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Facial Features Extraction From the Human Face

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Abstract **– This paper presents a new approach for automatically tracking the human face as well as facial features (nose, mouth)in a clear way.**

This technique became required in various future visual communication applications, such as teleconferencing, Facial recognition systems, Biometrics and Human computer interface etc.

The principle behind detecting the face feature is used to measure the respiration rate in the future as the nose represents the important region in the human face for breathing.

human face detection as elliptical area was investigated then image processing techniques were used to extract human face as elliptical area from the rest of image.

Several techniques were applied to detect the nose inside the elliptical area as rectangle region and then the mouth region was extracted as an elliptical region.

A skin-color segmentation with image processing techniques played an important role in detecting the human face as elliptic area and then several techniques were used such as enhancement, thresholding, Morphological, edge detections as well as binarization techniques to achieve the aim of the suggested method.

Nose detection as a rectangle region was also investigated by looking for the longest vertical line in the elliptical area. The nose was detected and extracted as rectangle region.Detecting the mouth was achieved by looking for the longest horizontal line under the tip of the nose then thresholding this region to detect the lips of the mouth; by extracting the points of the lips cornerswe extracted the mouth as elliptical region.

Further work is in progress to enhance the algorithm so that it can be used to detect the eyes and ears regions as well as apply these techniques in the medical field.

Keywords **– Face Detection, Facial Features, Nose, Mouth, Region of Interest.**

I. INTRODUCTION

Face detection is one of the most common biometric authentication technologies which is based on physiological characteristics and can be used in a wide range of applications such as identity authentication, access control, measuring breathing and surveillance [2].

Feature extraction techniques are the most important and critical step within pattern recognition and image processing. The concepts of features extraction is to look for significant information in an image [12].

Therefore it is very important to consider using a reliable face detection to reduce errors occurring in those applications [2].

Kwok-Wai et al [3] suggested two approaches they detect the location of the human face region using the genetic algorithmwhile detect the facial features using the eigenface technique.

Alfasly and Suresha [13] presented another approach to detect the human face as well as detect the facial features; eyes, eyebrows, nose, and mouth, based on sensing the edge points of face features and predict the intra-features points.

Rowley et al [9] presented a neural network for detectingand matchingthe human face.

Chang et al [7] tried to extract the eyes and mouth using color based feature extraction although this approach is limited due to the variation and complexity of image backgrounds.

The suggested method for detecting and extracting the human face as elliptical area was investigated. Image processing techniques were used to detect and extract the nose as a rectangle region and the mouth as elliptical area.

II. METHODOLOGY

The recorded images were processed off-line using the Matlab image processing toolbox.

Median low pass filter was used to enhance the recorded image.

The edge detection technique(Prewitt filter) was used to identify the boundary of the human' heads in the thresholded images[4].

-Since the imageenhancement by Medianlow pass filter. Several steps were applied

1-Skin color segmentation has been used widely in facedetection [10],The thresholded technique played an important role in this method as it is applied to the enhanced images to separate the human head from the image background.

This step considered as an important step in the human face detection process. The efficiency of the color segmentation of a human face depends on the skin color that is selected.A suitable threshold value for RGB was 100 [5].

2-Binarization the threshold image to identify the boundary of the subjects' heads as shown in Fig.1.

Fig. 1. Shows the application of thethreshold and edge detection techeneques on the filtered image.

3-In order to cover the filtered images by elliptical area [4]. The location and size of the ellipse were determined as follows:

- The highest (xmax) and lowest (xmin) pixels' locations of the head boundary in the vertical direction were identified and the centre between these two locations (x0) was determined.
- Centred at x0, the head boundary points in the horizontal direction was identified, providing ymin and ymax.. Then, the centre (y0) between ymin and ymax was calculated. The diagonals of the ellipse (i.e. 2a and 2b) were determined, where a and b were calculated from x0, and y0 toxmin and ymin respectively.

The ellipse equation (Eq2) was used to determine the location of ellipse on the enhance image.

$$\frac{(x_i - x_0)^2}{a^2} + \frac{(y_i - y_0)^2}{b^2} = 1 \qquad (1)$$

Fig. 2. shows the position of the ellipse on an original image

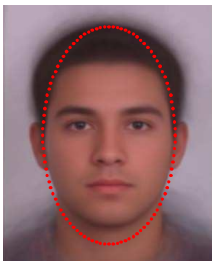

Fig. 2. Position the ellipse superimposed on the filtered image.

4-Then, the extraction of the human face as elliptical area from the original image was achieved as shown in Fig.3.

Fig. 3. Extract the human face as elliptical area

5-Thresholding the elliptical area of the human face[11], and then , scanning the ellipse area to identify the nose region. Detecting the nose is based on tracking the longest vertical line in the image. This line refers to the center of the nose as well as the tip of the nose. A rectangle (ROI) was placed on the identified region in such a way that it covered the nose based on location of the longest line as shown in Fig.4

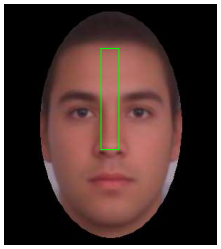

Fig. 4. The ROI: the position of the nose (ROI) as rectangle region on the human face.

6-Scanning the area under the tip of the nose to look for the longest horizental line to detrmied the mouth area as a rectangle region as shown in Fig.5

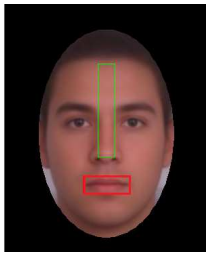

Fig. 5. The position of the mouth region as rectangle region on the human face

7-The rectangle region was thresholded to look for the lipsin the mouth region as shown in Figs(6 and 7).

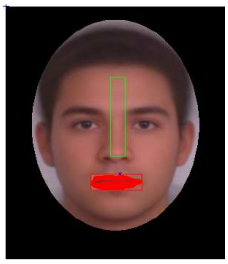

Fig. 6. The application of threshold technequetothe mouth region on the human face

Fig. 7. Binarazation the mouth region

Regarding the mouth, our goal is to locate the corners of the lips and then determined the mouth region as elliptical area as shown in Fig.8.

Fig. 8. Detect the mouth and lips as elliptical area

III. Results and Discussion

The tracking method was applied to 25 images and successfully tracked the human face as well as the facial features. Fig.9illustrated the success of this method to detect the human face as elliptical area and the nose as rectangle region as well as the mouth aselliptical area.

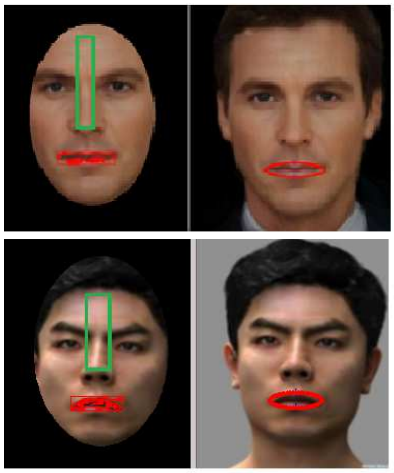

Fig. 9. Detect the human face , the nose as well as the mouth regions

IV. CONCLUSIONS

The main essence of this study was to detect the human face, nose as well as the mouth. The image processing techniques playan important role to detect the human face as ellipse region.

The human face was extracted as elliptical area from the background by using image processing (enhancement, thresholding and segmentation) techniques. Initially the human face was extracted as elliptical area. Secondly the humannose wasextracted as a rectangle region. Finally the mouth and lips regions were extracted as elliptical shape.

Image processing techniques was used to detect the human nose as a rectangle region. The noseregion extraction was achieved by tracking the longest vertical line in the elliptical area which represents the nose region.

The mouth region was extracted by looking for the longest horizontal line under the tip of the nose then thresholding this region to detect the lips of the mouth; by extracting the points of the lips corners we extracted the mouth as elliptical region.

The process was off-line due to the extent of image processing involved.

Further work on optimizing the image processing will enable measurements to take place in real time. There were further issues in detecting the facial features during the head movements. Use this algorithm to detect theeyes as well as the ears regions. The tracking techniques for the features are useful to detect the human health as it can be use to measure the respiration rate using signal processing techniques for the nose and the mouth regions. Further improvements are currently being sought to deal with these limitations.

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