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Gesture Analysis

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Abstract – *In the area of Human-Computer Interaction (HCI), Gesture recognition is the robust and extemporaneous mode of communication. The traditional way to interact with the computer was utilizing the input devices such as a joystick, keyboard, touch-screen, and mouse. But this kind of devices does not provide a natural interface. If moved towards the area of communication denotes to apportion the noetic conceptions, In the case of ordinary people, a way of communication is verbalization. But if speech and hearing impaired people have taken into consideration around 500,000 to 2,000,000 people use dactylology to apportion their celebrations. Therefore, the objective of gesture recognition is to establish a system which will help in the identification of specific human gesture in order to convey the information or in case of contrivance control. There are many areas where gesture recognition finds the application categorically in the community of deaf people. It is additionally utilizable in the reduction of hardware contrivances which generally use to control the operation of the computer. The paper presents a survey about various techniques, algorithms, and methods of gesture recognition. Various techniques discussed are digital image processing using color segmentation, image filtering, and image segmentation, template matching, and skin detection. There are two groups of gesture recognition which are vision-based method and glove based method. Mostly preferred technique of data collecting is vision based data collection technique. Different algorithms like Template matching feature extraction analysis, the Active shapes model, principal component analysis, linear fingertip models, and casual analysis are discussed in the paper.*

Keywords- *Digital image processing, Computer vision, Glove based, Vision based, Human computer interaction (HCI).*

INTRODUCTION

Communicare or the communico are Latin words from which/ the word communication is derived which denotes to apportion. It includes imparting of information. This impartation includes indicting, reading, or the utilization of visual signs. The way of communication for the mundane people is verbalization, but in the case of auditory impaired or imbecilic people way of communication is only dactylology. The prominent dactylology use by the auricular discerning impaired community is ASL (American dactylology). It is soundless communication which customarily done by utilizing hands, body language, or visages. This language uses planarity different grammar or vocab. Ergo it is arduous for the mundane people to understand such type of designation language. So there is a need to engender the bridge of communication between mundane people and the auditory perception impaired community.

The objective of the proposed work is gesture recognition in order to create a communication bridge between normal people and hearing impaired people.

Paper presents the survey about different techniques, algorithm, and methods of gesture recognition.

In the proposed system, Recognition is done in two ways either by wearing the data glove or by using the web camera in order to capture the hand image. A first and important step towards gesture recognition is gesture tracking and segmentation. In the case of a data glove based method, some sensors are used in order to accumulate gesture configuration and different movements. The process of digitization of hand and finger motion is done by sensor devices, Whereas In case of vision based method, the only web camera is required in order to keep the interaction between humans

and Computers. Different algorithms of gesture apperception, their advantages and disadvantages are discussed in this paper.

The term segmentation is utilized to find the connected region within the image, which can be on a different substructure such as color, the relationship between pixels, or intensity.

LITERATURE REVIEW

Some research has been done in the area of gesture recognition.

Xiaohui et al. proposed a data glove-based gesture recognition method. Initially, binary format of the raw data which has transmitted by using wireless data glove can obtain with the help of serial port. Structure data format along with gesture information is being transformed, from which based on the data definition. Then conduction of spouse decomposition is done on gesture information which has dictionary part & weight part after which SVM classifier is being used for final reset. Good real time high recognition rate can be obtained with this algorithm

Trigueiro et al. presented the composition in order to recognize the gesture of two datasets, efficiency comparison of district classifiers has been done. All the above efforts describe how much importance gesture recognition has in this present world.

Rautaray et al. Proposed a vision-based hand gesture this is which is specifically for object manipulation. In a virtual environment controlling the action of the mouse has replaced by a hand gesture. Some predefined commands have used for the virtual object manipulation. This method faced some challenges like noisy environment which creates a big contravention about recognition of the gesture. Three phases of the gesture recognition system have explained which are image preprocessing, tracking & recognition. Real time hand gesture recognition system uses for dynamic applications.

Paulo et al. [4] Vision based referee sign language recognition system. Author proposed a system which is able to interpret dynamic & static gesture of referee. Interpretation about the gesture of referee is being taken by the system & sent to the referee box which helps to send proper commands to the robots. This system is divided into modules 1) real time hand tracking & 2) feature extraction. Static hand posture identification is done by SVM (support vector machine), HMM is to recognize dynamic unistroke hand gesture control of the different system state transmits is done by FSM.

Watanabe et al. [5] proposed a method for interactive system which is able to perform the interacting. Eigen space which is constructed by using multi input image sequences contain self occlusion & confusion. Recognition of such type of complicated gesture also can be recognized. Degree information speed & magnitude can be obtained with the help of this method.

Manresa et al. [6] presented real time author to interact with the videogame which have the conception of touching & recognizing. Hand gesture algorithm is divided into three hand segmentation, tracking & gesture recognition by using feature. As human skin have different characteristics therefore, author used the color cue in the initial step i.e. hand segmentation after which second step used is tracking while performing the tracking concept of pixel labeling approval has used while tracking velocity kept constant. With the help of information which obtained is being extracted which further fed to FSM classification in order to identify the hand tracking & gesture recognition for HCS (human computers interaction).

Keck et al. [7] presented a frame work in order to detect & model the BD static occlusion which can be used in case of multi camera scenarios as well as for wide baseline can be used in a case where the no. of farmers are very small. concept of interactive learning procedure

used in this framework in which the problem of voxel occupancy is solved by using occlusion model whose solution can be use for updating of occlusion model.

Methodology

The process of gesture recognition starts by collecting the data by different sources. There are two different methods to collect the raw data which considered as an input to the gesture recognition system. In the first approach, the user needs to wear the input device which has the skill to measure different joint angles of the hand and six degrees of freedom tracking. In this method, the knowledge about hand position and data orientation can get with the help of instrumented gloves. The second approach to collect the input for gesture recognition system is the computer vision-based approach, In this approach, images of the user's hand are being collected with the help of one or more cameras. The image processing routine is to collect the random number of images captured by using web camera per second. The position of the hand is being founded with the help of 3D triangulation as well as gesture recognition

A. Data glove based method

In this approach of gesture recognition, Instrumented gloves are used in order to measure the finger movement. The instrumented glove is made up of the sensors which are mounted on the back side of the hand.

Thomas defined and Daniel Sadin had developed the glove for the application of National Endowment of the arts. The glove consists of flexible tubes in which light-based sensor is used which have the conception of the light source at one end and the photocell on the other end. According to bending of fingers the variation of light hits the photocell has taken place. Measure of finger flexion. Metatarsophalangeal joints and the interphalangeal joints of-of all the fingers have measured with the help of the glove.

Digital data entry glove had invented by Gary Grimes at bell telephone laboratories, in 1981.

It uses some sensors like knuckle-bend-sensors, proximity sensors, tilt sensors, and inertial sensors in order to replace the conventional keyboard.

In order to check thumb of the user is touching to other fingers or another part of the hand. When contact made, Silver filled rubber pads are used to send an electrical signal. Joint's flexion is being measured by using knuckle bend sensors. Tilt in the horizontal plane is measured with the help of two tilt sensors. Two inertial sensors are used to measure the flexing of the wrist and twisting of the forearm.

Limitations of the glove-based approach

In the case of the glove-based approach, for gesture recognition hardware is the necessity. And this hardware is for the specific purpose. The same kind of hardware can't be used for different application. It is unable to perform gesture recognition other than the application of ASCII character entry.

VPL research has developed data glove and z glove

This system is developed for a specific application which requires handling of the objects with the help of hand, finger spelling, and assessment of hand destruction through the devices which are general purpose. Five to fifteen sensors have used in order to measure flexion of proximal interphalangeal joints and meta phalangeal joints of all fingers along with the thumb. It measured for 10 DOF (Degree of freedom).

Abduction sensors are used to measure angles between adjoined fingers. Flexible tubes are used to make this kind of sensors whose wall is reflective. It has a light sensor at its one end and a photosensitive detector at another end. It helps to detect reflected light rays as well as direct light rays. Electrical resistance changes as per the bending of the tubes. Here electrical resistance is a function of light intensity.

Co-industries introduced a space glove in 1991. In such glove plastic ring need to place in between Meta phalangeal joints and proximal inter phalangeal joints. User should wear such ring in his finger and thumb. The flexicon of the Meta carpophalangeal joints is being measured with the help of A to D converter, which is of 12-bit.

Nissha electronics invented a super glove. It can have 10 minimum no. sensors and 16 maximum no. of sensors. It uses a different kind of resistive ink which is being applied to the flexible boards sewn inside the glove, according to its configuration. It is generally used to

measure the flexion of the proximal interphalangeal joints as well as metatarsophalangeal joints of all fingers. This type of gloves is feasible for both the left and right hand.

The type of glove which is constructed by using either 18 or 12 bend sensor known as a cyber-glove. It uses to measure the flexion of both meta phalangeal as well as proximal interphalangeal joints of all fingers. It also measures the angle between the finger which is known as abduction angle, wrist pitch, and wrist roll.

Limitation of input devices based on the glove approach is user need to wear gloves in order to recognize the gesture. Therefore it brings restriction on freedom of movement.

Vision-based approach

This is a robust approach to collect input in order to recognize the gesture. It is divided into four categories very first is how many numbers of cameras being used and how is the camera being placed for rumbustious recognition, visibility of hands for which track should be maximized. In that placement of the camera plays an important role. Otherwise, vision-based tracking faces many problems with the occlusion. A second and important component is an abstraction of hand data for which hands should be more visible to the camera. In order to recognize the gesture. Feature extraction is the third component in which features are being extracted from the raw input data. Forth and the last component is that extracted features are being passed through the recognition algorithms.

Comparison table

Distinct algorithmic techniques

In the determination of any posture or gesture. It is important to analyze the data collected by passing it through the various algorithms. That various algorithms are an analysis of feature extraction, the technique of principal component, causal analysis, the technique of template matching, Models of the linear fingertip, Active shapes model. Different techniques are discussed here along with their advantages and disadvantages.

The technique of feature extraction

For the production of higher-level semantic information, low-level information which is collected from raw data is being analyzed. After which that higher level information is being used in recognition of the gesture. This system gives 97% accuracy in gesture recognition.

Causal analysis

In this method, with the help of knowledge of actions from the scene is being taken place, with the help of a video stream. Combination and normalization of the features analysis are done by using the gesture analysis filter and causal knowledge about the interaction of the human with the physical world object is being recorded.

Template matching

This technique is used to verify whether the obtained data record belongs to a set of stored data records or not. In this method firstly template has created by doing the collection of data values of every posture in the posture set, After which the comparison of sensor reading and given set is taken placed in order to find matching.

Linear fingertip Models

The method is based on the assumption that only less no. of finger movements are rotational, mostly the finger movements are assumed to be linear.[9]

Active shape model

In this method, the feature has been located in the still image, this method is also known as ‘Smart Snakes’. For processing, contour has been used, where the contour is the shape of the feature. Contour manipulation is being carried out by its movement in the direction of nearby edges which force the contour to deform in order to fit in the feature

Analysis of principal component

The statistical technique in which reduction dimensionality of the data set is being carried out. It is the Transformation of new data set in place of the old data set. Because of the transformation advantage is most of the variation can get from the first variable.

CONCLUSION

Gesture apperception provides an intriguing interaction paradigm in different computer applications. The consequential part about different technology of gesture

apperception is accumulating raw data from input contrivances

There are two types of technologies available in order to accumulate the raw data from the input. The glove predicated technology which gives the quantification of the number of joint angles in the hand. In the glove predicated technology precision depends on which type of bend technology has been used. Cost of the glove differs according to its precision. most cost the glove have, the more the precision it has. Another way of accumulating data is vision predicated technology. It requires one or more cameras in order to record kinetics of the gesture. All the time users do not wear the data glove so vision predicated technology can instauration this arduousness. If some constraints are evaded vision predicated data amassment technology is the best one. Variants of algorithmic techniques withal discussed in the paper, which are template matching, Active shape model, causal analysis feature extraction.

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