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# Hand Gesture Recognition : A Survey

[I]Milind R. Hegade, [II]Neha Jamdar, [III]Abhijit Nale, [IV]Ankush Barkade,
[V]Pravin Ekhande, [VI]Shreyas Dayal
[I,II,III,IV,V,VI]Dept. of CSE, ISB&M School of Technology, Pune, India

**Abstract**
*Nowadays information technology is developing. Humans are trying to reduce there work by using machines. The communication between human and computer should be convenient so the different ways of communication are being searched. Use of hand gesture recognition is one of the way of human computer interaction. Gestures are mainly of two types static gestures and dynamic gestures. Most of the Research works have only concentrated on static gestures and in dynamic gestures they are having some limitations. We surveyed the literature on visual interpretation of hand gestures in the context of its role in HCI and various seminal works of researchers are emphasized. The purpose of this review is to introduce the field of gesture recognition as a mechanism for interaction with computers.*

**Keywords**
*Hand Gesture Recognition, Human Computer Interaction (HCI).*

## I. Introduction

In today's word the use of computer is increased in every domain. Human is trying to do all its works by using various technologies. With the development of information technology in our society, we can expect that computer systems to a larger extent will be embedded into our environment. Because of this there is a need of easy and better communication between human and compute with the interface that are natural.

In particular, visual interpretation of hand gestures can help in achieving the ease and naturalness desired for HCI. Gesture can be produced or perform by palm of users. Gesture is one of the most powerful virtual medium for communication between human and computer. Recent researches [1, 2] in computer vision have established the importance of gesture recognition systems for the purpose of human computer interaction.

Two approaches are commonly used to interpret gestures for Human Computer interaction. They are

### (a) Use of Data Gloves:

This method employs sensors (mechanical or optical) attached to a glove that transduces finger flexions into electrical signals for determining the hand posture. This approach forces the user to carry a load of cables which are connected to the computer and hinders the ease and naturalness of the user interaction.

### (b) Vision Based:

Computer vision based techniques are non invasive and based on the way human beings perceive information about their surroundings. Although it is difficult to design a vision based interface for generic usage, yet it is feasible to design such an interface for a controlled environment [3].

As shown in the figure 1 the gesture recognition system is divided into four parts.

First unit is Data acquisition unit in which image acquisition is done, second unit is gesture modelling in which gesture modelling is done, third unit is feature extraction in this important features are extracted from the image and the fourth unit is gesture recognition unit in this gesture is recognized from the image this unit is also used to forward the commands generated as per the users gesture.

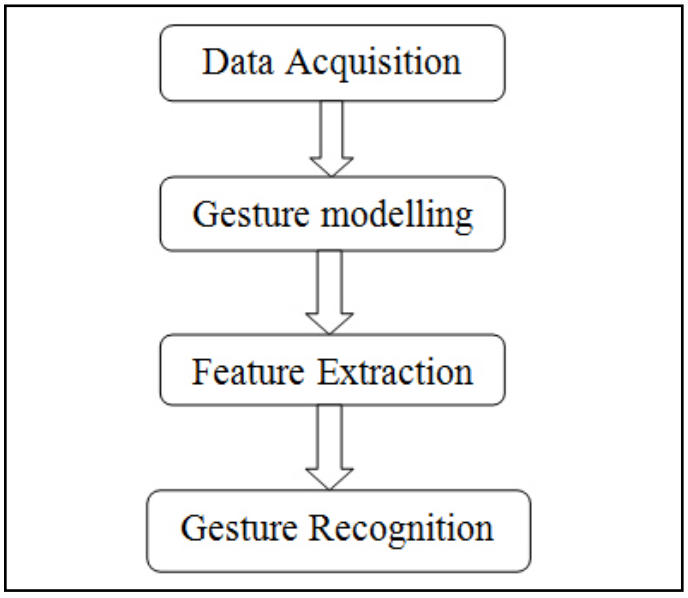


Fig. 1 Block diagram of gesture recognition system

## II. Use of Gesture in Various Domain

As the gesture recognition can be used in many areas we present some application domains that uses gesture recognition.

### A. Telerobotic

Telerobotic applications are typically situated within the domain of space exploration and military-based research projects. The gestures used to interact with and control robots are similar to fully-immersed virtual reality interactions, however the worlds are often real, presenting the operator with video feed from cameras located on the robot [4]. Here, gestures can control a robots hand and arm movements to reach for and manipulate actual objects, as well its movement through the world.

### B. Computer Applications

In desktop computing applications, gestures can provide an alternative interaction to the mouse and keyboard [5]. Many gestures for desktop computing tasks involve manipulating graphics, or annotating and editing documents using pen-based gestures [6].

### C. Games
When, we look at gestures for computer games. Freeman et al. [7] tracked a player's hand or body position to control movement and orientation of interactive game objects such as cars. Konrad et al. [8] used gestures to control the movement of avatars in a virtual world, and Play Station 2 has introduced the Eye Toy, a camera that tracks hand movements for interactive games [9].

### D. Sign Language
Since sign languages are highly structural, they are very suitable as testbeds for vision algorithms [10]. At the same time, they can also be a good way to help the disabled to interact with computers. Sign language for the deaf (e.g. American Sign Language) is an example that has received significant attention in the gesture literature [11, 12, 13 and 14].

## III. Hand Detection Approach
There are many techniques to detect hand from taken image some of them are as follows:

### A. Appearance Based Approach
Many researchers have used fingertip detection for the hand image construction [15]. As we are also using fingertip detection technique for our research work, this paper devotes great attention to work done by other researches using this technique. Nolker [15] focuses on large number of 3D hand postures in her system called GREFIT. She used finger tips in hands as natural determinant of hand posture to reconstruct the image. In her system she suggests few approaches to locate fingertip in hand. 1. Marked fingertips colored and making histogram 2. Using different templates or images of a prototype It takes 192x144 size gray scale image to process. Verma [16] extract features from image as fingertip, edges and vectors for 2D modeling. He used harris corner detector to extract fingertips corresponding to corners. Nguyen [17] used gray scale morphology and geometric calculations to relocate fingertip locations using learning based model on 640x480 pixel size frame. Here Author use similar approach to hand detector given by shin [18] to detect both hands based on skin color. To recognize hands Nguyen [17] used skin segmentation technique using Gaussian model. Density function of skin color distribution is as defined.

$$p(c|skin) = \sum_{i=1} \pi i \; pi\,(c|skin)$$

Where k is the number of components and $\pi i$ are the weight factors of each component. He used CIELUV color space to represent skin. Interestingly he used palm to finger length ratio to construct the hand figure. Zhou [21] worked with 320x240 size 24 bit image frames. Zhou used Markov Random Field to remove noise component in processed figure.

### B. Model Based Approach
Sawah [19] used histogram for calculating probability for skin color observation. Hu [20] take Gaussian distribution for background pixels marking then he subtracted the pixels from the new image to acquired gesture image. Lee [21] used the same technique to get gesture image.

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In the modelling of his application of human activity monitoring, Hu [20] applied Genetic Algorithm (GA) to Chromosome pool with Pc0 and Pm0 as crossover and mutation rate respectively which he founded using different statistic attributes. Crossover creates new chromosomes while mutation in this case introduces new genes into chromosome. Lee [21] use YCbCr skin color model to detect hand region and then he applied distance transform. Tarrataca [22] used RGB and HSI color space model based algorithm for skin detection.

## IV. Implementation
Mostly researchers who used image processing used MATLAB® with image processing toolbox while few used C++ also. Lee [21] and Zou used C++ for implementation on Windows XP® where Lu [19] and Lee [21] he used Microsoft® Foundation Classes (MFC) to build user interface and control.

## V. Accuracy
GREFIT [23] system was able to detect finger tips even when it was in front of palm, it reconstruct the 3D image of hand that was visually comparable. Nguyen [17] claimed results 90-95% accurate for open fingers that is quite acceptable while for closed finger it was 10-20% only. As shown in Figure 2 closed or bended finger are coming in front of palm, so skin color detection would not make any difference in palm or finger. According to him image quality and morphology operator was the main reason for low detection.

## VI. Conclusion
Gestures are meaningful body movement involving movements of fingers, hand with the intent of conveying information or interacting. Gesture recognition is a easy and natural way to interact with computer. A main problem hampering most approaches is that they rely on several underlying assumptions that may be suitable in a controlled lab setting but do not generalize to arbitrary settings. To ameliorate these problems there is a need for the establishment of a standard database for the evaluation and comparison of technique. By eliminating these problems and increasing accuracy gesture recognition could be a very good way to communicate with computer.

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