Hand Gesture Volume Control Using Machine Learning

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ABSTRACT
A systems that can recognize a hand motion in real time video is hand gesture recognition. Hand gestures are categorized according to their subject matter. The design of hand gesture recognition is one of the More difficult jobs, as it combines two significant issues. The detection of the hand is the first step and creating a sign that can only be utilized by one hand at a time. It can be used in a variety of settings, including human-computer interaction and sign language. The basic concept of hand segmentation and the hand detection system, which use the Haar-cascade classifier, may be used to construct hand gesture recognition using Python and OpenCV. We discuss a way for hand gesture identification based on shape-based features detection. The configuration comprises a single camera that captures the user's gesture and feeds it into the system. A fundamental goal of gesture recognition is to develop a system that can recognize specific human gestures and utilize them to send information for device control. With real-time gesture recognition, a user can operate a computer by making a specific gesture in front of a computer's camera. With the help of the OpenCV module, we will create a hand gesture. Without the use of a keyboard or mouse, the system can be controlled via hand gestures.

INDEXTERMS
- Camera input
- Hand tracking
- Feature extraction
- Gesture recognition

I. INTRODUTION
Hand gestures is the powerful communication medium for Human Computer Interaction (HCI).Several input devices are available for interaction with computer, such as keyboard, mouse, joystick and touch screen, but these devices does not provide easier way to communicate. In this, the system which is proposed will consists of desktop and laptop interface, hand gesture can be used by the users need to wear data gloves also can use the web camera or separate cameras for recording the hand gestures.

The first and most important step toward any hand gesture recognition system is to implement hand tracking system. Some Sensor devices are generally used in DataGlove based methods for digitizing hand and finger motions into multi parametric data. Other sensors used in this system will collect hand configuration and hand movements.

The vision Based method requires a web camera, so that one can realize natural interaction between humans and computer without using any other devices. The challenging part in these systems is background images or videos which is recorded or captured during taking the inputs i.e. hand gesture by the user, also sometime lightning effect the quality of the input taken which creates the problem in recognizing the gestures. Process to find a connected region within the image with some of the property such as color ,intensity and a relationship between pixels i.e. pattern is termed as segmentation. And have used some important packages which have OpenCv-python, tensorflow, numpy, mediapipe, imutils, scipy,numpy.

PROCESS OF HAND GESTURE VOLUME CONTROL
• Download and import these libraries – Mediapipe, OpenCV, Time, Math, Numpy, ctypes, comtypes and pycaw
• Turn on the webcamera
• Read all the frames one-by-one
• Detect all the hands (1 or more, if any) in the frame
• Get all the hand-landmarks for all the detected

hands
 • If the number of detected hands is more than one, then consider only one hand for the project.
 • On this hand, identify the index finger and the thumb.
 • Find the distance between the tips of the index finger and the thumb
• Access the volume-controlling ability of your system by using the ctypes library which uses functions cast and SetMasterVolumeLevel to control the volume of any system.
• Bring the tips of both the index finger and the thumb together and then away from each-other.
• Using the Interpolation function offered by Numpy, we can convert the changing distance between the index finger and the thumb (got by the movement of the two fingers), into the volume level of our system. Farther the tips of the two fingers from each-other, higher is the volume level, which means, nearer the tips of the two fingers, lower is the level of the volume in our device.
• Display the video captured by the web-camera, by displaying all the frames one after the other, thereby, displaying our hand and the action performed by the index finger and the thumb.

PHASES IN DETECTING HAND GESTURE
In vision community hand gesture is an active area of research, for the purpose of sign language recognition and human computer interaction. In this we have used some algorithms and some modules to detect the gestures of the person and these gestures are taken as the input in the system . Here, several modules are used like opencv-python, mediapipe, numpyetc for the purpose of tracking the gestures. After capturing the input from the user the image is used in the hand tracking system to check the dimensions and shape of the gesture which is received in the system. Hand tracking module plays a important role in identifying the input recorded in the system, after that classification and segmentation process is used to classify the gestures in the system .Machine learning and deep learning is also used to identify the training data from the system and identify it according to the requirement of the system .After this the gestures are identified from the trained data and on the basis of that data the gestures rae recognized and is used for processing of the the system to implement the functions like increase and decrease in volume.

II.   METHODOLOGY
For gesture recognition, the K-Nearest Neighbor (KNN) algorithm is a supervised machine-learning algorithm. KNN is used for classification, by which a data point's classification is determined by how its neighbor is classified. Euclidean distance is used to find the nearest neighbor in KNN.

Image processing is a method to perform some operations on an image, in order to get an enhanced image and or to extract some useful information from it. If we talk about the basic definition of image processing then "Image processing is the analysis and manipulation of a digitized image, especially in order to improve its quality". Image processing is basically signal processing in which input is an image and output is image or characteristics according to requirement associated with that image. Image processing basically includes the following three steps:
* Importing the image
* Analysing and manipulating the image
 * Output in which result can be altered image or report that is based on image analysis.

Mediapipe is an open source cross-platform framework provided by Google to build a pipeline for processing perceptual data from different modalities such as video and audio. The solutions used in MediaPipe include multiple items such as posture estimation and face recognition. In this paper, we will use MediaPipe Hands for hand tracking.

Advantages
1. Easy to use.
2. Earlydetection.
3. Hassle free.
4. Time-efficient.
5. More interactive.

Disadvantages
1. Technicalchallenges.
2. Requires a decent camera.
3. They are neither self revealing nor self explanatory.
4. May be confused by two palms.

III.   FUTURE SCOPE
The model successfully controls the volume of the system by hand gesture, that means the volume of the device is controlled without opening the volume-settings or the volume icon in the system. The accuracy of the model is 100%.This model successfully controls the volume of a device without a mouse, and without having to open the volume icon or the volume settings. The model uses the index finger and the thumb of our hand, and a camera. The model uses hand-landmarks defined by Google's Mediapipe library,

and the ctypes library, for seamless execution.

IV.   RESULT AND CONCLUSION

This project is presenting a program that allows the user to perform hand gesture for convenient and easier way to control the software .A gesture based volume controller doesn't require some specific type of markers and these can be operated in our real life on simple Personal Computers with a very low cost cameras as this not requires very high definition cameras to detect or record the hand gestures. Specifically, system tracks the tip positions of the counters and index finger of each hand.The main motive of this type of system is basically to automate the things in our system in order to make the things become easier to control. So in order to make it realiable we have used this system to make the system easier to control with the help of these applications.In this paper we mainly focused on detecting the hand landmarks and video cam. After which we can access the audio functions inside the system and based on the distance between the thumb and the index finger there will be alteration in the volume.

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