Gesture Recognition System

Mr. Tushar Tavate[1] Mr. Desmond Fernandes[2] Mr. Avinash Yadav[3] Prof. P. G. Magdum[4]
[1,2,3]Student [4]Assistant Professor
[1,2,3,4]Department of Computer Engineering
[1,2,3,4]Rajendra Mane College of Engineering and Technology, Ambav, Ratnagiri, India

Abstract— The idea to make something useful for the human-machine interaction has led us to the Gesture Recognition System. Since, human-machine interaction is one of the most emerging and trending technologies these days, the idea of creating an accurate gesture recognition system was formed. The system focuses on creative communication between machine and person, and also provides some functionality to do the basic required actions and use the intricate function of our hands to interact with the machine in an immersive way. After connecting device to the machine/computer, the device is switched on and the user can use the device as an input peripheral.

Key words: Gesture, HCNF, illumination, HMM

I. INTRODUCTION

Human-computer interaction has received a great amount of attention among the computer science community. The interest of this subject arises from the need of developing more intuitive mechanisms for humans to interact with computers and robots. In the recent literature, we can find works dealing with voice-based interfaces, special interface devices and gesture-based interfaces. The hand gesture is especially appealing for this kind of interfaces because it is, after oral communication, the second more important modality of interaction between humans. In the same way as oral communication, it does not require physical contact so; there are negligible interferences in the message passing phase. Gesture recognition can be defined as the recognition of significant expressions of human motion intended to communicate some information. Human gestures can be performed using fingers, hands, arms, the head and facial or body posture expressions. In particular, this work deals with hand gestures. That is, gestures performed using fingers, arms and hand pose. We have developed a computer vision system to recognize specific hand gestures. The main contribution of this work is the combination of hand geometry and color information of interesting regions in the image of a person interacting with a computer. The proposed system is fast enough to enable the recognition of hand gestures in real time. Hand detection and recognize is an important and hot research issue in the field of human-computer interaction because the host of gestures have great potential to be used to interact and control computers efficiently in the near future. With the high adoption of the built-in camera in the laptop, mobile phone and tablet, the huge number of applications of hand detection have been designed and demonstrated. However, most of them lack practical value to the majority of users. In this paper is driven by a simple idea: a keyboard and mouse-free input system.

II. LITERATURE SURVEY

During the previous decades, Human-Computer Interaction Techniques expressed by multi-touch technology have excited many concentrations of masters in the world, and have been perpetually famous in our day-to-day life. However, the current Contact Interactions based products are no longer satisfied by customers. They prefer to have behaviour recognition system that possessing beyond performance on handling comfort and convenience. Recently, a gesture recognition as a novel Human-Computer Interaction Technique has been widely studied for its incomparable advantage: diversity, ambiguity and difference in, time and space. And it is also an as image processing, pattern recognition and computer vision, etc. A comprehensive survey of computer vision-based human motion capture literature from the past two decades is presented. The main attraction is a general overview depends on a taxonomy of system capabilities, fall into four processes: initialization, tracking, pose estimation, and recognition [1]. The Fuzzy C-Means algorithm to classify the hand gesture since it has good speed in recognizing gestures with sufficient accuracy for real-time operation [2]. With the evolution of information technology in our society, we can anticipate that computer systems to a great extent will be implanted into our environment. These environments will impose needs for new types of human-computer-interaction, with interfaces that are natural and easy to use [3]. Hand posture can be defined as the static movement, holding the hand with specific pose is a posture, for example, a victory sign, pointing, and thumbs up. While in a complex posture, the fingers could be bent at any angle [4]. The features of hand gestures give an alternative to unmanageable interface devices for the systematic framework of the proposed method includes two main steps: feature extraction and classification with the HCNF classifier [5].

III. PROPOSED SYSTEM

The Leap Motion controller is a small USB peripheral tool and which is planned to be arranged on a physical desktop, facing in upward direction. It can also be mounted onto a virtual reality headset. Using two monochromatic IR cameras and three infrared LEDs, the tool notices a harshly hemispherical area, to a distance of 1 meter. The LEDs forms pattern-less IR light and the cameras forms almost 200 frames per second of reflected data. This is then passed through a USB cable to the host computer, where it is examined by the Leap Motion software with the help of "complex maths" in such a way that hasn't been published by the company, in some way synthesizing 3D position data by differentiating the 2D frames generated by the two cameras.

IV. EXISTING SYSTEM

The existing system consist of following device for interaction with system:

- Keyboard
- Mouse
- Gamepad or Joystick

V. SYSTEM ARCHITECTURE

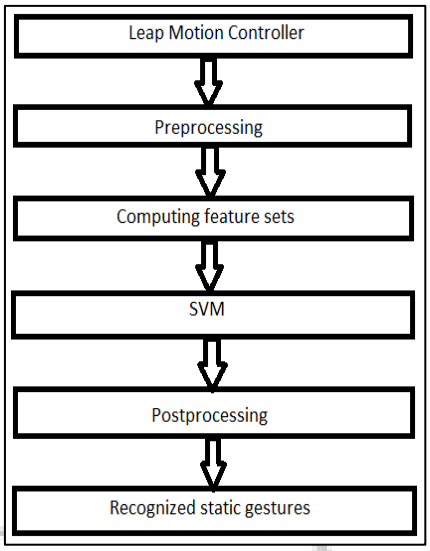

Fig. 2: System Architecture

VI. LEAP MOTION CONTROLLER

A. Controller

Leap Motion is an USB sensor device released in July 2013 by Leap Motion Inc., designed to provide real time tracking of hands and fingers in three-dimensional space with 0:01 mm accuracy. It allows a user to get information about objects located in device's field of view (about 150 degree with distance not exceeding 1 meter) Details of how Leap Motion performs 3D scene capturing have not been revealed by Leap Motion, Inc. However, it is known that hardware consists of three infrared LEDs which are used for scene illumination, while two cameras spaced 4 cm apart capture images with 50–200 fps framerate, dependant whether USB 2.0 or 3.0 is used.

Fig. 2: Leap Motion controller with Micro–USB plug

B. Data Access

Unlike Microsoft Kinect, Leap Motion does not provide access to raw data in the form of a cloud of points. Captured data is processed by proprietary drivers supplied by vendor and accessible through API. Leap Motion was intended to be a human-computer interface, not a general purpose3D scanner, so it is optimized for recognizing human hands and pointy objects. The main data container we get from Leap Motion API is a Frame. Average framerate while using dual core laptop and USB 2.0 interface, is 50 frames per second. One frame consists of hands, fingers, point tables (objects directly visible by a controller), and additional information, like gestures recognized by simple built-in recognition mechanism, frame timestamp, rotation, translation, and scaling data. For purposes of this project, we have created our own data format. It contains only information necessary for us and allows to easily save captured frames to file, and read them later for processing and testing purposes.

VII. TECHNOLOGY

The Leap Motion controller is a tiny USB peripheral tool that is designed to be mounted on a physical desktop, facing in the upward direction. It can also be placed onto a virtual reality headset. With the help of two monochromatic IR cameras and three infrared LEDs, the tool observes a harshly hemispherical area, to a distance of about 1 meter. The LEDs forms pattern-without IR light and the cameras form almost 200 frames per second of reflected data. This is then passed through a USB cable to the host computer, where it is analysed by the Leap Motion software with the help of "complex maths" in such a way that hasn't been published by the company, in some way synthesizing 3D position data by differentiating the 2D frames formed by the two cameras.

VIII. ALGORITHMS

A. Hidden Markov Model

A hidden Markov model (HMM) is an analytical Markov model in that the structure being modified is considered to be a Markov process with unnoticed (hidden) states. An HMM can be represented in the simple strong Bayesian system. In simpler Markov models (like a Markov chain), the situation is straight detectable to the observer, and hence the state transition possibilities are the only specifications. In a hidden Markov model, the situation is not straight detectable, but the outcome, based on the state, is detectable. A hidden Markov model can be assumed as a conception of combination model where hidden variables, which control the combine component to be considered for every assumption, are related through Markov process rather than independent of each other.

B. Euclidean Distance

Euclidean distance is a commonly used definition of distance. It is the distance between two points in the m-dimensional space. In two-dimensional and three-dimensional space, Euclidean distance is the distance between two points, enlarge to n-dimensional space, Euclidean distance is determined as:

d = sqrt(sum(sq(xi-yi))) , i = 1, 2,…..,n.

C. K-Means Clustering

K-means clustering aims to separate n considerations into k clusters in which every consideration belonging to the cluster with the closest mean, helping as a prototype of the cluster. This results in separation of the data space into

Voronoi cells. The algorithm initially randomly selects k starting points and iteratively performs two steps utilizing the idea of expected-maximization.

IX. CONCLUSION

In the light of this, it is concluded that the system will be an effective mediator between machine and human. Using the system, the user will have an immersive and a fun experience while operating the system. The product will be easy to use at the same time being intricate. Thus, making it very useful in various domestic and industrial work which require human finesse.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude towards our guide, Mr. P. G. Magdum for the help, guidance and encouragement, he provided during the B. E. Project. This work would not have been possible without his valuable time, patience and motivation. We would like to thank him for making our stint thoroughly pleasant and enriching. It was a great learning and an honor being his students. We are deeply indebted to Mr. M. Y. Gadkari (Head of Department) and Mr. P. G. Magdum (Project Coordinator) and the entire team in the Computer Department. They supported us with scientific guidance, advice and confidence, they were always cooperative and passionate and this inspired us in our work. We take the privilege to express our sincere thanks to Dr. M. M. Bhagwat, our Principal for providing the encouragement and much support throughout our work.

REFERENCES

[1] Thomas B. Moeslund and Erik Granum, "A Survey of Computer Vision-Based Human Motion Capture", Computer Vision and Image Understanding, 2001.
[2] Xingyan Li, "Gesture Recognition Based on Fuzzy C-Means Clustering Algorithm", The University of Tennessee Knoxville, 2003.
[3] G. R. S. Murthy and R. S. Jadon, "A Review of Vision Based Hand Gestures Recognition", International Journal of Information Technology and Knowledge Management, Volume 2, No. 2, 2009, pp. 405-410.
[4] Rafiqul Zaman Khan and Noor Adnan Ibraheem, "Survey on Gesture Recognition for Hand Image Postures", International Journal of Computer and Information Science, Vol. 5, No. 3; May 2012.
[5] Wei Lu, Member, IEEE, Zheng Tong, and Jinghui Chu, "Dynamic Hand Gesture Recognition with Leap Motion Controller", Volume. 23, September 2016,pp. 1188 – 1192.

