

Hand Gesture Recognition System for Numbers Using Thresholding

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Abstract. An efficient human computer interaction is assuming utmost importance in our daily lives. Human beings can communicate mainly by vision and sound. Human can recognize the meaningful expressions of motion using hand gesture. Hand Gesture is the most important to exchange ideas, messages, thoughts etc among deaf and dumb people. This paper discusses a simple recognition algorithm that recognizes the numbers from 0 to 10 using thresholding. The overall algorithm has three main steps: image capture, apply threshold and recognizing the number. The assumption is made that user must wear color hand gloves.

Keywords: Thresholding, Segmentation, Hand Gesture Recognition.

1 Introduction

Recognition of sign languages is one of the major concerns for the international deaf community [6]. Sign Language spotting is the task of detecting and recognizing signs in a signed utterance, in a set vocabulary. The difficulty of sign language spotting is that instances of sign vary in both motion and appearance. The hands express our thoughts and feelings. This is done in communication with one another. The hands move, appearing to further communicate what one is speaking. The hands also move reflecting the state of mind even when one isn't speaking [1]. Gesture recognition is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focuses in the field include emotion recognition from the face and hand gesture recognition. Many approaches have been made using cameras and computer vision algorithms to interpret sign language. Generally, hand gestures can be classified into hand postures and dynamic gestures. The first one focuses on hand shape and position, while the second one intends to convey the meaning of hand movements of people [6]. In the present day, there are different tools for gesture recognition, based on the approaches ranging from statistical modeling, computer vision and pattern recognition, image processing. In our life everyday hand gesture plays an important role in human communication. Hand gesture has been the most common and natural way for human to interact and communicate with each other. Hand gesture provides expressive means

of interactions among people that involves hand postures and dynamic hand movements [8]. A hand posture represents static finger configuration without hand movement, whereas dynamic hand movement consists of a hand gesture with or without finger motion. The ability to detect and recognize the human hand gesture posed many challenges to researchers throughout the decades. Hand Gesture recognition can be applicable for teleconferencing, for controlling household electronic appliances. Gesture recognition can be conducted with techniques from computer vision and image processing. In Human Computer Interaction, gesture based interface gives a new direction towards the creation of a natural and user friendly environment [3]. Segmentation is a process of grouping image pixels into units that are homogeneous with respect to one or more characteristics. There are many segmentation techniques like thresholding, boundary based, region based, hybrid based. Thresholding is the segmentation technique which is based on intensity and variance [5]. Otsu method is one of the threshold selection methods which are based on variance and intensity [11]. This paper is organized as follows, in section II related work is presented. Section III describes the main method with its architecture and Section IV includes experimental results.

2 Related Work

To recognize the sign language or numbers, the trackball, the joystick, and the mouse are successful devices for and based computer input. Devices such as the Data glove can be worn which sense hand and finger positions and then language and numbers can be recognized. Using shape based analysis [8] sign language or numbers can be recognized. Hand shape analysis can be useful whenever it is difficult to analyze hand feature directly from images with low resolution [2]. Static Hand Gesture Recognition (S-HGR) assumes a certain hand pose or configuration which has to be recognized using appropriate techniques [4]. Research on hand gestures can be classified into three categories. The first category, glove based analysis, employs sensors (mechanical or optical) attached to a glove that transduces finger flexions into electrical signals for determining the hand posture. The relative position of the hand is determined by an additional sensor. This sensor is normally a magnetic or an acoustic sensor attached to the glove. The second category, vision based analysis, is based on the way human beings perceive information about their surroundings, yet it is probably the most difficult to implement in a satisfactory way. Several different approaches have been tested so far. One is to build a three-dimensional model of the human hand. The model is matched to images of the hand by one or more cameras, and parameters corresponding to palm orientation and joint angles are estimated. These parameters are then used to perform gesture classification. The third category, analysis of drawing gestures, usually involves the use of a stylus as an input device. Analysis of drawing gestures can also lead to recognition of written text. The vast majority of hand gesture recognition work has used mechanical sensing, most often for direct manipulation of a virtual environment and occasionally for symbolic communication. Sensing the hand posture mechanically has a range of problems, however, including reliability, accuracy and electromagnetic noise. Visual sensing has the potential to make gestural interaction more practical, but potentially embodies

some of the most difficult problems in machine vision. The hand is a non-rigid object and even worse self-occlusion is very usual. In some interactive applications, the computer needs to track the position or orientation of a hand that is prominent in the image. Relevant applications might be computer games, or interactive machine control [10].

3 Method

Hand Gesture Recognition System for numbers using thresholding has three main steps to recognize the number from 0 to 10: Image capture, Apply thresholding, and recognition of the number. There is setup required to recognize the number like web camera up to 5 MP, background with black color, and color glove (with red, green, blue, pink, and yellow colored on the finger tip). The architecture of the proposed system is shown in Fig 1 and the Outline of the proposed method is shown in Fig 2.

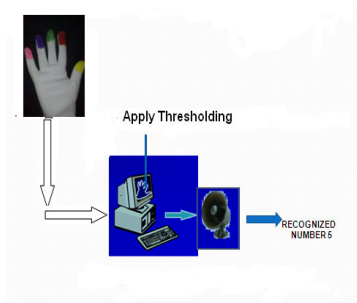


Fig. 1. Architecture of the proposed method

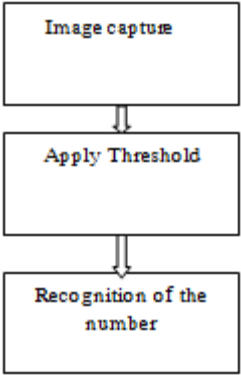


Fig. 2. Outline of the proposed method

A.Image Capture: Web camera is connected to the machine. RGB image (image of hand) is captured by the camera.The algorithm which has applied on captured image calculates the distance for all colors i.e. black (background), white (glove), and red, green, blue, yellow, pink.As we are focusing on colors for recognizing the numbers so initially the count for colors (Rcnt, Gcnt, Bcnt, Ycnt, Pcnt) is set to zero. Vertical and horizontal scanning is done on captured image.

B.Apply Threshold: We have declared threshold value which is fixed. Thresholding is the simplest method of image segmentation. On an image, thresholding is applied five times to know how many colors are present whether it is red, green, blue, pink or yellow. And according to colors we get count of particular color. Using the count value of colors next step is executed.

C. Recognition of the Number: If the color count is more than threshold value then that color is identified. Finally according to the conditions the number is recognized.

Conditions are given as below.

- 1.If count value of all five colors is greater than threshold value then that number is 5.
 - 2 If count value of four colors (red, green, blue, pink) is greater than threshold value then that number is 4.
 - 3.If count value of three colors (Red, green, yellow) is greater than threshold value then that number is 3.
 - 4.If count value of three colors (Red, Green, Blue) is greater than threshold value then that number is 6.
 - 5.If count value of three colors (Green, Blue, Pink) is greater than threshold value then that number is 9.
 - 6.If count value of three colors (Red, Green, Pink) is greater than threshold value then that number is 7.
 - 7.If count value of three colors (Red, Blue, pink) is greater than threshold value then that number is 8.
 - 8.If count value of two colors (Red, Green) is greater than threshold value then that number is 2.
 - 9.If count value of color (Yellow) is greater than threshold value then that number is 10.
 - 10.If count value of color (Red) is greater than threshold value then that number is 1.
 11. If count value of all five colors is less than threshold value then that number is 0.
- If the above conditions are false then image is recognized as invalid image.

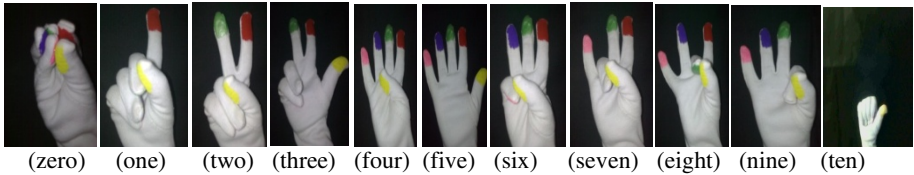


Fig. 3. Input Hand Gesture for Numbers

4 Experimental Results

For recognition of the numbers from 0 to 10 we have tested many images dynamically. Table 1 shows recognition ratio of the given input which is number.

Input Number	Recognition Ratio(%)	Input Number	Recognition Ratio(%)	Input Number	Recognition Ratio(%)
0	98	4	85	8	80
1	90	5	90	9	85
2	92	6	85	10	90
3	99	7	85		

5 Conclusion

There are many approaches to recognize hand gesture like glove based, sensor based, shape based analysis and each has its own strengths and weaknesses. The algorithm which is explained in this paper also has some strength and some weaknesses. The strength of the method is that according to intensity values number is recognized easily and there are no limitations like to check angle, scaling etc. but the weakness of the method is that user has to wear color glove with only five restricted colors. Second limitation is that background should be black. It does not matter whether the hand is vertical or horizontal, numbers are being recognized. Several part of the proposed method can be improved for more robust recognition. If the alignment is not proper still captured number is being recognized. So there is possible direction to improve the current method. In future, method will be implemented in such a way that alignment of hand will be proper, then and then number will be recognized.

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