



HCI GAME USING HAND GESTURES

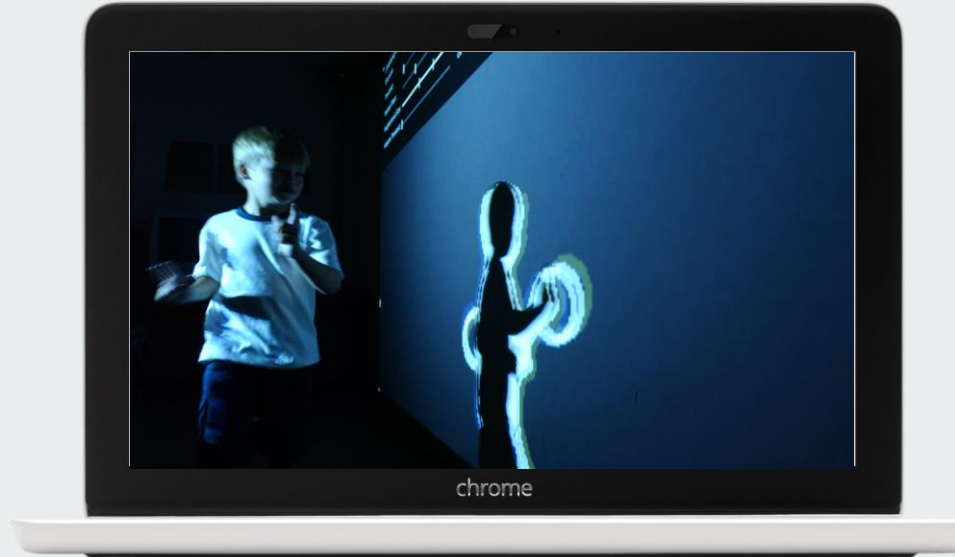
Review 1 Human Computer Interaction

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Outline

INTRODUCTION

PROBLEM STATEMENT

PROPOSED WORK

OUR CONTRIBUTION

WHY IT'S BETTER THAN EXISTING
SOLUTION

TECHNOLOGY USED

TOOLS

PROGRAMING INFORMATION

REFERENCES



Problem statement

To create a human computer interaction video game which can be played with the help of hand gestures. The primary objective is to provide a fun and interesting way of playing a video game and to provide users a much more natural and an adaptable way of controls as compared to the present traditional keyboard. It also proves to be of great help to the disabled people who have issues with utilizing the traditional methods of input. This form of human – computer interaction is improving every day and has a lot of potential in the future for development and usage in everyday life. Thus, we are trying to design a user friendly game where random obstacles would be created for the player who must dodge them in order to achieve a high score and can be played easily by anyone.

Introduction

From the recent years there has been an increased extent in trying to introduce a number of human-to-human communication modalities in HCI, one of which is human hand gestures. Human hand gestures can provide a natural and visceral alternative to some incompatible devices. We can use hand as a device to interact and communicate with computers as we do in our daily lives to interact with each other. We use our hand to point a person or an object, express or carry information about something, and to move, modify and transform an object. Exactly the same way we can use our hand to gesticulate while speaking to convey ideas. It is required to provide a way to explore the use of gestures in HCI so that it can be interpreted by computers. Gesture recognition based interactions, provide a more realistic and immersive interaction compared to traditional peripherals. The gesture based interaction interface showcased here can be applied towards many applications like virtual reality, communication techniques and Games. The focus of our project is on games as the application domain for this interaction method.



PROPOSED WORK

01

Paper Title	Gesture Recognition using Microsoft Kinect
Year of publishing	2014
Author names	K. K. Biswas
Objective	A method to recognize human gestures using a Kinect depth camera.
Technique used	<ul style="list-style-type: none"> The depth sensor consists of an infrared laser projector combined with a monochrome CMOS sensor The depth map is visualized here using colour gradients from white (near) to blue (far) <p>FEATURE EXTRACTION</p> <ul style="list-style-type: none"> CLAP: Clapping CALL: Hand gesture to call someone GREET: Greeting with folded hands • WAVE: Waving hand NO: Shaking head sideways – “NO” YES: Tilting head up and down – “YES” CLASP: Hands clasped behind head REST: Chin resting on Hand <p>Pre – processing</p> <p>A. Isolate the human making the gestures from the background scene. This is done by background subtraction from the depth image of the scene. This was done by using auto thresholding</p> <p>B. Features from ROI A region of interest (ROI) is created by placing a 14x14 grid on the extracted foreground. The gesture is parameterized using depth variation and motion information content of each cell of the grid.</p> <p>C. Training and Testing Each frame of the video was represented by a row of the matrix. The columns represent the feature points</p>



PROPOSED WORK

02

Paper Title	Vision-Based Hand Gesture Recognition and Applications
Year of publishing	2015
Author names	
Objective	<ul style="list-style-type: none"> The main objective faced by a vision based hand gesture recognition system include recognition in complex background, in dynamic background, in presence of multiple gestures in the background, under variable lighting condition, under different viewpoints etc
Technique used	<p>Vision-based hand gesture recognition methods can be classified into two categories:</p> <ul style="list-style-type: none"> Machine Learning based approaches: For a dynamic gesture, by treating it as the output of a stochastic process, the hand gesture recognition can be addressed based on statistical modelling, such as PCA, HMMs The second category is Rule based approaches: Rule based approaches consist of a set of pre-encoded rules between feature inputs, which are applicable for both dynamic gestures and static gestures. <p>Hand Detection</p> <p>Gesture Recognition</p> <p>Performance Comparison</p> <ul style="list-style-type: none"> compare the mean accuracy and mean running time between FEMD based hand gesture recognition system and Shape Context shape matching algorithm <p>Applications</p> <ul style="list-style-type: none"> Sudoku game: The user selects a square by hovering his hand over it and pushes once. He/she then commands a number to be filled into the square by performing the corresponding hand gesture



PROPOSED WORK

03

Paper Title	Design and implementation of a flexible hand gesture command interface for games based on computer vision
Year of publishing	2017
Author names	Aashni P Haria , Archanasri Subramanian , Nivedhitha Asokkumar, Shristi Poddar, Jyothi S Nayak
Objective	1.The main objective can successfully replace such devices (e.g. keyboard or mouse) needed for interacting with a personal computer 2. Maintain real time performance and a more intuitive and natural interaction between the user and the computer
Technique used	1. Segmentation: they consider the difference in colour of the palm region due to the presence of a red colour decoration on the fingertips and on the middle of the palm of the Bharatanatyam dancer. In order to deal with is, they used texture based segmentation as a basic segmentation technique to differentiate the hand from the background instead of using skin colour segmentation which would not detect the red colour areas as a part of the hand 2. Feature Point Extraction: After the hand region is obtained, the next step is to extract the contour of the hand. This method brings down the computational costs. the biggest contour was chosen as the contour of the hand palm after which the contour was simplified using polygonal approximation. The hand contour was obtained using the graham scan algorithm and to compute the convex hull of the hand. 3.Detection Module: Our main intention is to recognize static and dynamic hand gestures with the support of a depth camera. A large number of methods have been utilized for pre-processing the image which includes algorithms and techniques for noise removal, edge detection, smoothening followed by different segmentation techniques for boundary extraction i.e separating the foreground from the background. Tests and Results <ul style="list-style-type: none">• The first priority was to verify the posture analysis and recognition strategy



PROPOSED WORK

04

Paper Title	Interaction with Virtual Game through Hand Gesture Recognition
Year of publishing	2019
Author names	<u>Siddharth S. Rautaray</u> ; <u>Anupam Agrawal</u>
Objective	Ease the game development so that developers can easily use it to produce educational computer games for end-users.
Technique used	<ol style="list-style-type: none">Hand Gesture Vocabulary<ul style="list-style-type: none">Our framework targets to be used to produce the educational computer games with hand gesture interaction for preschool children. Hence we first need to define a hand gesture vocabulary for this purpose.We establish a hand gesture vocabulary closely related to preschool children education, so that children can answer simple questions using these hand gesturesFramework Overview<ul style="list-style-type: none">Design a game authoring tool named authoring GUI in which the game script and game component are created.Hand Gesture Recognition<ul style="list-style-type: none">The recognition component is responsible for gaining images from camera, segmenting hand gestures from images, and finally recognizing hand gestures.SegmentationHand Gesture Feature ExtractionRecognitionExperiments on Recognition Rate<ul style="list-style-type: none">Experiments to test our hand gesture recognition rate for five types of hand gestures. For each type of gestures we do 50 times to recognize them to find the average recognition rate.



PROPOSED WORK

05

Paper Title	Human Computer Interaction using Hand Gestures and Voice
Year of publishing	2019
Author names	<u>Prajakta Dhamanskar , Aniket C Poojari ;Harshita S Sarwade; Renita R D'silva</u>
Objective	<p>1. It eliminates motion blur and is able to detect gestures like clicking and also hand tracking</p> <p>2. A voice module is integrated to receive voice commands from the user and perform it. This enables intuitive HCI and interactive motion gaming.</p>
Technique used	<p>1.Speech to Text conversion: In the voice part a speech to text conversion library is used to convert the spoken commands of the user to text.</p> <p>2.Command Check: The text received is then analysed to perform a specific task. User can switch easily between the two parts.</p> <p>3.) Deep Learning object detection: A model is used to give the exact bounding box of the hand in the image.</p> <p>4) Skin colour Thresholding: This converts the skin colour part of the bounding box which contains the hand into white and the rest into black.</p> <p>3) Contour extraction and polygon approximation: Helps in finding the maximum area contour which is the hand.</p> <p>4) Convex hull and convexity defects extraction: Helps in finding the fingertips in the image.</p> <p>5).Experiment and results</p> <ul style="list-style-type: none">• It can be used on a real robot on which we can set up the operations to be performed upon recognizing the commands.• these object detectors can be used in autonomous driving research to detect vehicles, street signs and also pedestrians. This survey provides a broad introduction to the field of hand posture and gesture recognition as a mechanism of interaction with computers

Our Contribution

The proposed project has a promising future of the forthcoming pro-digital era as currently the game focuses on breaking the norms of current gaming industries by hand gesture recognition system. The method chosen i.e. hand gesture recognition would provide better indulging gaming due to better physical enhancement and a more realistic interaction between the user and the interface. The project requires no large space for playing and proves its adaptability and is highly user friendly nature. Thus, the game can even be played in a virtual space by the player. Due to the involvement of physical activities the user will have better health and will not lose his physique even if the user is playing in the long run.





Why it's better than existing solutions

Existing methods or models currently which are played on laptop majorly uses keyboard and mouse. Gestures provide the user with a new form of interaction that mirrors their experience in the real world. They feel natural and require neither interruption nor an additional device. Furthermore, they do not limit the user to a single point of input, but instead offer various forms of interaction.

The keyboard, mouse etc. lack the sensitivity desired in required application. Eventually the researchers working the area of Human Computer Interaction made a common emphasis to design and develop the user interfaces capable enough fulfil the intended performance criteria desired in the dynamic environment.

And the games we have displayed have easier movements to grasp onto and learn. It would take less time to get habituated to them and play efficiently. Palm open and close are the easiest movements one can grasp whereas other methods have very difficult gesture options. We have divided the screen into parts for the user to interact in an efficient way.



Technology Used

1. Touchless Interface

Touchless User Interface is an arising sort of innovation corresponding to motion control. Touchless UI (TUI) is the way toward telling the PC through body movement and motions without contacting a console, mouse, or screen. Touchless interface in addition to gesture controls are becoming widely popular as they provide the abilities to interact with devices without physically touching them.

There are a number of devices utilizing this type of interface such as, smartphones, laptops, games, television, and music equipment.



Technology Used

2. Input Device:

Gesture Based Controllers

These controllers act as an extension of the body which allow users to interact with their surrounding without controllers, when gestures are performed, some of their motions are conveniently captured by the software. One of the example of emerging gesture-based motion capture is skeletal hand tracking, which is being developed for virtual reality and augmented reality applications.

Standard webcam

A standard web camera present over PC's can be used for gesture recognition where the resources/environment would be convenient for other forms of image-based recognition.



Tools

PyCharm python IDE – This IDE is chosen over the rest because it is cross-platform and for accessing smart built in developer tools, scientific tools and customizability.

Webcam drivers – It is used to recognize the webcam associated with that device and for proper functioning of the webcam.



Programming Information

We will be using **Python** language and **Python** libraries and some API's for coding of the project. Python is easy to understand and is best for programming of large projects. Some of the libraries and API's we are going to include in our projects are:

- **Tensorflow:** TensorFlow is a Python library for fast numerical computing created and released by Google. It is a foundation library that can be used to create Deep Learning models directly or by using wrapper libraries that simplify the process built on top of TensorFlow. It was created and is maintained by Google and released under the Apache 2.0 open source license. The API is nominally for the Python programming language, although there is access to the underlying C++ API.
- **OpenCv:** The given library is used to access the webcam when the code is run for gesture recognition.



Programming Information

- **Multiprocessing:** Multiprocessing is a package that supports spawning processes using an API similar to the threading module. The multiprocessing package offers 13 both local and remote concurrency, effectively sidestepping the Global Interpreter Lock by using sub processes instead of threads.
- **Cv2:** OpenCV is a cross-platform library using which we can develop real-time computer vision applications. It mainly focuses on image processing, video capture and analysis including features like face detection and object detection.
- **Nes py:** nes-py is an NES emulator and OpenAI Gym interface for MacOS, Linux, and Windows based on the SimpleNES emulator.

References



- S. Belongie, J. Malik, and J. Puzicha. Shape matching and object recognition using shape contexts. IEEE Trans. on PAMI, 2002.
- M. Bray, E. Koller-Meier, and L. V. Gool. Smart particle filtering for 3d hand tracking, Sixth IEEE International Conf. 2004.
- Choi, Yoo-Joo., Lee, Je-Sung, Cho. We-Duke. A Robust Hand Recognition in Varying Illumination. Advances in HCI, Shane Pinder (Ed.), 2006.
- Le T N, Cong D T, Ba T N, et al. Contour Based Hand Gesture Recognition Using Depth Data. International Conference on Signal Processing, Image Processing and Pattern Recognition, 2013.
- Kang S K, Mi Y N, Rhee P K. Colour Based Hand and Finger Detection Technology for User Interaction. International Conference on Convergence and Hybrid Information Technology. IEEE, 2008.
- Human Computer Interaction using Hand Gestures and Voice IEEE , 2019.
- Interaction with virtual game through hand gesture recognition IEEE ,2019.
- Ananya Choudhury, Anjan Kumar Talukdar, Kandarpa Kumar Sarma| A Review on Vision-Based Hand Gesture Recognition and Applications | IGI Global PA August 2015 |IEEE,2019.
- Jing-Hao Sun, Ting-Ting Ji, Shu-Bin Zhang, Jia-Kui Yang, Guang-Rong Ji | Research on the Hand Gesture Recognition Based on Deep Learning | 2018 12th International Symposium on Antennas, Propagation and EM Theory (ISAPE) | IEEE,2018.