International Journal of Infinite Innovations in Technology|ISSN:2278-9057
IJIIT|Volume-IV|Issue-I|2015-2016 July|Paper-03
Reg. No.:20150603|DOI:V4I1P03

Multi-touch Interaction with Gesture Recognition

Deepali *Shrikhande*[#1], Prof. Ajitkumar khachane[*2]

Department of Information technology
VIYALANKAR INSITUTE OF TECHNOLOGY, MUMBAI UNIVERSITY
Deepali.shrikhande@vit.edu.in
Ajitkumar.khachane@vit.edu.in

ABSTRACT

In this paper we are going to build a system that learns and recognizes multitouch gestures – movements of human fingers on a multitouch surface. Consider a multi-touch gesture a gesture which can be performed on a multi-touch device like a tablet using more than one hand at the same time. A multi-touch gesture is rich in information. We can record from such gesture the position of each finger and its movement as well as the synchronization between the different fingers movements involved in same gestures. The focus is on camera based multi-touch techniques, as these provide a new dimension to multi-touch with its ability to recognize objects. The goal with this table, and the accompanying gesture recognition system, is to create an open and affordable multi-touch solution, with the purpose of bringing multi-touch out to the masses. By doing this, more people will be able to enjoy the benefits of a more natural interaction with computers.

Keywords*: Multitouch, gesture recognition, GUI.*

I. INTRODUCTION

In a wide variety of tasks, continuous graphical interaction using several fingers allows users to communicate information to a computer faster and more fluently than single-point graphical interaction techniques.

The human factors governing multi-touch interaction, with special emphasis on finger coordination. Continuous multi-touch methods are emerging as a valuable form of high-degree-of-freedom input, yet few guidelines exist to aid the designer of multi-touch interfaces.

Multi-touch screens enable capture of movements of multiple human fingers on an interactive surface. In gesture recognition technology, a camera reads the movements of the human body and after being processed for image recognition they are communicated to a computer that uses the gestures as input to control devices or applications. The captured gestures are processed for image recognition

A multi-touch gesture is a gesture which can be performed on a multi-touch device like a tablet using more than one finger at the same time. A multi-touch gesture is rich in information. We can record from such gesture the position of each finger and its movement as well as the synchronization between the different fingers' movements involved in same gestures. Multi-touch interfaces play an important role in everyday life. They are present everywhere: incorporated in wide range of technologies like smart phones, tablets and table tops. They can replace traditional input devices like keyboards or mouse when performing lightweight and mobile tasks like surfing the Internet, doing presentations.

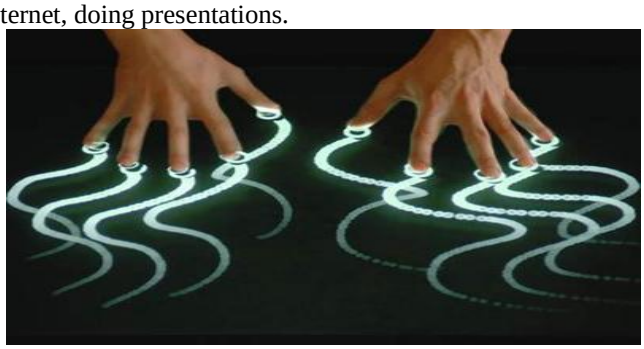


Fig 1.touch gestures

II. BACKGROUND OVERVIEW

A. Existing System

The most natural way to understand our environment is to touch and examine surrounding objects to conceive their meaning. Small children naturally use their hands to discover the world around them and by doing so they make their first learning experiences.

The motivation for this project is more effective, efficient and natural interfaces to support access to information, applications and people.

Multi-touch technology can be useful for the implementation of gesture to text conversion, object recognition, pattern recognition and many more resulting in the revolution which will merge the physical world to the digital world thereby making life simpler and faster

Single Touch

Single Touch occurs when a finger or stylus creates a touch event on the surface of a touch sensor or within a touch field so it is detected by the touch controller and the application can determine the X,Y coordinates of the touch event. These technologies have been integrated into millions of devices and typically do not have the ability to detect or resolve more than a single touch point at a time as part of their standard configuration.[3]

Single Touch with Pen Input

Single Touch with Pen input functionality can range from a simple, inactive pointer or stylus to complex, active tethered pens. Inactive pens enable the same input characteristics as a finger, but with greater pointing accuracy, while sophisticated, active pens can provide more control and uses for the touch system with drawing and palm rejection capabilities, and mouse event capabilities. [3]

Single Touch with Gesture

Enhancements to firmware, software and hardware by many single touch technologies have increased their touch functionality. Some touch technologies can use advanced processing capabilities to "detect" or recognize that a second touch event is occurring, which is called a "gesture event." Since single touch systems can't resolve the exact location of the second touch event they rely on algorithms to interpret or anticipate the intended gesture event input. Common industry terms for this functionality are two-finger gestures, dual touch, dual control, and gesture touch. [3]

Two Touch

Two Touch refers to a touch system that can detect and resolve two discrete, simultaneous touch events. The best demonstration of Two Touch capability is to draw two parallel lines on the screen at the same time. Two Touch systems can also support gesturing.[3]

Multi-touch

Multi-touch refers to a touch system's ability to simultaneously detect and resolve a minimum of 3+ touch points. All 3 or more touches are detected and fully resolved resulting in a dramatically improved touch experience. Multi-touch is considered by many to become a widely-used interface mainly because of the speed, efficiency and intuitiveness of the technology.

A multi-touch gesture is a time series of the set of x-y coordinates of finger touch points captured as the gesture is being performed. Each set consists of multiple touch points, each from one fingertip. However, it is not known which fingertip corresponds to which touch point, as the system orders them based on how users lay their fingertips down.

Moreover this order may vary from one time instance to another even within the same gesture. As a result, a set of touch points ordered by the system cannot be directly compared with another.

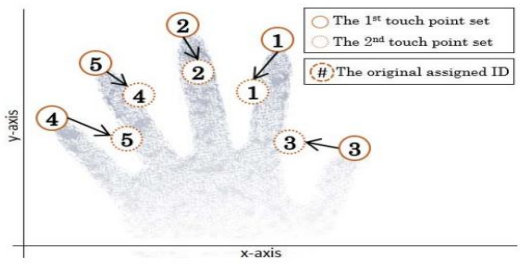


Fig.2 Multitouch gesture mapping

Advanced gestures made by the user or multiple users to initiate a set of reported touches that trigger a response from the application. These gestures have become the new standard of touch interactivity due to the surge in popularity of modern consumer devices such as smart phones and tablets. Multi-touch gestures include pinch and expand, zoom, rotate, as well as advanced multi-touch gestures which include several fingers simultaneously touching the screen such as multi-finger drag (2, 3, 4, 5 finger), multi- finger drag, and multi-finger flick [1]

Multi-touch Gestures

Advanced gestures made by the user or multiple users to initiate a set of reported touches that trigger a response from the application. These gestures have become the new standard of touch interactivity due to the surge in popularity of modern consumer devices such as smartphones and tablets. Multi-touch gestures include pinch and expand, zoom, rotate, as well as advanced multi-touch gestures which include several fingers simultaneously touching the screen such as multi-finger drag (2, 3, 4, 5 finger), multi- finger drag, and multi-finger flick.

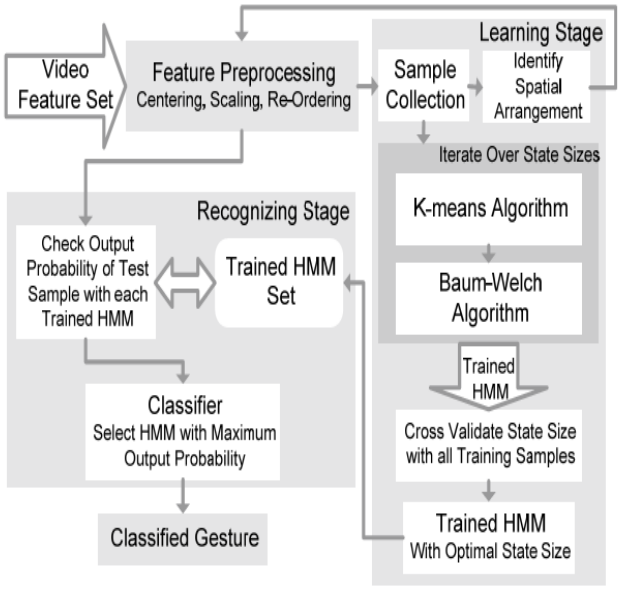


Fig 3.image processing pipeline

Learning and Recognition Pipeline

Computationally, we define a gesture as a human action that begins with placing one or more fingers on the interactive surface, and ends when no fingers remain on the surface. A sequence of frames from a camera is captured to record each gesture. For each frame of the sequence, a feature set is derived by an open source video processing and feature acquisition toolkit, and used to recognize the gesture through a pipeline of processing stages. Figure 3 shows the stages involved in the learning and recognition pipeline.

Training Set

Our goal is to build a practical system that uses natural movements of the hand to perform complex actions within an application. To start, we developed a vocabulary of 40 different gestures for testing the current learning and

recognition system. The gestures were formed to exemplify subtle differences in initial positions of the fingers and directions of movement. They are grouped by the number of fingers used to perform each one. Twenty samples of each gesture were collected from each of 10 users, 9 male and 1 female, all of whom are right-handed. We expect that the ability to recognize a vocabulary of gestures with subtle variations, such as the direction of movement of the thumb in gestures will be critical for developing expressive applications.

Feature Preprocessing

The feature preprocessing stage normalizes the data in the X, Y feature space to allow the gesture to be recognized irrespective of where it was performed on the screen. The samples of the training set are also scaled to a constant size for improved recognition.

The ordering of the fingers in the feature set provided by video processing is determined by the temporal order of placement of the fingers on the surface in the first frame of a gesture. Without preprocessing, this ordering is inconsistent across different samples of the same gesture, which is a problem for the learning and recognition system. We develop a solution to this problem of consistent feature ordering, which identifies the spatial arrangement of fingers as horizontal, vertical, or radial. The spatial arrangement is identified for the first frame of each gesture during the learning stage, and then applied during preprocessing during subsequent frames.

Learning Stage:

To learn gestures, we have randomly selected 20 samples of each gesture from across all users. the remaining samples are used to determine the accuracy of classification of the recognition system. During the learning phase, after the observations have been collected and preprocessed, they are passed to a K-means clustering algorithm.

The K-means clustering efficiently forms an initial estimate of the HMM parameters. The estimate is, in turn, passed to the Baum-Welch algorithm, which tunes these parameters to return a high probability for only the given training sample sequences.

Recognition Stage

For each sample to be recognized, we pass the sample into each trained HMM. The probabilities output from each HMM are collected and compared. We label the sample as the multitouch gesture whose model returns the highest probability.

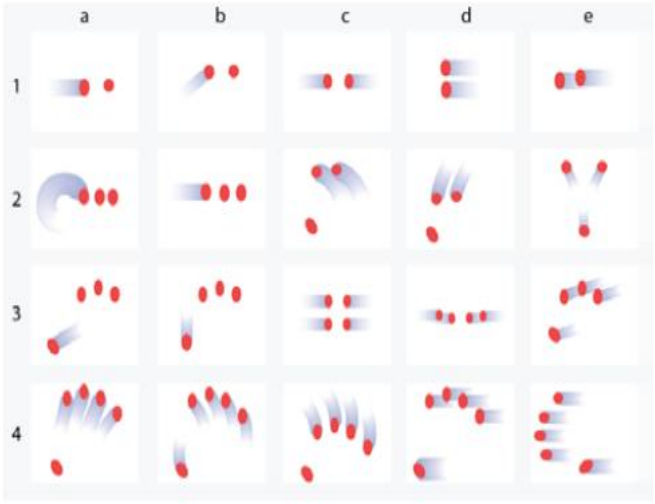
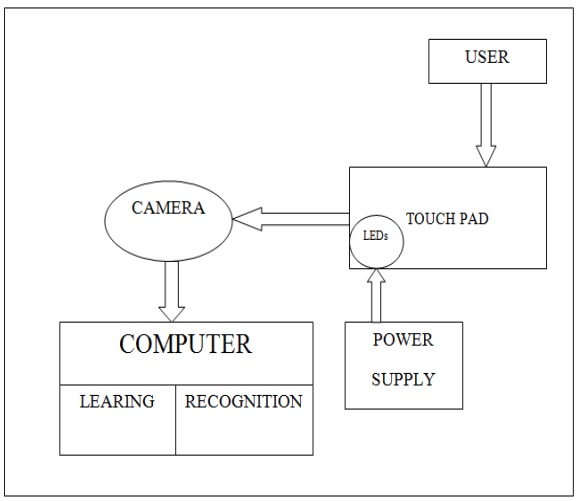


Fig . 4 touch gestures

III. THE PROPOSED SYSTEM

A system is to be built to learn and recognize multi touch gestures. The user will perform various multi touch gestures on a touch pad. LEDs are connected on the touch pad to illuminate the gestures performed. Power supply is given to the LEDs that make them glow and the gestures performed are made visible. The camera records the gestures. The captured image of the hand performing a particular gesture is originally in RGB format. It is converted to HSV format. Various image processing operations like color filtering , erosion, dilation, smoothing and thresh holding are performed to detect the blobs. Through a learning algorithm the gestures will be stored on the computer. Each gesture is then assigned a particular task

For recognizing the gestures the user will again performs the particular gesture. The camera will record it and compares it with the recognizing algorithm. The recognizing algorithm will then search for the particular gesture and the operation assigned to that gesture is then performed. The gestures are stored through an algorithm in which the x, y co-ordinates of the points of the gestures is calculated and the slope values are found. For recognition these slope values are compared and the particular pattern will be recognized.[5]



IV. SCOPE & APPLICATIONS

Gesture recognition is useful for processing information from humans which is not conveyed through speech or type. There are various types of gestures which can be identified by computers. Some areas where gesture recognition can be used are given below

- SIGN LANGUAGE RECOGNITION
- CONTROL THROUGH FACIAL GESTURES
- EYE TRACKING
- ALTERNATIVE COMPUTER INTERFACES
- IMMERSIVE GAME TECHNOLOGY

V. CONCLUSION

In the work, goal with this table, and the accompanying gesture recognition system, is to create an open and affordable multi-touch solution, with the purpose of bringing multi-touch out to people. The learning algorithm will be implemented for different gestures and when these gestures were performed again the recognizing algorithm will recognize them. Different tasks will be assigned to the gestures and accordingly they will be performed.

REFERENCES

[1] Napa Sae-Bae, Nasir Memon "Multitouch Gesture-Based Authentication", IEEE Transactions On Information Forensics And Security, Vol. 9, No. 4, April 2014

[2] Daniel Wood," Methods For Multi-Touch Gesture Recognition"

[3]http://solutions.3m.com/wps/portal/3M/en_US/TouchTopics/Home/Terminology/WhatIsMultitouch/

[4]Francisco R. Ortega, Naphtali Rishe, Multi-Touch Gesture Recognition Using Feature Extraction

[5] Sashikanth Damaraju, Andruid Kerne , " Multitouch Gesture Learning and Recognition System"

[6] Siddharth S. Rautaray, Anupam Agrawal, Real Time Hand Gesture Recognition System For Dynamic Applications, International Journal Of Ubicomp (Iju), Vol.3, No.1, January 2012.

[7] Rafiqul Zaman Khan, Noor Adnan Ibraheem , Hand Gesture Recognition: A Literature Review , International Journal Of Artificial Intelligence & Applications (Ijaia) , Vol.3, No.4, July 2012

[8] David Mcneill, University Of Chicago, Gesture: A Psycholinguistic Approach.

[9] Ala Abdulhakim Alarik, Azizah Abdul Manaf ,Touch Gesture Authentication Framework For Touch Screen Mobile Devices, Journal Of Theoretical And Applied Information Technology 20TH April 2014. Vol. 62

[10] Jangwoon Kim, Jewan Park, Hyungkwan Kim Chilwoo Lee , Hci(Human Computer Interaction) Using Multi-Touch Tabletop Display