Gesture Recognition System Methods and Usage: A Review

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Abstract-*Hand gesture recognition system gained great attention in the recent few years because of its many and varied applications and the ability to interact with machine efficiently through human machine interaction. In this paper we are presenting a review on hand gesture recognition systems. Key issues of hand gesture recognition system are presented with challenges of gesture system. A review about the methods in gesture recognition system. Advantages and drawbacks of the discussed systems are explained finally.*

Keywords-Hand gesture recognition, human computer interaction, contour analysis, HSV color space.

I. INTRODUCTION

Hand gesture recognition is a very challenging topic for real life applications because of its requirements on the toughness, accuracy and efficiency. This paper describes a system that enable a user to perform computer operations using hand gesture with a simple web camera as input device. This system involves four phases namely image acquisition, image pre-processing, feature extraction and gesture recognition[1]. In the first phase, the input image is acquired with the help of a camera. In the second phase, the skin colour of hand region is detected using HSV colour space and morphological operations such as erosion and dilation are performed to remove noise followed by smoothing and thresholding of hand image. In Feature extraction phase, contours of hand image are detected. Finally, Gesture recognition phase includes recognizing hand gestures using contour analysis to truly determine similarity. Each recognized gesture is assigned with the corresponding action[7].

Gestures are bodily actions made by humans to convey meaningful information to others. It comes easily to human and so using these gestures as a mode of interaction will help humans to interact with computer easily. A gesture is scientifically categorized into two distinctive categories: dynamic and static[3]. A dynamic gesture is intended to change over a period of time whereas a static gesture is observed at the spurt of time. A waving hand means goodbye is an example of dynamic gesture and the stop sign is an example of static gesture. The primary goal of hand gesture recognition system is to create a system which can identify specific hand gestures and use them to convey information or device control[2].

II. ISSUES TO HAND GESTURE RECOGNITION: EXTRACTION METHODS AND FEATURES EXTRACTION

Mostly gesture recognition system are classified mainly into three steps after acquiring the input image from camera, videos or even data glove instrumented device. These steps are: Extraction Method, features estimation and extraction, and classification or recognition[6].

Figure-1 Extraction Method and image pre-processing

Segmentation – first process for recognizing hand gestures. It divides the input image into regions separated by boundaries.Segmentation depends on type of gesture[5]. For dynamic gesture the hand gesture need to be located and tracked and for static gesture (posture) the input image have to be segmented only.

The common thing used for segmenting the hand is the skin colour, since it is easy and changeless to scale. Different tools and methods are used in skin and non-skin pixels to model the hand. These methods are parametric and non-parametric techniques, Gaussian Model (GM) and Gaussian Mixture Model (GMM) are parametric techniques, and histogram based techniques are non- parametric. However this classification changes due to some illumination and background. Some researches overcome this problem using data glove and coloured markers as they provide exact information about the integrated set of attribute and position of palm and fingers[4].

III. FEATURES EXTRACTION

Good segmentation then feature extraction process will be perfect and the latter play an important part in recognition process. From the segmented image feature vector is extracted in different ways according to different applications. Various methods have been proposed for representing the features to be extracted. Some methods use the shape of hand such as hand contour and silhouette, while other methods use the position of fingertips, palm centre etc. All these methods created 13 parameters as a feature vector. First aspect represent the bounding box of the hand and other 12 are mean values of pixels in any image[7][4][3].

Gestures Classification

After analysing the input of hand image, the image is been is classified to recognize the gesture from the dataset. Recognition process affect the proper selection of parameters with suitable classification algorithm[2][3][4].

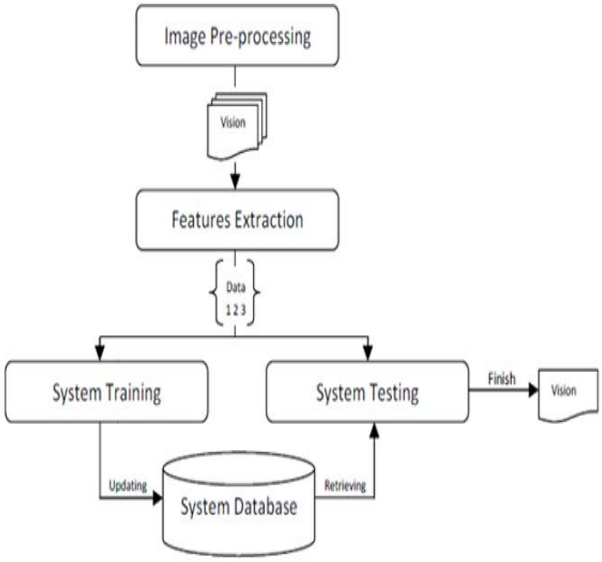

Figure -2 Gesture Classification

Applications

A. Robotics Applications[4]

Localization technique -determines robot location automatically based on GPS vision. It avoids obstacles. Robots use gesture recognition for visual serving and navigation purpose. This applications is used as a operation like PUMA robot manipulator. Human Robot Interaction (HRI). Intelligent robots interact with people and serve them.

Figure - 3 ROBOT Application

B.Industrial Automation[4][3]

Industrial examination like sensing defects and mensuration. Assemblage- creating a system of components assembled together for a particular purpose. Gesture recognition is used for barcode and package tag analysis also for item categorisation.

C. Medicine (Medical Imaging) [3]

- Classification and detection for example grazeorcells classification and growth discovery
- 2D/3Ddivision
- 3D reconstruction of organ (MRI or ultra sound)
- Robotics operation which is vision-guided

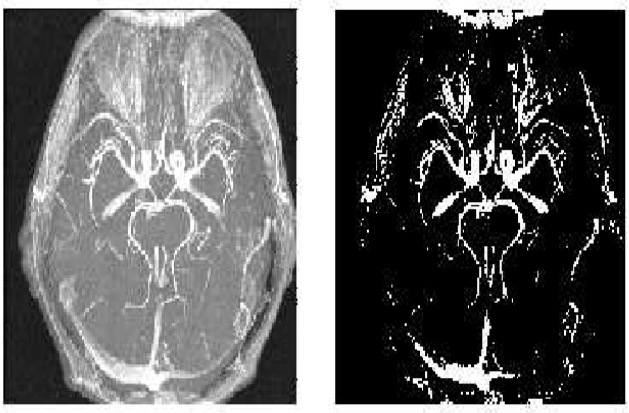

Figure - 4 Medical Imaging

D. Security[4]

Gesture recognition has a wide application in Biometrics (iris, fingerprint, face recognition). Detecting certain suspicious actions or activities.

Figure - 5 Face Recognition

IV. METHODS OF RECOGNITION [1][2][3][4]

A. Instrumented Gloves

Hand movement through various kinds of sensor technology is measured using Instrumented Gloves. The sensors are embedded on the back of hand or in the glove. Glove-based Input devices are basically categorized based on the production in marketplace and based on their companies.

B. Vision-Based Technology

Main difficulties in using glove-based input devices to collection of raw posture and gesture recognition data which is possible only by wearing the gloves by the user and attached to the computer. This will restrict freedom of movement similar to the traditional interaction methods.

Data collection of hand posture by vision-based solution consist of four important components.

The first is the placement and number of cameras used. Placing the cameras is critical because the visibility of the hand or hands being tracked must be maximized for correct recognition. Visibility is important because of the many blockage problems present in vision-based tracking. The number of cameras used for tracking is another important issue.

The second component in a vision-based solution for hand posture and gesture recognition is to make the hands more visible to the camera for simpler extraction of hand data.

The third component of a vision-based solution for hand gesture and posture recognition is the extraction of features from the stream or streams of raw image data.

The fourth component is to apply recognition algorithms to these extracted features.

Table - 1 Methods for Gesture Classification

Methods	**Glove-Based Model**	**Vision -Based mode l**
Cost	Higher	Lesser
User comfort	Lesser	Higher than GB Model
Hand Anatomy	Restriction high	Less
Calibration	Critical	Not critical
Portability	Lesser ability	High portability

V. CONCLUSION & DRAWBACKS

In this section, drawbacks of some methods are explained:

Orientation histogram method have some problem, like similar gestures might have different orientation histograms and different gestures could have similar orientation histograms. Besides the proposed method may also be implied to the images that might have similar properties like hand. Neural Network classifier is now been applied for gestures classification but it is working time increases as the data for classification increases. The performance of recognition algorithm decreases when the distance greater than 1.5 meters between the user and the camera. Besides that, its variation to lighting condition changes and unwanted objects might overlap with the hand gesture. The gestures are made with the right hand only, the arm must be vertical, the palm is facing the camera, and background is plane and uniform.

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