HAND GESTURE CONTROLLED POWERPOINT PRESENTATION USING OPENCV

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Abstract

A PowerPoint presentation with a slideshow is an attractive and effective technique for speakers to persuade the audience in today's digital age. Slides can be controlled with tools such as mouse, keyboard or laser pointer. Here the user needs to have prior knowledge about the devices. Earlier gesture detection became much important for controlling applications like media players, games and also robots. The usage of gloves and other objects is enhanced by this system. However, previously the use of gloves and markers used to increase the system cost. The proposed gesture detection technology is based on artificial intelligence which relies on the hand gesture detection. As the hand is more clearly visible in webcam and will be detected by proposed system software in power point slide. Thus it will help us draw the audience's attention to power point presentation in a most efficient way.

Keywords: Open Computer Vision, Hand detector, HCI, Presentation slides, Machine Learning.

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1.　Introduction

Human-computer interaction, has gained popularity in recent years because its automaticity, naturalness, and ease of use without the need for input via keyboards and mice. For instance, examining lip movements can be used to determine the language that is spoken, and hand gestures are also widely used in gaming [1]. Although there are several methods for recognizing hand gestures today, including wearables like rings, armbands, gloves, leap motion, controller-based motion detection like the Wii-mote, and conventional methods For instance, examining lip movements can be used to determine the language being spoken, and hand gestures are also used in gaming [2]. A photograph that has the foreground removed. The verified gesture is then utilized to confirm the gesture's sign. The purpose of the proposed study is to integrate artificial intelligence (AI) into a hand gesture recognition system and use it to control digital displays only using hand gestures.

2.　Materials And Methods

Pre-processing plays a vital role in image analysis and computer vision tasks as it aims to enhance image quality and prepare it for further analysis or application-specific purposes. By applying a series of operations to the raw input image, pre-processing helps to eliminate unwanted distortions, reduce noise, improve crucial components, and overall improve the image quality. The specific techniques used in pre-processing may vary depending on the particular application and characteristics of the images being processed. Some common pre-processing techniques include noise reduction, distortion correction, and feature enhancement.
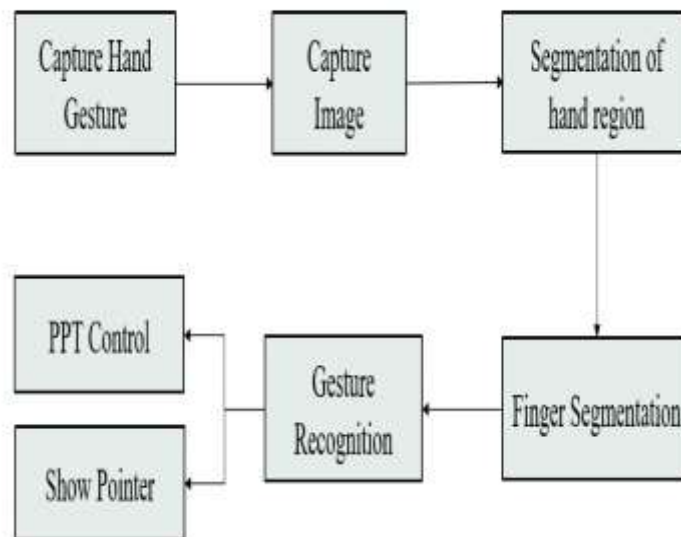
Fig 1. Flow of the System

● 　Choose a portion of the input image where we can look for hands by drawing a boundary around it.
● 　The slide won't be changed until the user makes a gesture in front of the camera.

● 　The slides will change after the hand gesture is recognized.

Working:
User Hand Gestures: The user positions their hand parallel to the webcam and

performs hand gestures within the frame of the video.

Hand Region Extraction: The video from the webcam is processed to extract the hand region. This step aims to isolate the hand from the rest of the scene.

Illumination and Background Considerations: Proper illumination is crucial to minimize errors in hand segmentation. The background should not contain any elements that have a skin color, as it can interfere with the accuracy of the segmentation.

Webcam Resolution: The resolution of the webcam is set to 640 x 480 pixels. This resolution is chosen to ensure a better quality video, which aids in accurate hand region extraction.

Background Subtraction: In real-world scenarios where the background can contain various elements, a background subtraction technique is employed. This technique helps to segment the hand region from other regions in the video by subtracting the static background.

Color Space Conversion: The video obtained from the webcam is typically in the RGB color model. To facilitate the identification of skin regions, the video is converted to the HSV (Hue, Saturation, Value) color model. Skin regions tend to have distinct hue and saturation values in the HSV color space.

Skin Segmentation: Once the video is in the HSV color space, skin segmentation rules are applied to identify regions that are likely to be skin. Typically, hue values between 0.4 and 0.6 and saturation values between 0.1 and 0.9 are used to determine skin regions.

Centroid Calculation and Bounding Box: The centroid of the segmented binary image of the hand is calculated. Additionally, a bounding box is drawn around the hand region to enclose it. The centroid and bounding box provide information about the position and size of the hand in the video frame.

Finger Length Calculation: If the hand is oriented in the vertical direction, the difference in the y-coordinates of the bounding box and the centroid can be used to estimate the length of the largest active finger. This can provide further information about the hand gesture being performed.

Binary Image: The regions that are detected as skin during the segmentation process result in a binary image. In this binary image, skin regions are represented using white color, while non-skin regions are represented as black.

Hand Region Selection: The largest connected region in the binary image that is detected as skin is considered the hand region of interest. This region represents the segmented hand, which will be used for gesture recognition.

Gesture Recognition: The segmented hand region is the region of interest for recognizing gestures. Various techniques, such as pattern recognition, machine learning, or computer vision algorithms, can be applied to analyze the hand region and classify the performed gestures.

IDE USED:
PyCharm
PyCharm is a Python-specific IDE that provides a huge range of critical tools for Python engineers and is securely integrated to provide an environment that promotes productivity.

Libraries
● Open-Source Computer Vision Library is an image processing library that teaches computers intelligence and allows them to view things like humans do. OpenCV is mostly concerned with pictures and videos. Because such digital images are stored in a matrix, when a computer sees a picture, it sees it as a pixel matrix. It is a free library that has been used to perform tasks such as face recognition, tracking of objects, landmark identification, and many more.

```
cap = cv2.VideoCapture(0)
# Camera Setup
cap = cv2.VideoCapture(0)
cap.set(3, width)
cap.set(4, height)
```

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● Hand detector

It detects both the right and left palms. The hand landmark model accurately locates 21 3D hand-knuckle coordinates inside the identified hand areas.

detectorHand=HandDetector(detectionCon =0.8,maxHands=1)

Find the hand and its landmarks

hands, img = detectorHand.findHands(img)

● NumPy

NumPy is a highly optimized numerical operations library. Because digital images are 2D arrays of pixels, array structure is critical. It provides high-performance multidimensional array objects as well as tools for interacting with these arrays, making array processing easy. It provides a large library of sophisticated mathematical features for usage on data structures like as arrays and matrices, as well as efficient information systems to enable trustworthy calculations with arrays and matrices.

● OS

In Python, the OS module contains methods for interfacing with the operating system. The OS module is a collection of functions that are used to carry out OS-related operations. Its primary function is to interface with your operating system.

pathImages = sorted(os.listdir(folderPath), key=len)

print(pathImages)

while True:

 # Get image frame

 success, img = cap.read()

 img = cv2.flip(img, 1)

pathFullImage=os.path.join(folderPath,pat hImages[imgNumber])

imgCurrent = cv2.imread(pathFullImage)

Hardware specifications

● Webcam: A video camera can be used to transmit real-time photos or movies to or across a network. In the system we propose, we would initially photograph the user's hand motions while using their webcam.

● Processor: at least an Intel (4)

● RAM: More than 1GB

● Hard disc: 20GB minimum

3. Results

Gestures:

 1. Pinky Finger: With this gesture presentation will show the previous slide. (Ref. Fig.1).
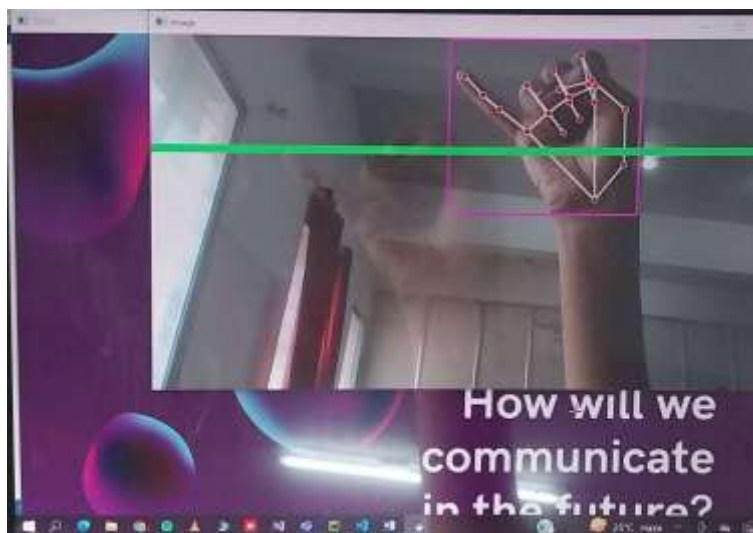

Fig1. Pinky Finger Gesture

Pinky Finger Gesture: **By doing pinky finger gesture, Next slide will be presented.** (Ref. fig 1). Skin segmentation rules are used to identify the hand region in the video. Gesture recognition techniques are applied to determine if the pinky finger gesture is detected. This could involve analyzing the hand region for specific

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finger configurations or patterns associated with the pinky finger gesture. Once the pinky finger gesture is recognized, trigger the action to move to the next slide. This could involve sending a signal to the presentation software or application you're using to advance to the next slide.

2. **Index Finger**: By moving this figure we can draw on the slides (Ref. Fig.2).

Fig 2. Index Finger Gesture

Index Finger Gesture**: By moving index finger we can draw on our slides.** (Ref. fig 2). Skin segmentation rules are used to identify the hand region in the video. Focusing on detecting the index finger and its movements. Track the position and movement of the index finger over time to determine when the user intends to draw on the slides. Implementing the drawing functionality by mapping the movements of the index finger to the corresponding movements on the slide canvas. As the user moves their index finger, translate those movements into drawing strokes or shapes on the slide.

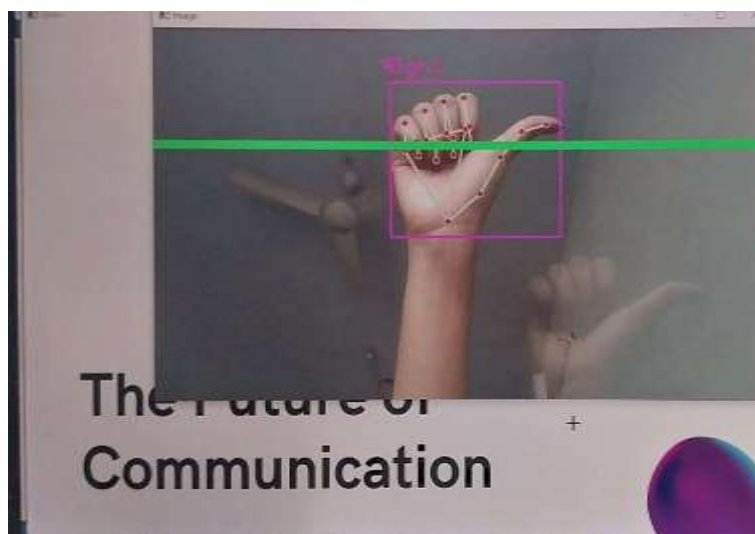3.**Thumb**: With this gesture we can change the presentation to next slide. (Ref.Fig.3)

Fig. 3. Thumb

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Thumb Finger Gesture: **By doing thumb finger gesture, Previous slide will be presented.** (Ref. fig 3). Skin segmentation rules are used to identify the hand region in the video. Applying finger detection methods to identify the thumb finger and its movements. Track the position and movement of the thumb finger over time to determine when the user intends to go to the previous slide. When the thumb finger gesture is recognized as a signal to go to the previous slide, trigger the action to navigate to the previous slide in the presentation.

4. **Index and Middle Finger**: This gesture shows a pointer. (Ref. fig.4)

Fig. 4. Index and Middle Finger
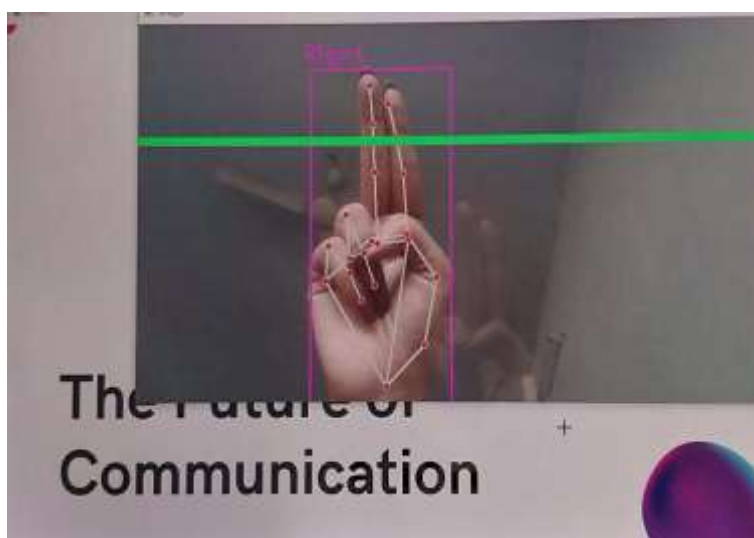
Index and Middle Finger Gesture: **By doing this gesture we can get a pointer.** i.e. we can use it as a pointer.(Ref. Fig 4). Skin segmentation rules are used to identify the hand region in the video. Applying finger detection methods to identify the fingers within the hand region. Focusing specifically on detecting the index and middle fingers and their relative positions. Tracking the positions and movements of these fingers over time to determine when the user intends to use them as a pointer. Using the detected positions of the index and middle fingers to determine the position of the pointer.

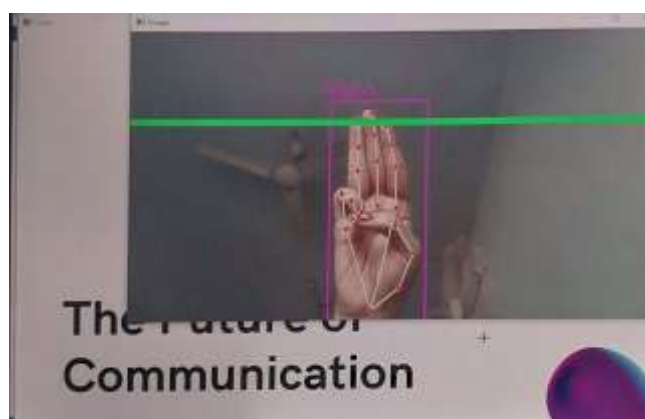5. **Three Finger**: This gesture is used as an eraser. (Ref. fig. 5)

Fig. 5. Three Finger

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Three Finger Gesture: **This gesture is used as an eraser** (Ref. Fig 5). Skin segmentation rules are used to identify the hand region in the video. Apply finger detection methods to identify the fingers within the hand region. Focus specifically on detecting the three fingers (index, middle, and ring fingers) and their relative positions. Track the positions and movements of these fingers over time to determine when the user intends to use them as an eraser. When the three finger gesture is recognized, activate the eraser functionality.

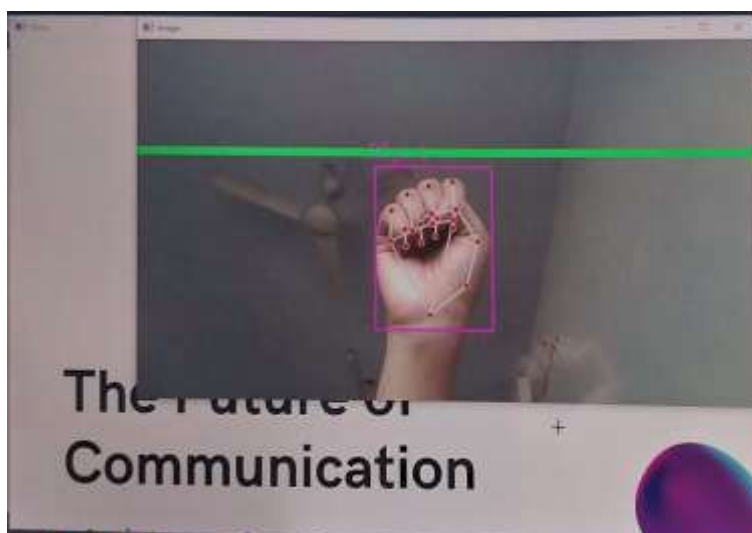6. **Palm band**: This gesture is used to stop the drawing. (Ref. fig. 6)

Fig. 6. Palm band

Palm Gesture: **By showing the palm we can stop all the representations.** (Ref. Fig 6). Skin segmentation rules are used to identify the hand region in the video. Applying gesture recognition techniques to identify the palm gesture. Tracking the position and movement of the hand over time to determine when the user intends to show their palm and stop all presentations or representations. When the palm gesture is detected, trigger the action to stop all ongoing presentations or representations.
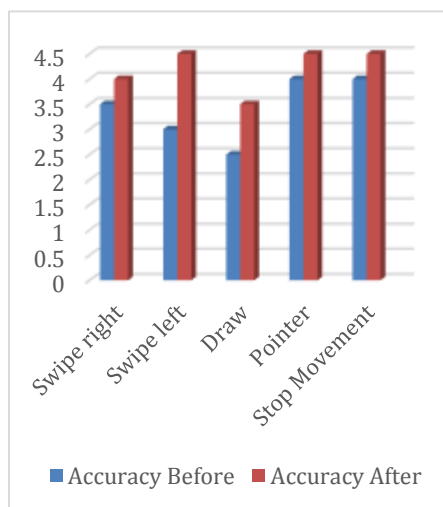

Fig. 7. Accuracy of Gestures

4. Discussion

Hand gestures are more natural in interaction than other technologies since they are a fundamental component of body language. When employing hand movements, interaction is easy and does not require any additional equipment. The suggested hand gesture detection algorithm for this device makes use of AI. If the speaker employed hand gestures, they could present more easily. The system's goal is to create application that shall enable presenters to control presentation slides using a range of hand gestures. With this system, you won't need a keyboard, mouse, or even a remote control to change slides.

5. Conclusion

Presentation is simple with the suggested method, "Hand gesture-controlled PowerPoint presentation." The speaker will be able to switch between slides within businesses or other settings where presentations are required for work.

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