

Face Recognition System: A Review

Arvind Kumar Pandey, Assistant Professor

Department of Computer Science, Arka Jain University, Jamshedpur, Jharkhand, India
Email Id- arvind.p@arkajainuniversity.ac.in

ABSTRACT: Several technologies have been introduced for identification of a person such as fingerprint, voice recognition system, face recognition system, etc. These technologies are being implemented at several places as per the needs and requirements. Among these face recognition system has been used very frequently nowadays because of precise ability to detect the person by capturing the face of the person and comparing it with the previously stored data in database. These face recognition system has been discussed in this paper along with its prior arts and the steps followed in the process. It provides several benefits because of which its implementation and demand have increased very sharply in last few years. It transmits the identification of individuals and may thus be utilised in many corporations as a key to security solutions. As it provides several benefits and have made several tasks easier, it has high demand and bright future.

KEYWORDS: Camera, Capture, Face detection, Face Recognition System, Security.

1. INTRODUCTION

The face is the most important organ in the human body. Research demonstrates that even a face can talk and has many phrases for different emotions. In dealing with individuals in society, it plays a significant function. It transmits the identification of individuals and may thus be utilised in many corporations as a key to security solutions. As an exceptionally secure and dependable security solution, the Face Recognition (FR) system is quickly rising worldwide. Thousands of companies and government organisations, due of its high degree of safety and dependability, are increasingly paying attention[1]. Figure 1 shows the Face Recognition System.



Figure 1: The above figure shows the Face Recognition System [amsecuritysystem].

In addition, compared to conventional biometric safeguards like palms and fingerprints, the FR system offers huge advantages. Without engaging with the individual, it collects biometric dimensions of a person from a certain distance. This method can assist many organisations identify a person with a criminal record or other legal concerns in criminal dissuasive applications. For many residential structures and business entities, this technology becomes important. This approach is based on a human face recognition and comparison with the previously recorded faces between the different characteristics of a face[2].

It is designed to include several nodal points of the face with user-friendly features and functions. The nodal points of one face are roughly 80 to 90. The FR system is able to measure from these nodal points key features like eye distance, jaw length, cheekbone form, and eye depth. These points are measured through the creation

of a code called the faceprint representing the face identification in the computer database. With the advent of state-of-the-art technology, 2D graphics systems on 3D graphics are now accessible to enhance the system's accuracy and dependability[3].

The science and technology for the measurement and statistics of biological data is termed as biometrics. They are measurable behavioural and/or physiological traits quantifiable that may be used to authenticate person identification. A single biometric might be used for each individual to verify. In growing numbers, biometric systems are being employed in areas such as jail security, safe access and forensics. By employing diverse biological elements, such face, hand shape, iris, retina and fingerprints, biometric systems are recognisably authenticated by humans. The FR system is a more natural and biometrically diverse information process. Thus, FR has become a recent topic in computer science related to biometrics and machine learning[4].

The major objectives of this paper are the construction of a deep FR system using fog-computing transfer learning. This method is based on contemporary approaches for the development of deeply convoluted neural systems (DCNN) and machine education. The approaches described may record a person's biometrical measures at a particular distance without engaging with him for criminal dissuasive reasons. This allows numerous companies to identify a person with any type of criminal record or other legal concerns with the methods given[5].

Real-time implementation of face recognition system in which discussed how the capacity to identify and recognise an individual by his/her faces called face recognition. Face recognition is multidimensional, thus many mathematical calculations are required. Face recognition system is vital and crucial to ensure security, mug shoot matching, law enforcement applications, user verification, user access management, etc. An effective face recognition system is required for all applications[6]. The main research objective was to build face recognition systems with better accuracy and better facial recognition time. Their study proposed to combine two facial recognition approaches by merging the Linear Discriminant Analysis Component (LDA) Principle (PCA) with a hybrid facial reconciliation algorithm. The Jacobi technique for computing PCA and LDA algorithms is used to calculate the Eigenvector. On the Embedded System Raspberry pi 3 board, the Face Recognition system has been built[7].

Face Recognition Technology in which he explained how recently, the multimedia access society has attracted a great deal of attention towards face recognition system. Through facial recognition technologies fields such as security of the network, indexing and retrieval of material, and video compression have gained lot of advantages as , the focus is on 'people' in many videos. Network access control via facial recognition not only makes it practically impossible for hackers to acquire their "password," but also enhances the usability of the connection between person and computer. For users such as news reporters, political scientists and moviegoers, indexing and/or retrieving video data based on personal appearance are helpful. In addition, the use of facial recognition enables a more effective coding system for the applications of video and teleconferencing. He has introduced this innovative information processing method in this article. The study demonstrates the readers how the facial recognition system is general and what the face recognizer often meets. There will also be some well-known facial recognition methods, including props and neural networks[8].

Face recognition system in which they explained how Facial recognition is gaining more and more attention as artificial intelligence develops quickly over recent years. Facial recognition offers numerous benefits, including, although limited to non-contact, high competitor and easy to use, compared to standard card recognition, finger print recognition and iris recognition. It has great potential for usage in public, security, e-commerce, retail, education and many other areas. . This paper extracted face traits by integrating and comparing various models and then build a deep neural network that forms and builds the combined characteristics. The benefits of several four models may therefore be combined to indicate the accuracy of recognition. This article discusses the advantages and cons of the two models, and the different commercial goods that are necessary to the server client model, comparing the pure-client model to the server-client model[9].

Image-based Face Detection and Recognition in which they explained how in the system of surveillance facial recognition played an essential part, as it does not need the cooperation of the object. Uniqueness and acceptability is the real benefit of face-based identification above other biometrics. Since the human face is a dynamic entity with tremendous variety, it made face detection a difficult issue in computer vision. Since the human face is a dynamic entity with tremendous variety, it made face detection a difficult issue in computer vision. Precise identification and speed are a key concern in this area[10].

1.1 Steps in face recognition:

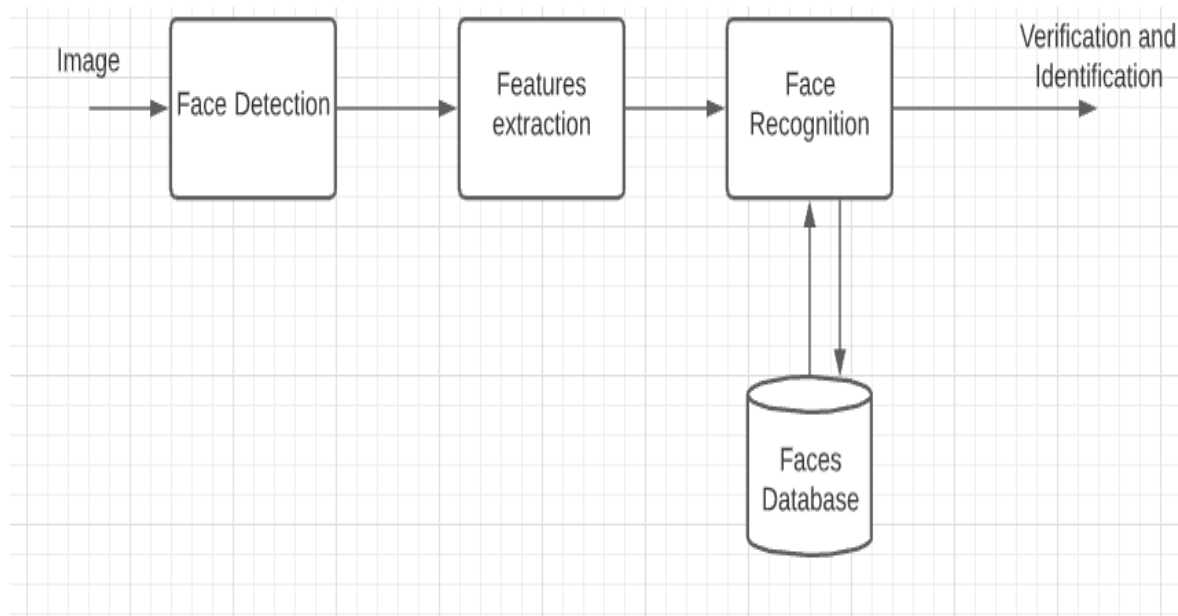


Figure 2: Above figure shows the Representation of steps involved in face recognition system.

Figure 2 represents steps involved in face recognition system. The development of a strong face recognition system includes three fundamental steps: first, is face detection, next is feature extraction, and last is face recognition. The face detection stage is utilised to detect and find the picture of the human face that the system generates. In order to extract vectors for any human face in the first phase, the characteristic removal step is used. Finally, the face identifier comprises the features retrieved from the human face to match it with every template face database in order to determine the identification of the human face.

1.1.1 Face Detection:

The process of facial recognition starts by locating the human faces in a certain image. This phase is intended to assess whether or not the incoming image contains human faces. The lighting and facial expression changes might hinder accurate facial detection. Pre-processing procedures are done to help the design and robustness of another face recognition system. Many approaches are employed in the detection and location of the human face picture, such as Viola–Jones detector.

1.1.2 Feature extraction:

This stage mainly involves extracting the characteristics of the facial pictures that are discovered during detection. This stage depicts a face with a collection of characteristics known as a "signature" with a geometrically significant aspect of the face picture such as mouth, nose, and eyes. The structure, size and form of each face are characteristic that allow it to be recognised. Multiple procedures involve mouth, eye or nose extraction for the size and distance of the face. Scale Invariant Transform Functions (SIFT), Gabor Filter, Locals Phased Quantification, Haar Wavelets, Fourier Transformation and Local Binary Pattern (LBP) techniques for extracting facial characteristics are widely employed.

1.1.3 Face Recognition:

This phase takes the characteristics extracted from the background during the extraction of a feature in a particular database and compares them with known faces. There are two general facial recognition applications: one is termed identification and another is called verification. The test face is compared with a set of faces to identify the most probable match in the identification stage. In order to take a judgement on acceptance or rejection, a test face will be compared to a known face on the database during the identification stage. Correlation filters, CNN (convolutional neural network), and K-nearest neighbours (K-NN) are known to solve this issue successfully.

1.2 Working Procedure:

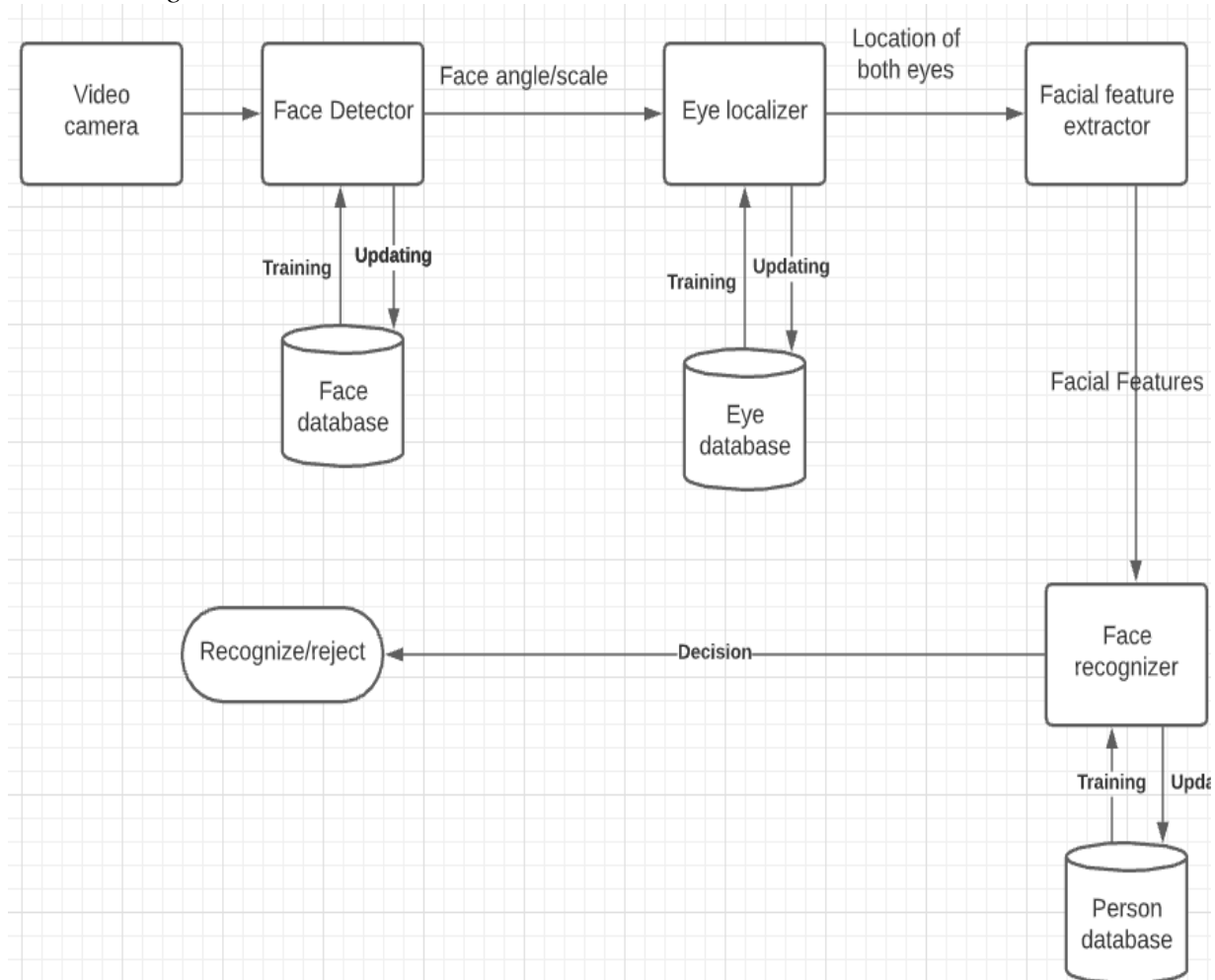


Figure 3: Representation of working procedure of face recognition system.

Figure 3 represents working procedure of face recognition system. As soon as the camera detects the person's image is captured and passed to the face detector, which compares the image with faces, which are already stored in face database. This determines face angle/scale and passes the data to the eye localizer. The eye localizer compares the eyes of the received image with the eyes already stored in the eye database. It passes data related to location of both eyes to facial features extractor, which extract the facial features and passes it to the face recognizer, which compares all the data received from all the detectors with the person's database already stored. Depending upon that if all features are matched it recognizes the person otherwise if any of the features is not matched it rejects it.

2. DISCUSSION

Face recognition system has been trending on a very large scale in several countries worldwide because of its capability to very precisely determine a person's face. It is a technique that allows a subject to be identified or verified using an image, video or audio-visual aspect of his face. Generally, the programme, system or service may be accessed by using this identifier. It is a biometric identification approach, which employs body measurements to check a person's identity, face and head, through its data. The system captures a number of unique biometric data about each individual's face to identify, verify and/or authenticate a person. This paper also discusses the same concept of face recognition system along with its working and the processes involved in it.

It collects biometric dimensions of a person from a certain distance without engaging with the individual. This method can assist many organisations identify a person with a criminal record or other legal concerns in criminal dissuasive applications. For many residential structures and business entities, this technology becomes important. This approach is based on a human face recognition and comparison with the previously recorded faces between the different characteristics of a face.

CONCLUSION

This paper solely focuses on face recognition system, which has been very popular nowadays because of the several advantages it provides. Face acknowledgement facilitates tracking of burghers, thefts and offenders. It analyses the private and public feed networks of CCTV cameras. The technology is not limited to tracking down criminals. For example, finding lost children and elderly people might potentially be made easier. Face recognition may reduce the intrusion of passenger safety checks at airports. This paper also discusses same technology in detail. It discusses represents steps involved in face recognition system. The development of a strong face recognition system includes three fundamental steps: first, is face detection, next is feature extraction, and last is face recognition. The face detection stage is utilised to detect and find the picture of the human face that the system generates. In order to extract vectors for any human face in the first phase, the characteristic removal step is used. Finally, the face identifier comprises the features retrieved from the human face to match it with every template face database in order to determine the identification of the human face.

It discusses working of the face detection system. It explains how procedure of face detection system works. As soon as the camera detects the person's image is captured and passed to the face detector, which compares the image with faces, which are already stored in face database. This determines face angle/scale and passes the data to the eye localizer. The eye localizer compares the eyes of the received image with the eyes already stored in the eye database. It passes data related to location of both eyes to facial features extractor, which extract the facial features and passes it to the face recognizer, which compares all the data received from all the detectors with the person's database already stored. Depending upon that if all features are matched it recognizes the person otherwise if any of the features is not matched it rejects it. As it provides several benefits and have made several tasks easier, it has high demand and bright future.

REFERENCES

- [1] Y. W. M. Yusof, M. A. M. Nasir, K. A. Othman, S. I. Suliman, S. Shahbudin, and R. Mohamad, "Real-time internet based attendance using face recognition system," *Int. J. Eng. Technol.*, 2018, doi: 10.14419/ijet.v7i3.15.17524.
- [2] M. I. Younis and R. S. Muhammad, "IFRS: An Indexed Face Recognition System Based on Face Recognition and RFID Technologies," *Wirel. Pers. Commun.*, 2018, doi: 10.1007/s11277-018-5800-8.
- [3] M. üg. Çarıkçı and F. Özen, "A Face Recognition System Based on Eigenfaces Method," *Procedia Technol.*, 2012, doi: 10.1016/j.protcy.2012.02.023.
- [4] "Face Recognition Systems Using Different Algorithms: A Literature Review," *Aust. J. Basic Appl. Sci.*, 2017.
- [5] W. Xu, Y. Shen, N. Bergmann, and W. Hu, "Sensor-assisted multi-view face recognition system on smart glass," *IEEE Trans. Mob. Comput.*, 2018, doi: 10.1109/TMC.2017.2702634.
- [6] K. Raju and Y. Srinivasa Rao, "Real time implementation of face recognition system on Raspberry Pi," *Int. J. Eng. Technol.*, 2018, doi: 10.14419/ijet.v7i2.17.11564.
- [7] A. Wagner, J. Wright, A. Ganesh, Z. Zhou, H. Mobahi, and Y. Ma, "Toward a practical face recognition system: Robust alignment and illumination by sparse representation," *IEEE Trans. Pattern Anal. Mach. Intell.*, 2012, doi: 10.1109/TPAMI.2011.112.
- [8] D. T. Nguyen, T. D. Pham, N. R. Baek, and K. R. Park, "Combining deep and handcrafted image features for presentation attack detection in face recognition systems using visible-light camera sensors," *Sensors (Switzerland)*, 2018, doi: 10.3390/s18030699.
- [9] G. Yovel and W. A. Freiwald, "Face recognition systems in monkey and human: Are they the same thing?," *F1000Prime Rep.*, 2013, doi: 10.12703/P5-10.
- [10] R. Ramachandra and C. Busch, "Presentation attack detection methods for face recognition systems: A comprehensive survey," *ACM Comput. Surv.*, 2017, doi: 10.1145/3038924.