ISSN 2394-739X
International Journal for Research in Science Engineering and Technology

REVIEW ON HAND GESTURE RECOGNITION TECHNIQUES FOR HUMAN-COMPUTER INTERACTION

[1] **DiptiNawale,**
[1] G. H. Raisoni Institute of Engineering and Technology.

Abstract:-

The gestural equivalent of direct manipulation interfaces are 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 a brief review on the technology used to capture gesture input is presented. Finally we summarize the lessons learned from these interfaces.

Keywords: - human-computer interaction, gesture recognition, tracking technologies

1. INTRODUCTION

Gestures and gesture recognition are terms increasingly encountered in discussions of human-computer interaction. For many (if not most) people the term includes character recognition, the recognition of proof readers symbols, shorthand, and all of the types of interaction like Marking Interfaces. In fact every physical action involves a gesture of some sort in order to be articulated. Furthermore, the nature of that gesture is generally an important component in establishing the quality of feel to the action. The type of communication that we are discussing here is far richer in many ways than what we have been dealing with. Consequently, it is not hard to understand why this use of gesture requires a different class of input devices then we have seen thus far. For the most part, gestures, as we discuss them, involve a far higher number of degrees of freedom than we have been looking at. Trying to do gesture recognition by using a mouse or some other "single point" device for gestural interaction restricts the user to the gestural vocabulary. You may still be able to communicate, but your gestural repertoire will be seriously constrained. The gestures that are used vary greatly among contexts and cultures yet are intimately related to communication. Gestures can exist in isolation or involve external objects. Free of any object, we wave,beckon, fend off, and to a greater or lesser degree (depending on training) make use of more formal sign languages. With respect to objects, we have a broad range of gestures that are almost universal, including pointing at objects, touching or moving objects, changing object shape, activating objects such as controls, or handing objects to others. Within these categories there may be further classifications applied to gestures. Here primary focus is how gestures can be used to communicatewith a computer so we will be mostly concerned with empty handed semiotic gestures.These can further be categorized according to their functionality[1][2].

• Symbolic gestures:These are gestures that, within each culture, have come to have asingle meaning. An Emblem such as the "OK" gesture is one such example.

• Deictic gestures:These are the types of gestures most generally seen in HCI and arethe gestures of pointing, or otherwise directing the listeners attention to specific events orobjects in the environment. They are the gestures made when someone says “Put thatthere”.

• Iconic gestures:As the name suggests, these gestures are used to convey informationabout the size, shape or orientation of the object of discourse. They are the gesturesmade when someone says “The plane flew like this”, while moving their hand through theair like the flight path of the aircraft.

• Pantomimic gestures:These are the gestures typically used in showing the use ofmovement of some invisible tool or object in the speaker’s hand. When a speaker says “Iturned the steering wheel hard to the left”, while mimicking the action of turning a wheelwith both hands, they are making a pantomimic gesture.

2. TRACKING TECHNOLOGIES

A) GLOVES

Gesture only interfaces with syntax of many gestures typically require precise hand posetracking. It is achieved using a hand glove. This hand glove is called as data glove. This data glove is equipped with sensors which captures data like position of hand, orientation of hand, finger flex etc. It consists of optic fibres having small cracks in it. Light is shone down the cable so when the fingers are bent light leaks out through the cracks. Measuring light loss gives an accurate reading of hand pose. This data glove lacks to measure the movements of fingers sideways which is termed as abduction. But it successfully measures with accuracy 5 to 10 degrees [3][4]. Thus to overcome the abduction, Cyber glove was developed. Cyber glove places the strain gauge between the fingers to recover abduction. However, it has also increased the accuracy while sensing the bends. Sensing (Figure 1). Since the development of the Data glove and Cyber glove many other gloves based input devices have appeared

Figure 1: The Cyber Glove

The CyberGlove captures the position and movement of the fingers and wrist. It has up to22 sensors, including three bend sensors (including the distal joints) on each finger, fourabduction sensors, plus sensors measuring thumb crossover, palm arch, wrist flexion andwrist abduction[5].

Once hand pose data has been captured by the gloves, gestures can be recognized usinga number of different techniques. Neural network approaches or statistical templatematching is commonly used to identify static hand poses, often achieving accuracy rates of better than 95%. Time dependent neural networks may alsobe used for dynamic gesture recognition. Hidden Markov Models may also be used to interactively segment out glove input intoindividual gestures for recognition and perform online learning of new gestures. In these cases gestures are typically recognized using pre-trained templates, howevergloves can also be used to identify natural or untrained gestures[4][5].

Although instrumented gloves provide very accurate results they are expensive and encumbering. Computer vision techniques can also be used for gesture recognition overcoming some of these limitations. In general, vision based systems are more natural to use that glove interfaces, and are capable of excellent hand and body tracking, but do not provide the same accuracy in pose determination.[6] However for many applications this may not be important. Following are the limitations for image based visual tracking of the hands:

• The resolution of video cameras is too low to both resolve the fingers easily and cover the field of view encompassed by broad hand motions.

• The 30 or 60 frame-per-second conventional video technology is insufficient to capturerapid hand motion.

• Fingers are difficult to track as they occlude each other and are occluded by the hand.

B) NATURAL GESTURE ONLY INTERFACES

At the simplest level, effective gesture interfaces can be developed which respond to natural gestures, especially dynamic hand motion... The hands work in extremely subtle ways to articulate steps in what is actually a continuous control space..This tracking method is quite successful because there is a direct mapping of hand motion to continuous feedback, enabling the user to quickly build a mental model of how to use the device.[7] Background subtraction and edge detection can additionally be used to create a silhouette of the user and relevant features identified. The feature recognition is sufficiently fine to distinguish between hands and fingers, whether fingers are extended or closed, and even which fingers.[8] With this capability, the system has been programmed to perform a number of interactions, many of which closely echo our use of gesture in the everyday world. Figure 2 shows a kind of "finger painting" by pointing at items with the index finger. Here the index finger is recognized and when extended, becomes a drawing tool. Shaping the hand in a fist, so that the finger is no longer extended lets the hand be moved without inking.

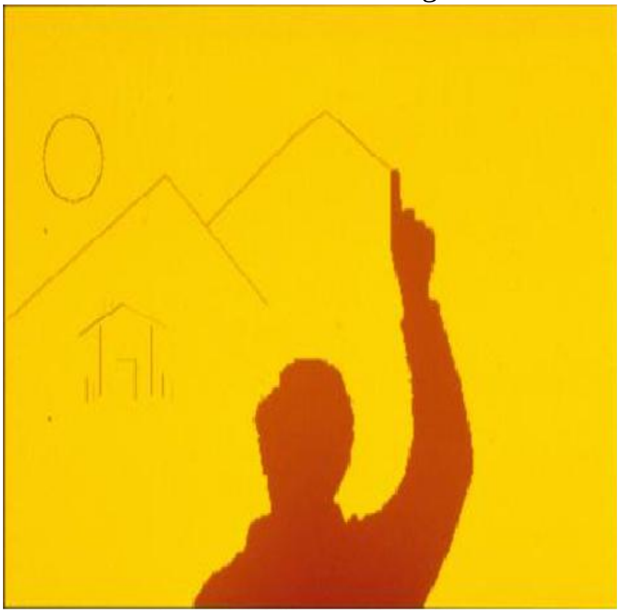

Figure 2: Finger Painting

C) SYMBOLIC GESTURE RECOGNITION

Finger painting respond to natural free form gestures, however interfaces with a wider range of commands may require a symbolic gesture interface. In this case certain commands are associated with pertained gesture shapes.[9] Symbolic gesture interfaces are often used in immersive virtual environment where the user cannot see the real world to traditional input devices. In this setting there are typically a set of pertained gestures used for navigation through the virtual environment and interaction with virtual objects. The GIVEN virtual environment (Gesture-driven Interactions in Virtual Environments), uses a neural network to recognize up to twenty static and dynamic gestures [10]. These include pointing gestures for flying, fist gestures for grabbing and other whole hand gesture for releasing objects or returning back to the starting point in the virtual environment.

There are a number of advantages in using symbolic gestures for interaction, including:

• Natural Interaction: Gestures are a natural form of interaction and easy to use.

• Terse and Powerful: A single gesture can be used to specify both a command and its parameters.

• Direct Interaction: The hand as input device eliminates the need for intermediate transducers. However the problems with symbolic gesture is users may become tired making free-space gestures and gesture interfaces are not self-revealing, forcing the user to know beforehand the set of gestures that the system understands. Naturally, it becomes more difficult to remember the gestural command set as the number of gestures increase. Here is also a segmentation problem, in that tracking systems typically capture all of the user's hand motions so any gestural commands must be segmented from this continuous stream before being recognized. This causes a related problem in that the gestures chosen may also duplicate those that are very natural and used in everyday life.

CONCLUSION

The importance of gesture recognition lies in building efficient human–machine interaction. Its applications range from sign language recognition through medical rehabilitation to virtual reality. Given the amount of literature on the problem of gesture recognition and the promising recognition rates reported, one would be led to believe that the problem is nearly solved. Sadly this is not so. 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. Several common assumptions include:

assuming high contrast stationary backgrounds and ambient lighting conditions. Also, recognition results presented in the literature are based on each author's own collection of data, making comparisons of approaches impossible and also raising suspicion on the general applicability. To ameliorate these problems there is a need for the establishment of a standard database for the evaluation and comparison of techniques In summary, a review of vision-based hand gesture recognition methods has been presented. Considering the relative infancy of research related to vision-based gesture recognition, remarkable progress has been made. To continue this momentum, it is clear that further research in the areas of feature extraction, classification methods and gesture representation are required, to realize the ultimate goal of humans interfacing with machines on their own natural terms.

REFERENCES

[1] Justine Casella framework for gesture generation and interpretation.MIT Media Lab 20 Ames Street Cambridge, MA 02139-4307

[2] Swapnil Athavale1 Mona Deshmukh. Dynamic Hand Gesture Recognition for Human Computer interaction; A Comparative Study.International Journal of Engineering Research and General Science Volume 2, Issue 2, Feb-Mar 2014 ISSN 2091-2730

[3] Maria eugeniacabrera*, Juan manuelbogado, Leonardo fermin, Raul acuna, Dimitarralev. Glove-based gesture recognition system. CLAWAR 2012 – Proceedings of the Fifteenth International Conference on Climbing and Walking Robots and the Support Technologies for Mobile Machines, Baltimore, MD, USA, 23 – 26 July 2012

[4] Piyush Kumar, JyotiVerma and Shitala Prasad. Hand Data Glove: A Wearable Real-Time Device for Human-Computer Interaction. International Journal of Advanced Science and Technology Vol. 43, June, 2012

[5] FaridParvini, Dennis McLeod, Cyrus Shahabi, BaharehNavai, BaharakZali, ShahramGhandeharizadeh. An Approach to Glove-Based Gesture Recognition. Computer Science Department University of Southern CaliforniaLos Angeles, California 90089-0781[fparvini,mcleod,cshahabi,navai,bzali,shahram]@usc.edu

[6] Siddhartha S. Rautaray, AnupamAgrawal. REAL TIME HAND GESTURE RECOGNITIONSYSTEM FOR DYNAMIC APPLICATIONS. International Journal of Unicom (IJU), Vol.3, No.1, January 2012

[7] HervéLahamy * and Derek Litchi.REAL-TIME HAND GESTURE RECOGNITION USING RANGE CAMERAS. Department of Geomatics Engineering, University of Calgary, 2500 University Dr NW, Calgary, Alberta, T2N1N4Canada - (hdalaham, ddlichti)@ucalgary.caCommission I, WG I/3

[8] Praveen Kumar Sharma1, Shreya Sharma. Evolution of Hand Gesture Recognition: A Review. International Journal Of Engineering And Computer Science ISSN: 2319-7242 Volume 4 Issue 1 January 2015, Page No. 9962-9965.

[9] Tatsuya Fujii, Jae Hoon Lee, Member, IAENG and Shingo Okamoto.Gesture Recognition system for human- robot interaction and its application to robotic service task. Proceedings of the International MultiConference of Engineers and Computer Scientists 2014 Vol I, IMECS 2014, March 12 - 14, 2014, Hong Kong.

[10] EbrahimAghajari, DamayantiGharpure. Real Time Vision-Based Hand Gesture Recognition for Robotic Application. International Journal of Advanced Research in Computer Science and Software Engineering. Volume 4, Issue 3, March 2014 ISSN: 2277 128X.