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Human Face Detection and Segmentation of Facial Feature Region

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Abstract

Human face, facial feature detection and Segmentation have attracted a lot of attention because of their wide applications. In computer-human interaction, face recognition, video surveillance, security system and so many application use automatic face detection. This paper is about a study of detecting human faces within images and segmenting the face into numbered regions which are the face-, mouth-, eyes- and nose regions respectively. For face detection we have used the Violaâ??"Jones object detection framework. Sometime the VJOD make a false frame of object detection. Here trying to detect the problem of identification and improve the detection quality by changing the threshold value. It detect the frontal face of human which is 2D. From detected face image we separate the extracted part of face in a single image and Segment nose, eyes, lip and hole face portion by Discontinuous based Image Segmentation. The development and experiments demonstration of this research is done on MATLAB 2013. The learning behavior of the algorithm was tested on different face of human.

Index terms— face detection, viola jones object detection, feature extraction, image segmentation.

1 I. Introduction

utomated face detection is an interesting and important computer vision problem with many commercial and law enforcement applications. It is very easy for human beings but very hard to automate in computerized applications. In practice, applications of automatic face recognition include access control, video-surveillance, identity variation, etc. The problem of automating the process of human face recognition is very complex and depends on many parameters such as lighting conditions, facial expressions, positions and orientations of the human faces. Researches in automatic face recognition started in the 1960s. There has been significant progress in the recent years that includes a number of face recognition and modeling systems. The Viola-Jones object detection framework is the first object detection framework to provide competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones. [1] [2]This algorithm is implemented in OpenCV. The basic problem to be solved is to implement an algorithm for detection of faces in an image. This can be solved easily by humans. However there is a task contrast to how difficult it actually is to make a computer successfully solve this task. In order to easy the task Viola-Jones limit themselves to full view frontal upright faces. If we want to detect the entire face must point towards the camera and it should not be tilted to any side.A brief introduction to the foundations of face detection algorithms have discussed is this paper. For Face detection we have used viola jones algorithm and try to improve the detection changing the threshold value of image and describe the problem of detection. Face detection is a feature based approach in which face geometry is taken which includes face shape and other facial features like mouth, eyes, nose etc. The algorithm requires 2-D images whose threshold values of intensities are taken into consideration in the measurement of the number of the pixels to get the entire face feature area. We also compute the boundary box value where the detection portion are exist. From detected face image we separate the extracted part of face which are nose, eyes and lip and hole face portion by Discontinuous based Image Segmentation.

2 II. Related Researches

Researches in automatic face recognition started in the 1960s. The first attempt to automated facial recognition approach consisted of checking the measurements between different facial features such as the corners of the eyes, the hair lines, holes of nose etc. This attempt was not that much successful. Towards the end of 1980s, the eigenfaces2 techniques prompted more intense researches which were used to find a face in a photo and to compare the images of field has reached up to that point where the operational use of facial recognition on high resolution frontal image was now feasible. The Viola and Jones face detector is the first ever face detection framework to provide successful face detection in real time. It contains three main ideas that make it possible to run in real time: the integral image, classifier learning with Adaboost, and the intentional cascade structure [1]. However, it produces a high false positive rate and false negative when directly applied to the input image. Various research contributions have been made to overcome these problems, such as using pre-filtering or post-filtering methods based skin color filter to provide complementary information in color images. In [2] [3] the authors proposed an interesting method to reduce the false detection by using a skin color as a prefiltering stage prior to the application VJFD. In [4] the authors proposed a hybrid method to reduce false positive in the VJFD by using skin color face postfiltering method in HSV color space. To reduce the effects of lighting, the authors in [5] applied an illumination compensation algorithm in the first step and then, they combine VJFD and the skin color detector to detect face. In [13] the authors proposed a method to reduce the false positive rate and keeping the high detection rate of the VJFD in real applications. In [6] the author has been proposed an algorithm for face detection based on edge information and hue. Though the results were not accurate for all type of images. Recently, a lot of research is being done in the vision community to accurate face detector in real work application, in particular, the seminal work by viola and Jones [7]. The Viola and Jones face detector has become the de facto standard to built successful face detection in real time, however, it produces a high false positive (detecting a face when there is none) and false negative rate (not detecting a face that's present) when directly applied to the input image.

3 III. Image Segmentation

Image segmentation is one of the most essential part in digital image processing. In image segmentation, images are divided into multiple set of pixels, generally required to detect the region of interest (ROI) from an image based on some homogeneity criteria such as color, intensity or texture, which helps to locate and identify objects or boundaries in an image.

There are currently different kind of algorithm, for doing the segmentation process. Each of them are separate from each other.

Currently image segmentation approach, based on two properties of an image, is divided into two categories: a) Discontinuities based In this category, subdivision of images are done by the basis of suddenly changes of the intensity of grey levels of an image. Our task is primarily based on identification of isolated points, lines and edges. This include image segmentation like edge detection.

4 b) Similarities based

In this category, subdivision of images are done by the basis of similarities in intensity or grey levels of an images. Our task here is on determine of similar points, lines and edges. It is also includes image segmentation algorithms like thresholding, region growing, region splitting and merging.

There are different kind of method for Image segmentation and one of them is edge detection based. There are many different ways to perform edge detection, however, two most prominent used algorithm is Gradient Based Method and Gray Histogram Technique. We have used a operator of Gradient Based Method which is sobel operator.

Gradient is the first derivative for image f(x, y). In an image when there is an abrupt change in the intensity near edge [9]. Basically sobel operator, canny operator, Laplace operator, Laplacian of Gaussian (LOG) operator etc is used as operator in gradient based method. Usually canny operator is used but there are a problem. Because it takes more time as compared to sobel operator. For this reason we have used Sobel operator. The sobel operator consists of a pair of 3×3 convolution kernels map as shown in Figure 1.One kernel is simply the other rotated by 90°. These kernels are designed to edges running vertically and horizontally relative to the pixel grid, one kernel for each of the two perpendicular orientations. The kernels can be applied separately to the input image, to produce separate measurements of the gradient component in each orientation (call these Gx and Gy).

Typically, an approximate magnitude is computed using: which is much faster to compute. The angle of orientation of the edge (relative to the pixel grid) giving rise to the spatial gradient is given by [7]:

5 IV. Viola Jones Object Detection Framework

The viola jones is a object detection frame work which is used to detect the human face. The main concept of the Viola-Jones algorithm is capable of detecting faces across a given input image. The viola jones performed operation in each pixel of a required area . [11].

6 a) Feature Selection

The Viola-Jones face detection framework work in a analyzes a given sub-window using features consisting of two or more rectangles, such as two- Rectangle feature of an image can be measure by using an intermediate representation for the image which we call the integral image. [4] The integral image at location x, y contains the sum of the pixels above and to the left of x, y, inclusive:(7) (8) (9) | | ? | | | | | |

(1)

where ii (x, y) is the integral image and i (x, y) is the original image (see Fig. 2). Using the following pair of recurrences (2) (3) where s(x, y) is the cumulative row sum, s(x,?1) =0, and ii (?1, y) = 0) the integral image can be computed in one pass over the original image. Using the integral image any rectangular sum can be computed in four array references (see Fig. **??**). One alternative motivation for the integral image comes from the "boxlets" work of Simard et al.

7 Methodology

The process for build up the propose system will be included parts:

? Face Image Acquisition:

? Smoothing/Filtering ? Features Extraction ? Image segmentation. After performing detection it is possible to detect the human face and segment the different part of face. The process of getting image from any source, especially hardware is called as image acquisition. For image acquisition we can use normally digital camera. In the image processing it is impossible without image receiving/acquisition. The sweetest Acquisition process is a digital camera into various formats such as Bitmap, JPEG, GIF and TIFF etc. We can also collect image from different kind of we page.

8 b) Smoothing/Filtering

The purpose of smoothing is to reduce noise and improve the visual quality of the image often; smoothing is referred to as filtering. For this purpose of filtering we have used Gaussian Filtering Techniques. The Gaussian function are given below: (6) If the image is not noisy it is not necessary to filtering. Because filtering is not suitable for every image. We have use filtering for better result if necessary.

9 c) Features Extraction

It is obvious that feature is very significant to any object detection algorithm. In matlab 2013 have used computer vision object detector tool box. For feature selecting here used the viola jones algorithm. Basically, there are a lot of features, such as eyes, nose, the topology of eye and nose, can be used for face detection. In viola jones face detection, a very simple and straightforward feature has been used. Each feature can be obtained by subtracting white areas from the black areas. Here, the area means the summation of all the pixels' gray value within the rectangle. Aiming at calculating these features, a special representation named as integral image has been used. In figure 15 face has found 3, nose found 2 and one mouth. But it's detection is incorrect. In figure 16 shows a side view of face image. In this case it doesn't found any face.

10 VII.

11 Conclusion

In our task we trying to improve the face detection using viola john algorithm and segment the part of face like eyes, nose, lip etc. Then make the edge detection to convert image into binary image which can use in various purpose in image processing field .In our research we only work with the frontal face of human. If we use side view of image it cannot detect correctly. In future we will try to detect the face from various orientation, angle, geometric view and we want make classification of human face base on this information we extracted from this work. We will try to classify face expression based on segmentation of lip and mouth region. We think it will be very efficient for classification and detection.

VIII. [1] [2] [3]

[1] © 2016 Global Journals Inc. (US) 1

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[3] © 2016 Global Journals Inc. (US) 8. Paul Viola and Michel J. Jones: "Rapid Object Detection Using a Boosted Cascade of Simple

1

Figure 1: Fig. 1 :

-1	0	+1
-2	0	+2
-1	0	+1

Gx

+1	+2	+1
0	0	0
-1	-2	-1

Gy

2

Figure 2: Fig. 2 :

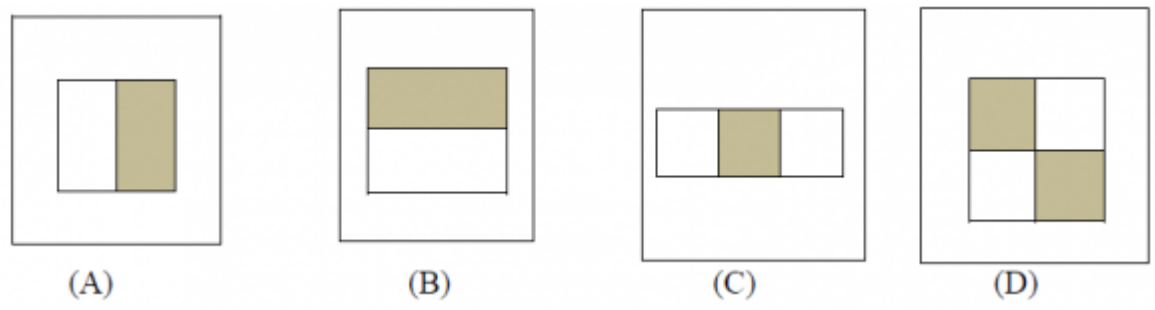


Figure 3:

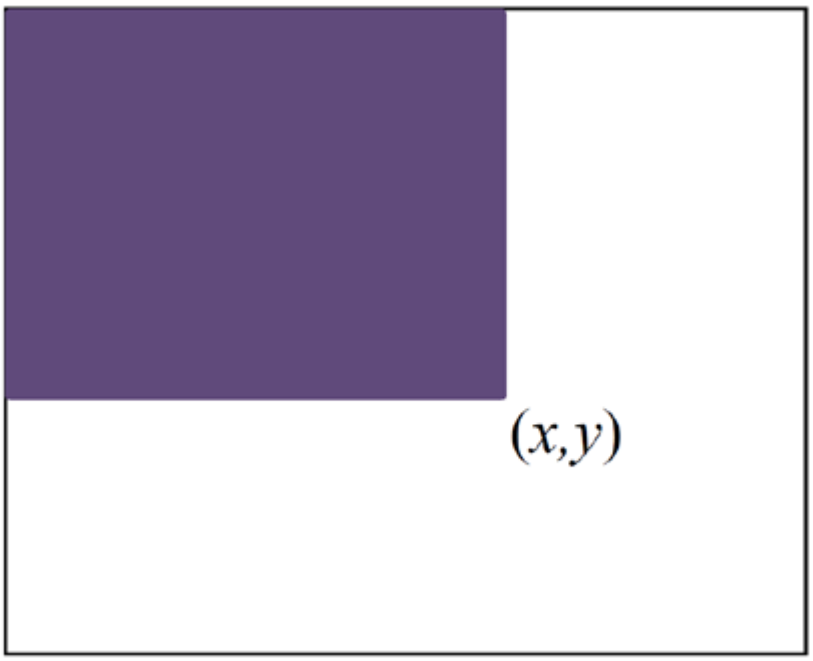


Figure 4: [11]Fig. 3 :Fig. 4 :

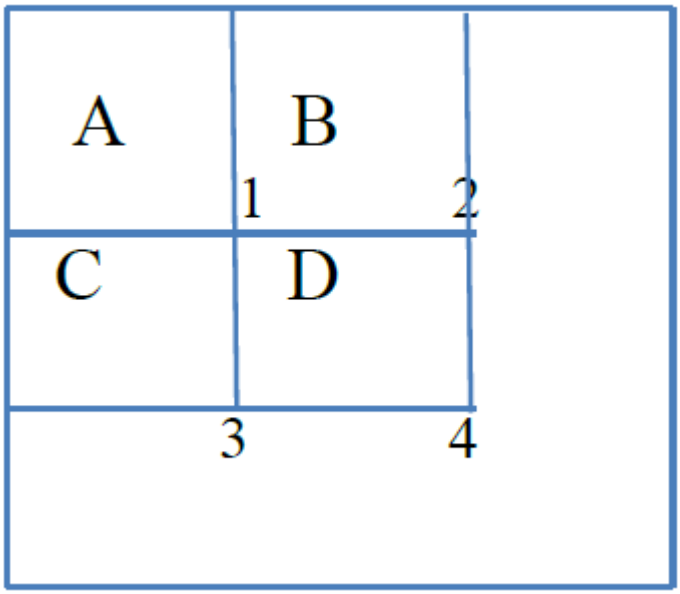


Figure 5: ? 3 © 4)

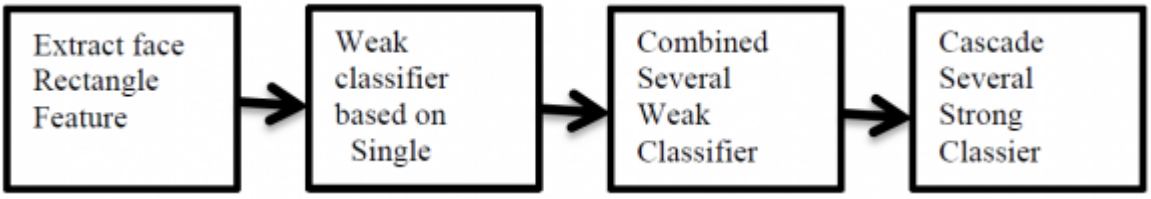


Figure 6: (5)Fig. 5 :Fig. 6 :

Input:
A greyscale image, a scaling factor (s) and scanning factor (p)

Output:
The location and size of a detected face

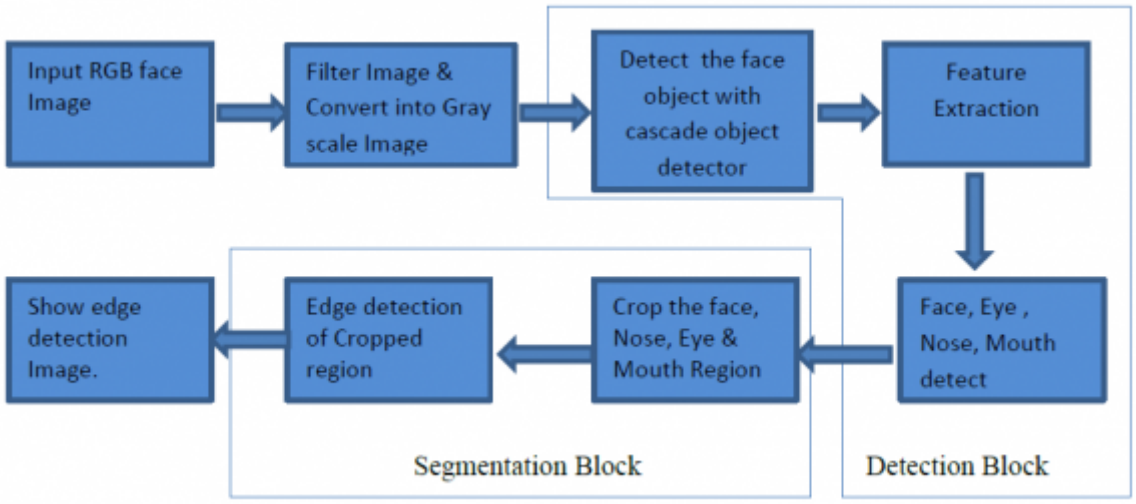
Procedure:

```
Size = detector. Size
while size _ image. height AND size _ image. width
do
for i from 0 to image. width-size in increments of
p do
for j from 0 to image. height-size in increments
of p do
if runCascade(subwindow of image of
size size located at (i,j)) then

runCascade(subwindow of image of
size size located at (i,j)) then
Add (s,i,j) to detection list
size = RoundUp (size * s)
return average of detections.
```

7

Figure 7: Fig. 7 :



5

Figure 8: 5 ©

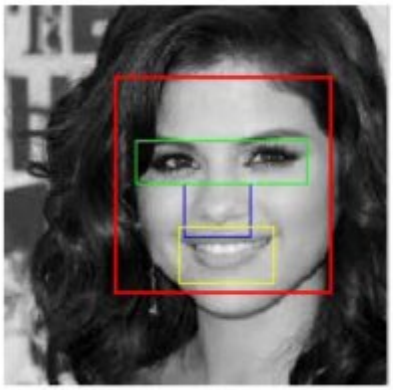
10

Figure 9: Fig. 10 :

111314

Figure 10: Fig. 11 :Fig. 13 :Fig. 14 :

15



BBOXES	X	Y	Width	Height
Face	61	40	116	116
Nose	98	97	35	29
Mouth	95	120	51	31
Eyes	72	74	92	23

Figure 11: Fig. 15 :

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