

Hand Gesture Recognition Applications

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Abstract— This paper quests into the vast and intricate field of vision based technologies. This technology supports all natural means of interaction a human can perform with machine; it can be done either by using his hands, legs or facial expressions. The implementation of such human computer interfaces (HCI) require high end processing of images, graphics, machine learning, intuitive and cognitive analysis. This technology possess a great deal of potential in all kinds of control, detection, automation, navigation and interaction applications be it visual surveillance, a species identification system or controlling a PC, a car, an aircraft, an electric circuit or home use appliances. It has got a high sense of applicability in what kind of future we want to build i: e more natural, quick and responsive. The basic implementation structure of making such natural interfaces includes 3 steps that are:- 1. Detection 2. Tracking and recognizing gesture and 3. Executing the functionality associated with each kind of gesture. The main purpose of our paper is to exhibit the worthiness of a vision-based technology and its future applications.

Keywords— Natural interfaces, Hand Gesture Recognition, Applications

1. Introduction

The requirement of computers and computing devices is increasing day by day. They have become an indispensable part of our lives. The increasing requirement of such computing devices and gadgets increase the necessity of devising more natural computer interfaces.

Computer vision started back in 1960's at the universities that were pioneering artificial intelligence. Later in the next decade the studies and researches in the field of computer vision became rigorous. The field of computer vision applications involves realizing the existing systems in the form of varied combinations of software and hardware, and increasing the processing speed and precision of the existing systems using vision based interaction and control.

New technologies are evolving for making systems that are artificially intelligent. One of the popular technologies in this field is Cyber glove technology.

Cyber glove was created by virtual technologies in 1990. Cyber glove is an input device that is worn on the hands like a glove and forms a basis for human computer interaction. The glove is enabled with various kinds of sensors and tracking devices, number of sensors ranges between 18-22. It has got different types of sensors that detect the bending of fingers also different types of motion tracking devices such as magnetic tracking device or inertial tracking device. The movements are predicted by the software accompanied by the glove. This technology was a revolution in the virtual world but was too costly to be afforded by many and so it was more popular among technological freaks only. No doubt this unprecedented flex sensor technology gives the best virtual reality experience but due to the cost of high end sensors, makes it unfeasible to be used in daily lives for interaction with computer systems.

Our work deals with designing a more natural form of interface that uses no input devices or sensors for the movement or gesture capture. It is economic as it bears no extra cost of any kind of glove. We work on using hand gestures for the interfacing. It is easy to use and needs no prior training to know how to operate. It can be afforded by not one but many.

2. Related Work

Our goal is to make a system that is capable of capturing hand movement and then tracking the gesture made by the human. For this purpose, we developed a software application that was able to access camera for input and then perform recognition operations. The gestures we used for the recognition process are simple hand gesture for counting numbers like 1,2,3 and so on.



2.1 Technology Used

We used the following technologies -:

- 1) Java interface
- 2) OpenCV library

Java gives an easy way for constructing interfaces. Being an object oriented language, it models with the real world well. OpenCV is an open source library for computer vision applications. It includes functions for real time frame capturing, image processing and tracking gestures. We used java programming language as it is easy to learn and understand. OpenCV can be used in integration with java very efficiently. It enables us to perform intricate and cumbersome processing of real time hand gestures accurately. Being an open source library, using OpenCV in our software application keeps the cost minimal.

2.2 Various modules

This section explains various steps for making a vision controlled application-:

2.2.1 Camera detection

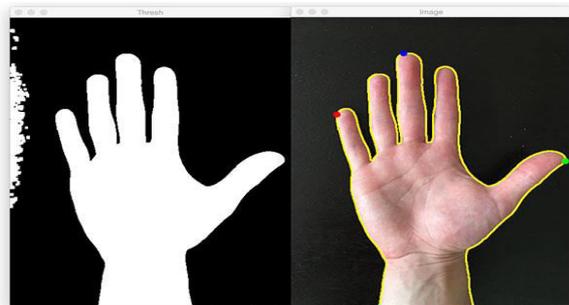
Camera interfacing is the major part of any gesture based system. The openCV library provides a function to capture an image and convert it into a buffered form so that the image processing functions can be applied on it.

2.2.2 Skin Filtering

Selection of a proper color space is an important factor in the segmentation of a hand gesture from the background.

RGB color space is a mix of three kinds of color information. The range of clustering varies a lot in RGB color space. HSV color space is an intensity/saturation/hue color space that has better clustering features than RGB color space.

The RGB image is converted into an HSV image. After obtaining the HSV color space of an image the binarization of an image is performed. HSV image is converted into a grayscale image, this process is known as binary image conversion.



2.2.3 Blob detection and convex hull

A group of integrated pixels in an image that share a common property for e.g.-: a gray scale value, is known as a blob. Our aim is to find the biggest blob that is particularly our hand. Already we have converted the image of our hand into grayscale image, so that it can be easily detected as the biggest blob.

Convex hull algorithm is run against the blob dimensions for the detection of patterns. This algorithm is efficient in determining the finger pattern of our hands. The algorithm works by finding the depth points and peak points formed by the blob. The number of peak points would give the number of fingers pointed by that particular hand gesture and thus recognize the gesture made by our hands.

2.2.4 Recognition and Control

On the basis of number of fingers recognized by our application program, we can control any functionality. The recognized gesture can be used to open or close any application on our system, for instance showing one in front of the web camera opens up the notepad window or showing three shuts down the system. This can be further extended to a more wide range of control and co-ordination. It can be used to control electric appliances at home or control the switching of lights, fans, ac's at homes.



3. CONCLUSION

This project has a vast arena of development. The further research in this field holds a great potential to transform how we see or perceive the digital world.

Gesture control can bring a whole new energy in the worlds of the physically challenged people, transforming them into technologically abled people. This technology can enable them to do work without any obstruction. They can be able to use their different parts of body for the control operation. By their bodies they can control anything they cannot control normally like physically fit people.



Gesture control foresees a well-controlled and coordinated future. Gesture control technology is the more natural form of interfacing that will overtake the world in near future. There has been a shift in technology from using touchscreens, touchpads and keyboards to simply using hand gestures for controlling devices and gadgets. Its roots can be clearly seen in the video gaming world where people use hands to control the car, bike or gun operation.



Imagine if you could control all the appliances, gadgets, devices, lights, fans at your home just by a pair of your hands. What if you could turn on the faucet, the hand dryer, and flush the toilet even without touching anything. What if your home actually started to sense you, lights in the room go on and off when you enter and leave, the doors unlock when you touch the door knob with your hands, your computer locks and unlocks when it detects you approach or leave. Fascinating, isn't it. The future of fully automated homes is very near and becomes certain by this kind of gesture control technology.

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