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Face Recognition Using HAAR Wavelet Transform and Correlation Coefficient from Group Photograph

Jyoti Chopra
Research Scholar,
Chandigarh Group of Colleges, Gharuan,
Punjab, India

Mandeep Singh
Associate Professor,
Chandigarh University,Gharuan,
Punjab, India

Abstract— Face detection is very important approach to recognize the face procedure, head tracking and many more applications. There are different methods to detect the face. We have worked on detecting and recognizing faces from group photograph. In the presented work, face detection problem in a group photograph is worked out using the jones-viola algorithms. We have used ORL database of faces for implementation. The face recognition is done using combined approach of HAAR Wavelet transform and 1D Correlation coefficient. In present work comparison with eigen value and have checked that our system is more accurate in terms of efficiency and speed. Also our system is working accurately with variation in poses. The ten best matches of faces are displayed as result according to ranking based on ascending order of correlation coefficient index.

Keywords—Viola-Jones , HAAR Wavelet, LL Sub-band, Correlation Coefficient.

I. INTRODUCTION

Face detection and recognition is very important routine requirement for many access systems in almost all the organizations and used for security systems. Face detection is very important approach to recognize the face procedure, head tracking and in many more applications. There are different algorithms to detect the face. Further, the face detection performance gets poorer if the luminance conditions are not perfect. If there are different illuminance conditions for the same group photograph, then there may be different results. In the proposed system, face detection is using Viola-Jones algorithm and recognized the face using HAAR Wavelet transform and correlation coefficient. The face recognition is addressed in wavelet domain using LL sub band image. LL sub-band is used to extract the face features. Matching of features using correlation between test and stored database images. A facial data base images are taken from ORL database. In ORL database, there are set of 10 poses of single person.

II. RELATED WORK

AdaBoost is a machine learning boosting algorithm that is useful of constructing a strong classifier with a weighted combination of weak classifiers (classifies correctly in only a little bit more than half the cases) To match this technique to the presented theory each feature is considered to be a potential weak classifier.[13] Face recognition, the detected images are decomposed using HAAR wavelet into LL, LH, HL and HH frequency sub bands. The LL sub band image contains the maximum energy out of all the four sub bands. The advantage of decomposition is that for (NxN) image, a (N/2 x N/2) image is obtained and that is in denoised form.[9] The face identification is very commonly performed by using the facial marks. This is very erroneous technique as the face posture varies, the features are completely changed and a very poor performance is observed while recognizing the given face image from that of the data base image.[1] Face detection problem may be analyzed in different color coding sachem like RGB color format, YCBCr format and HSV format. Each color scheme has their own advantages and disadvantages. In each color coding scheme, primarily skin color is detected for face detection. However, it is quite obvious that while retrieving the face part based on skin color, other body parts may also get extracted and confuses the system. This is the very basic problem while extracting or detecting the face image from the group photograph using the skin color detection. [2]. Face recognition problem is very successfully addressed in the neural network domain. A self organizing map based neural network is designed using face features as input neuron and based on the winning neuron optimization, face recognition is performed. [3]. A self organized map is a supervised learning approach and works well when input neurons are normalized in between the range [-1 1]. Further, the output is obtained in form of a winning neuron that is vectored approach for identifying the face from the data base. [4] Again , a skin color based information, the face part is detected with combination of R, G and B values and taking their combinations [5] The skin color based information is used for detection of face location in group photographs. [6] Face recognition is very well solved in frequency domain using the DCT. DCT coefficients are discrete cosine transform coefficients and give a color intensity frequency map based on facial color intensity variation.[7]

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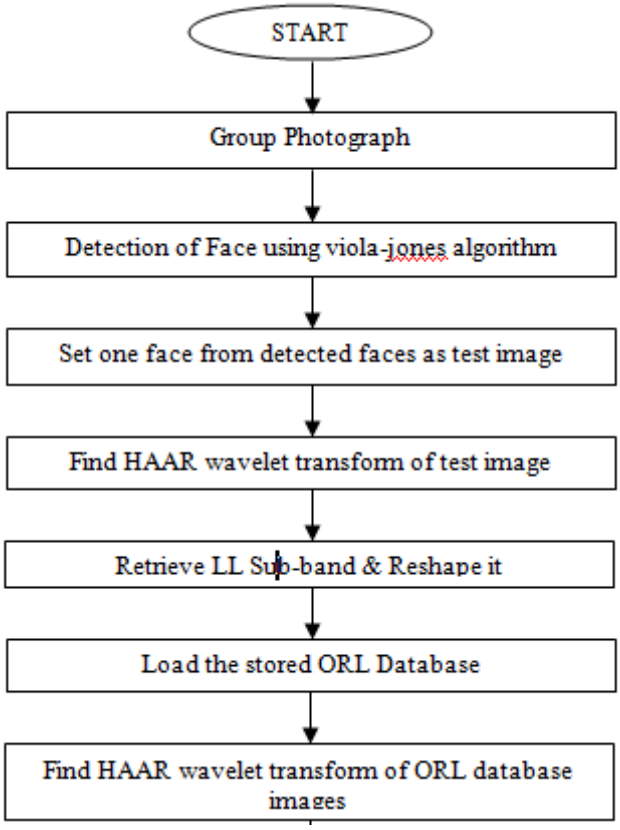
III. ALGORITHM

We are developing a face recognition system, in which we are using ORL database , in this system, we give one image as test image, that is compared with 390 images that are stored in image database. In this system, At first, Detect the faces from group photograph using viola-jones algorithm. Recognition of faces is done by using HAAR Wavelet transform and 1-Dimensional correlation coefficient. Following are the steps of this proposed work:-

1. *Give an input image of group photograph.*
   Give the input image of group photograph, in which number faces of humans are present.
2. *Detection of single faces from group photograph as test image.*
   Detection of human faces from group photograph using Viola-Jones algorithm for further proceeding and select one image for recognizing the image.
3. *Apply HAAR Wavelet transform.*
   HAAR wavelet transform is applied to obtain four sub-bands on test image which we have selected for testing.
4. *Retrieve LL Sub-band from HAAR wavelet transform of test image & Reshape it.*
   LL Sub-band have maximum information & Use LL sub-band is used to extract the features from face image. Then, reshape the image means converting 2D matrix to 1D matrix of image.
5. *Load the stored ORL Data base.*
   Loading of 390 images of human faces that are stored in database for processing.
6. *Apply HAAR wavelet transform on stored ORL database images.*
   HAAR Wavelet is applied to all the images that are stored in data base to obtain four sub-bands.
7. *For stored database images Retrieve LL Sub-band & Reshape it.*
   LL Sub-band have maximum information & Use LL sub-band is used to extract the features from face image. And Then, reshape that for converting 2D matrix to 1D matrix of image to find 1D correlation.
8. *Find 1D correlation between test image & stored ORL database images.*
   1D correlation is calculated between test image and stored ORL database.
9. *Feature matching.*
   Calculate the correlation coefficient between test and stored data base images then Matching of face features based on maximum correlation coefficient value.
10. *Ranking of matched images.*
    Ranking of similar face images based on ascending order of correlation coefficient.
11. *Display Results.*
    Finally, display all the matched images.



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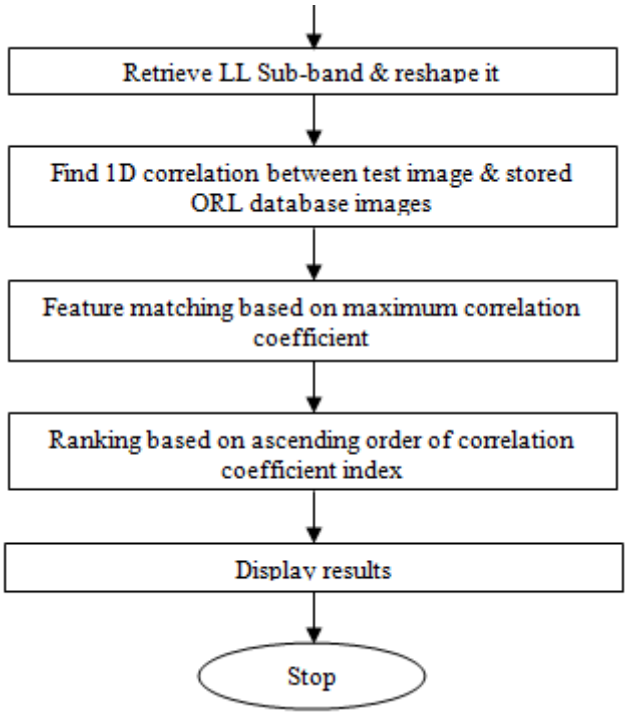

Fig-1 Flow chart of proposed system

IV. RESULTS

We have given a group image as input to face detection module. There are number of faces in group image. That faces are detected using viola-jones Algorithm from group photograph. From that detected images, select one image for testing. There are 400 images in ORL Database, in this work 390 images are taken in stored database for proceeding.

Fig-2 Group Photograph

(Faces are grouped in one image from ORL Database)

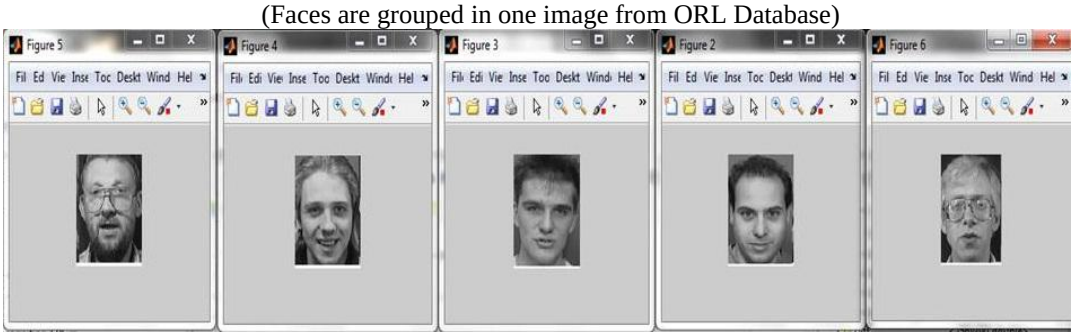

Fig-3 Single Faces are detected from group image

Fig-4 Test Image

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We have selected one single image to give as test image. Then that image using HAAR Wavelet converted into four sub-bands take LL-band that have maximum information. LL-subband would be of 2D that would be converted into reshaped into 1D format for find 1D-correlation to matching the features of face with stored database.

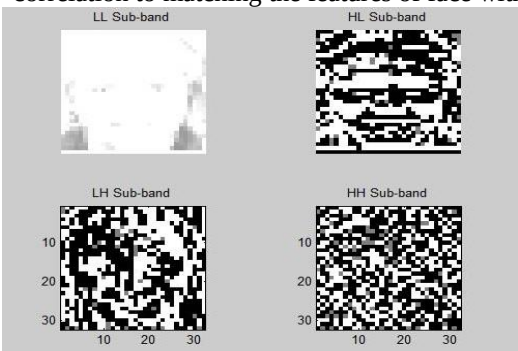

Fig-5 Haar Wavelet Sub-Bands (LL,HL,LH,HH Sub-Bands)

Fig-6 Recognized Image at variation of pose

Fig-7 Ranking based upon maximum correlation coefficient

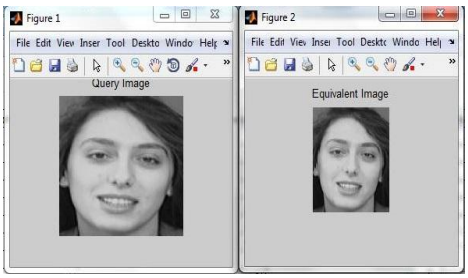

Fig-8 Matching of faces using Eigen Values (same pose)

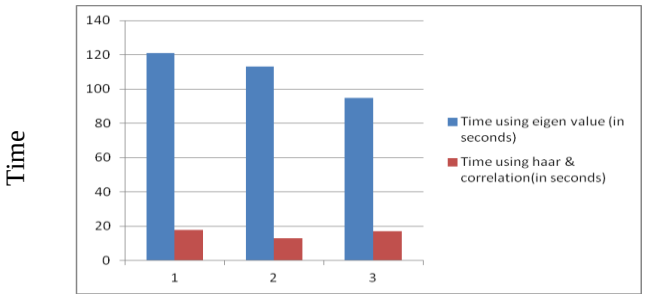

Fig-9 Graph shows the comparison between face recognition using eigen value and using HAAR Wavelet &1D correlation.

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IV. CONCLUSION

In Face recognition system, challenging to detect the face from group photograph & recognize the faces at different poses. In the proposed work, we have done the detection of human face from group photograph using Viola-Jones algorithm. From the detected faces, we have selected one face image from group photograph's detected faces as an test image. Using HAAR Wavelet and correlation coefficient, we have recognize the face at different poses. Matching of face features based on maximum correlation coefficient Index. Ranking of similar face at different poses done in this system. That is based upon ascending order of maximum correlation coefficient index and We have compared proposed system with face recognition using eigen values. In proposed system, system is more accurate to recognize the face at different poses and speedy. Big difference came in time. Processing Time between eigen value and proposed system is ~110 seconds and ~15 seconds respectively to recognize one face at a time. Face Recognition with eigen values is less accurate to recognize the different pose as compared to proposed work.

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Ms. Jyoti Chopra received her B.Tech. in CSE from KC college of Eng. & IT, Nawanshahr and is pursuing his M.Tech. from Chandigarh group of colleges, Gharuan. Her field of expertise is in image processing based application development

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