

VISION BASED CURSOR CONTROL USING HAND GESTURE RECOGNITION SYSTEM

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ABSTRACT

Hand gesture recognition is very significant for human-computer interaction. The proposed system is vision based, which uses machine learning techniques and inputs from a computer webcam. In our framework, the hand region is extracted from the background with the background subtraction method. Then, fingers are segmented so as to detect and recognize the fingers. Finally, a rule classifier is applied to predict the labels of hand gestures. The experiments on the data set of 1300 images show that our method performs well and is highly efficient. Moreover, our method shows better performance than a state-of-art method on another data set of hand gestures.

Keywords: *Hand gesture, open cv, machine learning.*

1. INTRODUCTION

Computers have made numerous advancement in both fields of Software and

Hardware, Still the basic way in which Humans interact with computers remains the same, using basic pointing device (mouse) and

Keyboard or advanced Voice Recognition System, or maybe Natural Language processing in really advanced cases to make this communication more human and easy for us.

Our proposed project is the Hand gestures recognition system to replace the basic pointing devices used in computer systems to reduce the limitations that stay due to the legacy systems such as mouse and Touchpad. The proposed system uses hand gesture, mostly no of fingers raised within the region of Interest to perform various operations such as Play, Pause, seek forward, seek back word in video player .The proposed system can be used to control various soft panels like HMI systems using hand gestures with help of programming by within python using pyautogui module to facilitate interaction within different functions of computer through the Camera to capture video frames.

2. SCOPE

The scope of this project is to build a real time gesture classification system that can automatically detect gestures. In order to

accomplish this objective, a real time gesture based system is developed to identify gestures. The main priority of this system is to simple, easy and user friendly without making any special hardware. All computation will occur on single PC or workstation. The hand gestures are recognized based on cursor control and virtual keyboard. Our primary objective in doing this project was to build a device inspired from Leap motion.

3.LITERATURE SURVEY

- “*Research on the Hand Gesture Recognition Based on Deep Learning*” by Jing-Hao Sun ; Ting-Ting Ji ; Shu-Bin Zhang ; Jia-Kui Yang ; Guang-Rong Ji. The main goal is the rapid development of computer vision, the demand for interaction between human and machine is becoming more and more extensive. The paper realizes the segmentation of hand gestures by establishing the skin color model and then, the area of hand gestures which has been detected in real time is recognized by convolutional neural network so as to realize the recognition of 10 common digits. Experiments show 98.3% accuracy.
- “*Hand gesture recognition using deep learning*” by Soeb Hussain ; Rupal Saxena ; Xie Han ; Jameel Ahmed

Kha; Hyunchul Shin, 2017. In order to offer new possibilities to interact with machine and to design more natural and more intuitive interactions with computing machines, our research aims at the automatic interpretation of gestures based on computer vision. In this paper, we propose a technique which commands computer using six static and eight dynamic hand gestures. The three main steps are: hand shape recognition, tracing of detected hand (if dynamic), and converting the data into the required command. Experiments show 93.09% accuracy.

- “*Hand Gesture Feature Extraction Using Deep Convolutional Neural Network for Recognizing American Sign Language*” by MdRashedulIslam ; Ummey Kulsum Mitu ; Rasel Ahmed Bhuiya, Jungpil Shin, 2018. Human-Computer Interaction (HCI) is a fascinating field about the interaction between humans and computers. Interacting with computers, human Hand Gesture Recognition (HGR) is the most significant way and the major part of HCI. In this proposed model, Deep Convolutional Neural Network (DCNN) is used for extracting efficient hand features to recognize the American Sign

Language (ASL) using hand gestures. Finally, the Multi-class Support Vector Machine (MCSVM) is used for identifying the hand sign, where CNN extracted features are used to train up the machine. Distinct person hand gesture is used for validation in this paper. The proposed model shows satisfactory performance in terms of classification accuracy, i.e., 94.57%.

- *“Real-time hand gesture recognition with EMG using machine learning”* by *Andrés G. Jaramillo ; Marco E. Benalcázar, 2017.* In this paper, we propose the development of a model for real-time hand gesture recognition. We use surface electromyography (EMG) and Machine Learning techniques. The primary goal of this research is to obtain a real-time hand gesture recognition model for various applications in the field of medicine and engineering.dimensionality).
- *“A Robust Hand Gesture Recognition Method via Convolutional Neural Network”* by *Xing Yingxin ; Li Jinghua ; Wang Lichun ; Kong Dehui, 2016*

This paper proposes a robust method for hand gesture recognition based on convolutional neural network, which is utilized to automatically extract the spatial and semantic feature of hand

gesture. Our method consists of a modified Convolutional Neural Network structure and data preprocessing, which corporately increase hand gesture recognition performance. The experimental results on both Cambridge Hand Gesture Dataset and self-constructed dataset show that the proposed method is effective and competitive.

4. MODEL AND WORKING OF PROPOSED SYSTEM

In order to reduce the effects of illumination, the image can be converted to chrominance colour space which is less sensitive to illumination changes. The HSV colour space was chosen since it was found by to be the best colour space for skin detection. Background subtraction was then performed to remove the face and other skin colour objects in the background. Morphology Opening operation (erosion followed by dilation) was then applied to efficiently remove noise. A Gaussian filter was applied to smooth the image and give better edge detection. Edge detection was then performed to get the hand contour in the frame. Using the hand contour, the tip of the index finger was found and used for hand tracking and controlling the mouse movements. The contour of the hand was also used for gesture recognition.

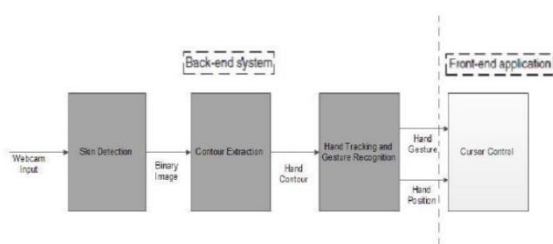


Fig1 : Flow chart of main components

Skin detection using colour information has recently gained a lot of attention, since it is computationally effective and provides robust information against scaling, rotation and partial occlusion. In the proposed method, the HSV colour space was used with the Histogram-based skin detection method.

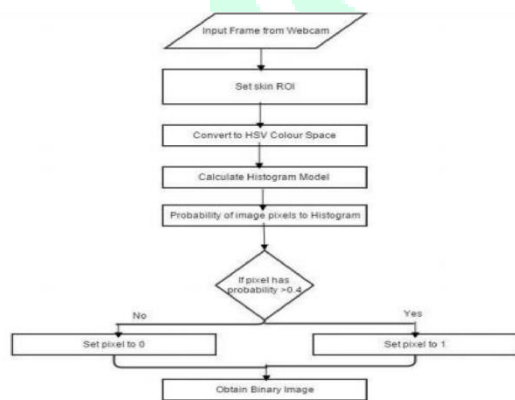


Figure 2 : Skin Detection Algorithm

The HSV colour space has three channels, Hue (H), Saturation(S) and Value (V). The H and S channels hold the colour information, while the V channel holds the intensity information. The input image from the webcam would be in the RGB colour space. The Histogram-based skin detection method

proposed by uses 32 bins H and S histograms to achieve skin detection. Each pixel in the image is then evaluated on how much probability it has to a histogram model. This method is also called Histogram Back Projection. The result would be a grayscale. In the contour extraction process, we are interested in extracting the hand contour so that shape analysis can be done on it to determine the hand gesture. The assumption was made that the hand is the only moving object in the image and the face remains relatively stationary compared to the hand. This means that background subtraction can be applied to remove the stationary pixels in the image, including the face region. This is implemented in the “BackgroundSubtractorMOG2”. Once the hand gestures are recognized, it will be a simple matter of mapping different hand gestures to specific mouse functions. It turns out that controlling the computer cursor, in the python programming language is relatively easy.

Table 1 : Operations Performed based on Number of fingers detected

Number of Fingertips Detected	Operations Performed
One	forward
Two	Volume up
Three	Forward
Four	backward
Five	Close

Each color in the profile produces a binary image which in turn are all summed together. A nonlinear median filter is then

applied to get a smooth and noise free binary representation of the hand.

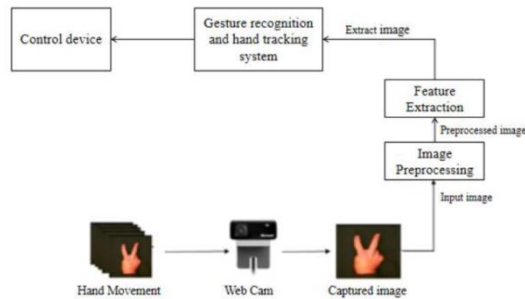


Fig 3 : System Architecture Diagram

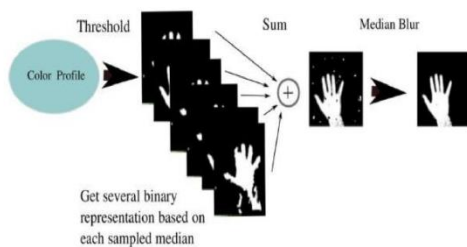
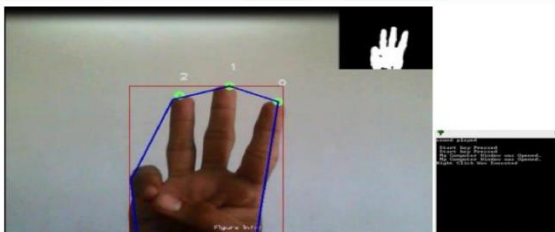


Fig 4 : Hand gesture recognition



This detects 3 fingertips and hence three fingers.

Fig5 : Hand Gesture Recognition output

The properties determining whether a convexity defect is to be dismissed if: $Length < 0.4lbb$ $Angle > 800$ The analysis results in data that can be of further use in gesture recognition: Fingertip positions ,Number of fingers ,Number of hands , Area of hands.

5. CONCLUSION AND RESULT

The system was able to control the movement of a Cursor by tracking the users hand. Cursor functions were performed by using different hand gestures. improve the performance of the software especially hand tracking in the near future. And we also want to decrease the response time of the software for cursor movement so that it can completely be used to replace our conventional mouse.

6. REFERENCES

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