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REVIEW PAPER ON: DYNAMIC FACIAL RECOGNITION FOR ACCESS CONTROL

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Abstract - *It is extremely important in today's world to secure identity of a person. Traditional methods like keys badges, passwords have low efficiency to stop intrusion. The main reason for the failure of these security measures is that the authentication is done on basis of passwords and codes generated by machines like our PIN and identity cards etc which can be forgotten, replicated or stolen hence it is easy to gain access in an restricted area. These problems can be solved using face recognition as it is very difficult to gain access for an intruder as it does not require any key, badge or password rather the only requirement is the face of a person.*

1. INTRODUCTION

Access control is one of the most important counter measures in security for unauthorized access. One of the prominent reason for the inefficiency in traditional access control methods is that the authentication done on basis of key & lock, passwords, badges and identity cards is not reliable as these could be forgotten, stolen or tempered. The advancements in Artificial Intelligence (AI) has made face recognition technology more reliable than ever before. This technology has potential to make access control more secure, reliable, contactless and cost efficient. The reduction in cost and sizes of high resolution cameras & powerful computing machines are making facial recognition new hotspot for research. We aim to study systems capable of dynamic video based authentication for making access control efficient and trouble free.

2. ACCESS CONTROL

Before you In order to provide restricted access to a place (location) or other resources access controls are used.

2.1 Traditional access controls

2.1.1 Key and lock system:

Key and lock system consist of two entities a lock-fastening device used for securing Door's, windows etc and is released by a key.

A key- can be a physical object or confidential information(passcode) which is used to release a lock

2.1.2 Badge:

A compact and portable metal piece or plastic with name or picture printed on it.ID can be carried with you or cab be fasten to your clothes, in order to present who you are, that you are a member of group, etc

2.1.3 Password/Code/Pin:

A password often called as passcode is a confidential information which is memorized secret. It is used to verify identity of a user. Passwords can be a string of random letters numbers or other symbols.

2.1.4 Identity cards

An identity card which is also referred as identity document, is a document that is provided to prove identity of a person. It is generally small, portable and in size of a credit card.

2.2 Modern access controls

2.2.1 Key and lock system:

A fingerprint is an impression of the friction ridges of a human hand. Each and every person can be uniquely identified by using fingerprint. Human finger print have a unique pattern which remains same throughout the life time of an individual and cannot be altered

2.2.2 Retinal Verification :

There is a unique pattern on a human retina blood vessels. Retina scanners use this unique pattern for verification and authorization purpose this verification technique has been used by various organizations like FBI and NASA.

2.2.3 Iris Recognition:

Every human being has unique patterns in the ring shaped region which is surrounded by pupil of eye so iris of every human is distinctive to an individual. The patterns on iris is captured by using specialized digital camera.

2.2.4 Facial verification :

Humans can be authenticated using facial recognition system this technology matches a users face from a digital photograph or a video frame against a face database.

3. WHY FACIAL VERIFICATION ?

Facial recognition systems are being favored nowadays majorly due to its ease in implementation and deployment. User authentication on the basis of facial recognition requires face detection and face matching, these processes for identification requires very less time. In this type of authentication system the user does not requires to have physical contact with the device also the reduction in cost of cameras has made facial recognition a popular method for access control.

3.1 Traditional access controls like keys badges, passwords are proven to be less efficient to stop unauthorized access due to problems like:-

- Passwords ,Keys and badges could be forgotten
- Keys, Badges and Identity cards can be replicated or altered.
- Password, Keys and badges could be stolen.

3.2 Modern access control methods like Iris, Retinal, Fingerprint and voice recognition has disadvantages like:-

- Diseases like cataracts can affect measurement accuracy in Iris and Retinal recognition.
- In voice recognition accuracy can be affected by, diseases like Bronchitis and common cold and surrounding noises.
- Humans that need to be scanned must be in close proximity with camera.
- Iris and retinal recognition requires high equipment cost.
- Fingerprint recognition requires contact with devices.

4. TECHNIQUES FOR FACE RECOGNITION

To identify a user face facial recognition system is used .Generally facial recognition system carry out four steps the first step is face detection, It is used to separate users face from background image. In second step the facial features are accurately localized using alignment process. In this alignment process the separated facial image is aligned to deal with size of image, position of face and photographic characteristics like lighting and grey scale. The third step is extraction of facial features and then feature vector is established. In fourth step the feature vector is matched against the database of faces.

4.1 Face recognition using feature extraction for machine learning

The paper [6] has mainly described a system for facial recognition which takes live feed using fisher face, principle component analysis [3] and Single value decomposition algorithms and how all these algorithms work together . A model is defined to improve precision and accuracy of facial recognition. In this paper[6] various conditions are tried to be tackled which obstruct the efficiency of facial recognition system like angle of photos, rotation of photos etc.

The AT and Tdatabase(Face) is used to generate images ORL pictures [7]. Data set consists of 40 persons for each person 10 different images are taken. Images are captured in different lighting and emotions , various details such as beard and spectacles are also taken into consideration. The execution is performed on a system with specifications Processor:-Intel core i5 and RAM:- 4GB.

Work is done with the images of size 128*128 from original size of 320*243 for 4 face recognition algorithms. To Deal the problem of background, behind the face a dark background is used . The persons are made to stand in different positions such as front and side position.

In this paper [6] two dataset models are trained for recognition of face. The first model uses fisher face for extraction of feature and uses k-nearest neighbor classifier method. The 2nd model is trained using SVD technique from the two trained models a subset is obtained of the predicted subjects. If the obtained subset has unique label count more than one then all the lables according to the minimum distance are ranked and the label with lowest rank is selected. Final recognized face is given as the desired output.

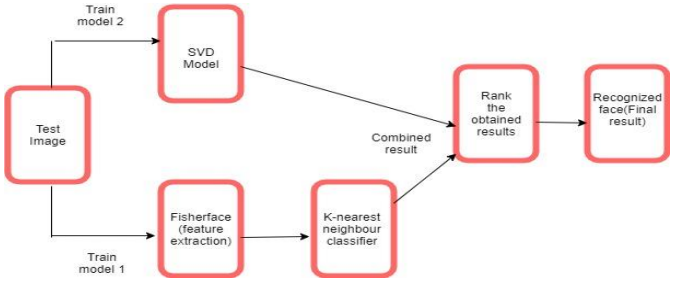

Fig -1:. Flow chart for face recognition using live feed

In conclusion, in this paper [6] PCA model in combination with Fisherface method and SVD projections to gain results for higher accuracy it has been observed that rate if recognition of standalone SVD is 88.98% and with PCA and Fisherface are 93.92%. The accuracy and efficiency are improved but there is a need for better creation of training sets for better efficiency and accuracy.

4.1 Face Recognition system used for attendance management.

Face recognition technology has various applications. One of the most popular and challenging application of this

technology is attendance system based on real time face recognition. This study [3] uses a hybrid feature based extraction method using CNN-PCA for development of face recognition-based attendance system using real-time cameras, that function as a face detection tool and human face identification. The steps in face recognition process consist of on data acquisition, face detection process, preprocessing, feature extraction process, and classification processes can be seen in Fig. II.

The face detection process is executed by camera using face detection based on the Viola-Jones from the OpenCV package. The raw image taken by camera consist of both face and objects. The system recognizes patterns. To decide a pattern is face or not the system searches and detects facial features. As a result of normalization or preprocessing the face image is obtained which has previously detected by face detection process. Normalization is used to optimize facial recognition while sharpness of image is improved using preprocessing which is used to predict many changes in illumination this usually happens while capturing face.
The 2D-3D reconstruction process is applied resulting in the face database which is used for face recognition process. 2D-3D reconstruction process is used for fast face recognition computing and has high accuracy. In order to convert 2D face image to 3D face image CNN (Convolutional Neural Network) is used. Correlational points on latest face image are obtained by combining texture and vector shapes. These points are similar to first image used this outcome is preprocced using face recognition database.2D-3D image reconstruction using CNN is done using equation :S = Ś + Ud.αd + Ue.αe.Fig.2. shows 2D-3D image reconstruction using CNN.

Texture and vector shapes are combined to get correlation point on the new face image which has similarities with the initial image used this result is processed using a database for face recognition process.S = Ś + Ud.αd + Ue .αe equation is used for 2D-3D image reconstruction using CNN.Fig.2. shows 2D-3D image reconstruction using CNN.

Principal component analysis (PCA) [3]is a feature extraction method by which face image resolution is reduced. It is used to obtain a form of other smaller variable by converting it from large variable data. Classification is done using .Mahalanobis distance method. The classification process is used to determine extent of similarities of features in for producing better face recognition. The identification data produced by these results is registered as attendance data

Accuracy of 90%-96% is obtained by using of PCA feature extraction[3] on proposed attendance machine. The CNN-PCA method produced accuracy between 90%-98%. We can conclude that it is better to use PCA-CNN rather than PCA for real time face recognition

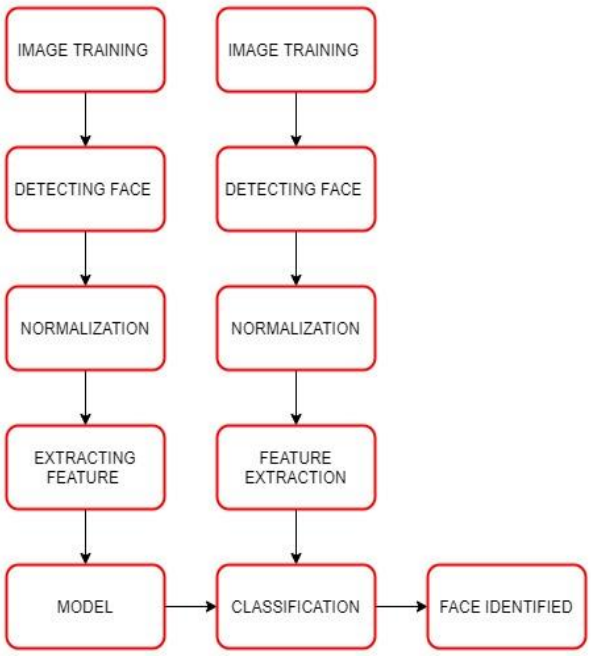

Fig -2:. Steps for the process of facial recognition

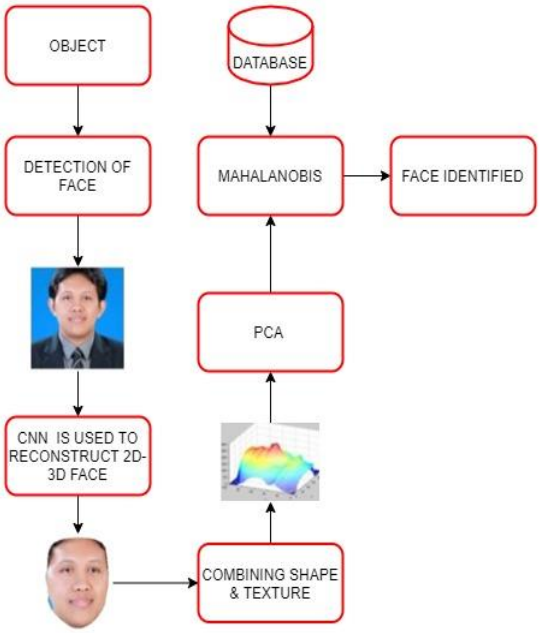

Fig -3:. 2D-3D Image reconstruction process using CNN.

4.3 Face Recognition Method Based on ICA and Binary Tree SVM.

T.Wang[8] proposed a Binary tree SVM in which ICA has been used for feature extraction on ORL dataset of images. Furthermore, the improvised binary tree Support Vector Machine proposed has been used for recognition. ICA algorithm is a statistical technique for feature extraction and image processing. ICA works in two phases, In first phase is the construction of an objective function for finding the

independency of the separation resultant matrix. Then, an algorithm for optimization is chosen for the function to find the matrix of separation. ICA is used for processing the vector signal of images which are the 1D vector of images from the dataset. T.Wang [8] used FastICA for feature extraction from the images.

Proposed Improved Multi class classification based on Binary tree SVM is followed in 3 steps:

- Pre-processing of input Facial images.
- Feature extraction using ICA.
- Classification of extracted images.

In the experimental results of T. Wang [8] by taking the three distance metrics L2,L1 and cosine for comparison with the Binary tree SVM proves that the combination of BT-SVM with ICA provides highest accuracy 95.7% for recognition with ORL library dataset.

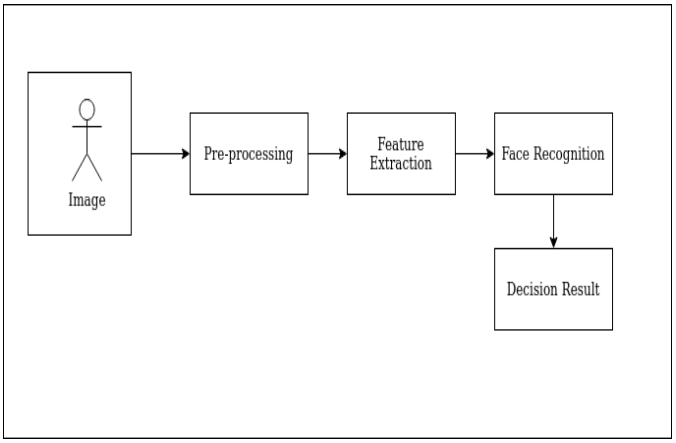

Fig -3: Face Recognition module

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4.3 Enhancing Face in Video Recognition with CNN based Key Frame Extraction

In FiVR technology, there are many challenges like improving the face recognition algorithms, huge amount of video and audio data, and large volume of simultaneous processing . For solving these types of challenges frame selection in Face Recognition stage is an important and necessary process. This study [9] proposes a CNN-build GPU accelerated KFE-engine ,enhancing the assessment element of Face classification. The analysis of performance under theoretical analysis, assessed 1-person video dataset like PaSC and FiA. The practical analysis performance, assessed several-person video with the help of dataset named chokepoint.

The main aim of the proposed engine is to high standard frames with best grade image of recognized person and then sending it to Face Recognition in backend. The benefit of using KFE are : Firstly, one can drastically minimize the data size required to be sent at the backend. Secondly, it has potential to Enhance Face Recognition execution by removing frames from the video having low quality like change in head position, poor lighting and background conditions, etc.

In Implementation stage, below steps are performed:

- Face detection and tracking is performed for all incoming video frames.
- Then we extract the key and frames having high quality of face for every identity. For enhancement, we are using GPU for fastening face detection process, for tracking of face and for module belonging to CNN FQA.
- The KFE-Engine is used to generate multiple key and frame for identical identity. Also, in the proposed methodology different threshold is used to choose the first N-top high quality frames rather than the one high quality frame.

4.4.1 Assessment Dataset:

- Dataset for PaSC: The Dataset of PaSC contains 9,376 count of motionless images and nearly 2,800 individual videos of 290 non-identical identities.
- Dataset for ChokePoint: The ChokePoint contains 16 motion picture with people moving individually, and 2 motion picture with mob.
- Face-in-Action dataset : The Dataset of FiA contains majorly 3 different gathering of videos which is captured on dissimilar dates and every session contains majorly 2 parts: outdoor session and indoor session. It uses nearly 230 individuals and arbitrary picking 5 images from gallery for every individual.

4.4.2 Performance Results:

For PaSC dataset CNN-based approach is better than all other methods. 1 Percent is the Rate of True Positive majorly known as TPR and 3 Percent is the Rate of False Positive known as FPR. For ChokePoint dataset CNN-based approach performs very good over almost all methods. For 1 Percent Rate of True Positive and 10% Rate of False Positive, the method is best one.

In analysis of theoretical-performance, Key and Frame engine has resulted in high performance in comparison to all other methods. Key and Frame engine also exhibits a good proficiency while handing the mob videos with very near to actual world scenarios. When dealing with HD videos, Key-and-Frame engine is able to attain higher reach when

compared to actual processing speed by applying the GPU acceleration.

5. CONCLUSION

After reference and analysis from various resources, journals, articles and research papers related to facial recognition technologies we came across various techniques and algorithms. We studied various traditional, HID, 3-D recognition and thermal cameras and came across various challenges in facial recognition. We conclude that facial recognition technology is blooming technology and can further be improved for access control by developing more robust algorithms and by reduction in cost of hardware devices which can provide better accessibility, flexibility and security to users.

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