International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 05 | May-2016 www.irjet.net p-ISSN: 2395-0072

A Review on Hand Gesture Detection Using Combine HSI, YCbCr and Morphological Method with Recognition

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Abstract - *During past few years, human hand gesture for interaction with computing devices has continues to be thriving area of research. Hand gesture Recognition system received great attention in recent years because it provides human computer interaction and sign language. Hand gesture recognition is contain three stages: Pre-Processing, Features Extraction, classification. Most current approaches is based on the static hand gesture recognition Hand gesture recognition is often too sensitive to poor resolution ,environment of background, occultation among other prevalent problems and recognition dynamic hand gesture. So, proposed work investigates dynamic hand gesture recognition using Conditional Random Field. Result shows dynamic hand gesture recognition under complex background and achieve better recognition rate.*

***Key Words*: Skin detection, HSI, YCbCr, Morphological, and Combine Approach.**

1.INTRODUCTION

Hand gestures provide a natural and intuitive communication modality for human-computer interaction. Efficient human computer interfaces (HCI) have to be developed to allow computers to visually recognize in real time hand gestures. However, vision-based hand tracking and gesture recognition is a challenging problem due to the complexity of hand gestures, which are rich in diversities due to high degrees of freedom (DOF) involved by the human hand. In order to successfully fulfill their role, the hand gesture HCIs have to meet the requirements in terms of real-time performance, recognition accuracy and robustness against transformations and cluttered background. Interaction between humans comes from different sensory modes like gesture, speech, facial and body expressions . The main advantage of using hand gestures is to interact with computer as a non-contact human computer input modality. The state of art of human computer interaction presents the facts that for controlling the computer processes gestures of various types of hand movements have been used .The present research effort defines an environment where a number of challenges have been considered for obtaining the hand gesture recognition techniques in the virtual environment. Being an interesting part of the Human computer interaction hand gesture recognition needs to be robust for real life applications, but complex structure of human hand presents a series of challenges for being tracked and interpreted. Other than the gesture complexities like variability and flexibility of structure of hand other challenges include the shape of gestures, real time application issues, presence of background noise and variations in illumination conditions. The specifications also involve accuracy of detection and recognition for real life applications The present research effort has a goal of developing an application using vision based hand gestures for manipulation of objects in virtual environment. Our application presents a more effective and user friendly methods of human computer interaction intelligently with the usage of hand gestures. Functions of mouse like controlling of movement of virtual object have been replaced by hand gestures. The complexity involved is with the detection and recognition phases of the simulated virtual application. The challenges encountered are noisy environment which creates a big impingement on the detection and recognition performance of human hand gestures. The application has been designed to be cost effective and uses low cost input tools like webcam for capturing hand as input. Manipulation of virtual objects has been done through modeling of some predefined command based hand gestures. There are several applications of hand gesture recognition systems such as sign language recognition, human-robot interaction, controller less video gaming, smart TV, video surveillance etc. With such widespread applications, it has become imperative for us to study and to make such systems as user friendly as possible. Hand segmentation is the pre-requisite in gesture recognition system since if we get better segmented output of the region of interest i.e. hand, better recognition rates can be achieved.

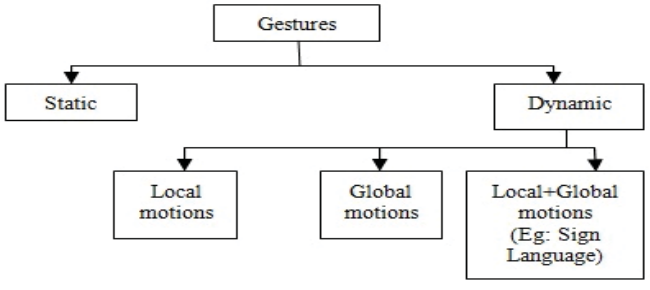

Fig-1: Types of gestures

2. RELATED WORKS

This section describes review or the studies which give an idea that can be research done in direction of Hand Gesture Recognition system.

Druva N. et al. [5] explored the various possible ways of segmentation using different color spaces and models and presents with highest accuracy. Segmentation was based on different color spaces. In this paper authors compare RGB, Y'CbCr and HSI color spaces. Images obtained from the camera obtained in RGB color spaces. RGB color space is primary color space since it primary colours red, green and blue as its color components. In digital photography is Y'CbCr color space which contain Y' or luma component which describe brightness, Cb is describe blue difference chroma and Cr is describe red difference chroma component. H or Hue describes primary color, S or Saturation describes as total amount of color and I or Intensity is described total amount of light intensity. Clearly seen from authors result that HSI model would greatly benefit in order to segment the hand and fingers. Future work include robust video processing algorithm to identify various gesture and keep memory of database minimal.

Jayshree R. Panesara et al. [6] describe real time system for HCI through gesture recognition for ISL. In this paper, Authors define the mainly four stages- Image pre- RGB color space image converted into YIQ space images, then using grey threshold to detection the skin color. In region extraction, extract hand region using blob for getting ROI. In feature extraction, extract the feature of ROI. Finally comparison done between current and database image using Euclidian Distance. This system recognize skin color so, it fails to extract the hand region if other body part is in plane closer to camera. The system was sensitive to red color.

Hanning et al. [7] presented hand gesture recognition system based on local orientation histogram feature distribution model. Skin color based segmentation algorithms were used to find a mask for the hand region, where the input RGB image converted into HSI color space. To compact features representation, k-means clustering has been applied. This system was based on static hand gesture and time consuming. Authors only labelled a relatively small set of training images.

Nasser H. Dardas et al. [8] presented real time system which including detecting and tracking hand in cluttered background using skin detection and contour comparison algorithm after face detection and subtraction and recognition using principle
component analysis (PCA). In this paper face detection and subtraction using Viola Jones method. For hand gesture detection using HSV color model for skin color detection and finally hand gesture recognition using PCA. Authors Experiments show that system could achieve satisfactory real time performance as well as classification accuracy above 90% under variable space, orientation, and cluttered background. Feature work was achieving more accuracy.

Saad et al. [9] proposed the process for detecting, understanding and translation sign language gesture to vocal language. There were two mode recording and translation mode. In recording mode, user adds gesture to dictionary. In translation mode, gesture was compared with gesture stored in dictionary. In this method call this gesture "Recording Translation Gesture" or "RTG". This method contains foursteps: 1.Getting joint of interest 2. Normalize the skeleton frame data 3. Build link list of temporary storage data 4. Detecting gesture. Dynamic Time Wrapping algorithm is used to compare gestures. It is provide 91% accuracy. It was not suitable for finger movement.

Parul Hardeep et al. [10] provide method for recognize sign language. It has three steps: 1. Pre-processing: First input sign image in RGB to convert into Lab colour space where L is lightness a and b are two colour channel. 2. Feature Extraction: It was done using Area, height, Euclidance distance, Average height. 3. Classification:
Feed forward back propagation algorithm was used for training and classification. Feed forward back propagation training algorithm was supervised learning algorithm. In this input and output vector were provided for training network. It was provide 85% accuracy. It was not recognize dynamic gesture.

Mohanmmad I. Khan et al. [11] proposed the HGR using in 3D environment using depth camera. For segmentation it was uses YCrCb color space for accurate skin detection. It was use encoded nonlinear RGB. After detecting hand remove noise from image. For contour detection find boundary region of detected hand then draw rectangular box around the contour and find centre of hand. Three features were effectively used to recognize the gesture: orientation, Area of hand, Angle of Box. After find area of hand find angle of box by using draw box around hand contour area. Classification was done using Hidden Markov Model (HMM). Probability of each class sequence can be computed and highest probability was considered as output. After that polling method is used for classify gesture. This proposed method was providing 80.67% accuracy. It was not more dynamic.

Ananya Chodhury et al. [12] presented preliminary step of gesture recognition process. In this paper define hand segmentation of gesture in complex background. In this paper hand segmentation was done using RGB color space converted into HIS color space. HSI is independent of luminance and reflectance. For background subtraction using simple method where one frame subtracted from another. Contour matching was used for recognition and classifying image object. In contour matching use for

containing pixel that were edge of object is place on all possible position in the
search image and comparing match value for every position. In this paper authors define largest contour having largest area in hand gesture. For correct gesture define threshold value of difference. Results show the effectiveness of the system. In this paper only focus on preliminary steps of gesture recognition. In this paper only focus on the detection of hand under complex background.

3. DIFFERENT METHODS

In image pre-processing stage firstly, the input gesture which is acquired capture by the webcam or camera. In pre-processing stage operation are concentred to extract the hand gesture and prepare the hand gesture for feature extraction. In this stage skin segmentation, filtering and edge detection can happen.

Skin segmentation is the process of dividing an image into multiple parts. This is used to identify objects or other relevant information or data in digital images. There are many different ways to perform image segmentation, including: RGB, HSI, YCbCr, CIE-Lab [4], Depth data [8]. RGB: Hues or colors are determined as far as three primitive colors: red (R), green (G) and blue (B).

HSI: Colors are determined as far as hue (H) define colors, Saturation(S), and Intensity value (I) define brightness which are three characteristics that are seen about color . Other similar color spaces are HSV, HLS. It is signify image precisely with institutive qualities.

YCbCr: Colors are determined as far as in terms of luminance (the Y channel) and chrominance (Cb and Cr channels). Cb defines blue difference and Cr defines red difference. Depth Data: This is one type of color restriction techniques typically limits the environment by using color marker or using fix color background. Accessibility of depth information of image objects can overcome hand movement trouble and noise difficulties easily define. It can be used for gesture recognition in 3D space. Filter is most used for remove noise in image. Different type of filtering technique is presented like: Spatial filter, Mean Filter, Median Filter, Morphological filter, Gaussian filter. Spatial Filter can be successfully used to eliminate several types of noise in digital images and it is commonly worked on small neighbourhoods ranging from (3x3) to (11x11). Mean filter is averaging filters and it has worked on nearby groups of pixel called neighbourhood and swap the centre pixel with the average of the pixel in this neighbourhood. Median filter size of nearby neighbourhood is characterised and then work on it. The centre pixel is swapped by the median or the centre value present among its neighbour, unlike by average. Median filter is nonlinear filter.

Morphological filtering is created to get a smooth, closed, and complete contour of a gesture by using a sequence of dilation, opening, closing and erosion operations. Gaussian smoothing is operative for removing noise. It can provide weights give higher significance to pixels close to edge. It is linear low pass filters. Edge detection first edge point corresponding image find and then merged to form line and object outlines. Edges are carrying useful information about object boundaries. It can be used for image analysis, object identification and filtering.

4. PROPOSED METHODOLOGY

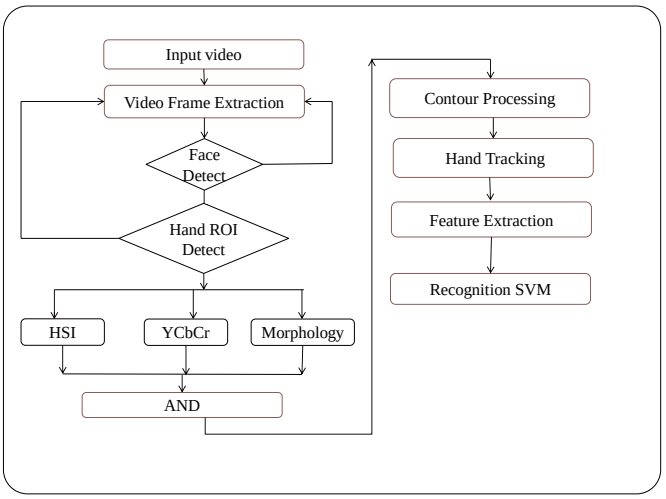

Fig-2: Proposed Work Flowchart

In proposed work first input the video. Video is capture by the web came or camera. Then converted that video into frame. The detect the face using Haar classifier. Then detect the hand using Region of Interest. Proposed will use the combination of HSI, YCbCr and morphology instead of only HSI and YCbCr color model use in skin color segmentation. Then apply contour processing on the output of skin segmentation.Then apply hand tracking using centroid and then apply feature extraction using Euclidian distance. And finally recognition or classification using SVM.

Combination of HSI, YCbCr and Morphology:

Aim of this step is proper skin color segmentation

In this step segmentation process is carried out by taking Cb, Cr and S and I value is cosider.

By using histogram method :

Cb and Cr for skin color is (x,y)= (Cb<=118) & (Cr>=130 & Cb<=165)

H and I for skin color is (x,y)= (v1>=0.5 & v1<=0.8) & (h>=0.01 & h<=.13)

Output pixel at point (x,y) is classified as skin color.

The segmentation eqution is:

O (x,y) = 1 {if H, I, Cb ,Cr value point falls inside their respective range} 0 {otherwise}

5. EXPECTED OUT COMES

All the methods, algorithms, and techniques described above have limitations and advantages according to specific situation. Existing systems mostly recognize only static hand gesture without any frame extraction. Accurate classification of dynamic hand gesture is vital role to develop a HGR system which used for Human Computer Interaction and Sign Language. The methods described above does not produce same result every time, errors in edges and boundaries for hand detection, noise, problem over segmentation, memory requirement, Background with red color, complex background, cluttered background, recognition rate and accuracy problems.

6. CONCLUSION AND FEATURE WORK

Recently, Gesture recognition is very active area of research. The surrounding of the hand gesture itself dictates the degree of difficulty hand detection for dynamic hand gesture recognition .In existing system skin segmentation using HSI. Only HSI not detect proper hand in dynamic hand gesture because of in dynamic hand gesture motion in hand so not detect proper hand and noise also create. In Proposed dynamic hand gesture recognition ,combining of HSI, YCbCr and morphology for skin segmentation ,Euclidian distance method is proposed for feature extraction provide to CRF for Classification.CRF provides classification with good recognition rate static hand gesture. Same and better recognition rate in dynamic hand gesture . In future work make hardware for this system so it will take less time.

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