

Methods on Real Time Gesture Recognition System

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Abstract

Gesture recognition deals with discussion of various methods, techniques and concerned algorithms related to it. Gesture recognition uses a simple & basic sign languages like movement of hand, position of lips & eye ball as well as eye lids positions. The various methods for image capturing, gesture recognition, gesture tracking, gesture segmentation and smoothing methods compared, and by the overweighing advantage of different gesture recognitions and their applications. In recent days gesture recognition is widely utilized in gaming industries, biomedical applications, and medical diagnostics for dumb and deaf people. Due to their wide applications, high efficiency, high accuracy and low expenditure gestures are using in many applications including robotics. By using gestures to develop human computer interaction (HCI) method it is necessary to identify the proper and meaning full gesture from different gesture images. The Gesture recognition avoids use of costly hardware devices for understanding the activities and recognition example lots of I/O devices like keyboard mouse etc. Can be Limited.

Keywords: (HCI) Human Computer Interaction; Segmentations; Hidden Markov Model (HMM), Hand Gesture Recognition; Associative Processor (AP);

1. Introduction

To exchange the information and data control actions between human and computer simple Gestures are used. This is how is this paper computer is made to recognize and understand the human language through facial expressions, displacement hands and positions of lips to say something to computer. Gesture recognition is more application specific. Gesture recognition from live video can have following modalities: Face detection, Shoulder movement detection, Hand tracking, Hand gesture recognition, Lip movement and Finger tracking. Tracking deals with detecting any specific object (like face, hand, lips). Classify the current state of the movement/state of the modality as suitable gesture. Further based on contour gestures, image can be recognized. For example thumbs up and thumbs down can trigger various on screen events. Smile and Shout could be probable lip gesture. Eye blink can be probable eye gesture and so on.

The aim of gesture recognition is to develop a practical methods/device which can notice and understand what function has to be carried out based on the simple human Gestures. And utilize them to control particular system activities. The various researchers' analysis and work has to be investigated/studied to understand what the gesture recognition is?

Normally the gesture recognition is nothing but at anytime person can present his commands/directions to the computer by standing in front of a camera connected to a computer system. But a person (user) it is far away from the computer (not being exactly in front of computer) the computer must recognize his Gesture & image pattern of the Gesture of a person has to be processed real time to achieve this fast collection of the Gesture in the form of images catches by a camera near to him has to be examined, identified and processes at a fast rate as required by the real-time operations

2. Gesture Recognition System

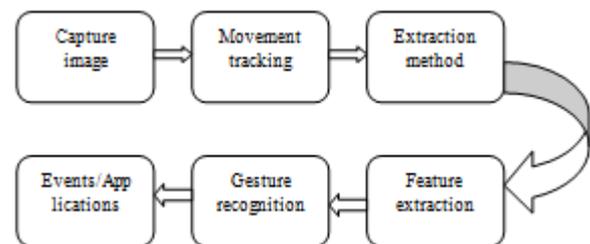


Fig. 1: Gesture recognition system

The processing of image carries the most part of implementation. The steps involved in processing of image are capture the image by using digital technique or binary, zooming in or zooming out, or selecting required & changing size.

The processed image is given to the image processor.

There are about three functions involved in Gesture recognition after the image is obtained from images or videos. Those steps are

1. Method of extraction
2. Estimation or extraction of feature
3. Identification or categorization

Image segmentation is main function of extraction

The first activity of recognizing hand gesture is segmentation, where in which ,process of dividing image or hand gesture image is divided into different regions separated by boundaries.

The process of this segmentation varies for the type of gesture or image. Suppose the gesture is of dynamic in nature then gesture has to be traced and then found and next segmented. Otherwise (static or non-movable) only the Image has to be segmented.

3. Collection of Data for Hand Gestures

This consists of instrumented gloves and vision based. Instrumented glove is device that measure and gathers hand position and orientation of data. The user's hands movement pictures are collected by various cameras by using a method which is based on vision.

A instrument hand gloves which consists of sensors. These are embedded on backside of hand gloves. Light intensity based sensors are used with dentist and photos all at one end and source of light at other end on the gloves. The quality of light hit the photocell depends on the bent of fingers. In glove based sensing devices the problem is in the way the raw images and recognition is performed and its interface with the computer system. If wires are used it will in a moment distance / displacement. The Collection of data by vision based method is classified into four functions. These functions are the number of cameras to be utilized and positioning of cameras. The position of the camera is necessary because to get maximize recognition for the gesture to be tracked. The more visible the hands the better is extraction of data from the camera. From the stream of raw pictures captured from the gesture is identified. The last function is by using their recognition algorithms the purpose of gesture has to be extracted

Table 1: Comparison of Various Models

Parameters	Glove based method	Vision based method
Cost	High	Less
User comfort	Less	More
Hand analysis	High Restriction	Less Restriction
Calibration	Critical	Non critical
portability	Less	High

4. Gesture Recognition Methods

A. Hidden Markov Model:

The Hidden Markov Model (HMM) is a very efficient tool for hand gesture detection in the time domain. Hidden Markov Model can be considered for simplification of Markov chain, without Markov chain constraint. Hidden Markov Model (HMM) model deals with the dynamic aspects of gestures. Gestures can be extracted from a series of video pictures by tracking the color of skin or equivalent to the hand into a body- face space centered on the face of the individual. The aim is to recognize two classes of gestures one is deictic and second is symbolic. The image is filtered using data base or a fast look-up indexing table or database.

After filtering, in order to determine homogeneous areas, skin color pixels are collected into blobs. Blobs are nothing but the statistical objects based on the location of image(x,y) and the colorimetric (Y,U,V) of the skin color pixels for similar ranges.

In the time domain the very efficient old used is the hidden Markov model for hand gesture detection.

The dynamic aspects of the gestures are dealt with the HMM. The Markov chain can be simplified using hidden Markov model. The gestures can be derived from successive images from video by following the color or skin or equivalent to the hand into a body. The gesture recognition main purpose is to recognize dual classes of gestures those are symbolic and deictic. By using data base or fast look up indexing label or database the filtering image is done. The model is covered up as in all can be seen is a progression of explanations. Gee is portrayed as takes after:

- Annotations set as $A = \{A_1, A_2 \dots A_T\}$ where $T=1, 2, 3 \dots t$
- Set of 'n' conditions $\{C_1, \dots \dots C_N\}$
- Symbols for Discrete capacity $k = \{B_1, \dots \dots B_k\}$.
- State change lattice $M = \{m_{ij}\}$ where m_{ij} is likelihood of progress from condition C_i to C_j .
- Probability of Observation network $O = \{o_{ij}\}$

- Probability circulation for introductory states $\Pi = \{\pi_j\}$, where $j = 1, 2, 3 \dots N$.

Hidden Markov Model (HMM) is created by doing parallel association of each HMM and in this way extension of new HMM or clearing a current HMM ought to be conceivable easily. Utilizing time flight camera strategy For signal grouping this idea utilizes x and y projections of the photo or picture and profundity highlights for order of motion. The framework utilizes a TOF i.e. 3-Dimnsional time off light. Sensor has the primary preferred standpoint for rearranging hand division. The pictures utilized as a part of the framework demonstrates a decent division along the two picture tomahawks. Thus, the hand projections onto the x-hub and y-hub are utilized as fundamental highlights for the arrangement. In the intention to find out similar areas, skin color pixels are collected in blobs of the filtering. These blobs are the statistical objects based on the location of the image and colorimetric of skin color pixels for homogeneous ranges.

B. Using Time Flight Camera Method

This technique utilizes x and y projections of the picture and discretionary profundity highlights for motion order. The framework utilizes a 3-Dimnsional time-off light (TOF) sensor which has the significant preferred standpoint for rearranging hand division. The motions utilized as a part of the framework demonstrate a decent detachment along the two picture tomahawks. Consequently, the hand projections onto the x-hub and y-hub are utilized as highlights for the order.

C. Appearance Based Approach

This strategy is extremely basic and utilizations picture highlights to display the visual based appearance of the hands and balance these parameters with the removed picture highlights from the photo or video input. Continuous introduction or execution is simple because of the simpler 2 Dimensional picture includes that are being used. This technique is quickly forward and simple strategy that is as often as possible utilized.

5. Hand Segmentation

Division is a procedure, which is the main method for distinguishing hand motions and which isolates individual hand area from the others. It is the technique of isolating the information picture uncommonly hand motion picture into locales separated by a few confinements. Division process contingent upon the kind of picture utilized, the picture is non static motion or static motion. In the event that non static motion then the hand signal should be followed and situated, for static motion the info picture must be just portioned. Hand ought to be found initially. Skin shading data is utilized to extricate the hand area in most hand division techniques. The skin shading based technique for hand area extraction is genuinely basic yet it is extremely touchy to light. It is troublesome for foundation which has numerous comparable hues like skin. Skin shaded questions, for example, wood, light back ground and backdrops. Need to track the moving hand and important to separate the hand shape precisely. The motion ought to be precisely found to begin with, limit should be indicate contingent upon the shade of skin and furthermore, the hand motion must be followed and for following the signal there are two primary techniques; the video ought to be partitioned into casings and individual edge must be handled, for this situation the motion outline is dealt with as a stance and division is done, or utilizing some following data, for example, shade of skin, shape by utilizing some accessible apparatuses. Distinctive strategies and devices are utilized for skin shading and non-skin shading pixels to demonstrate the hand motion. A few methodologies are parametric methodologies like Gaussian Model (GM) and Gaussian Mixture Model (GMM) and non-parametric

methodologies like histogram based methodologies, Color models HSV which focuses on shades of the pixel, YCbCr shading space or standardized r-g shading space can be utilized. A few capacities are connected, for example, subtraction, edge recognition, and standardization to upgrade the sectioned hand picture.



Fig. 2: Segmentation for Hand gesture.

To find the hand motion development data; we expect that the information motion is dynamic or non stationary. At the point when objects move in a succession of picture or spatial time space, movement locator instrument can track the moving motions or pictures by looking at the neighborhood dark level changes. Let $E_i(x, y)$ the n th casing of the arrangement and $E_{n+1}(x, y)$ is the picture distinction between the n th and the $(n+1)$ th edge can be is characterized as

$$E_i(x, y) = T_i \{ |D_i(x, y) - D_{i+1}(x, y)| \}$$

$E_i(x, y)$ is binary image defined as

$$E_i(x, y) = \begin{cases} 1, & |F_i(X, Y) - D_{i+1}(x, y)| \geq \text{threshold} \\ 0, & \text{Otherwise} \end{cases}$$

Where T_i is a threshold function, $E_i(x, y)$ and $D_i(x, y)$ are all images.

A. Thresholding:

Separating an area from the non static protest than the thresholding can be apply on contrast outlines for getting the conceivable moving locales in foundation which is more mind bogging. Utilize some simple thresholding ways to deal with distinguish moving areas. Development identification is given by $M = 0.15\mu$. Where μ is the general normal of picture caught $D_i(x, y)$.

Skin Detection of Hand: By utilizing the shading data we identify the hand district in the first place, we utilize RGB i.e. $R > G > B$, for finding the skin shading zones, which contain extensive variety of hues like red, dark colored, orange and pink shading. We can discover numerous regions other than the skin region. For instance a territory in orange shading won't be distinguished as the hand zone. Presently can get some case hues from the hand area. For finding the skin locales, we separate the hues in the zones with the pre-put away case hues. In the event that it is likely same, at that point the territory ought to be skin region. By procedure of following in the past edge the hand locale is acquired. We can dispense with some skin likely hues at long last and demonstrate skin shading picture as $S_i(x, y)$.

Detection of Edge: Detection of edge is to isolate the area of arm from the district of hand. Edge location is connected. It is easy to discover edges on the arm district than on the area of palm. we can utilize edge identification way to deal with get distinctive edges heading, and afterward select the aggregate most extreme every pixel estimation of to shape the edge picture of i th outline as $E_i(x, y)$.

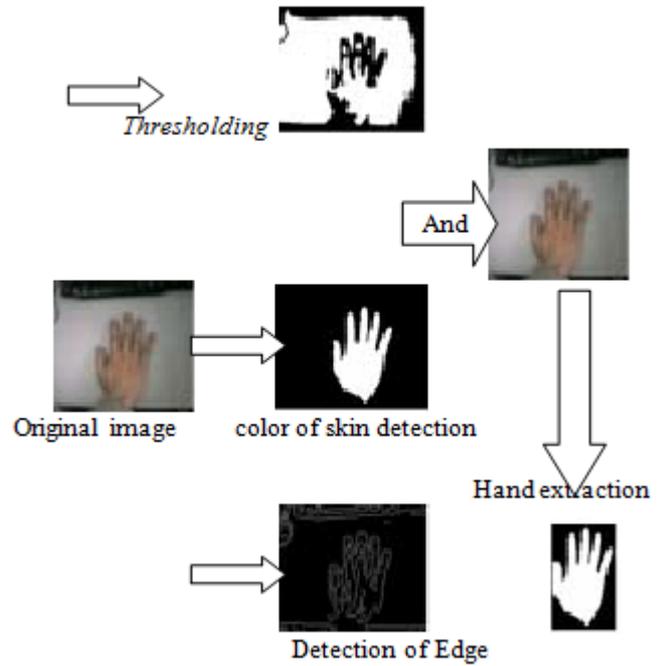


Fig. 3: Process of hand region extraction

6. Features Extraction

The procedure of division prompts the correct element extraction strategy and the last assume a critical part in the effective ID process. Portioned picture highlights can be separated from multiple points of view as per particular application.



Fig. 4: Different features of hand gestures.

Concentrate the highlights of hand motion territories by utilizing directional measurements histogram approach. As appropriation histograms the picture highlight is shaped. Also, by circulations of histogram hand signal locale are separated as the highlights.

Hand motions as appeared in Fig. 4 for directional interface which is intuitive edge: These signals execute tasks like finger LEFT, finger RIGHT, hand UP and pass on are for centering in four ways; hands OPEN and hands CLOSE are utilized for open and close. Hands CLOSE can be translate as STOP when center is moving.

7. Applications of Hand Gestures System

For various applications Hand motions has been connected on various fields including robot control, medicinal fields, communication via gestures interpretation and distinguishing proof, virtual conditions so on.

A. Robot Control: Robot Control is one of the intriguing application for Controlling the robot utilizing signals. A framework or a procedure that uses the numbers to tally the five fingers for dealing with a robot utilizing the hand postures signs or images. The orders are given to the robot to complete a particular procedure or errand, every image has a particular importance and gives distinctive activities for instance, "one" designates "push ahead", and "five" specifies "stop", et cetera.

B. Graphic Editor Control: For preprocessing task the hand motion to be followed by utilizing Graphic manager control system. The non static pictures for altering and drawing realistic framework. Shapes for drawing are; ectangular, circle, triangle, vertical and flat line for drawing, and charges for altering realistic framework are; erase, fix, duplicate, swap,, move and close.

C. Recognition Of Numbers: One more use of hand signal is distinguishing the numbers. From a programmed frameworks significant picture can be perceived from hand movement of Arabic numbers from 0 to 9 out of a constant framework utilizing Hidden Marchov Model..

D. Television Control: TV can be controlled by utilizing motions. Hand motions and pictures are utilized for the Television gadget controll. Hand motion are utilized to control the TV tasks, for example, to turn the TV on and kill the TV in mode, sound quieting, expanding and diminishing TV volume, and channel changing should be possible by utilizing the open and close hand.

E. Language Recognition By Sign: This dialect is utilized for explanationing and translation of an a few subjects amid the exchanging of informaion, this technique has gotten more consideration. Numerous techniques have been came into picture to recognize pictures utilizing diverse kinds of signs or gesture based communications. For instance perceived American Sign Language (ASL) utilizing edge histogram, MLP neural system and dynamic programming coordinating. Japanese gesture based communication JSL utilizing Recurrent Neural Network, 42 letter set and 10 words. Arabic Sign dialect ArSL utilizing two distinct kinds of Neural Network, Partially and Fully Recurrent neural Network.

8. Conclusion

In this paper different methodologies has been talked about for perceiving the signal framework these methodologies incorporate Hidden Marchov Model HMM, utilizing clock light camera technique, appearance based approach and hand division strategies (for the most part helped for motion re perception), highlights extraction a few calculations and strategies are required. To procure the state of the hand motion as in the choice of particular calculation for acknowledgment relies upon the application required. In this work application territories for the motions framework are introduced quickly. Rundown of some chose frameworks are quickly recorded too. In this paper, confront based versatile skin shading model and movement history picture based hand moving heading strategies were proposed. There are four unique hand motions moving down, hand climbing, moving left, and moving right and two static hand signals clench hand and waving hand characterized.

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