

Challenges in Face Detection and Recognition techniques

Ravendra Kumar, Rahul Sajwan, Praveen Kumar Jha, Sachin Sharma



Abstract: Face Recognition System is popular topic in the biometric world. This system provides features to detect the person's face and identify on basis of existing records in database. The aim of this study is to describe how to show various facial features of an image. Face Recognition system, based on Biometric AI, uniquely finds out a person by analyzing the person's facial textures and shape. In this paper, our aim is to study various face detect and recognition techniques such as Haar Like Feature Algorithm resulting to retort criminality and public crisis. Also, some facial recognition approaches PCA and LDA have been discussed in the research paper for abstracting the image information.

Keyword- Face recognition system, biometric, database, facial features

I. INTRODUCTION

In 1960 Facial Recognition was introduced and Facial Recognition father's Name was Woodrow Wilson Bledsoe "Woody". He was American mathematician and Computer. In 2011, US Secretary of Homeland Security along government of panama Janet Napolitano had done installation of facial recognition system on Airport. In 2017 Apple implement this feature in I Phone X. it was a revolution in mobile security. Later on almost all phone company is adopting this feature. Because of less technology face recognition was not come into light. At that time this system was work manually. After some time in 1970s Goldstein Harman and Lesk started a research on woody' system and add some features like Lip thickness, Hair color etc. by using these features, they provided the more accuracy of that system. In 1988 Linear algebra's concept added by Sirovich and Kirby to solve the some specific problems of face recognition system. After in 1990s for progression of face recognition system, DAR Project agency and NIST started a face recognition technology program. Later on there are many updations came in this technology. In 2010 Facebook began implementing this technology,

which helped to identify the people. Last In mobile security, Unlock the phone after verify the face of authorized person using this technology protect the personal data and insure that, if phone is stolen by someone so sensitive data remain inaccessible. Face recognition system widely used in public place surveillance, this technology provide facilitate to better identification of criminals dead bodies and missing persons. Some time ago, in India Modi government have used face recognition system to recognize the Chaotic element during NRC CAA protest. In this paper we make a system that is video based face detect and recognition system, provide the security at public places and other places. The overview of this system is show in figure 1.

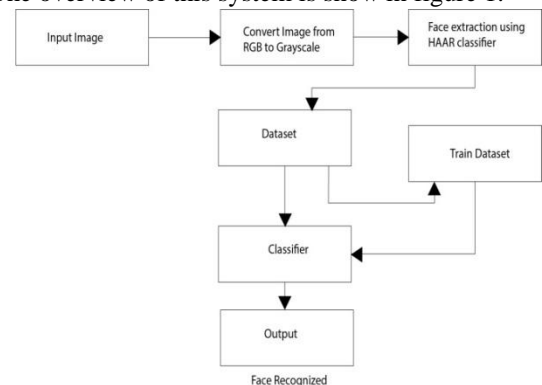


Fig: 1.(Face Recognition System Overview)

II. RELATED WORK

A. Face Detection

There are multiple technique to detect the faces by using these technique we can identify the faces with higher accuracy. Here we take open cv to perform operations. When human face come into range after pre- processing will start and image will start convert from BGR to Greyscale because it is easy task to detect the face.

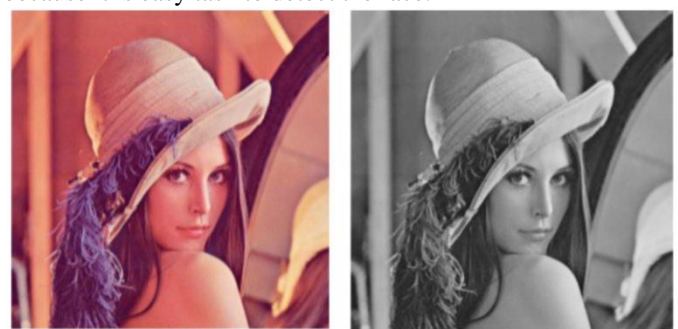


Fig: 2.(Converting BGR to Greyscale Image)

Revised Manuscript Received on June 30, 2020.

* Correspondence Author

Dr Sachin Sharma*, Assistant Professor, Department of Computer Applications Manav Rachna International Institute of Research and Studies, Faridabad, India.

Ravendra Kumar, MCA 4 Sem Student, Faculty of Computer Applications, Manav Rachna International Institute of Research and Studies, Faridabad, India.

Rahul Sajwan, MCA 4 Sem Student, Faculty of Computer Applications, Manav Rachna International Institute of Research and Studies, Faridabad, India.

Praveen kumar jha, MCA 4 Sem Student, Faculty of Computer Applications, Manav Rachna International Institute of Research and Studies, Faridabad, India.

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After required operations are performed like cropping, resize, blurring on image, after the process image divide the segments into small different subparts so the classifier can easily detect the face.

B. Haar like Feature Algorithm

Haar like feature algorithm proposed by Viola and Jones for face detection. This algorithm used to detect the face from a image. Each person have some different and unique properties like eyes size nose size forehead size etc. using Haar like feature algorithm apply the feature of extraction on image and help of edge detection centre detection and line detection detect the eye, nose, mouth and other segments of image.

These detection features are used to extract the features for face detection. Edge detection technique are used to detect all edges.

Detect edge by using simple threshold-

$$\left| \frac{df(X)}{dx} \right| > T \Rightarrow \text{edge}$$

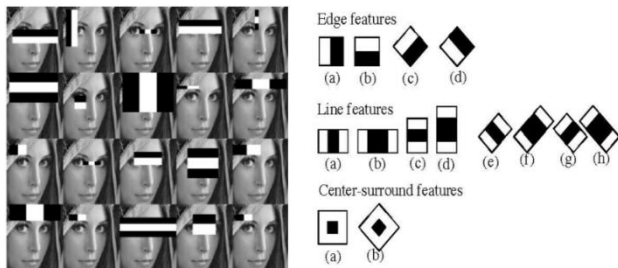


Fig: 3.(using Haar like feature algorithm face detection)

According to the face structure ,get the value of coordinate X,Y,H,W .(X,Y)(X+W,X+Y) are four pixel location to detect the face and on the basis of these value a rectangle will draw on face .

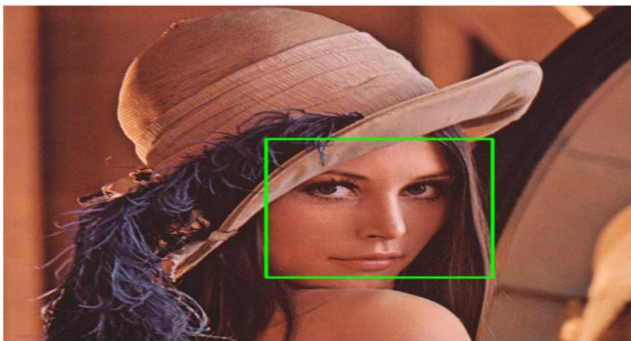


Fig: 4.(face Detected)

C. Face Recognition

Many algorithms are available to recognize faces with PCA and LDA approaches but here we use LBPH algorithm, LBPH stands for Local Binary Patterns Histogram. LBPH is a binary based best texture operator.

Eigenfaces uses PCA approach and follow the appearance-based approach for facial recognition. It records the variation of the different facial image of the person and

utilizes this recorded data for comparing the images of the individual faces.

Fisherfaces uses LDA approach and follow the appearance-based approach for facial recognition. It is often called better version of eigenfaces as it is very similar to the eigenfaces but somewhat superior because of its try to maximize the separation between classes in the training process.

Suppose a face detected with dimension of face is M x N. Face is divided into small regions. Local binary pattern apply on every region. LBP operator define 3x3 window.

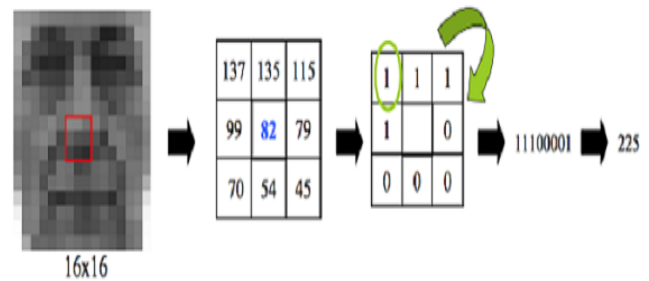


Fig :5 (Pixel to Decimal Conversion)

Now according to figure 5 a region is select, and pixel value store in a matrix,

this process follow binary tree properties centre value treat as root node(median threshold) and start compare with eight neighbours value one by one ,if neighbour value is less to the central value then set as 0 or neighbour value is grater or equal to central value then set 1.

$$\text{LBP}(x_a, y_a) = \sum_{p=0}^{p-1} s(i_m - i_a) 2^p$$

Where i_a is the value of center pixel and (x_a, y_a) , i_m is the value of eight neighbour pixels.

$$f(x) = \begin{cases} 1, & x > 0 \\ 0, & x < 0 \end{cases}$$

Where $f(x)$ is function, and x denotes as neighbour value and 0 denote as center value. After the value combine in clockwise manner and get a binary number, and translate them into decimal number, received decimal value known as pixel LBP value. These values always exist in between 0 to 255. And extract the histogram of each region and combine all histogram and Faceinto database as train dataset after when a face get as a input then all process repeat and get a final histogram and this histogram compare with existing train dataset and return the closest histogram. There are many method to compare histograms like Euclidean distance ,chi-square and absolute value etc. in this paper we Euclidean distance.

$$\text{ED} = \sqrt{\sum_{i=1}^n (\text{histogram1}_i - \text{histogram2}_i)^2}$$

After this if we get a closest or similar histogram, then result will get face recognized.

III.COMPARISON OF DIFFERENT FACE RECOGNITION ALGORITHM

There are various facial recognition algorithms that are currently being used in the different facial recognition systems. Each algorithm has a different way of extracting image information. For Example, some algorithm for extracting facial features, it analyses the shape of the nose, size of eyes, and shape of eyebrows.

A face recognition algorithm that is robust in all situations is currently not available. Some algorithm is better in case of illumination, some for pose problem and some for person aging problem. Let us now briefly consider a few of them.

A. Eigenfaces

Eigenfaces follow the appearance-based approach for facial recognition.it records the variation of the different facial image of the person and utilizes this recorded data for comparing the images of the individual faces in a holistic manner. Since then, there have been numerous first-party extensions and numerous advancements to the automated face recognition system. For Getting the Eigenfaces we need dimension reduction techniques for that **Principal Component Analysis** (PCA) is used. PCA is used to eliminate the information which is not relevant, hence it removes the dimension of data and accurately decomposes the individual face structure into the orthogonal principal component which we know as Eigenfaces.

B. Fisherfaces

Fisherfaces also follow the appearance-based approach for facial recognition. it is often called better version of eigenfaces as it is very similar to the eigenfaces but somewhat superior because of its try to maximize the separation between classes in the training process. Fisherfaces uses onlyPCAapproach. The reduction of face space dimension is done using the PCA method and then LDA method is used to obtain characteristic features of image. Fisherfaces algorithm is preferred over eigenfaces because it ability extracts principle components that separates one individual from another unlike eigenfaces algorithm. So, now feature of one can't dominate another feature if another person.

C. Local Binary Patterns Histograms

This type of histogram was first introduced in 2006.which was used in facial recognized system. This algorithm is simple and efficient in recognizing people.Unlike the fisherface and eigenface, this one is not a holistic approach. It compare the center pixel of the image to it immediate neighbors. If the neighboring pixel is smaller than a middle pixel, the binary digit 0 will be introduce to the threshold square, if the pixel is larger than the middle pixel a 1 will be added. That how we obtain 8 binary values from 8 neighbors which later translated to decimal number called the pixel LBP value. A histogram will be generated after finding the local binary value. The generated histogram is compared to the database and the image with the closed histogram is returned if it exists in the database. Both Eigenfaces and Fisherfaces get affected by different light condition and perfect lighting condition cannot be available in the real life all the time but with LBPH this is not the case as changes in light condition does not increase or decrease its accuracy and efficiency.

IV.RESULTS

For the detection of the face, Harr like Feature algorithm is used for the analysis part. Here the same algorithm is executed on the training dataset detected by the computer. The details of detecting the face by same technique are as given below:

A. Face Detection



Fig: 6 (Data detected by computer)

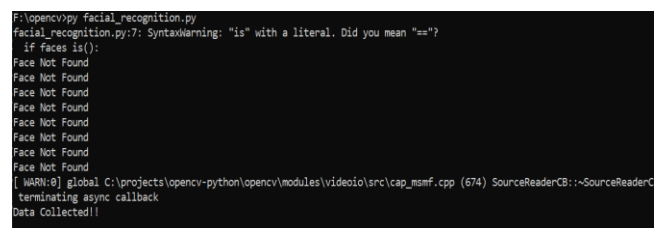


Fig 7 (Data Collected)

Table:1 (Face Detection Using Haar Like Feature Algorithm)

Total Images	Detected Images	Undetected img	Time
150	142	8	20 sec

B. Face Recognition

After storing the training dataset, we perform the face recognition task. In this technique, the LBPH algorithm checks the accuracy of face recognition.

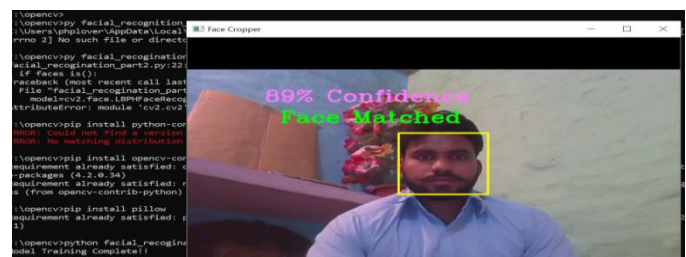


Fig 8 (Face Recognition)

Table: 2 (Comparison between LBPH and existing algorithms)

Algorithm	Accuracy
LBPH(Local Binary Pattern Histogram)	89%
Fisherfaces[16]	70%
Eignfaccs[17]	80 %

Table 2 represents the comparative study of LBPH and existing algorithm. The above table shows that the accuracy of LBPH is much better than previous algorithm with respect to face recognition.

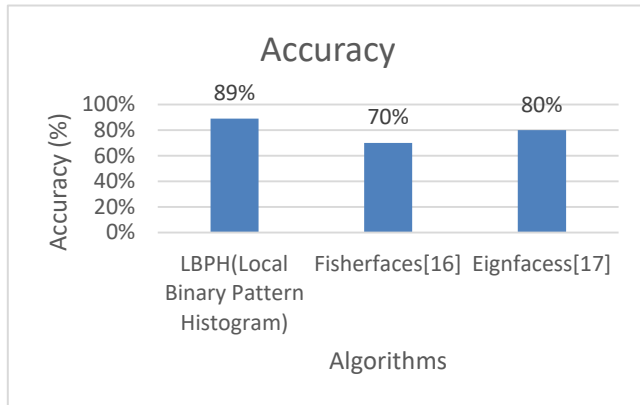


Fig: 9 (Accuracy of various algorithms)

After analysing the above result it is concluded that LBPH gives better result as compared to the Fisherfaces and Eigenfaces technique in terms of accuracy.

V.CONCLUSION

This report can be concluded by saying that deployment of face recognition is manifold and have been used to retort to criminality and public crisis. It is not possible to perform any criminality by scanning the face of any person at any time, for any crime. The regular scheme that is propose here wisely allows communities to impose that difference. Finally, there is still no robust face recognition technique for unconstraint real-world application and these are directions for future work and are useful due to the numerous advantages they offer to us.

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AUTHORS PROFILE



Dr. Sachin Sharma obtained Doctorate in Computer Applications in the field of Data Mining. He is currently working as Assistant Professor in the Faculty of Computer Applications, Manav Rachna International Institute of Research and Studies, Faridabad. He is engaged in teaching MCA and BCA Classes and has teaching experience of more than 20 years. He has published more than 25 research papers in the national and International Journals etc. He has guided various students of MCA students for their project works. He is editor and reviewer of several reputed Scopus indexed journals. He is member of various research organizations such as Computer Society of India, ACM, TOJET, IJCST, IEIE Transactions on Smart Processing and Computing and so on. He is on the editorial board of various National and International Journals. He has chaired various sessions in reputed conferences. He has conducted and organized many workshops on latest IT technologies His main interest areas include Data Mining, Data Structures, Big Data and Data Science. He has published three books.



Ravendra Kumar, MCA 4 Sem Student, Faculty of Computer Applications, Manav Rachna International Institute of Research and Studies, Faridabad



Rahul Sajwan, MCA 4 Sem Student, Faculty of Computer Applications, Manav Rachna International Institute of Research and Studies, Faridabad



Praveen kumar jha, MCA 4 Sem Student, Faculty of Computer Applications, Manav Rachna International Institute of Research and Studies, Faridabad