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Gesture Recognition for 3D Human Computer Interface: A Review

Ramandeep Kaur[1], Vijay Laxmi[2]

[1]M.Tech
Department of Computer Science and Engineering,
Guru Kashi University, Talwandi Sabo,
Punjab, India
er.ramandeep7@gmail.com

[2]Associate Professor,
Department of Computer Science and Engineering,
Guru Kashi University, Talwandi Sabo,
Punjab, India
cse_vijay2003@yahoo.co.in

Abstract: ***In today's world every individual is surrounded by smart technology. Everyone needs a technology that can interact and work. Research is going on to develop new methods of man-machine interfaces that are more user friendly. Touch based interaction has become a common method to operate mobile phones and tablet PCs. Another gesture recognition technology uses a camera that 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. Gesture recognition enables humans to interface withthe machine (HMI) and interact naturally without any mechanical device i.e. without any physical contact. Thispaper presents a survey on different Gesture recognition ways currently in use and under research.***

Keywords:Gesture, Human Machine Interface (HMI), 3-Dimension, recognition**.**

1. INTRODUCTION

Gestures are expressive, meaningful body motions involving physical movements of the fingers, hands, arms, head, face, or body with the intent of: Conveying meaningful information or Interacting with the environment. A gesture may also be perceived by the environment as a compression technique for the information to be transmitted elsewhere and subsequently reconstructed by the receiver. Gesture recognition has wide-ranging applications as shown in Figure 1.

With the computer technology continues to grow up, the importance of human computer interaction is enormously increasing.Nowadays most of the mobile devices are using a touch screen technology.However, this technology is still not cheap enough to be used in desktop systems.

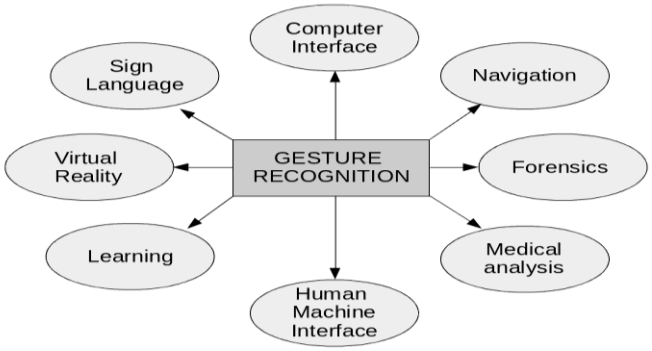

Figure 1: Applications of gesture recognition

Creating a virtual human computer interaction device such as mouse or keyboard using a webcam and computer vision techniques can be an alternative way for the touch screen. In literature, finger tracking based a virtual mouse application has been designed and implemented using a regular webcam [1]. The motivation was to create an object tracking application to interact with the computer, and develop a virtual human computer interaction device. "Many researchers in the human computer interaction and robotics fields have tried to control mouse movement using video devices. However, all of them used different methods to make a clicking event.

1.1HAND AND ARM GESTURES

This kind of human-machine interfaces would allow a user to control a wide variety of devices through handgestures. Most work in this research field tries to elude the problem by using markers, marked gloves or requiring asimple background. Glove-based gesture interfaces require the user to wear a cumbersome device, and generally carry a load of cables that connect the device to a computer. Figure2 shows the strategy for implementation of image capture andrecognitionprocess.

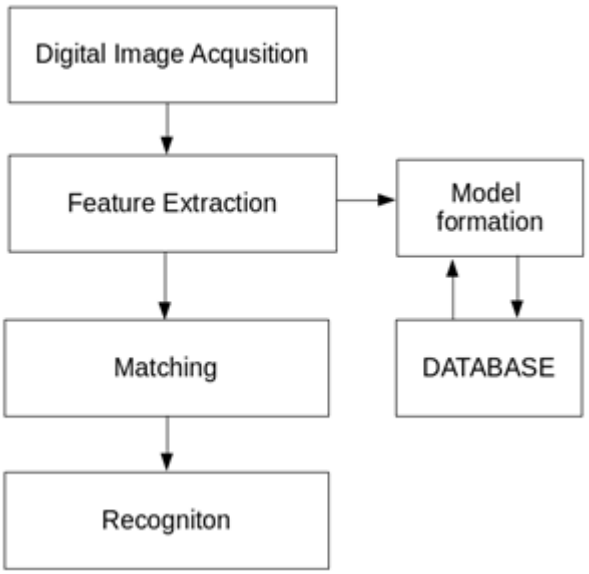

Figure 2: Basic algorithm for image recognition

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 [2]. Another technique is the virtual reality using camera for detecting hand gestures as shown in Figure 3. 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 [3].

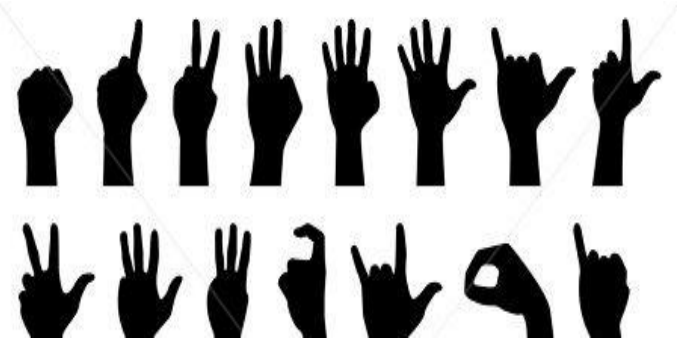

Figure 3: Different hand gestures

Wang et al. present a work where hand gesture detection is used in three applications: animated character inter-action, virtual object manipulation, and sign language recognition [5].

1.2 HEAD AND FACE GESTURE

An automatic facial expression recognition system generally comprises of three crucial steps [6]: face acquisition, facial feature extraction, and facial expression classification. Facial feature extraction attempts to find the most appropriate representation of the face images for recognition. There are mainly two approaches: holistic template-matching systems and geometric feature-based systems [7]. In holistic systems, a template can be a pixel image or a feature vector obtained after processing the face image as a whole. In the latter, principal component analysis and multilayer neural networks are extensively used to obtain a low-dimensional representation. In geometric feature-based systems, major face components and/or feature points are detected in the images. The distances between feature points and the relative sizes of the major face components are computed to form a feature vector. The feature points can also form a geometric graph representation of the faces.

2. VISION BASED HAND GESTURE RECOGNITION

In vision based hand gesture recognition system [6], the movement of the hand is recorded by video camera(s). This input video is decomposed into a set of features taking individual frames into account. The hands are isolated from other body parts as well as other background objects. The isolated hands are recognized for different postures. Since, gestures are nothing but a sequence of hand postures connected by continuous motions, a recognizer can be trained against a possible grammar. With this, hand gestures can be specified as building up out of a group of hand postures in various ways of composition, just as phrases are built up by words. The recognized gestures can be used to drive a variety of applications. The approaches to Vision based hand posture and gesture recognition are:

3. 3D HAND MODEL BASED APPROACH

Three dimensional hand model based approaches rely on the 3D kinematic hand model with considerable DOF's, and try

to estimate the hand parameters by comparison between the input images and the possible 2D appearance projected by the 3D hand model. Such an approach is ideal for realistic interactions in virtual environments. This approach has several disadvantages that have kept it from real-world use. First, at each frame the initial parameters have to be close to the solution, otherwise the approach is liable to find a suboptimal solution (i.e. local minima). Secondly, the fitting process is also sensitive to noise (e.g. lens aberrations, sensor noise) in the imaging process. Finally, the approach cannot handle the inevitable self-occlusion of the hand.

4. APPEARANCE BASED APPROACH

This method use image features to model the visual appearance of the hand and compare these parameters with the extracted image features from the video input. Generally speaking, appearance based approaches have the advantage of real time performance due to the easier 2D image features that are employed. There have been a number of research efforts on appearance based methods in recent years. A straightforward and simple approach that is often utilized is to look for skin colored regions in the image. Although very popular, this has some drawbacks like skin colour detection is very sensitive to lighting conditions. While practicable and efficient methods exist for skin colour detection under controlled (and known) illumination, the problem of learning a flexible skin model and adapting it over time is challenging. This only works if we assume that no other skin like objects is present in the scene. Another approach is to use the eigenspace for providing an efficient representation of a large set of high-dimensional points using a small set of basis vectors.

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Author Profile

Er. RamandeepKaur, I have received my B.Tech degree in Computer Science & Engineering from GianiZail Singh

College of Engineering and Technology, Bathinda (under Punjab Technical University, Jallandhar) in 2010 and pursuing M.Tech degree in Computer Science & Engineering from Guru Kashi University, Talwandi Sabo (Bathinda). My Research area is Digital Image Processing.

Dr Vijay Laxmireceived her B.Tech degree in computer science & Engineering from SLIET Longowal in 2003, and Ph.D degree in Computer Science & Engineering in year 2012. Her research area is Grid Computing & OCR. She has published 25 research papers in various National/International Conferences and Journals. At present, she is engaged in Guru Kashi University, Talwandi Sabo, and Punjab as Dy. Dean Research and an Associate Professor in Computer Science Engineering & Information Technology department.