the Viola-Jones cascade classifier in the OpenCV library. The proposed process is started with pre-processing of the training data by converting the RGB images to grey-scale images and reducing the images to 8-bits colour. Then implementing the Haar Cascade method to the images by going through the Haar feature phase, integral image and cascade classifier. The process of facial recognition with the Haar Cascade and Eigenface method is able to detect and recognize the face both during the day and night (with good light) as shown in the test results. Although the type of detection is for straight faces (frontal faces), it is still able to detect the face when it is facing to the side until about 15o (degrees). The facial recognition process with the Haar Cascade and Eigenface method is able to optimize facial recognition with more than one face with accuracy up to 91, 67%. The facial recognition process with the Haar Cascade and Eigenface method can be successfully performed at a distance of more than 200 cm using a webcam.

In [5] camera which has equipped with hi-tech features is no longer a new invention. It has the capability to recognize each of face parts as an object, the major development of biometric system. Face detection is still enthusiastically developed by identifying an individual object in digital image, analysing and comparing its pattern. As we know that face is a real object which reflects self-identity and differentiates mankind from one another. Face detection can be used to find and index pictures and videos with background, size and position. There are some methods of face detection. One of these is haar cascade. It allows the system to recognize people's face with varied illumination. In this paper Pre-process in face detection process includes changing in image size and colour to grayscale. If in this process face image is found, then the system will determine the best version of the face image. Dim light affects the system performance; therefore, it cannot detect the image completely the detection speed of the system on moving object is good in every condition. When the result is calculated with TF-IDF, the highest value is when the testing used the light from the lamp. On TF IDF weighting 62.7% for lamps and 37.2% of the Sun's light. Making light of a lamp which could prove that

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face detection can work well if using light bulbs. Good illumination will help and improve face detection in order to get good value and performance with TF-IDF.

In [6] this process many redundant features are required to be eliminate also. During feature elimination, some features also get suppressed due to inappropriate thresholds. Hence, there is a requirement of feature extraction in such a way that it reduces the chance of data redundancy and system complexity. This paper presents a facial recognition technique by inclusion of superimposed version of all relevant images which improves the accuracy of the model by roughly 43 percent. The algorithm aims to establish the importance of superimposition strategy in the field of face recognition. The Haar feature based classifier is used, where a cascade function is trained from a set of images. We have used the open source database of faces from the archives of AT&T Laboratories Cambridge to train and test our model. all the corresponding training samples of the subjects are overlaid. By doing this, corresponds to all the images of training samples of a subject, only a single superimposed entity is formed. It contains nearly all the features of the entire training images of the corresponding subject. In addition to this, as the superimposed face image is overlapped, it does not associate similar features repeatedly. Now, features are extracted from the overlaid images. Further, these features are used for the training. This paper introduced a new approach for better face recognition which is motivated by the recent advancements in the various developing fields of Biometrics, including Facial Recognition.

In [7] Automatic individual face recognition is the most challenging query from the past decade in computer vision. However, the law enforcement agencies are inadequate to identify and recognize any person through the video monitoring cameras further efficiently; the blur conditions, illumination, resolution, and lighting are still the major problems in face recognition. Our proposed system operates better at the minimum low resolution of 35px to identify the human face in various angles, side poses and tracking the face during human motion. We compare the input face images with database face images and work as if the given appearance images, after extracting features compared with the dataset so finally, we can figure-out the face image is favourably recognized otherwise the face image would not be recognized. We used Local Binary Patterns at low resolution for the face recognition. It essentially contains three major parts, the representation of the face, feature extraction, and finally classification. While in Face representation describes the input of face behaves and moreover, it limits the algorithms for the detection and recognition. Further, for feature extraction, this LBPH histogram found a novel result and finally we classify input detected face compare with the proposed DATASET (LR500). Then we can analyse our system either recognized a known person or unknown person.
In [8] a smart home security system by using local binary pattern histograms (LBPH) face detection algorithm is proposed to enhance the security level of entry-system. Face recognition is an interesting but challenging in machine learning field and impacts important applications in many areas such as remote sensing, machine/robot vision, pattern recognition, medical field, banking and security system access, and authentication in personal electronics gadget. In this research paper, we proposed the door lock security system using image processing instead of traditional key and digital lock system. The image processing mainly consists of three parts, namely face representation, feature extraction and identification of face. Face representation represents how to model a face with LBPH algorithms of detection and recognition. The most useful and unique features of the face image are extracted in the feature extraction phase. In the identification of face the new face image is compared with the images which are already extracted and saved on database. Face detection and recognition method was applied to allow the authorized dwellers and the guest and prevent unwanted person to enter inside the house. With this research, we can claim that the proposed system not only increase the level of security level but also improve the level of intelligence on the building entry system. Entry-system can understand the face of the authorized user (Family-member) like the Security-Guard man and they can enter inside the house.

III. METHODOLOGY

To capture the images and selecting the best Haar feature image using Adaboost Training and recognising the faces using LBPH face recogniser.
The recognised faces are then compared by the automatic face recognition system.
To give the access to the person by opening the gates using a DC motor if the captured images match with the existing images in the database otherwise mail is sent to the owner for authentication.

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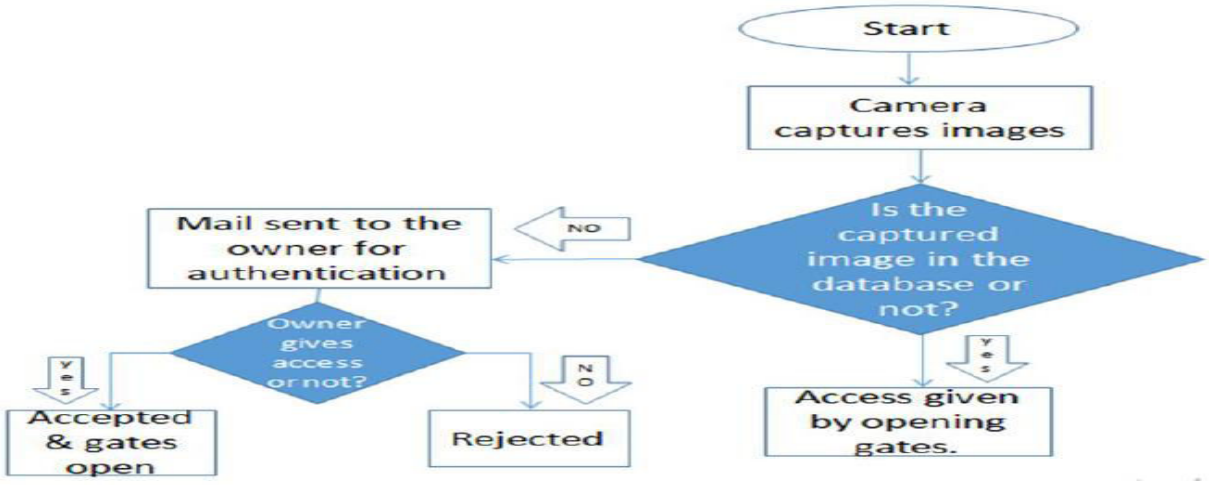

Fig 1. System Methodology

IV. CONCLUSION AND FUTURE WORK

The proposed and developed system for surveillance has tested under different lighting conditions, facial positions and distances. We have used surveillance video camera to locate faces from video and then used face recognition method to test the credibility of the system. Although the main goal of this developed system is to detect individuals by their faces from a video camera, we also discuss the performances of face detection methods under different conditions. Finally, The framework achieves not only scalability and flexibility but also security features and has simple identity-based management for data confidentiality.

For the system Machine learning concepts can be applied to the footages on cloud in real time to detect the crime. The location and type of crime along with a snapshot will be sent to the respective authorities immediately and further actions can be taken.

Image processing techniques can also be added to enhance the acquired footage for better analysis image processing technique can be used for face detection, which helps to recognize the criminal. With this facial details, the person's details will be fetched and hence the criminal cannot exploit.

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