Hand Gesture Recognition for Computer-Vision Technology

Dave Rupit, Patel Jwolin

EC Department, Parul Institute of Technology
PIT-Limda ,Vadodara,India

Abstract:**In Computer Vision technologyhand gesture recognition used for interacting with computer it will recognize the hand gesture according to a different vision-based algorithm.Computer vision techniques to extend commonly used interaction.]The user interacts with a virtual plane that rests in between the user and the display. On this plane, hands gestures are tracked and sequences of gestures are recognized and according to that gesture it will perform the mouse operation. It can be implemented using a single camera like webcam or Laptop. In Our method focus is on skin color detection and speed up the performance of hand gesture recognitionand for that we use ROI (region of Interest) for skin color, and using color modal we can detect skin color hand gesture.**

Keywords- Computer Vision, Gesture Recognition, Human Computer Interface(HCI).

I. INTRODUCTION

Computer is used by many people now days at their work or home for performing several tasks like office work, gaming, designing and entertainment etc. Keyboard and mouse are frequently used for this purpose. Now as the technology is increased changes is also occurs in the hardware also[2].

Now a days the more research is going on the HCI – Human Computer Interaction. In which the user can access and controlling the digital devices on the bases of the human body like a eye, head, and the hand gesture which makes physical world and digital world closer[3].

Human Computer Interaction(HCI)

The idea is to make computers understand human interactions and develop a user friendly human computer interfaces (HCI). Making a computer understand speech, facial expressions and human gestures are some steps towards it. Gestures are a type of nonverbally exchanged information.It enables natural human-computer interaction at a distance without requiring the user to adapt his or her behavior, or spend time calibrating the system. In this system we use some interface defined by the gestures. These gestures must happen within the field of view and range of camera device.[1] The frontend web-cam will be capturing the motion up to 3-4 feet apart from the Laptop .To interact with the system the user has to wear a band on his/her finger.

In propose system the webcam enable laptop/PC is continuously capturing the hand gestures through webcam and identify the gesture and in advanced perform the mouse operation like clicking and scrolling.

Computer Vision Technology

Three common tasks for computer vision processing are 1) Detection, 2)Tracking, 3) Recognition.[6]

1)Detection:The human visual system has the amazing ability to detect hands in almost any configuration and situation, and possibly a single hand is responsible for recording and signaling. The computer vision research has not quite yet achieved this goal.

2) Tracking:To track the user's hands in a computationally way, we use the different algorithm. One of the most widely used examples for hand gestures recognition is data glove but drawbacks of data glove is that it is cumbersome with the limitation of hand movement. In Enhancement of this approach the user need to wear a colored band and the computer vision different algorithm tracks the color objects and perform certain operation interpreted to operations. The use of band could be relaxed via skin-color tracking by applying skin detection algorithm though we use them primarily because of the low computational overhead of the involved algorithms.

3) Recognition:The third computer vision component of the hand gesture interfaceattempts posture classification at and near the image location of the tracked hand.The terms posture classification and

recognition are used in this dissertation in themeaning of view dependent hand configuration classification that is determiningthe configuration formed by the fingers. A posture in this sense is in fact acombination of a posture and a view direction, allowing for the possibility todistinguish two different views of the same finger configuration.The classification method does not require highly accurate output of the handtracking module for two reasons. First, an area larger than the exact trackedlocation is scanned for the key postures. Second, the method has explicitknowledge of a "no known hand posture" class and can therefore produce correctresults without requiring knowledge about the presence of a hand in the imagearea.

Gesturing

As per the context of the project, a gesture is defined as an expressive movement of hand which has a particular message, that is communicated precisely between a sender and a receiver. A sender and a receiver should have the same set of information for a particular hand gesture for a successful communication. A gesture can be categorized as dynamic and static. 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 meaning goodbye is an example of dynamic gesture and a still hand sign is an example of static gesture.

II. ALGORITHMS FOR HAND GESTURE RECOGNITION

There are different algorithms which is used for hand gesture recognition and increasing the performance and speed which are

1) Pie Menus Algorithm: In Computer interface design, a Pie-Menus is a Circular context menu when detection is depends on direction interaction with the stylus or mouse. In Pie- Menus whole screen is not access but only the menu is access through gesture. A goal of the Pie-Menus is to provide a smooth, reliable gesture style interaction.

2) Cam-shift Algorithm: The Cam-shift is a more robust way to track an object based on color and hue. It is based on Mean-Shift algorithm which identifies the mean of the gesture and improves accounting to dynamic probability distributions. Cam-shift is works well in the tracking of flesh colored objects.[1]

3) Hidden Markov Model: Hidden-Markov model can be considered as generalization of a mixture model where the hidden variable is control through the mixture components. Hidden-Markov Model is specially known for pattern recognition, speech recognition and Gesture recognition.

4) Blob detection Algorithm: In Blob detection algorithm it is first check the first line of captured image and find the group of one or more white pixels. These pixels are the blobs on certain line, called lineblobs. Repeat this sequence on next line and find again lineblobs and overlap that blobs. Now at the end if we merge these all lineblobs it will give one blob and it's a gesture recognition.[2]

5) Skin Detection Algorithm

Skin detection is the process of finding skin-colored pixels and regions in an image or a video.This process is typically used as a preprocessing step to find regions that potentially have humanfaces and limbs in images. Several computer vision approaches have been developed for skindetection. A skin detector typically transforms a given pixel into an appropriate color space andthen use a skin classifier to label the pixel whether it is a skin or a non-skin pixel. A skin classifierdefines a decision boundary of the skin color class in the color space based on a training databaseof skin-colored pixels.[5]

6) Viola Jones Algorithm

Viola and Jones employed a statistical approach for thetask of face detection to handle the large variety of humanfaces .It used "Integral Image" concept to compute set of Haar-like features at various scales at constant processing time. Moreover, feature selection algorithm is based on AdaBoost learning algorithm, which automatically selects the best features. the extended Haar-like feature set proposed by Lienhart. This Haar-like feature set includes four edge feature, two center-surround features, one special diagonal line feature, and eight line features. The Haar-like features uses the ratio between pixels under black area and white area within a kernel.[2]

III. PROPOSE WORK

In propose system the webcam enable laptop/PC is continuously capturing the hand gestures through webcam and identify the hand gesture according to algorithm and perform the mouse operation like clicking and scrolling.

Processing Steps:

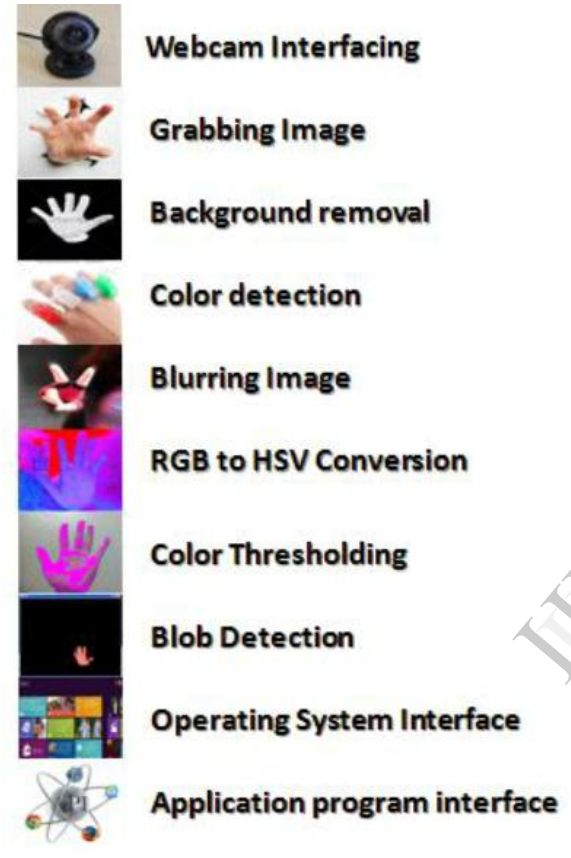


Fig.1 Processing steps and operations

Webcam Interfacing: In Webcam Interfacing is a process to interface or connect the webcam to the certain computer by using the different programming software.

Grabbing Image: The webcam enable PC/Laptop Continuously capturing the small frames or images this is called the grabbing image.

Background removal algorithm:When the Image is captured then it is removed the background of that image based on certain algorithm so the gesture is identify easily.

Color detection: It is used to detect the color pixels in the image.

Blurring an image: In blurring image the color pixels which are detected is being stretched.

RGB to HSV Conversion: In this process the RGB pixels is Converted into HSV pixels.

ColorThresholding: In this process According to the intensity level the thresholding is generated.

Algorithm: Now after completion of these steps we have to apply suitable algorithm which is identify the gesture

Operating system Interface: It is the operating system on which we are performing and developing the software

Application program Interface(API): These are the applications and software which is used to develop a system

IV. ANALYSIS AND RESULTS

After completion of webcam interfacing it will capture the RGB image and we have to store that image and performing the operation on that image. The images is capture according to the given baud rate.

RGB Image:

An RGB image has three channels: red, green, and blue. RGB channels roughly follow the color receptors in the human eye, and are used in computer displays and image scanners.

Gray-scale Image:

In photography and computing, a gray-scale digital image is an image in which the value of each pixel is a single sample, that is, it carries only intensity information. Images of this sort, also known as black-and-white, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest.

YCbCr Image:

YCbCr and Y′CbCr are a practical approximation to color processing and perceptual uniformity, where the primary colorscorresponding roughly to red, green and blue are processed into perceptually meaningful information. By doing this subsequent image processing transmission and storage can do operations and introduce errors in perceptually meaningful ways. Y′CbCr is used to separate out a luma signal (Y′) that can be stored with high resolution or transmitted at high bandwidth, and two chroma components (C_B and C_R) that can be bandwidth-reduced, subsampled, compressed, or otherwise treated separately for improved system efficiency.

HSV Image:

HSV stands for hue, saturation, and value. HSV are the two most common cylindrical-coordinate representations of points in an RGB color model. The two representations rearrange the geometry of RGB in an attempt to be more intuitive and perceptually relevant than the cartesian (cube) representation.

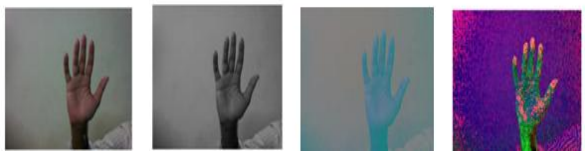
Region Of Interest(ROI):

A ROI is a selected subset of samples within a dataset identified for a particular purpose.

The concept of an Region Of Interest is commonly used in many areas. For example, in medical imaging, the boundaries of a tumor may be defined on an image or in a volume, for the purpose of measuring its size. In computer vision and optical character recognition, the ROI defines the borders of an object under consideration.[2]

Edge detection:

It is the name for a set of mathematical methods which aim at identifying points in a digital image at which the image brightnesschanges sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. The same problem of finding discontinuities in 1D signals is known as step detection and the problem of finding signal discontinuities over time is known as change detection. Edge detection is a basic tool in image processing, Computer vision and Machine vision, particularly in the areas of feature detection and feature extraction.it is hard to find an edge detector that performs significantly better than the Canny edge detector.



RGB ImageGray Image YCbCr Image HSV Image

Region Of Interest

Edge Detection Skin Color Detection

Fig.2 Different Conversion of image

V. ADVANTAGES AND APPLICATION

Advantages

- Easy to use.
- System is robust.
- It is built on a familiar interaction paradigm.
- It can be implemented using a single camera.
- The interaction between human and machine can be simplified with gesture recognition,

Application

- PowerPoint presentation
- Media Player Control
- 3D Interaction
- Gaming

VI. CONCLUSION

In natural and comfortable interaction between humans and computers has received much study in recent years. In hand gesture recognition initially by using computer vision techniques we can identify the gestures by performing different image and video processing steps and based on that gesture it will performing certain operation which provides better flexibility to access data through hand gestures.

VII. FUTURE WORK

In future different algorithms and method can be used to increase the hand gesture recognition which provides the better accuracy and also think about to speed up the performing mouse operation which provides the better flexibility and accessibility of the device.

REFERENCES

[1] Daniel R. Schlegel, Albert Y. C. Chen, CaimingXiong, Jeffrey A. Delmerico, Jason J. Corso, "AirTouch: InteractingWith Computer Systems At A Distance", IEEE 2010.

[2] EhsanulhaqI, Syed JahanzebHussainPirzadcl, MirzaWaqarBailandHyunchul Shin, "New Hand Gesture Recognition Method for Mouse Operations"IEEE 2011

[3] PrasannaDhisale, Puja Firodiya, PriyankaGawade and ManjiriMahamuni, "Virtual Touch – Human Computer Interaction at a Distance"International Journal of Computer Science and Telecommunications [Volume 4, Issue 5, May 2013]

[4] Siddharth S. Rautaray, AnupamAgrawal,"Real time hand gesture recognition system for dynamic applications"International Journal of UbiComp (IJU),January 2012.

[5] Ahmed Elgammal, Crystal Muang and Dunxu Hu, "Skin Detection - a Short Tutorial" Encyclopedia of Biometrics by Springer-Verlag Berlin Heidelberg 2009

[6] Mathias Kolsch, "Vision Based Hand Gesture Interfaces for Wearable Computing and Virtual Environments", University Of California, Santa Barbara,2004

[7] Alok Nanda, Asutosh Mishra "Master Hand Technology For The HMI Using Hand Gesture And Color Detection" , National Institute of Technology, Rourkela ,2010

[8] X. Zabulisy, H. Baltzakisy, A. Argyroszy, "Vision-based Hand GestureRecognition for Human-Computer Interaction."2010.

[9] J.R.Parker, "Algorithms For Image Processing And Computer Vision", Second Edition ,2011.