

Intelligent Gesture Analysis, Recognition and Computation – Wizard

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Abstract— A software which has almost unlimited amount of usage and future aspect, a software on the basis of its functionality and because of its diverse functionality and almost infinite room for growth Gesture-Wizard or Ges-Wizard.

There are numerous possibilities which can be achieved through this application, although for now we would like to discuss about four use cases which are the foundation of this application.

Now a days we see a sudden boom in the visual technologies, cameras are becoming dominant piece of technology in every field, so why not make the most out of it. Ges-Wizard Is a gesture recognizing application which not only recognizes faces, hand gestures it may also be able to use those and compute data or even control the computer with just hand gestures.

Wouldn't it be great to be standing for a presentation and changing the slides of the presentation with just your hand swipes in air! Wouldn't it just amaze the people? Is it not just like a wizard!?

In computer science and language technology, Gesture recognition is a wide topic with the goal of interpreting human gestures via mathematical algorithms.

Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focuses in the field include emotion recognition from the face and hand gesture recognition.

Many approaches have been made using cameras and computer vision algorithms to interpret sign language. However, the identification and recognition of posture, gait, proxemics, and human behaviors is also the subject of gesture recognition techniques.

Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse.

Keywords— Camera and Computer Vision Algorithms, Gait, Proxemics, Text User Interface.

1. INTRODUCTION

Gesture Recognition is the ability of a device to identify and respond to the different gestures of an individual. It can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse. A child is sensed by a simple gesture recognition algorithm detecting hand location and movement.

Gesture recognition enables humans to interface with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.

Gesture recognition can be conducted with techniques from computer vision and image processing. Interface with computers using gestures of the human body, typically hand movements. In gesture recognition technology, a camera reads the movements of the human body and communicates the data to a computer that uses the gestures as input to control devices or applications.

For example, a person clapping his hands together in front of a camera can produce the sound of cymbals being crashed together when the gesture is fed through a computer. One-way gesture recognition is being used is to help the physically impaired to interact with computers, such as interpreting sign language.

The technology also has the potential to change the way users interact with computers by eliminating input devices such as joysticks, mice and keyboards and allowing the unencumbered body to give signals to the computer through gestures such as finger pointing. Unlike Haptic interfaces, gesture recognition does not require the user to wear any special equipment or attach any devices to the body.

The gestures of the body are read by a camera instead of sensors attached to a device such as a data glove. In addition to hand and body movement, gesture recognition technology also can be used to read facial and speech expressions (i.e., lip reading), and eye movements.

The literature includes ongoing work in the computer vision field on capturing gestures or more.

GESTURE ONLY INTERFACES

The gestural equivalent of direct manipulation interfaces is those which use gesture alone.

These can range from interfaces that recognize a few symbolic gestures to those that implement fully fledged sign language interpretation.

Similarly, interfaces may recognize static hand poses, or dynamic hand motion, or a combination of both.

In all cases each gesture has an unambiguous semantic meaning associated with it that can be used in the interface. In this section we will first briefly review the technology used to capture gesture input, then describe examples from symbolic and sign language recognition.

Finally, we summarize the lessons learned from these interfaces and provide some recommendations for designing gesture only applications.

CONTROLLER-BASED GESTURES

These controllers act as an extension of the body so that when gestures are performed, some of their motion can be conveniently captured by software.

Mouse gestures are one such example, where the motion of the mouse is correlated to a symbol being drawn by a person's hand, as is the Wii Remote, which can study changes in acceleration over time to represent gestures.

SINGLE CAMERA

A normal camera can be used for gesture recognition where the resources/environment would not be convenient for other forms of image-based recognition.

Although not necessarily as effective as stereo or depth aware cameras, using a single camera allows a greater possibility of accessibility to a wider audience.

Gesture recognition is an active research field which tries to integrate the gestural channel in Human Computer Interaction. It has applications in virtual environment control [1], but also in sign language translation [2], robot remote control [3] or musical creation [4].

Recognition of human gestures comes within the more general framework of pattern recognition. In this framework, systems consist of two processes: the representation and the decision processes.

The representation process converts the raw numerical data into a form adapted to the decision process which then classifies the data (see Figure 1).

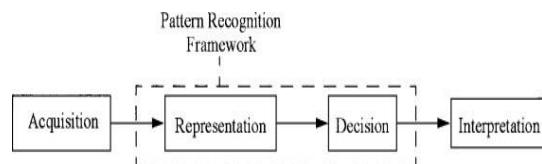


Fig. 1. General structure of a gesture recognition system.

Gesture recognition systems inherit this structure and have two more processes: the acquisition process, which converts the physical gesture to numerical data, and the interpretation process, which gives the meaning of the symbol series coming from the decision process.

It is generally accepted that any hand gesture is made up of four elements the hand configuration, movement, orientation and location, a crude classification of gestures can also be made by separating the static gestures, which are called hand postures, and the dynamic gestures which are sequences of hand postures.

Two main families of gesture acquisition systems, device-based and vision-based, can be considered.

In device-based systems, the acquisition of gestures is made by a physical device that directly measures some characteristics of the gesture, generally the different joint bending angles.

A good review of device-based inputs is given in.

In vision-based systems, the gesture is captured by a camera.

The main advantage of the vision-based approach is its unconstrained nature.

It allows a natural execution of a gesture by the user as long as he/she stays in the camera field. Its main drawbacks are the complexity of processing's which makes it unsuitable for real time application as well as the fact that the user must stay in the camera field. Device-based methods, on the opposite, are fast and robust. They are often criticized because of the constraint of wearing a glove linked to the computer by wires. However, the advent of wireless data gloves makes it possible to imagine embedded sign recognition systems that could be used anywhere, in the streets as well as in laboratories.

The goal of this paper is to use the fuzzy set theory and rule-based aggregation to build a simple model of human perception of the hand. This model is then utilized to recognize gestures. In this model, a hand posture is described linguistically, by giving the configuration each finger takes in this particular posture. Finger configurations are in turn described with linguistic terms.

Such a recognition system has two main advantages. The first one is that it is not a black box system: the recognition process is intuitive and so it is reliable and easily maintainable. The second advantage is that it is the

representation process that is trained and not the decision process as is usually the case.

The representation process is only trained once to recognize the finger configurations correctly. Then the recognition process can recognize any hand posture if the rule describing it is well defined.

This system is applied to the recognition of hand postures corresponding to control actions for a small robot.

2. PROPOSED ALGORITHM

A. Related work -

Hand gesture recognition research is classified in three categories. First "**Glove based Analysis**" attaching sensor with gloves mechanical or optical to transduces flexion of fingers into electrical signals for hand posture determination and additional sensor for position of the hand. This sensor is usually an acoustic or a magnetic that attached to the glove. Look-up table software toolkit provided for some applications to recognize hand posture.

The second approach is "**Vision based Analysis**" that human beings get information from their surroundings, and this is probably most difficult approach to employ in satisfactory way. Many different implementations have been tested so far. One is to deploy 3-D model for the human hand. Several cameras attached to this model to determine parameters corresponding for matching images of the hand, palm orientation and joint angles to perform hand gesture classification. Lee and Kunii developed a hand gesture analysis system based on a three-dimensional hand skeleton model with 27 degrees of freedom. They incorporated five major constraints based on the human hand kinematics to reduce the model parameter space search. To simplify the model matching, specially marked gloves were used.

The Third implementation is "**Analysis of drawing gesture**" use stylus as an input device. These drawing analysis lead to recognition of written text. Mechanical sensing work has used for hand gesture recognition at vast level for direct and virtual environment manipulation. Mechanically sensing hand posture has many problems like electromagnetic noise, reliability and accuracy. By visual sensing gesture interaction can be made potentially practical but it is most difficult problem for machines.

Full American Sign Language recognition systems (words, phrases) incorporate data gloves. *Takashi and Kishino* discuss a Data glove-based system that could recognize 34 of the 46 Japanese gestures (user dependent) using a joint angle and hand orientation coding technique. From their paper, it seems the test user made each of the 46 gestures

10 times to provide data for principle component and cluster analysis. The user created a separate test from five iterations of the alphabet, with each gesture well separated in time. While these systems are technically interesting, they suffer from a lack of training.

Excellent work has been done in support of machine sign language recognition by *Sperling and Parish*, who has done careful studies on the bandwidth necessary for a sign conversation using spatially and temporally sub-sampled images. Point light experiments (where "lights" are attached to significant locations on the body and just these points are used for recognition), have been carried out by *Poizner*. Most systems to date study isolate/static gestures. In most of the cases those are fingerspelling signs.

B. Problem Definition:

There are many problems we face while we in our day to day lives which can be based of with this research some of those are mentioned below:

I. Communication with deaf and dumb.

We face problems as we do not know which gestures mean what while communication with a specially-abled person such as a deaf and dumb.

We aim to counter this as the system might recognize what the person wishes to say with only their hand gestures.

II. Imitation of Intelligence through gestures (Ai Aspect).

Wouldn't it be better and would feel more intelligent if the computer may recognize how the person is feeling by their emotions or gestures and would bring it closer to imitate intelligence. A wide variety of applications can be made on this.

III. GESTURE COMPUTER CONTROL.

Using the computer screen as a touch screen without even touching it just through the camera and hand gestures made in front of it.

As we progress forward, we may encounter many such problems which our very own wizard may be capable of handling.

C. PROPOSED WORK -

Hand detection is related to the location of the presence of a hand in a still image or sequence of images i.e. moving images. In case of moving sequences, it can be followed by tracking of the hand in the scene, but this is more relevant to the applications such as sign language. The underlying concept of hand detection is that human eyes can detect objects which machines cannot with that much accuracy as that of a human. From a machine point of view, it is just like a man fumble around with his senses to find an object.

The factors, which make the hand detection task difficult to solve, are:

Variations in image plane and pose

The hands in the image vary due to rotation, translation and scaling of the camera pose or the hand itself. The rotation can be both in and out of the plane.

Skin Color and Other Structure Components

The appearance of a hand is largely affected by skin color, size and also the presence or absence of additional features like hairs on the hand further adds to this variability.

Lighting Condition and Background

As shown in Figure 1.1 light source properties affect the appearance of the hand. Also, the background, which defines the profile of the hand, is important and cannot be ignored.

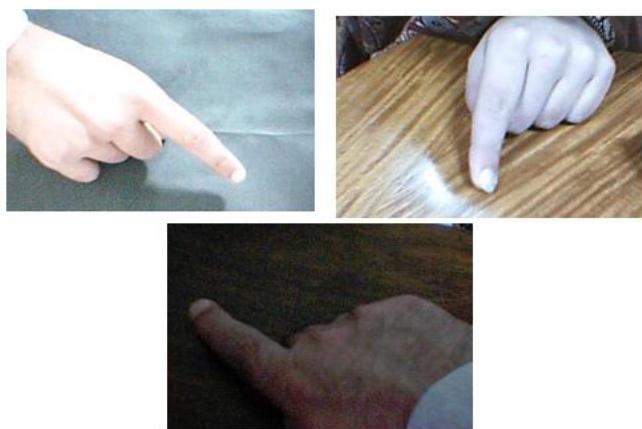


Figure: 1.1: Lighting Condition and Background

Hand detection and recognition have been significant subjects in the field of computer vision and image processing during the past 30 years. There have been considerable achievements in these fields and numerous approaches have been proposed. However, the typical procedure of a fully automated hand gesture recognition system can be illustrated in the **Figure 1.2** below:

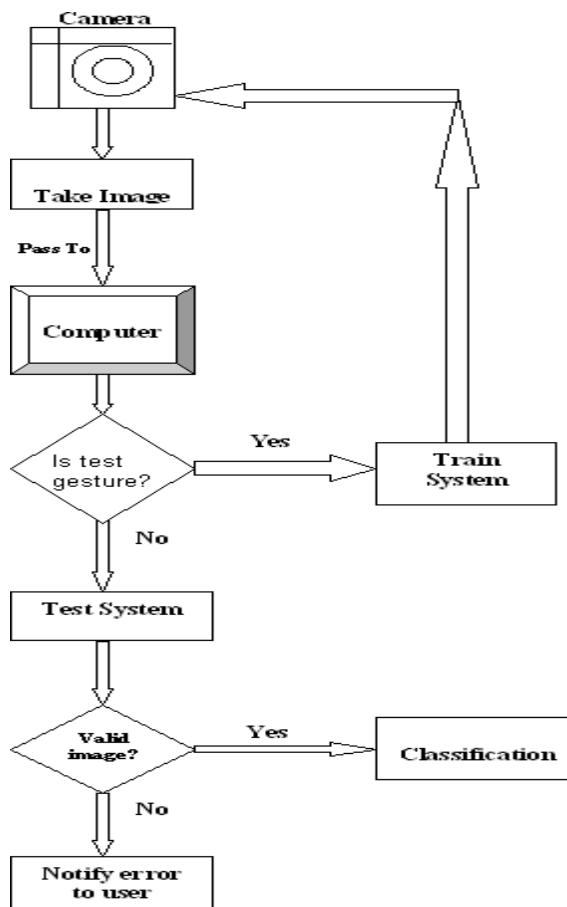


Figure 1.2: Hand Gesture Recognition Flow Chart

D. Experiment and Result

Performed experiment shows the achieved result and estimate gesture recognition system projected in chapter 4. The experiment divided into two categories to better analyze system performance and capabilities. The more general approach to work with differently user independent system developed to interact with multi users with different kind of skin colors and hands shapes. It is very important approach to attempt for independent multi-user system. The system can be used by various users.

Two main aims for this work to detect hand and recognition of hand gesture with neural network and real classification. The first aim to detect hand with different skin tones, using explicitly defined skin region. Secondly gesture recognition with neural network and real classification by different algorithms. This system designed to test the hypothesis that detection and recognition rate would increase as:

- Hand detection with different skin tones
- More training pattern are used to train neural network

- Gesture recognition

The analysis of each experiment which mentioned above is presented here one by one according to above sequence.

Conclusion

In this paper we have presented a method to recognize the unknown input gestures by using hand tracking and extraction method. We apply this system to recognize the single gesture.

In the experiments, we assume stationary background so that our system will have smaller search region for tracking. Using this model, we have developed an application where we can control mouse with the finger using it on web cam.

Also, we are aiming to converse with the deaf and dumb with this technology.

Moreover, we are trying to control the movement of the mouse cursor with the tips of our fingers

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