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CONTROL WHEELCHAIR BY SMILE AND WINK EXPRESSIONS OF A PARALYTIC PERSON

Gowtham Kiran Varma. P[1], Prasanna Kumar. P[2], Uday Kumar. S[3]

[1,2,3]*Dept. of Electronics and Communication Engineering. Kalasalingam University, Virudhunagar (Dist), Tamilnadu, India*

ABSTRACT

There are many systems developed by human to control the devices, one of the smart ways of doing it is by using Facial expressions like smile and wink to make our work done easily. The real-time face expression recognition plays a vital role in understanding the mood of the person but the same expressions and gestures which can be able to control a device, using the efficient image processing techniques. This system pioneers in helping the paralytic and disabled persons to get on in their lives without depending on others. This paper describes the efficient methodologies in controlling the wheelchair by facial expressions like Smile and Winking in which the face is detected by color matching and the expressions are detected by pattern recognition through NI Vision Development module in LabVIEW.

Keywords: Facial expressions, Gestures, Color matching, Pattern recognition, NI Vision Development module, LabVIEW.

1. INTRODUCTION

Technology is improving day-by-day with innovations and inventions. As this happens, the problems of the people are solved. It is very difficult to the paralytic persons to move from one place to another place. This paper describes a better way for paralytic persons to move independently. For this, some expressions like Smile and Wink are considered. To locate eyes and mouth, first face of the person is to be identified. The color feature from the sample template (color image of the paralytic person) is extracted first and then compared with the test image in order to identify the face of the person. After the identification of the face

a. Smile (with the teeth visible) is to be detected to move the wheelchair forward.

Smile is detected by the pattern matching in which the algorithm understands the edges of the teeth by detecting the edges from the sample template (the image of the paralytic person smiled with his teeth visible) and compares it with the edges of the test image.

b. Wink is to be detected to move the Wheelchair Left/Right.

Wink is detected by detecting the eyes first and then IMAQ clamp vertical min in LabVIEW locates the edges along a set of parallel search lines or rake where the edges are determined based on their contrast and slope.

2. COLOR SPACE MODELS

In real time applications we use different way for face detection, but the most of the algorithms are based on the face detection are based on skin color or facial expressions. As it is been use in the most of the cases so it should be low computing complexity and can run as fast as possible. As facial

expressions based algorithms take much more time than the skin color detection and will be more effective. In general there are different types of color models like RGB, HIS, CIELab, YCbCr…Etc.

a. RGB color space model:

The most common color space model in digital image storing and processing is RGB model. As the chrominance and luminance components are mixed in RGB color space model. It is very difficult to separate both. However it is device dependent, it means based on the device resolution it varies from device to device. Because of all these reasons it is not used in the skin color segmentation algorithm.

b. YCbCr color space model:

In YCbCr color space model chrominance and luminance components are complete separated. It is the best way of clustering and for the transformation from RGB to YCbCr color space model in linear manner. As chrominance and luminance are separated, thus it performs best way in skin segmentation. In YCbCr color space model Y indicates the luminance component which means the weighted sum of RGB values. Cb indicates blue difference chrominance component. Cr indicates red difference chrominance component. The only drawback in this color space model is blue omponent have only less area in the skin color. The following equations conversion from RGB to YCbCr:

c. YCgCr color space model:

In YCgCr color space model chrominance and luminance components are completed separated explicitly. Here Cb component is the difference between the luminance component and the blue component. Because of the blue component have smaller proportion in the skin color. De Dios had proposed a new color space model which is known as YCgCr color space model. Similarly, Cg indicates the difference between green component and the luminance component. This is the best way for color segmentation of skin color. The following equations conversion from RGB to YCgCr:

3. FACE DETECTION

In this process the RGB is converted into YCgCr color model so that it makes easy to segment the skin like regions and non-skin regions in the space. Now, for detection purpose and to get edge of the image we do thresholding segmentation process as it is the simplest method which has better computation process than Gaussian skin color model.

3.1 Face detection using color matching:

It is done on the basis of the skin color matching process. Here some samples template is stored in the database and all these are been compared with the given live camera recordings or color images. Based on the color of the image in the samples the face is been detected. The Face Detection is done by skin color matching

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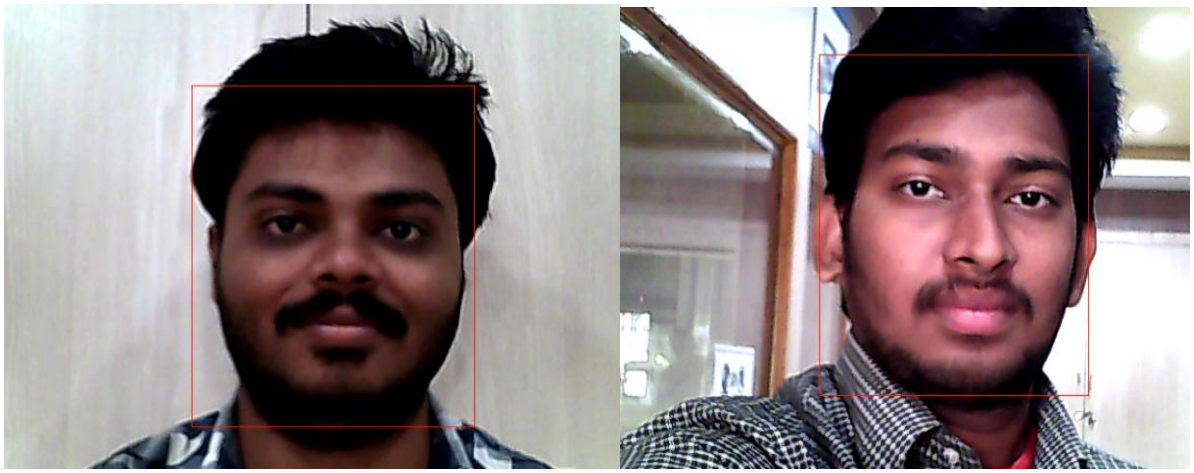

Fig.1. Samples of face detection using color matching

The color information is extracted from the sample template given. The algorithm searches for the traces of color in the image to be processed. The disadvantage using the color matching algorithm for face detection is it can detect the other parts of the body or the other things in the background which have the same color of the matching template given. The image after detection of the face undergoes other processes for Smile and Wink detection, however the detection of body parts other than face cannot able to trace the signs of Smile and Wink.

4. EDGE DETECTION

It is also used in the detection of face as the edges of the images are recognized through thresholding segmentation in which the darker region and brighter region. Which means the darker region indicates the non-skin region whereas the brighter region indicates the skin region.

4.1 Smile detection by template matching:

In coarse selection, the process is done on the basis of the area. When the input image is given then the feature is extracted and that is compared with the sample templates in the database. The teeth region is extracted. The template matching is done by using Manhattan distance .There are three feature vector generation algorithms: PPED, CED, and EM. In CED based algorithm, cell of required size is selected and compared along the image pixels. So, that the edge flags are calculated. In EM algorithm eye and mouth are detected by passing the template in horizontal manner. So, that darker region will be identified easily. As the teeth region is used for detection for smile.

The main objective is to use better expressions to make the wheelchair move forward and to move right/left. The expression we choose to make the wheelchair move forward is Smile. The smile with our teeth visible is considered to be the efficient method which has less chance of errors than the existing system (Normal smile with no teeth visible). In Fig.2 the red overlay on the image shows the boundaries of detection of smile. Fig.3 Shows no traces of detection of smile because the teeth was not detected.

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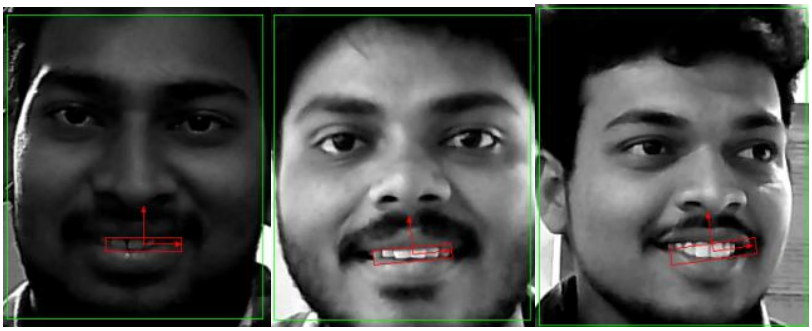

Fig.2. Smile detection for different faces

Fig.3. No traces of smile detection

4.2 Wink detection

In directing the wheelchair to Left/Right the Wink expression is the suitable one. In this both the eyes are to be considered to conclude whether the right eye is closed or the left eye. To make the wheelchair move right, the right is to be closed and the left eye is to be opened. To make the wheelchair move left, the left is to be closed and the right is to be opened.

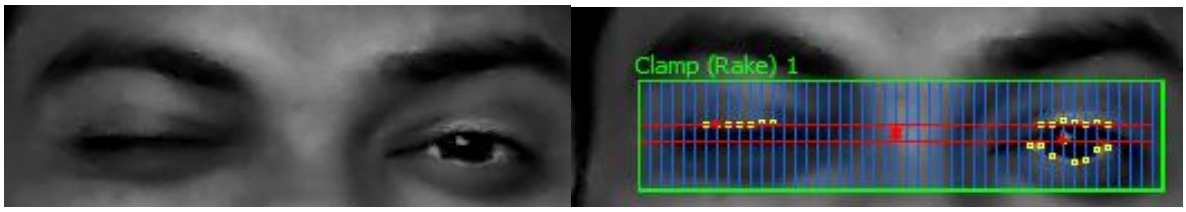

Fig.4.Measuring the vertical distance for an opened eye

As shown in Fig.4 measuring the vertical distance can be done by IMAQ Clamp vertical min in the NI vision. From the center of the ROI(Region of interest) towards the horizontal sides of ROI locates edges along a set of parallel search lines or rake where the edges are determined based on their contrast and slope. The contrast(the difference between the average pixel intensity before the edge and the average pixel intensity after the edge) specifies the threshold of the edge. Only edges with contrast greater than this value are used in the detection process.

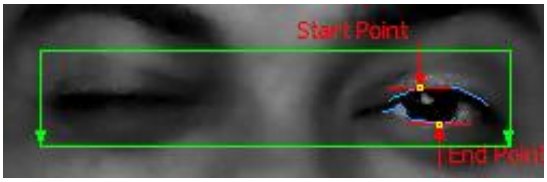

Fig.5 Edges along the ROI

IMAQ Clamp max vi finds edges along a region of interest (rotated rectangle only) and measures the distance between the furthest opposed points on the edges found. Edges are determined by extracting contours from the ROI and analyzing their order and geometry. When valid calibration information is present, the distance is measured in pixels and real-world units. In the same way the wink with right eye also be detected as shown in fig.5 and triggers the signal correspondingly to move the wheelchair left/right. If both the eyes are opened the wheelchair detects the distance between the eyelids through IMAQ clamp vertical min which shows the wink is not occurred.

5. CONCLUSION

In order to control the wheelchair, Smile and Wink can be the best way and relatively less complex in computational aspect and also invariant to rotation. This process sophisticates the Human Computer Interaction (HCI) and can be further improved to operate the computers and various electronic devices.

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REFERENCES

[1] Guanghui Xu, Yingcai Xiao, Shuai Xie, Sen Zhu;"Face Detection Based on Skin Color Segmentation and AdaBoost Algorithm".

[2] Yasufumi Suzuki, Tadashi Shibata;"An Edge Based Face detection Algorithm Robust against illumination, Focus, and scale variations".

[3] G.N. Matrel, S. K. Shah;"Facial Expresssion Detection".

[4] Caifeng Shan;"An Efficient Apporach to Smile Detection"

[5] Baosheng Yu, Dacheng Tao;"Anchor Cascade for Efficient Face detection".

[6] Hari Singh, Dr. Jaswinder Singh; "Detection of eye movement for controlling a television".

[7] Hossian Mahbub Elahil, Didar Islam, Imtiaz Ahmed, Syoji Kobashi, Md. Atiqur Raham Ahad; "Webcam-based Accurate Eye-Central Localization".

[8] Kevin El Haddad;" Non Verbal Conversation Expressions processing for Human-Agent Interactions".

[9] Lili Lin,Yiwen Zhang, Weini Zhang, Zhihui chen, Yan yan, Tianli Yu;"A Real-time Smile Elegance Detection System: A Feature- level Fusion and SVM Based Approach".