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Face detection using Haar Cascade Classifier

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ABSTRACT: Face detection is process of detecting face in a digital image with the help of some facial characteristics of face. Face detection is a complex process for computer vision field. There are many factors like illumination variations, different type of face expressions, different environmental conditions which may affect the face detection. Proposed methodology is based on feature extraction from the input image. For feature extraction system applies HAAR features. Each Haar feature is developed in order to detect unique facial characteristics. First of all we have to find best threshold value for each feature from training data to decide whether corresponding feature is present or not in the input image. Selected Haar features should be of minimum error rate and unambiguous. Input Image passes from each of the Haar feature which will scan whole input image and get single value which will be compare with threshold value .

KEYWORDS: HAAR like features, Cascading, Adaboost , Integral image.

I. INTRODUCTION

Face detection is popular area in research of computer vision based application .Human face detection has been playing an important role in application where humans interact with the machine. There are vast applications of face detection which helps to solve real time problems. Face detection is nothing but detection of facial features like nose portion, hair, face skin, eyes portion in given input image. Input image might be consisting of thousands of different objects like tables, buildings, tress .means all objects other than human face but detecting human face is quite difficult because of time changing features like expressions, illuminations, background, skin colour etc. hence it is very difficult to build a computational model which is more precise and more effective.

There are some algorithms have been developed which can classify the image based on its texture. In 2002 ,Ojala discovered Local Binary Pattern (LBP) which is used as texture descriptor. LBP is also one of the effective algorithm for face detection and recognition but it is less accurate as compared to Haar cascade classifier. In 2004 viola proposed some haar features which extract facial features for human face detection. Haar features are capable to detect human face features but still there are some errors in detection.

.Researchers are trying to increase the accuracy rate in detection by modifying haar features . Generally viola jones algorithm contains three main components i.e. Haar features, Integral representation and adaboost. Haar features are used for feature extraction whereas adaboost is used to eliminate redundancy (common features) and to select a best feature which have minimum error rate. We can also use opencv for detection as well as for training purpose. It helps to train the classifier. Opencv (Open Source Computer Vision Library) is basically an open source computer vision and machine learning software library which consist of more than 2500 optimized algorithms.

II .RELATED WORK

Author K.kadir ,M.k.Kamaradduin,H.Nasir ,S.I.Saife ,Z.A.Bakti proposed a paper in which they describesComparative study between LBP an HAAR Like features using opencv[1].Comparison has been made between haar features and LBP in three different databases to calculate detection speed.Haar like feature are effective for frontal face detection but ideal for arbitrary or moving positons.

AuthorLi cuimei ,Qi Zhiliang , Jia Nan,Wu Jinhua Bakti proposed a paper in which they describesHaar cascade by classifier combine with additional classifiers technique for implementations[2].Viola –Jones’ detector uses Adaboost,

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series of nodes with each node being a definite multi-tree Adaboost classifier. The key advantage of Haar cascade classifier over others is its calculation speed.

Author by Souhail Guennouni, Ali Ahaitouf, Anass Mansouri proposed a paper in which they describes Two algorithms; edge orientation matching algorithm and Haar like features combined with classifiers are compared [3]. The key advantage of haar cascade classifier over Edge orientation algorithm is it's High detection accuracy.

Author Zheng jun, Hua Jizhaq, Wang proposed a paper in which they describes Color space Model and local binary pattern. Color space Model is uses various color models for skin detection whereas LBP used for texture extraction [4]. LBP gives simple and efficient way for face detection but takes more time than Haar cascade.

III. ALGORITHM

The main aim of our system is to detect a face. This is done by the Viola Jones algorithm. The algorithm steps are summarized as follows.

1. **Input image:** This is first step where we are taking input image from the user through camera.
2. **Viola jones algorithm:** Apply viola-Jones algorithm on gray-scaled input image. This can be
 - a. **Integral Representation:** Haar feature will scan each portion of input image and produce integral representation of haar feature.

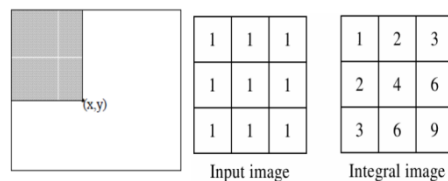


Fig. 1. Detected Face

- b. $\text{Sum1} = \text{sum of the pixels present in light region of the haar integral image}$
- c. $\text{Sum2} = \text{sum of the pixels present in dark region of the haar integral image}$
- d. $\text{Sub} = \text{Sum1} - \text{sum2}$

3. Processing the results :

a. if sub is greater than threshold then we can say that Corresponding facial characteristics is present Else corresponding facial characteristics is not Present.

b. if all facial characteristics present in given input system will draw rectangle around detected human face else system will give output as "human face is not present". It will also show a that how many faces are detected in the case of multiple faces.

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Working of viola jones algorithm can be represented by following flow diagram:

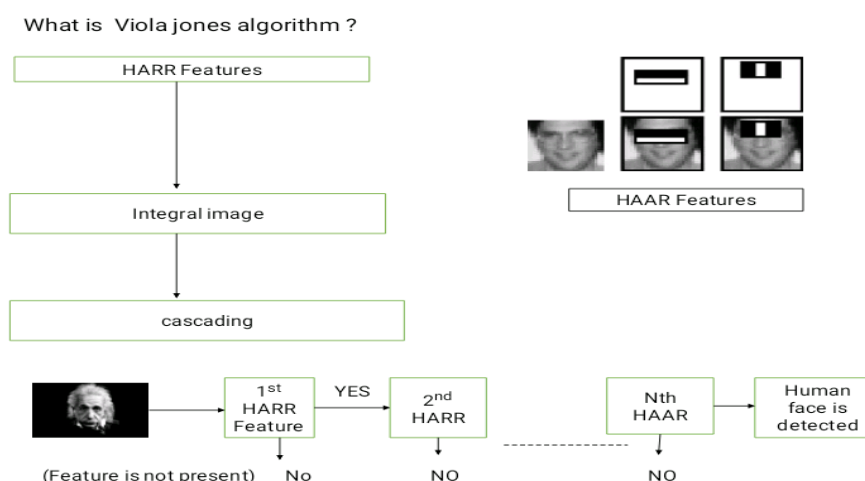


Fig.2flow diagram for face detection.

As shown in fig.(2).In HAAR cascade classifier we can apply n Different features like edge features, line features. on the input image. If images passes out one feature then another feature is applied on the image and in this way if respective images passes all features then we get result as detected face otherwise if any feature is not present in the image then face remains undetected.

In a images measure part is consist of the non face area so it is better to have a easy method to check if the area is face area or non-face area. So Cascade of classifiers simplifies the method and instead of applying each feature differently it groups the features into the various stages of classifiers. If input image passes all features then it results in detected face otherwise if image fails to pass then it get discarded. It helps in reducing the time consumption.

IV. EXPERIMENTAL RESULTS

Figure shows the results of face detection from an image. Fig. 3, shows the detected face output. Green rectangle around the face shows that face is detected whereas Fig.4 shows the output of the system when face is not detected.

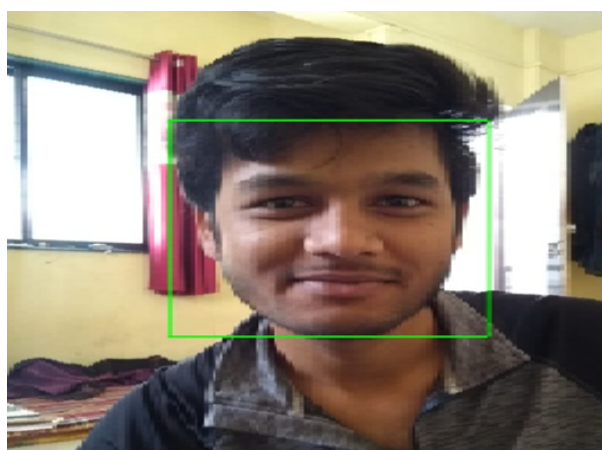


Fig. 3. Detected Face.

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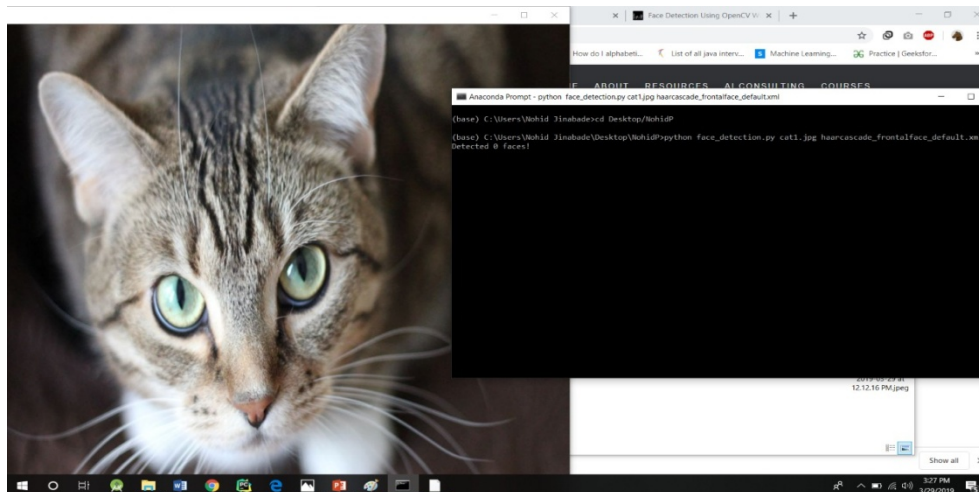


Fig. 4 Non detected Face. It shows output as “No face is detected.”

V.CONCLUSION

We have implemented an Face detection using HAAR Cascade feature. Our algorithm successfully detects the Face region from the image. We have applied our algorithm on many images and found that it successfully detect the faces with various face expression and with different environmental conditions.

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