Original Research Paper

Volume - 12 | Issue - 09 | September - 2022 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Machine Learning

CRIME DETECTION SYSTEM USING FACE RECOGNITION

Apoorva Verma Computer Science & Artificial Intelligence, Indira Gandhi Delhi Technical University for Women

ABSTRACT Real-time crime detection application using face recognition. Identification of criminal is done through thumbprint identification. However, this type of identification is constrained as most of criminal nowadays getting cleverer not to leave their thumbprint on the scene. With the advent of security technology, cameras especially CCTV have been installed in many public and private areas to provide surveillance activities. The footage of the CCTV can be used to identify suspects on scene. In this paper, an automated facial recognition system for criminal database was proposed. This system will be able to detect face and recognize face automatically. The results show that about 98% of input photo can be matched with the template data. Face recognition is one of the most challenging topics in computer vision today. It has applications ranging from security and surveillance to entertainment websites. Face recognition software are useful in banks, airports, and other institutions for screening customers. Human face is a dynamic object having high degree of variability in its appearance which makes face recognition a difficult problem in computer vision. In this field, accuracy and speed of identification is a main issue. It is a particular form of biometric technology that describes the automatic face identification of computing systems by looking at the face. As a result, a robust system with good generalisation capability can be built by adopting cutting-edge techniques from learning, computer vision, and pattern recognition. Earlier methods treated face recognition as a standard pattern recognition problem; later methods focused more on the representation aspect after realising its uniqueness using domain knowledge; and more recent methods have been concerned with both representation and recognition. This system consists of four phases- database creation, face detection, face recognition, attendance updation. The goal of this paper is to evaluate face detection and recognition techniques and provide a complete solution for image based face detection and recognition with higher accuracy, better response rate and an initial step for video surveillance.

KEYWORDS : Face, recognition, criminal, biometric.Face Recognition, Face Detection, Local Binary Pattern Histogram, Crime Detection, support vector machine, multi-classification, Optimization, Feature Extraction, Accuracy algorithm.

1 INTRODUCTION

Computers are employed for a wide variety of tasks, from straightforward to complicated problem-solving. Face recognition technology has evolved as a valuable tool to identify facial features by their inborn characteristics among such contributions. Humans have the innate ability to recognise hundreds of faces thanks to their visual system and cognitive abilities, which enable them to do so even after a significant amount of time has passed. Criminal record contains personal information about a particular person along with photograph. To identify any criminal we need identification regarding that person, which are given by the eyewitness. Identification can be done by finger print, eyes, DNA etc. One of the applications is face identification. The face is our primary focus of attention in social intercourse playing a major role in conveying identity and emotion. Although it is difficult to infer intelligence or character from facial appearance, the human ability to remember and recognize faces is remarkable. A face recognition system uses a database of images and compares another image against those to find a match, if one exists. For each facial image, identification can be done using the RGB values for the eye color, the width and height of the face,etc.

How it will prevent crime?

Whenever a person is recognized with 98%+ accuracy, the system sends a notification to the admin and can also send it to Police.

The most significant biometric authentication method from the previous several years is face detection and recognition.Verification and identification are the two primary functions of a face recognition system. For a system to correctly identify a certain entity, it must be reliable. The goal is to guarantee that only authorised users and not other people can access the services. In order to accurately detect and recognise faces, the face recognition method is implemented in this research. In this paper, we have discussed about the modules of face recognition, the various face databases and the algorithms that work on them. Then we move on to discuss the challenges to face recognition systems, algorithms to overcome them and improve performance of the system. The multitude of applications of face recognition technology has been discussed briefly towards the end.

2. Current Research on face recognition and techniques available

Key goal of computer vision researchers is to create automated face recognition systems that can equal, and eventually surpass, human performance. To this end, it is imperative that computational researchers know of the keyfindings from experimental studies of face recognition [1]. These findings provide insights into the nature of cues that the human visual system relies upon for achieving its impressive performance and serve as the building blocks for efforts to artificially emulate these abilities. The face recognition problem has been studied for more than two decades. The approaches proposed in the literature so far can mainly be classified into two categories: model based and appearance based as described by Fu Jie Huang and Zhihua Zhou [5]. The model based method tries to extract geometrical parameters measuring the facial parts while the appearance based approach use the intensity or intensity-derived parameters such as eigen faces coefficients to recognize faces. Due to the changes of lighting condition, expression, occlusion, rotation, etc., the human face appearance could change considerably. There are existing approaches proposed to recognize faces under varying pose. One is the Active Appearance Model proposed by Cootes [5], which deforms a generic face model to fit with the input image and uses the control parameters as the feature vector to be fed to the classifier. The second approach is based on transforming an input image to the same pose as the stored prototypical faces and then using direct template matching to recognize faces, proposed by Beymer, Poggio and later extended by Vetter [5]. The third method is the eigenspace from all of the different views, proposed by Murase and Nayar, and later used by Graham and Allinson in face recognition [5]. 2.1 Two-Dimensional and Three-Dimensional Techniques In the early years of the 21st century, we found ourselves continually moving further away from the necessity of physical human interaction playing a major part of everyday tasks. Striding ever closer to an automated society, we interact more frequently with mechanical agents, anonymous users and the electronic information sources of the World Wide Web, than with our human counterparts. It is therefore perhaps ironic that identity has

become such an important issue in the 21st century. It would seem that in an age where fraud is costing the public billions of pounds every year and even the most powerful nations are powerless against a few extremists with a flight ticket, it is not who we are that is important, but rather, that we are who we claim to be. For these reasons, biometric authentication has already begun a rapid growth in a wide range of market sectors and will undoubtedly continue to do so, until biometric scans are as commonplace as swiping a credit card or scrawling a signature [4]. 2.2 Various categories of facial recognition algorithms: Neural networks. Feature analysis. Graph matching. Information theory. Face recognition has a number of advantages over biometrics, it is non-intrusive. Whereas many biometrics require the subject's co-operation and awareness in order to perform an identification or verification, such as looking into an eye scanner or placing their hand on a fingerprint reader, face recognition could be performed even without the subject's knowledge as described by the NSTC Committee [4].

3. Methodology

The methodology aimed to describes the steps we are follow to accomplish face recognition system as well as the software and hardware that we need to identify criminal. The methodology will guide to do those things: i. How does computer can differentiate between faces? ii. How to Design face recognition system depends on both Identification and verification. iii. How to Test the result 3.2 RESEARCH METHODOLOGY We do investigation about project to know how face detection can be implemented and which Algorithm can be used to recognize faces And how to solve problem that can be found In image process. 3.2.1 Use Fisher face algorithm Fisher face is one of the popular algorithms used in face recognition, and is widely believed to be superior to other techniques, such as Eigen face because of the effort to maximize the separation between classes in the training process. 3.2.2 Analysis and Design Describes the analysis that is required in order to develop the proposed system through functional requirements and non-functional requirements. Functional requirements outline what the system should do and support the user activities in performing and completing tasks by using the proposed FRCI (face recognition system for criminal identification). The list below shows the functional requirements for FRCI. The system allows the user to log in by using username and password and will be logged in after system detects his face. The system allow user to input image to be matched. The system allows image to be compared. The system provides matching event if the input has more similarity with the image in the face database then return the result.

4. Face Recognition Techniques

The method for acquiring face images depends upon the underlying application. For instance, surveillance applications may best be served by capturing face images by means of a video camera while image database investigations may require static intensity images taken by a standard camera. Some other applications, such as access to top security domains, may even necessitate the forgoing of the nonintrusive quality of face recognition by requiring the user to stand in front of a 3D scanner or an infra-red sensor [4].

l Featured-based

Feature-based approaches first process the input image to identify and extract (and measure) distinctive facial features such as the eyes, mouth, nose, etc., as well as other marks, and then compute the geometric relationships among those facial points, thus reducing the input facial image to a vector of geometric features. Standard statistical pattern recognition techniques are then employed to match faces using these measurements.

l Holistic Holistic

Approaches attempt to identify faces using global representations, i.e., descriptions based on the entire image rather than on local features of the face. These schemes can be subdivided into two groups: statistical and AI approaches.

l Statistical

In the simplest version of the holistic approaches, the image is represented as a 2D array of intensity values and recognition is performed by direct correlation comparisons between the input face and all the other faces in the database. Though this approach has been shown to work under limited circumstances (i.e., equal illumination, scale, pose, etc.), it is computationally very expensive and suffers from the usual shortcomings of straightforward correlation-based approaches, such as sensitivity to face orientation, size, variable lighting conditions, background clutter, and noise.

l Predominant Approaches

There are two predominant approaches to the face recognition problem: geometric (feature based) and photometric (view based). As researcher interest in face recognition continued, many different algorithms were developed, three of which have been well studied in face recognition literature: Principal Components Analysis (PCA), Linear Discriminate Analysis (LDA), and Elastic Bunch Graph Matching (EBGM) [4].

5. Principal Components Analysis (PCA)

PCA is the technique pioneered by Kirby and Sirivich in 1988. With PCA, the probe and gallery images must be the same size and must be normalized to line up the eyes and mouth of the subjects within the images. The PCA approach is then used to reduce the dimension of the data by means of data compression and reveals the most effective low dimensional structure of facial patterns. This reduction in dimensions removes information that is not useful and precisely decomposes the face structure into orthogonal (uncorrelated) components known as eigen faces. Each face image may be represented as a weighted sum (feature vector) of the eigen faces, which are stored in a 1D array. A probe image is compared against a gallery image by measuring the distance between their respective feature vectors. The PCA approach typically requires the full frontal face to be presented each time, otherwise the image results in poor performance. The primary advantage of this technique is that it can reduce the data needed to identify the individual to 1/1000th of the data presented. In the training phase, you should extract feature vectors for each image in the training set. Let A be a training image of person A which has a pixel resolution of M £ N (M rows, N columns). In order to extract PCA features of A, you will first convert the image into a pixel vector ÁA by concatenating each of the M rows into a single vector. The length (or, dimensionality) of the vector ÁA will be M £N. In this project, you will use the PCA algorithm as a dimensionality reduction technique which transforms the vector ÁA to a vector A which has a dimensionality d. For each training image i, you should calculate and store these feature vectors I.

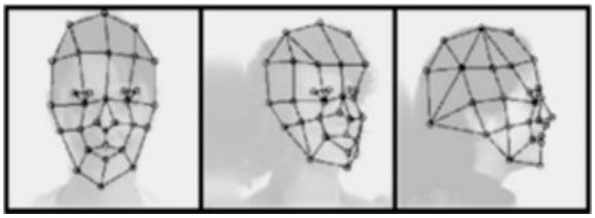
In the recognition phase (or, testing phase), you will be given a test image J of a known person. Let J be the identity (name) of this person. As in the training phase, you should compute the feature vector of this person using PCA and obtain J. In order to identify J, you should compute the similarities between J and all of the feature vectors I's in the training set. The similarity between feature vectors can be computed using Euclidean distance. The identity of the most similar I will be the output of our face recognizer. If I = J, it means that we have correctly identified the person J, otherwise if I! = J, it means that we have misclassified the person J.

6. LDA: Linear Discriminant Analysis

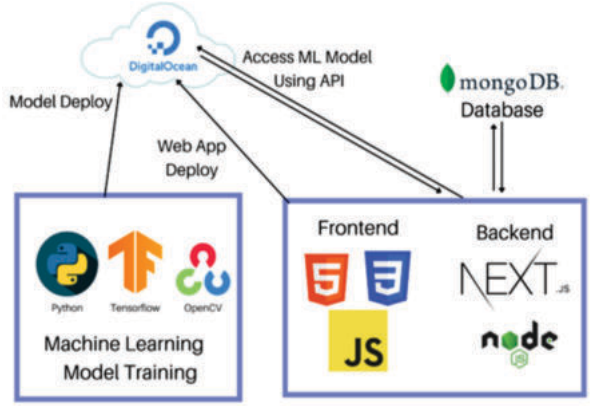
LDA is a statistical approach for classifying samples of unknown classes based on training samples with known classes.(Figure 2) This technique aims to maximize between-class (i.e., across users) variance and minimize within-class (i.e., within user) variance. In Figure where each block represents a class, there are large variances between classes, but little variance within classes. When dealing with high dimensional face data, this technique faces the small sample size problem that arises where there are a small number of available training samples compared to the dimensionality of the sample space.

7. EBGM: Elastic Bunch Graph Matching

EBGM relies on the concept that real face images have many nonlinear characteristics that are not addressed by the linear analysis methods discussed earlier, such as variations in illumination (outdoor lighting vs. indoor fluorescents), pose (standing straight vs. leaning over) and expression (smile vs. frown). A Gabor wavelet transform creates a dynamic link architecture that projects the face onto an elastic grid. The Gabor jet is a node on the elastic grid, notated by circles on the image below, which describes the behavior around a given pixel. It is the result of a convolution of the image with a Gabor filter, which is used to detect shapes and to extract features using image processing.

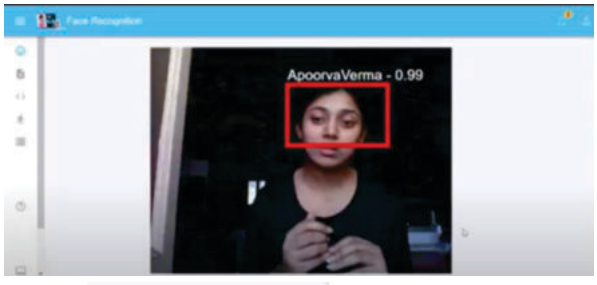


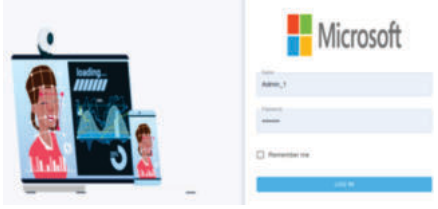
8. Architecture

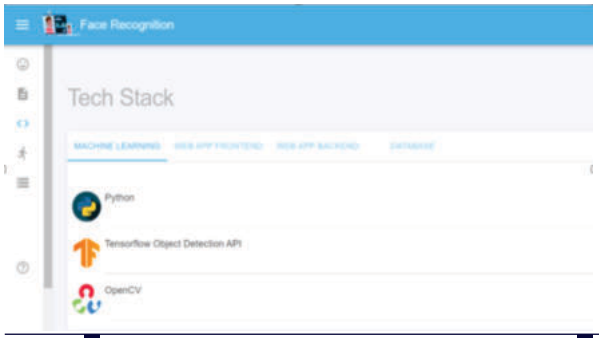


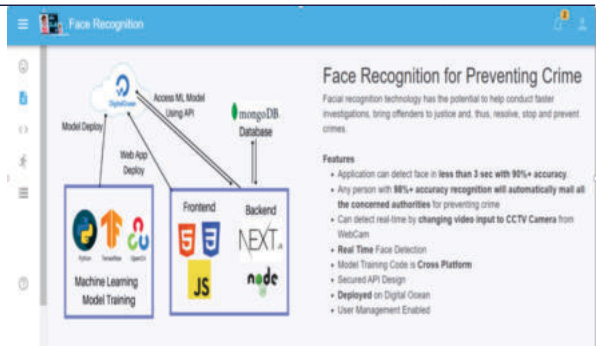
9. RESULTS

Web App Link: *https://frme.igscs.in/login*
Username: Admin_1
Password: 12345678









10. Drawbacks

Face recognition is employed in a multitude of everyday applications ranging from simple to complex ones. This technology has made a significant contribution to biometrics, law enforcement access control, surveillance systems, social media, security, and various other disciplines. However, as the application grows in scope, the complications involved also grow. It is a very hard skill to execute because of the various conditions that a human face may be found in. Humans have the innate capacity to identify numerous faces, thanks to their visual system and intellect. This allows them to identify familiar faces even after a long time. However, making systems grasp facial traits and compute them for future recognition is a challenging task. There is no technology that can compete with the human ability to recognize faces despite differences in appearance. Building an intelligent system similar to human perception system is still an active area of research.

Certain challenges of face recognition systems such as illumination, pose variation, expression, occlusion and aging hamper the development of a robust system that works well under all circumstances. The above mentioned factors that can impact the performance of face recognition systems have been discussed in detail in this section.

11. Summaries

This paper has attempted to review a significant number of papers to cover the recent development in face recognition. Making optimum and full fledged use of face recognition will only be possible when the various challenges to it can be surpassed with the help of advanced algorithms providing improved accuracy. Even though some techniques like the ones about which we have discussed in this paper, have been instrumental in overcoming barriers to face recognition and enhancing performance of FRS, desirable level of correctness is yet to be acquired and the day this would happen doesn't seem much far, keeping in mind the pace with which advancements in the field of technology are being made.

12. REFERENCES

1. Adriana Kovashka Margaret Martonosi- Feature-Based Face Recognition for Identification of Criminals vs. Identification for Cashless Purchase Ole Helvig Jensen "Implementing the Viola-Jones Face Detection Algorithm"
2. Solanki, Kamini, and Prashant Pattalia. "Review of Face Recognition Techniques." International Journal of Computer Applications, vol. 133, no. 12, January 2016.
3. Nazeer, Shahrin & Omar, Normah & Khalid, Marzuki. (2007). Face Recognition System using Artificial Neural Networks Approach. Proceedings of ICSCN 2007: International Conference on Signal Processing Communications and Networking. 420 - 425.10.1109/ICSCN.2007.350774.
4. Kaur, Jashanpreet & Akanksha, & Singh, Harjeet. (2018). Face detection and Recognition: A review.
5. Lal, Madan, et al. "Study of Face Recognition Techniques: A Survey." International Journal of Advanced Computer Science and Applications, vol.9, no. 6, 2018.
6. Zhao, Wen Yi, and Rama Chellappa. "Imagebased Face Recognition Issues andMethod."
7. Hashmi, Sameer Aqib. "Face Detection inExtreme Conditions: A Machine-learningApproach."
8. Ohlyan, Sonia, et al. "A Survey On Various Problems & Challenges In Face Recognition." International Journal of Engineering Research & Technology, vol. 2, no. 6, June - 2013.
9. Rabia Jafri* and Hamid R. Arabnia* A Survey of Face Recognition Techniques
10. Face Recognition- NSTC Committee on Technology Committee on Homeland and National Security Subcommittee on Biometrics.
11. Fu Jie Huang Zhihua Zhou "Pose Invariant Face Recognition".