

Gesture Controlled Web Game

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ABSTRACT

Gesture Recognition is a technique which is used to interpret human gestures with the help of machines. Use of this technique is increasing at an exponential rate and has many applications including entertainment, healthcare, sports. Times have changed and so did the customer preferences. Nowadays, more and more people don't want to use touchscreens. Many of us think it's unhygienic to use a touchscreen of a public device such as an informational table, especially in times of the pandemic. To remove the cost barrier and focusing on customer preferences hand gesture recognition algorithm is used. The basic aim of this research is to create a gesture-controlled game. The game would be totally played using hand gestures. The underlying algorithm utilizes only computer-vision techniques. The tool is able to recognize gestures in real-time.

Keywords—Gesture recognition, computer-vision, neural network

I. INTRODUCTION

With the development in technology, and as humans tend to naturally use hand gestures in their communication process to clarify their intentions, hand gesture recognition is considered to be an important part of Human Computer Interaction (HCI), which gives computers the ability of capturing and interpreting hand gestures, and executing commands afterwards.

Recent years witnessed an increased research interest in the development of natural, intuitive user interfaces. Such interfaces have to remain invisible to the users, allowing them to unobtrusively interact with an application, without the need of specialized and costly equipment. They have to support a natural interaction and be adaptable to the user without imposing elaborate calibration procedures. At the same time, they have to fulfil their role in real-time, with accuracy, and provide robustness against background clutter. These various requirements and their inherent complexity still provide significant challenges for researchers.

Hand gesture recognition is divided into static and dynamic gesture recognition, static gesture recognition is the recognition of hand shape, read out the meaning of hand expression, and dynamic hand

gesture recognition is the recognition of hand motion trajectory in space, and then perform the corresponding operation based on obtained trajectory parameters, such as for the playing courseware on the projection, hand gestured can be used to flip up and down, pause, start, etc.

Vision based gesture recognition takes use of the camera to capture hand gestures to system, and after image preprocessing such as detection and segmentation to extract features of extracted image sequence to understand and describe its behavior. When one or more cameras obtain the video stream of user gestures, the system will monitor whether there are hand gestures contained in the data stream according to the interactive mode of gesture, if there are, separates them. Then choose appropriate method to detect and extract features, and choose appropriate classifier to recognize the gesture in current image. The greatest advantage of vision-based hand gesture recognition is that the input is simple with lower dependence on equipment, and it is in line with the people's daily interaction, therefore, vision-based hand gesture recognition is bound to be the new pursuit of human-computer interaction.

II. LITERATURE SURVEY

This chapter focuses on research, covering relevant literature relating to this project on touchless hand gesture based human computer interaction. Appropriate journals, books, Internet sites will be used to gather the relevant literature. The literature also involves previous studies that aimed at development of similar systems.

Rios-Sorial[1] they presented a technique to detect hand gestures using computer vision techniques. They tuned the algorithm to detect six gestures at real time using only the web camera.

Rataray[2], they implemented system with the C++ and openCV. In this they used camera to recognize hand position using Haar Cascade and further finding convex hull of this contour. These points obtained are interpreted as commands for the virtual game.

Many techniques on HOG (Histogram of Gradient) like [3] have been proposed in the past which employ edge and gradient based descriptors for hand gesture recognition. But they are only able to detect hand

gestures in a simple background and are liable to fail when the background is cluttered.

The authors in [4] putted up with a method based on hand characteristic curves, the result of combination of color, motion and edge information, this method can reduce the dependence on hand segmentation, but the computation is too complex, and the real-time performance is poor.

Human hand gestures integrated with vocal language and facial expressions make the communication process more interactive and convenient for user. There are many application areas for human hand gestures based human computer interface including virtual gaming, security, sign language recognition [5][6]. Human Computer Interaction using human hand gestures requires a human hand recognition system that can recognize and classify variety of the hand gestures in real time.

Paper [7] extracted the edge pixels of hand gesture, took use of the idea of model-based matching using Hausdorff distance to realize the recognition of Chinese alphabet, the method proposed had advantages of small computation and strong adaptability but disadvantages of ignoring the situation of rotation, scaling and skin color interfere.

III. PROPOSED METHODOLOGY

Gesture Recognition

Gestures can be described as different types of human movements. These can be two dimensional or three-dimensional and can be specific to the hand, arm or body movements as well as facial expressions. (Hoffman et al (2004)). Gesture recognition enables humans to interface with the machine and interact naturally without any external devices such as the keyboard. It is a method of assigning commands to the computer (machine) to perform specific tasks. This project will be focusing specifically on hand gesture, as they are easier to perform and recognize with less effort. Also, the users of the software are going to be a mixed crowd so it might be difficult for some people to perform elaborate gestures.

Image processing

“Images are stored as a collection of pixels.” Color Images consists of a red, green and blue value, which is combined to allow colors to be represented. Grayscale images are different however; “as pixels are represented by a single number ranging from 0 to 255, where 0 is very black and 255 is very white.”

Image processing in computing is used to extract useful information form images to perform some specific tasks. Image processing generally involves three basic steps. Image segmentation, which involves image conversion between different color spaces to minimize the complexity of image.

Skin detection, which gets rid of any unwanted background objects and noises associated with the image. Contour detection, to locate an object in the image.

Color Spaces

A device color space simply describes the range of colors, or gamut, that a camera can see, a printer can print, or a monitor can display . The various color spaces exist because they present color information in ways that make certain calculations more convenient or because they provide a way to identify colors that is more intuitive.

RGB

RGB is an initial for Red, Green and Blue. RGB is one of the most widely used color spaces for processing and storing of digital image data. However, high correlation between channels, mixing of chrominance and luminance data makes RGB not a very favorable choice for color analysis and color- based recognition algorithms

HSV (Hue Saturation Value)

Hue-saturation based colour space is another popular color space that is based on human perception color. Hue defines the major color of an area. Saturation measures the colourfulness of an area in proportion to its brightness. The value is related to the color luminance. It was introduced for users who need to define the color properties numerically. It is easier to implement and also can be converted to and from RGB anytime.

Image segmentation

In computing, segmentation refers to the process of partitioning a image into multiple segments (sets of pixels). The main aim of segmentation is to simplify and/or change the representation of an image into something more meaningful and easier to use and analyze Image segmentation is one of the first step involved in the process of gesture recognition in our case hand gesture recognition. The image captured by the camera cannot be used to track hand or recognize gestures as the image consists of other background objects and exists generally in RGB color space which makes skin detection process complex due to the involvement of different color pixels in the image. So, in order to make the skin detection process simpler, the image needs to be converted to a simpler color space which is easier to analyze and which involves lesser color pixels. After the HSV skin color model is built, it can be used for skin detection.

Skin Detection

Skin color is one of the most important features in the humans. There are lots of color spaces that have been used in early work of skin detection, such as RGB, YCbCr, HSV. Although RGB color space is one of the most used color spaces for processing images, it is not widely used in skin detection algorithms because the chrominance and luminance components are mixed. Some work has been done to compare different skin color space performance in skin detection problems. According to Zarit et al., HSV gives the best performance for skin pixel detection. When building a system, that uses skin color as a feature for detection, several points must be kept in mind like what color space to choose and how to model the skin color distribution.

In this project, “a skin color model based on HSV color space will be built because it has only two components (H, S) which help to speed up the calculations and also the transformations from RGB color space into HSV color space is done using simple and fast transformations”..

Explicitly Defined Skin Region

The first step in skin detection is pixel-based skin detection. This is one of the easiest methods as it explicitly defines skin-color boundaries in different color spaces. Different ranges of thresholds are defined according to each color space components as the image pixels that fall between the predefined ranges are considered as skin pixels (Vezhnevets et al) The simplicity of this method have attracted (and still does) many researchers .

Contour Detection

The term contour can be defined as an outline or a boundary of an object. Therefore, contour detection deals with detecting various objects in an image .Use of contour detection in image processing is to locate objects and their boundaries in Images. Also, output of contour detection shows only the prominent region boundaries leaving behind unwanted edges in the image. Hence, detection of specific objects in the image is only possible through contours So in this project, it is very important to detect contours of the hand before we can extract the hand features from the image taken from the camera.

FLOWCHART

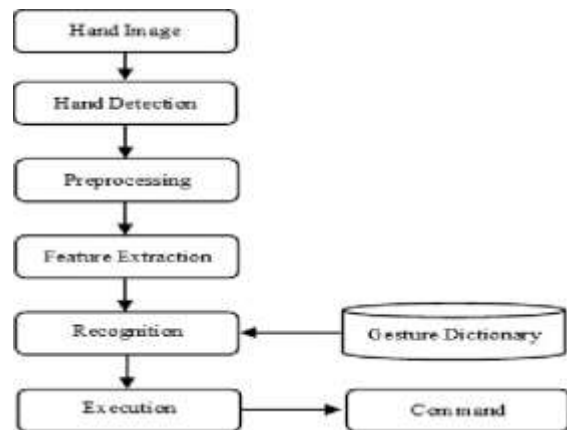


Fig 1

- Use a zero before decimal points: “0.25”, not

Algorithm

1. Start
2. Cv2.VideoCapture(0)
3. Set frame dimensions
4. Capture frame using camera.read()
5. Cv2.cvtColor(COLOR_BGR2GRAY)
6. Remove Noise (cv2.GaussianBlur())
7. If no_of_frames < 30:
8. Calculate cv2.accumulateWeightage()
9. Else :
10. Calculate segmented area
11. If segmented area is not None:
12. Cv2.drawContours()
13. Hull = Cv2.convexHull()
14. areahull = cv2.contourArea(hull)
15. areact = cv2.contourArea(segmented) =
16. If areact !=0:
17. Perform action for game
18. Else:
19. Return to step 4
20. If keypress() == 'q':
21. Break

IV. RESULT

The player’s live video feed would be captured and hand would be detected using convex hull method. Further the points calculated would be feed to the opencv.contourArea() function to perform a specified type of command for the game.

V. CONCLUSION

From reviewing various journals, it is concluded that gesture recognition is a growing industry and it can be used in various fields like healthcare, military and entertainment.

A gesture-controlled game reduces cost and encourages no-touch playing.

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