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Feature Extraction of Gesture Recognition Based on Image Analysis for Different Environmental Conditions

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Abstract
Gesture recognition system received great attention in the recent few years because of its manifoldness applications and the ability to interact with machine efficiently through human computer interaction. Gesture is one of human body languages which are popularly used in our daily life. It is a communication system that consists of hand movements and facial expressions via communication by actions and sights. This research mainly focuses on the research of gesture extraction and finger segmentation in the gesture recognition. In this paper, we have used image analysis technologies to create an application by encoding in MATLAB program. We will use this application to segment and extract the finger from one specific gesture. This paper is aimed to give gesture recognition in different natural conditions like dark and glare condition, different distances condition and similar object condition then collect the results to calculate the successful extraction rate.
Keywords—Feature Extraction, Gesture Recognition, Image Analysis.

I. INTRODUCTION

Gestures have vivid, concise and intuitive features that it is very worthy to be researched in Human-Computer Interaction. For example, a same gesture may present different meanings in different cultures. The research of gestures can help people to distinguish different gesture cultures. It can also improve and enhance the conditions of lives and work for those people who have disabilities with speaking and listening especially who have lower educational level to communicate with others normally [1]. Our hands have many characteristics which can affect feature detection and extraction. The hand is an elastic body with individual variability. A single gesture can be given differently by different people. The hand has a lot of redundant information. The fundamental of gesture recognition is to recognize human's fingers thus the palm is redundant. Our hands exist in a three-dimensional space thus it is hard to locate the position. Because an image is a two-dimensional, the projection direction is very important. Hand gesture recognition can also be used in computer sign language teaching [2].

II. GESTURE RECOGNITION BASED ON IMAGE ANALYSIS

The gesture recognition algorithm is illustrated in the figure 1. According to the algorithm, the gesture recognition system first gets the input from the imaging device which is installed with the system. Then the system converts that image into gray image. Than the system find the threshold value for black and white parts of the image based on Otsu's method.

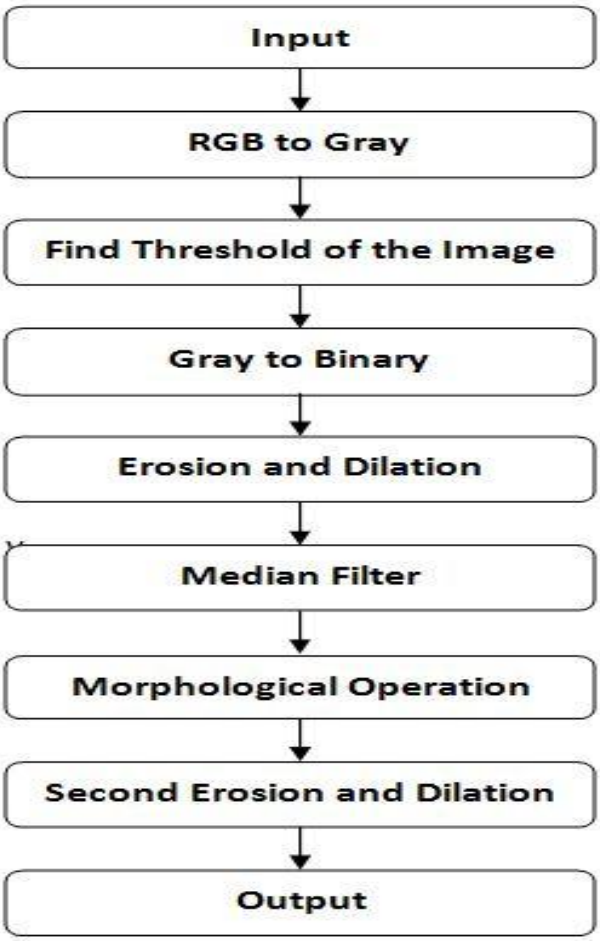

Fig. 1 Gesture Recognition Algorithm

Than the image converted from gray to binary based on Otsu's method based on pixels value. Ex. - Pixels with value higher than threshold value is changed to 1, lower changed to 0. Then Erosion and Dilation are used to eliminate small bridges between objects and remove small structures. Then Median Filter is used to remove noise from the image and preservation of edges of the image which are important to recognize gesture. Then the morphological operation which gives preservation of edges of the images by using a structuring element after that again Erosion and Dilation process are done for final processing of the image and then the system gives the output of recognized gesture.

III. THEORETICAL BACKGROUND

A. MEDIAN FILTER

Median filtering is a nonlinear digital filtering technique to remove noise and gives a good result in processing speckle noise and salt-pepper noise. The main idea of the *median filter* is to run through the signal entry by entry replacing each entry with the median of neighboring entries [3]. The pattern of neighbors is called the "window", which slides, entry by entry, the entire signal. For 1D signals, the most obvious window is just the first few preceding and following entries whereas for 2D (or higher-dimensional) signals such as images, more complex window patterns are possible (such as "box" or "cross" patterns) [3].

B. IMAGE BINARIZATION BASED ON HSV COLOR SPACE

HSV color space is one common cylindrical-coordinate representation of points in RGB color model. HSV is represented by three variables which are Hue (H), Saturation (S) and Value (V). Hue (H): Hue is the basic property of a color (for example red, blue or yellow). Saturation (S): Saturation is the purity of a color. The higher the saturation is, the purer the color will be. Otherwise, the color will gradually be grayed out. The range of Saturation we can take is 0 ~ 100%. Value (V): We can also call it "Brightness". It represents the intensity of a color. The range of Value (V) is 0 ~ 100%.

Image Binarization is the processing to translate a digital image into an image with only two colors (black and white). Typically the method transforms an image by comparing each pixel value with a specified threshold value or a specified range.

C. EROSION AND DILATION

Erosion and Dilation are morphological operations in image analysis and both are widely used to eliminate small bridges between objects and remove small structures.

Erosion operation is making objects defined by shape in the structuring element smaller [4].

Dilation operation is making objects defined by shape in the structuring element larger [4].

D. IMAGE SEGMENTATION

Image segmentation is the process of dividing a digital image into multiple segments. The goal of segmentation is to simplify and make the image easier to be analyzed [5] [6]. Image segmentation is typically used to find objects and to get the edge of each object in an image. The methods of image segmentation depend on what the users need.

IV. RESULTS

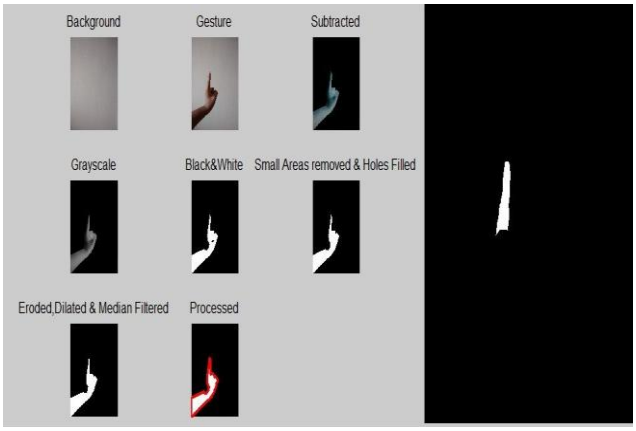

Fig. 2 Recognition of Gesture 'ONE'

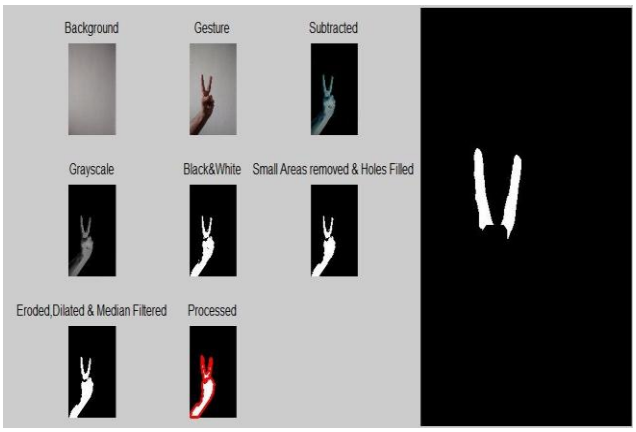

Fig. 3 Recognition of Gesture 'TWO'

In the figures 2 to 6, the output of MATLAB simulation of recognition of the gesture "one", "two", "three", "four", and "five" shown respectively. The simulation process is same as explained in the section II. First of all the imaging device captures a background image of the place where it is placed. Then the imaging device continuously scans the images and processes it. When gesture is given, it is captured by imaging device and processed as shown in the algorithm. The output of each stage is also given in the output images shown in figure 2 to 6.

As shown in the algorithm the each stage's processed output is shown in the output images and the final output which gives the final recognition result is also shown in the right side of each resultant image.

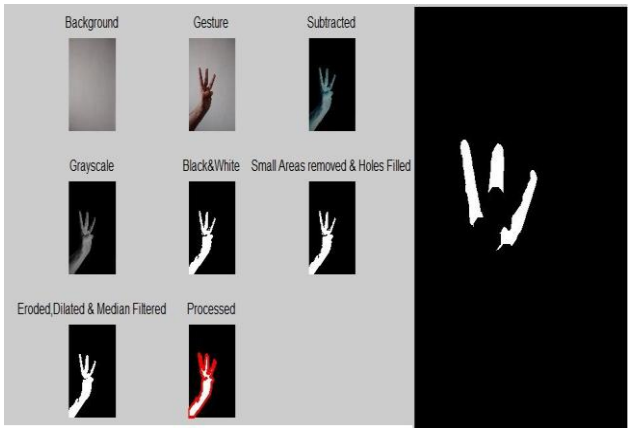

Fig. 4 Recognition of Gesture 'THREE'

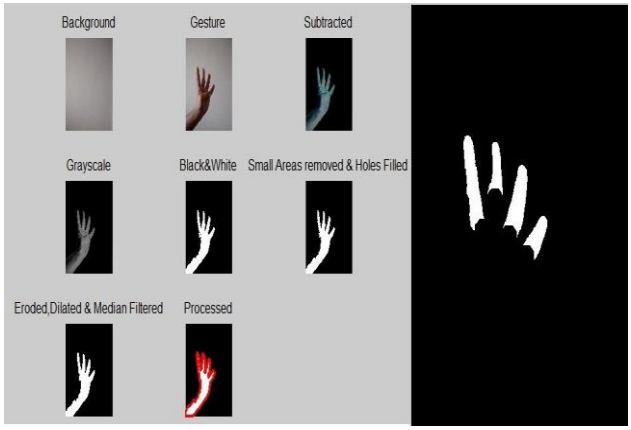

Fig. 5 Recognition of Gesture 'FOUR'

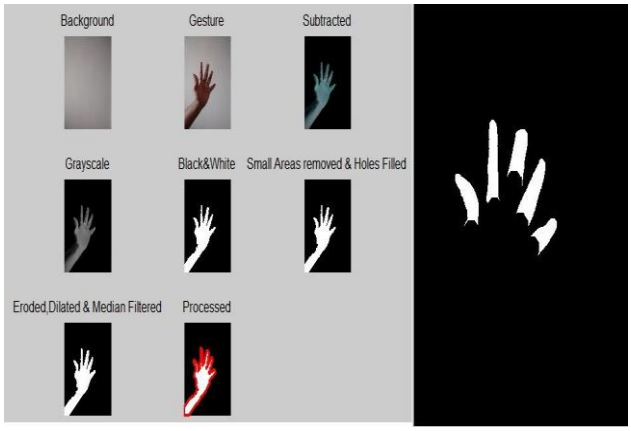

Fig. 6 Recognition of Gesture 'FIVE'

Thus from the results we can say that the gesture recognition system can give efficient recognition of the gesture. Thus this system can be interfaced with any other system as per the gesture recognition application and we can do automation of the system.

V. CONCLUSION

This paper explains the methods are used to recognize a gesture in different environmental conditions. By using the given algorithm the system can recognize gestures in different environmental conditions like dark, glare, similar object conditions, and different distance conditions. This system gives successful extraction rate of recognizing gesture. On the basis of outputs obtained by the system, it can be concluded that the recognition of gesture can be done in different environmental conditions.

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