



Human Computer Interaction Using Hand Gesture

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Abstract: We present in this paper a new approach for communication with computer systems using hand gesture. The process is based on extracting features of the hand region and then using these features for communication with computer system. Our approach is defined in three steps (i) Segmentation for hand localization, (ii) Feature extraction and (iii) Feature identification to create a fuzzy rule base. The gesture is a natural way of communication for many people with sign language. In computer systems, gesture recognition is very difficult and complex task since the full recognition system should be able to identify the hand in different scales, positions, orientations, contrasts, funds, luminosity, and others. The gesture communication with machines are enriched by instrumented gloves, which are used to control virtual actors, to describe and manipulate objects on computer screens or even to recognize the sign language. Unfortunately, these gloves are expensive and fragile, and their cables are a hindrance. We present a new system using hand detection technique based on the color classification using fuzzy logic system, image segmentation using edge detection and use Ellipse method and Comparative based method to localize the hands from others objects detected in the image.

Keywords: Fuzzv Rule Base. Hand Gestures. Hand Localization.

I. Introduction

Computer Imaging can be defined as an acquisition and processing of visual information by computer. Computer representation of an image requires the equivalent of many thousands of words of data, so the massive amount of data required for image is a primary reason for the development of many sub areas with field of computer imaging, such as image compression and segmentation.

Another important aspect of computer imaging involves the ultimate “receiver” of visual information in some case the human visual system and in some cases the human visual system and in others the computer itself.

Computer imaging can be separated into two primary categories:

1. Computer Vision.
2. Image Processing.

In computer vision application, the processed images output for use by a computer, whereas in image processing applications the output images are for human consumption.

Image processing [1] is computer imaging where application involves a human being in the visual loop. In other words the images are to be examined and acted upon by people. Computer imaging systems are comprised of two primary components types, hardware and software. The hardware components can be divided into image acquiring sub system (computer, scanner, and camera) and display devices (monitor, printer). The software allows us to manipulate the image and perform any desired processing on the image data. Gesture recognition systems can be categorized into computer imaging systems. There are few ways to perform hand gesture recognition. Let us classify it into two categories.

- 1) Glove based systems

This category [2] is involved heavily in hardware parts, employ sensors (mechanical or optical) attached to a glove that transduce finger flexion's into electrical signals to determine the hand posture. Normally, the sensors that used are acoustic or magnetic sensors which are embedded into the glove.

Fig 1: Sample Glove based gesture recognition system.



2) Stylus based systems

The second category [2] is analysis of drawing gesture, which are involved using special input devices such as stylus. Most of hand gesture recognition currently works by using mechanical sensing, most often for direct manipulation of a virtual environment. But this type of sensing has a range of problems such as accuracy, reliability and electromagnetic noise. These two categories involved external hardware parts.

Fig 2: Stylus based gesture recognition system.



3) Vision based systems

This category involves the manner in which humans perceive their surroundings. This method is elaborated in the following section.

II. Proposed Work

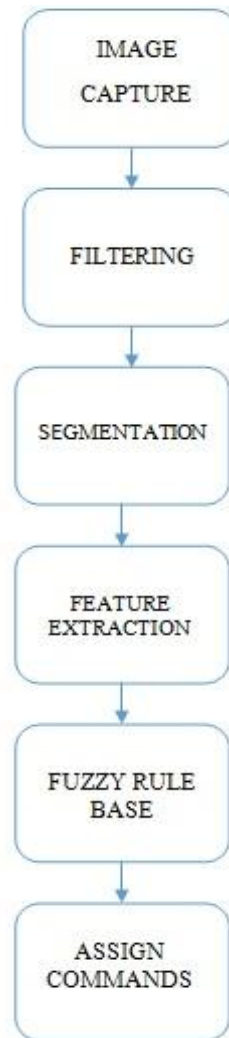
The vision based analysis which is based on the way human beings perceive information about their surroundings. Visual sensing has the potential to make gestural interaction more practical and this type of method is most intuitive method to perform hand gesture recognition because it involves no external hardware part, this means it can recognize our hand gesture freely without anything put on our hand. What it needs is just a camera, webcam, camcorder or anything can capture image that is able to interface with computer. We divide the system into two major components: Trainer Module and User Module.

2.1 Trainer Module

The Trainer module selects a sample image from any location from the computer system. This selected sample image is then fed to the filtering phase which performs the edge detection for the read image, the segmentation based on elliptic shapes then extracts the hand region from the image. The feature extraction phase selects features like major and minor axis, area from the segmented hand region which is then passed to the fuzzy rule base, which depending on the features assigns the action to be performed.

The Trainer module provides the knowledge-base to the system which defines the action to be performed on a particular gesture. Filtering can be performed for noise removal using morphological operations like dilation, erosion etc. The segmentation [2] is carried out through edge detection, to identify objects in the image.

Fig 3: Training Module workflow overview.



The region of interest (ROI) being hands in the image, providing gestures. Edge detection can be performed using many methods like Sobel filtering, Prewit filtering, Shen operator, Canny operator [2] etc. The canny operator being the most powerful since it uses two different thresholds to identify strong and weak edges. Hand localization is done based on the edges found. The required features of this ROI are extracted and a fuzzy rule base depending on these features can be created which will decide the command to be executed.

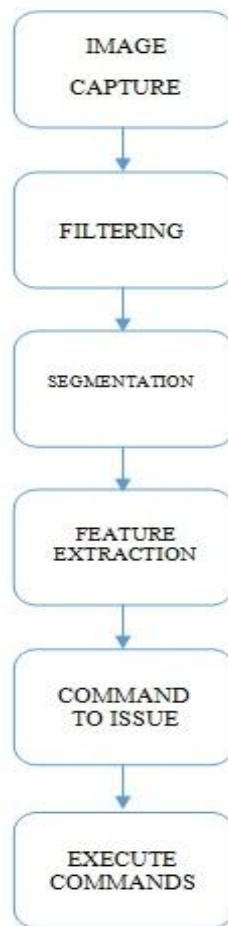
2.2 User Module

The user module is provided with a real time camera interface which allows the user to pose the gesture to the system. The user can here input the required gesture to the system. The filtering, segmentation, feature extraction phases work similarly to that of the Trainer module.

After extracting the required features from the image, the fuzzy rule base then finds for any match in the trained data, if so decides the command to be issued, the system then executes it.

The system now poses real time interaction between user and the computer. The user needs to place the gesture in front of the web camera, the filtering phase makes the required background removal for the identification of hand region. This background removal can be done through many techniques like using the skin color space which relies on the color of skin which contain major portion of red color due to blood cells available in the hand. Another technique using fuzzy classification can be done by taking sample images for hand classification. After ROI is identified, the features are extracted which are then passed to the fuzzy rule base created in the Training phase. Depending upon the match command is issued.

Fig 4: User module workflow overview.



III. Conclusion and Future Work

We present in this paper an approach for communication with computer systems with hand gesture. The system requires removal of unnecessary regions from the image except for the hand region. The attributes of the hand region are straight forward for gesture communication, this makes it easy to measure the features of the hand region. Although management of features extracted is quite a complex task. The feature values must be stored and used with caution. The system acts just as an interface for communication with computers, future orientations can be made for a system that can completely communicate with computer system as a single input device.

References

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