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A Hybrid Approach for Detecting Human Face using Viola Jones Method

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Abstract:- This paper describes the Viola Jones methodology for detecting the human face.This work manages single face. This work sectioned the faces and eyes from a specific picture utilizing image handling strategy in Matlab which is best technique for discovery of human faces and eyes. The face can be effectively recognized with this technique. Likewise portion the face from generally picture and afterward fragment the eyes from entire picture. Here the precision of the planned framework can be determined. The total framework is appeared in a block diagram. Also, result is appeared in a table. The precision of framework can be determined and it will shows that face detection accuracy is 100% however the eyes segmented accuracy is 70%.

Keywords*: Face detection, segmentation, histogram etc.*

*****

I. INTRODUCTION

Face detection from a given picture is the most intriguing and testing research points from recent years. Face recognition is carrying an entirely different measurement to gaming. Google as of late acquainted the capacity with look for pictures by contrasting them with others. By transferring a picture or giving Google a picture URL, it will give you where that picture is utilized on the Web, and show comparable pictures as well. The capacity to scan for matching pictures is aboon for photographic artists hoping to check where their pictures have been utilized.

II. METHODOLOGY

The basic principle of this algorithm is to scan a sub-window capable of detecting faces across a given input image. The standard image processing approach would be to rescale the input image to different sizes and then run the fixed size detector through these images. This approach turns out to be rather time consuming due to the calculation of the different size images. Contrary to the standard approach Viola-Jones rescale the detector instead of the input image and run the detector many times through the image – each time with a different size. At first one might suspect both approaches to be equally time consuming, but Viola-Jones have devised a scale invariant detector that requires the same number of calculations whatever the size. This detector is constructed using a so-called integral image and some simple rectangular features reminiscent of Haar wavelets..

This is the block diagram of GUI based human detection by face recognition method. It contains many blocks which we will discuss below.

The steps in block diagram are elaborated below:

1. Image Acquit ion Method:

In this method image is acquired from various sources like camera, mobile camera, input devices like scanners.

2. Vision cascade detector:

Vision cascade detector is used to solve the problems in detection of faces in an image. A human can do this easily, but a computer needs precise instructions and constraints. To make the task more manageable, Viola–Jones requires full view frontal upright faces. Thus in order to be detected, the entire face must point towards the camera and should not be tilted to either side. While it seems these constraints could diminish the algorithm's utility somewhat, because the detection step is most often followed by a recognition step, in practice these limits on pose are quite acceptable.

 ISSN: 2454-4248
19 - 25

3. Image Resize:

The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today. Here image is resized in desired size to save the memory. Here we used 450x806 image resolution.

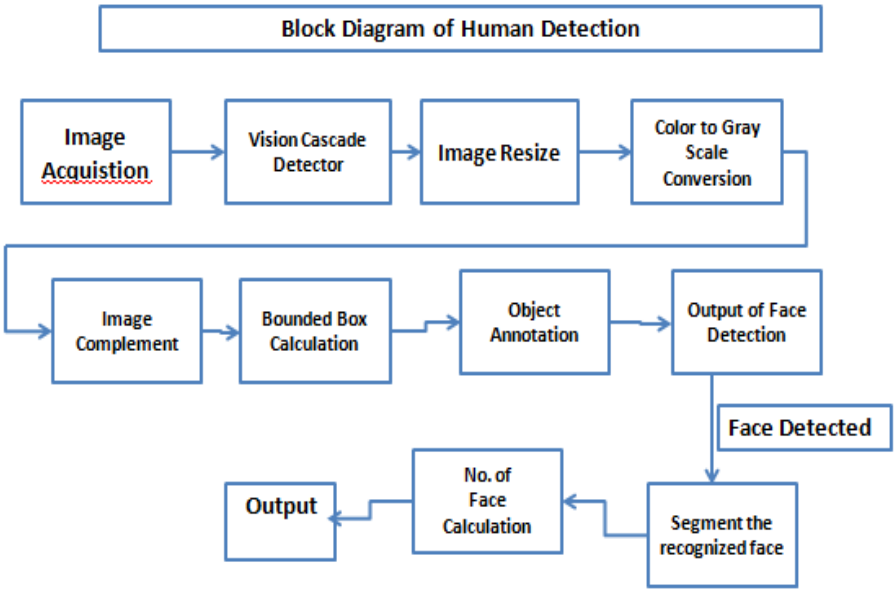

Fig1: Block Diagram of vehicle detection from satellite image using canny edge

4. Color to Gray scale image conversion

The algorithm described here is independent of the type of colours in image and relies mainly on the gray level of an image for processing and extracting the required information. Colour components like Red, Green and Blue value are not used throughout this algorithm. So, if the input image is a colored image represented by 3-dimensional array in MATLAB, it is converted to a 2-dimensional gray image before further processing.

5. Image Complemented:

In the complement of a image, zeros become ones and ones become zeros; black and white are reversed. In the complement of an intensity or RGB image, each pixel value is subtracted from the maximum pixel value supported by the class (or 1.0 for double-precision images) and the difference is used as the pixel value in the output image. In the output image, dark areas become lighter and light areas become darker.

6. Face Detection by Bounding Box Analysis

Bounding Box Analysis is a fundamental technique of machine vision based on analysis of consistent image regions. As such it is a tool of choice for applications in which the objects being inspected are clearly discernible from the background. Diverse set of Bounding Box Analysis methods allows creating tailored solutions for a wide range of visual inspection problems.

7. Object Annotation

This MATLAB function returns a truecolor image annotated with shape and label at the location specified by position

8. Histogram Calculation:

Histogram calculation is used to show the numbers of gray values with image resolution in the image. It is very useful for pixel gray values

 ISSN: 2454-4248
19 - 25

9. Face Segmentation:

When face is detected by voila jones algorithm so we need to segment the particular detected image. So we have segmented the face from recognised face.

III. MATHEMATICAL APPROACH

- Given examples images $(x_1,y_1),...,(x_n,y_n)$ where $y_1=0,1$ for negative and positive examples.
- Initialize weights $w_{1,i} = \frac{1}{2m}, \frac{1}{2l}$ for $y_1=0,1$, where m and l are the numbers of positive and negative examples.
- For $t=1,...,T$:

1) Normalize the weights, $w_{t,i} \leftarrow \frac{w_{t,i}}{\sum_{j=1}^{n} w_{t,j}}$

2) Select the best weak classifier with respect to the weighted error:

$$\varepsilon_t = \min_{f,p,\theta} \sum_i w_i \left| h(x_i, f, p, \theta) - y_i \right|$$

3) Define $h_t(x) = h(x, f_t, p_t, \theta_t)$ where f_t, p_t and θ_t are the minimizers of ε_t.

4) Update the weights:

$$w_{t+1,i} = w_{t,i}\beta^{1-e_i}$$

where $e_i = 0$ if example x_i is classified correctly and $e_i = 1$ otherwise, and $\beta_t = \frac{\varepsilon_t}{1-\varepsilon_t}$

- The final strong classifier is:

$$C(x) = \begin{cases} 1 & \text{if } \sum_{t=1}^{T} \alpha_t h_t(x) \geq \frac{1}{2} \sum_{t=1}^{T} \alpha_t \\ 0 & \text{otherwise} \end{cases}$$

where $\alpha_t = \log \frac{1}{\beta_t}$

Cascaded Classifier (Face Recognition type of BB calculation)

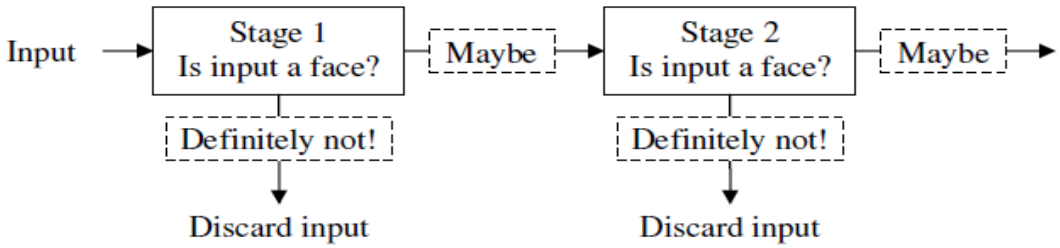

Fig 2. Cascaded Classifier

Process to detect faces

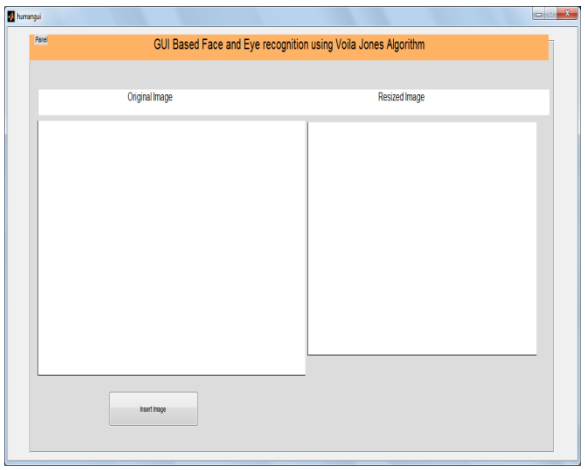

Fig. 3 GUI Window created in Matlab

 ISSN: 2454-4248
19 - 25

Process to detect face include many steps. Descriptions of these steps are as following:

Fig 4: Acquired Image

Load Image using Insert image Button

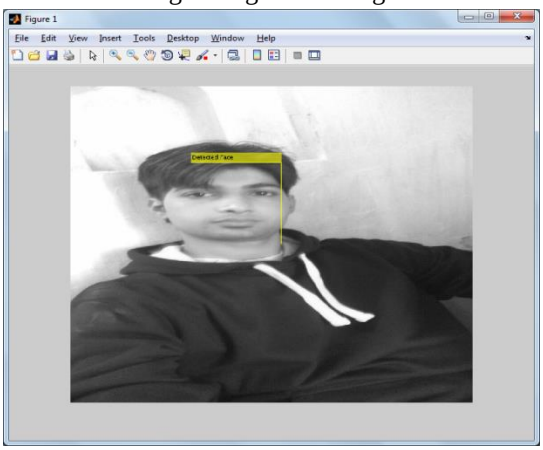

Fig. 5 Detected Face or human by yellow square

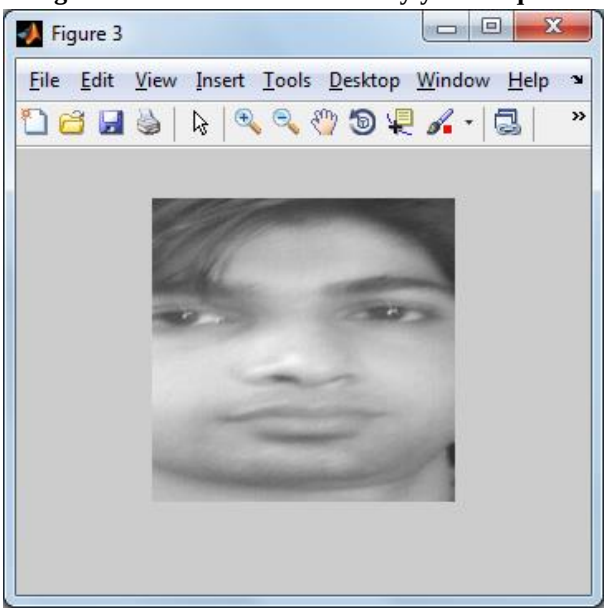

Fig.6 Segmented Face of an Image

 ISSN: 2454-4248
19 - 25

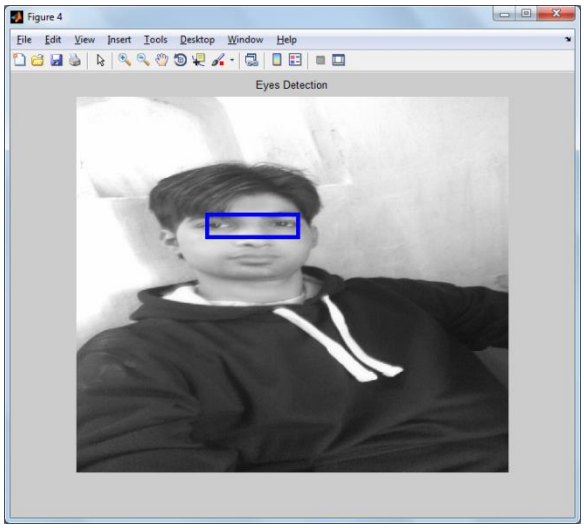

Fig.7 Eyed Detected

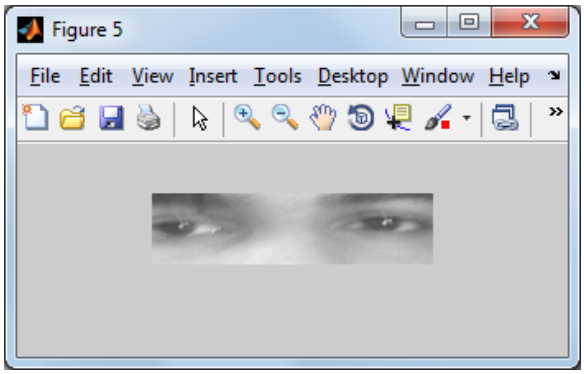

Fig.8 Eyes Detected

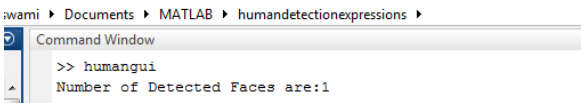

Fig.9 Displays no. of faces in the image.

IV. RESULT

Table 1 show the result of face detection, face segmentation and eye segmentation. It shows that our system is detecting all faces and segmented all the faces but in some images in cannot segment the eyes. The accuracy of face detection and face segmentation is 100% but the accuracy of eyes segmentation is 70%.

Table1

Overall Result TableImage Name	Face Detection	Face Segmented	Eyes Segmented
1.jpg	Yes	Yes	Yes
2.jpg	Yes	Yes	Yes
3.jpg	Yes	Yes	Yes
4.jpg	Yes	Yes	Yes
5.jpg	Yes	Yes	No
6.jpg	Yes	Yes	Yes
7.jpg	Yes	Yes	No
8.jpg	Yes	Yes	Yes
9.jpg	Yes	Yes	Yes
10.jpg	Yes	Yes	No

 ISSN: 2454-4248
19 - 25

Face Detection:

Face Detection Rate among 10 images
Face Detection= Detected Face/ No. of face

Face Detection = 10/10 That
Accuracy = 100 %

That mean 100 % faces are detected using this algorithm

Eye Detection :

Eye Detection = Detected Eyes/ No. of Images
Eye Detection = 7/10
Accuracy in %= 70%
70% Eyes are detected

V. CONCLUSION AND FUTURE SCOPE

Viola-Jones rescales the detector instead of the input image and run the detector many times through the image – each time with a different size. At first one might suspect both approaches to be equally time consuming, but Viola-Jones have devised a scale invariant detector that requires the same number of calculations whatever the size. This detector is constructed using a so-called integral image and some simple rectangular features reminiscent of Haar wavelets. The result shows that our system is detecting all faces and segmented all the faces but in some images in cannot segment the eyes. The accuracy of face detection and face segmentation is 100% but the accuracy of eyes segmentation is 70%.

Future Scope

- This approach works on only single face in given image. But this will not work on multiple faces in a given image so it is a future enhancement to design a system which works on multiple face detection.
- In this system the eye segmentation accuracy is 70%. So we have a scope to improve the result.

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 ISSN: 2454-4248
19 - 25

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