

# A Survey Paper on Controlling Computer using Hand Gestures

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**Abstract** - The availability of the cheap webcams with, at least, sufficient qualities open up new chances concerning the implementation of human computer interaction (HCI) interfaces. Gesture is one among the foremost detailed and powerful approach of communications between human and computer. Hence, there has been a growing interest to form feasible interfaces by directly using the natural communication and management capability of humans. Hand gesture recognition system contains a decent surveillance present days thanks to simple and straightforward intercommunication between human and machine. The main target of developing hand gesture is to make a much better conveyance between human and computer for delivering information.

Hand gestures are a kind of nonverbal way to interact that may be employed in several fields. Research and survey papers supported hand gestures have acquire so many alternative techniques, including those supported on sensor technology and computer vision. This paper mainly focuses on a review of the related work readily available hand gesture techniques and introduces their excellence and restrictions under different situations. This paper could be a general summary of hand gesture implementation. It shows all methods that were employed for hand gesture recognition in numerous research papers. The aim of this study is to perform a scientific literature review for identifying the foremost prominent techniques, applications and difficulties in controlling computer using hand gestures.

**Key Words:** hand gestures, computer vision, image processing, gestures recognition, human-computer interaction.

## 1. INTRODUCTION

Gesture recognition is a full of life analysis field in Human Computer Interaction technology. It has several employments in virtual environment management, medical applications, sign language translation, robot control, music creation, or home automation. During this project Controlling a Computer using Hand Gestures, we are going to make a real-time application using OpenCV and Python.

OpenCV is a real-time open-source computer vision and image-processing library. We'll use it via the OpenCV python package.

There has been a special significance recently on Human Computer Interaction (HCI) study to form convenient interfaces by directly using common communication and handling expertise of humans. Among different chassis parts, the hand is the most helpful interaction tool, because of its adroitness. The word gesture is employed for several different cases involving human motion particularly of the hands, arms, and face, only some of these are co-operative or informative.

Gesture recognition is a crucial field that specify human gesture using computer vision techniques and algorithms. There are numerous bodily motion which may develop gesture however the usual type of gesture generation arises from the face and hands. The complete policy of tracing gesture to their representation and changing them to some useful command is called as gesture recognition. Various technologies has been used for the design and implementation of such kind of application.

The CNN or convolutional neural networks are the extremely popular used technique for image classification domain. An image classifier takes an image, or sequence of images that is video as an input and classifies it into one of the possible categories or classes that it was trained to recognize. They have applications in several different fields like driver less cars, defense, education, medical field, fraud detection, etc. There are many algorithms for image classification and also there are some challenges like data overfitting, environment like background color, structure, etc.

## 2. LITERATURE REVIEW

The initial approach of communication with computer employing hand gesture was first projected by Myron W. Krueger in 1970 [1]. The purpose of the approach was attained and also the mouse cursor control was accomplished using an external webcam (Genius FaceCam 320), a software package that would paraphrase hand

gestures and so turned the acknowledged gestures into OS commands that handled the mouse operations on the display screen of the computer [2]. Selecting hand gesture as an interface in HCI will permit the implementation of a good vary of applications with none physical contact with the computing environments [3]. Nowadays, majority of the HCI relies on devices like keyboard, or mouse, however an enlarging significance in a category of techniques based on computer vision has been came out because of skill to acknowledge human gestures in a habitual manner [4].

The primary aim of gesture recognition is to spot a specific human gesture and carry information to the computer. General objective is to create the computer acknowledged human gestures, to manage remotely with hand poses a good sort of devices [5]. The automated vision-based recognition of hand gesture for management of tools, such as digital TV, play stations and for sign language was take into account as a significant exploration topic lately. However the common issues of those works arise because of several problems, like the complicated and disturbing environments, tone color of skin and also the kind of static and dynamic hand gestures. Hand gestures recognition for TV management is suggested by [6]. During this system, just one gesture is employed to regulate TV by operating user hand. On the display, a hand icon seems that follows the hand of user. In this paper [7], the actual HCI system that based on gestures and accept gestures uniquely operating one monocular camera and reach out the system to the HRI case has been evolved. The came out system depends on a Convolution Neural Network classifier to grasp features and to acknowledge gestures.

The Hidden Markov Model delivers as a crucial tool for the recognition of dynamic gestures in real time. The method employed HMM, works in actual and is built to operate in static environments. The approach is to make the use of LRB topology of HMM in association with the Baum Welch Algorithm for training and also the Forward and Viterbi Algorithms for testing and checking the input finding sequences and producing the most effective attainable state sequence for pattern recognition [8]. In this paper [9], the system is designed even it appears to be easy to use as compared to latest system or command based system however it is less powerful in spotting and recognition. Require to upgrade the system and attempt to construct further strong algorithm for both detection and recognition despite of the confused background environment and a usual lighting environment. Also require to upgrade the system for several additional categories of gestures as system is built for just six classes. However this system can use to manage applications like power point presentation, games, media player, windows picture manager etc. In this paper [10], hand gesture laptop makes the use of an Arduino Uno, Ultrasonic sensors and a laptop to perform the activities like controlling media, playback and volume. Arduino, Ultrasonic sensors, Python used for serial connection. This type of technology can be employed in the classroom for easier and

interactive learning, immersive gaming, interacting with virtual objects on screen.

Arduino UNO and ultrasonic sensors based hand gesture to control a computer where they can play pause videos and scroll up and down pages [11]. This paper [12] suggest an efficient ultrasonic based hand gesture monitoring system which is designed with the help of Arduino microcontroller ATMEGA32. The hand gestures recognized effectively with ultrasonic sensors. It is proved that no extra hardware is needed to identify hand gestures and proved that simple inexpensive ultrasonic sensors can be employed to find several ranges to identify hand gestures. In this paper [13], Arduino UNO ARDUINO and python programming with wired ultrasonic sensor based hand gesture system to control a computer where they can zoom in/out and rotate the image is developed. This is successful trial of working of hand motion sensing system using sensors i.e. ultrasonic sensors and finger contact sensors and using in it to Arduino kits in wireless mode using radio frequency. HCI for MS office and media player and have their own dataset, used skin coloured based technique [14]. Application that switch in a Web browser, Web page scrolling, Task switching, Changing the slides of the presentation, Play/pause the video, Video forward and rewind is implemented. Arduino, PySerial, PyautoGUI, etc. used [15].

This project is built in order to make smart home appliance system. Two deep CNN architectures are evolved in this system which are revised from AlexNet and VGGNet, respectively [16]. Done the implementation of the system using Convolutional Neural Network and Back Propagation methodologies. They built a gesture controlling and hand recognition system for the one who are disables [17]. In this paper they have used the surface electromyography (sEMG) sensors with wearable hand gesture devices and mostly applied classifier is Artificial Neural network for sign language hand gesture. In this authors faced overfitting problem in the dataset [18]. The vision based real-time system with Python programming language and OpenCV libraries and Linux framework was implemented. A real-time human gesture recognition using an automated technology called Computer Vision is demonstrated using Linux operating system and Lenet is a CNN architecture used for training of the gestures [19]. This approach is relied on image comparison and motion recognition mechanism to try to do mouse indicator activities and make choice of the icon.

A Virtual gesture control mouse is an approach is developed to help the cursor of the mouse and perform its operations with the help of real-time camera. This method is also built on the basis of image comparison and motion recognition mechanism to try to do mouse indicator operations and choice of icons [20]. Developed a system that assists user friendly interaction such as full-body game and system generating a three-dimensional environment. It is an exploratory study on the gesture selection for operations and also settled an information recapture system to address

several doubt phase of users [21]. Hyperparameter of CNN structures which are relied on Alex Net model, are advanced by heuristic optimization algorithms. This suggested approach is tried out on gestures language digits and at the same time Thomas Moeslund's gesture detection datasets. In this paper they achieved the 94.2% accuracy. Simultaneously, for Thomas Moeslund's gesture recognition dataset, the established method got 98.09% average accuracy performance and 94.33% average recognition performance [22]. In this paper, they have built an algorithm for real-time hand gesture recognition using convolutional Neural Network (CNN) and they got an average accuracy of 98.76% on the dataset that they have proposed. Dataset consists of total nine hand gestures and 500 image samples for each gesture [23]. A wireless hand gestured controlled fan system is formed. Gyro sensor is employed so as to work out the modification in co-ordinates of the hand. Also used a microcontroller and particularly an Arduino in which coded functions have been run. Hand gesture detection achieved with testing accuracy of 98.61% [24]. To build the gesture detection system and also to minimize the unnecessary information of EMG signals and optimize the dimension of the signal, the Principal Component Analysis (PCA) and GRNN neural network are employed. In this system they have taken total nine static gestures as input observations and made the use of electromyography instrument to examine the characteristics of the signal. The all in all recognition accuracy of the system came to 95.1% [25].

This paper [26] suggest a quick, easy and powerful gesture recognition algorithm for automation application that automatically acknowledges a restricted samples of gestures. However, the segmentation method ought to be strong and needed to be cope with temporal trailing, obstruction and three dimensional modelling of hand. In paper [27], they have proposed hand gesture for controlling power point and VLC media player. This paper [28] thought about the advanced design of hand segmentation that escapes the confused classification of objects on kalman filtering and TSL color space that offer high accuracy. This method gets a sensible hand segmentation. This paper [29] targeted on vision based recognition system. Skin tone color model and thresholding method with template matching using PCA were the parameters on which database of hand gesture was based on. The primary step is hand segmentation which is done by applying the skin color model, followed by the second step that is differentiate the image of hand from background environment. In last step, PCA, a format based matching is formed in order to identification of gesture. Vision based hand gesture recognition techniques from surveys of past 16 years are analyzed. Also this paper analyses 26 publicly accessible hand gesture datasets [30]. This paper [31] implemented hand gesture recognition application for HCI that was relied on vision based method. They established real time system to dam the mouse's movements in windows by without using ANN training and employing detection technique which was color based.

This paper [32] have made the use of various features and multiclass SVM model to recognize and trace uncover hand, and to manage an system by command produced by a grammar in a complex background environment, via skin tone color detection and outline curves comparison algorithm. Also K-means clustering algorithm and scale invariance feature transform (SIFT) have used to retrieve the important attributes from the images that have trained. But, the segmentation and localization technique is not clear for the application and also there is no diligent geometric details of the object components. In [33], a system has been suggested that primarily capture the human hand movements that is gestures into the disk and then transform them into binary image by deriving frame from each video one by one and then form 3D Euclidian space for binary image, for classifying hand gestures. For training part they have used back propagation algorithm and supervised feed-forward neural network which is convenient for just very easy type of gesture and having not much complex background. This paper [34] proposed hand gesture recognition using three dimensional depth sensors. There are various form of fields including static hand motion, 3D hand modeling, and hand route gesture within this application. This paper focused on gesture identification techniques and in which domains those methods are employed is also described. This paper [35] suggests a method for detecting the uncover hand with none color cap. The RGB image is modified into Hue image. The technique which removes arm region, the hand skin segmentation technique is employed for localization and segmentation. As in [36], they have proposed a hand gesture identification method for home automation using depth sensor. This technique have mainly two steps that is in initial step the dataset is formed for application and in second step, different attributes are derived from the labeled hand parts that are employed for providing command to system.

### 3. CONCLUSIONS

I With the growth of present technology, and as humans generally makes the use of hand movements that is hand gestures in the daily communication in order to make intentions more clear, hand gesture identification is treated to be a crucial portion of Human Computer Interaction (HCI), which provides devices the capability of detecting and classifying hand gestures, and perform activities subsequently. Research and analysis in the field of hand gestures has become more popular and exciting. It also allows a way of natural and simple interaction. Standard interactive techniques based on several tools like a mouse, keyboard/touch pad, or touch screen, joystick for gaming and consoles for system management.

In this paper we have discussed the overall review of gesture acquisition methods, the feature extraction process, the classification of hand gestures, the challenges that face researchers in the hand gesture recognition process.

Hand gesture recognition used in many applications like HCI, robotics, sign language, digit and alphanumeric value, home automation, etc. In this survey paper we have discussed in brief on basic methods of hand gesture recognition and find that Arduino and ultrasonic sensor is used widely in comparison of vision based technology. Also can conclude that recognition of static hand gesture needs less computation gesture in comparison to dynamic hand. Hand gestures recognition provides an interesting interaction field in a several different computer applications.

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