

“Gesture Recognition using OpenCV”

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Abstract: - Developing a solution for Gesture commands for operating Laptops/PCs for frequently used operations such as moving presentation slides back and forth, highlighting content, writing on slides, etc.

Gesture recognition is a rapidly growing field that aims to enable natural and intuitive interaction between humans and computers. It has applications in diverse fields such as human-computer interaction, virtual reality, gaming, healthcare, automotive, robotics, and smart homes.

Key-Words: Gesture, presentation, recognition, OpenCV, frequently, etc.

I. Introduction

For any user, authenticated by face recognition, few gestures or voice commands could be defined for frequently used tasks- save, exit, print, screen-lock, screen unlock, system shut down, system restart. Save, print and exit operations are context sensitive meaning that it is applicable for current application. For example if word document is open and the gesture for save is done then the document will saved, if print voice command is given then the printer dialog will open etc. Similarly a gesture or a voice command could be defined for close/exit which will close the current application. If no application is opened then it will work as system shut down. It is similar to Alt+F4 key press functionality on Windows PC.

II. Problem Formulation

Over a period, the generation has witnessed a paradigm shift- a switch that altered the entire practice that we employ to manage and operate electronic devices. The digital era has welcomed gesture recognition software to meet the dynamic need of technological innovation, which can recognize hand and face movements and perform the assigned/asked task after that. The software interprets human gestures using programmed mathematical algorithms. It has facilitated every arena lying in the digital sphere of the world, such as a graphic designer who can correctly make changes in an image without using the keyboard or mouse. An engineer can zoom in or zoom out on a 3-Dimensional representation of any model only by the hand gestures when the device is in their hand. Gesture recognition technology has a lot of benefits by which the human can direct their businesses and personal life.

Gesture recognition consists of three basic levels:

Detection. With the help of a camera, a device detects hand or body movements, and a machine learning algorithm segments the image to find hand edges and positions.

Tracking. A device monitors movements frame by frame to capture every movement and provide accurate input for data analysis.

Recognition. The system tries to find patterns based on the gathered data. When the system finds a match and interprets a

gesture, it performs the action associated with this gesture. Feature extraction and classification in the scheme below implements the recognition functionality.

III. Literature Review

An Efficient Framework for Indian Sign Language Recognition Using Wavelet Transform [1] : The proposed ISLR system is considered as a pattern recognition technique that has two important modules: feature extraction and classification. The joint use of Discrete Wavelet Transform (DWT) based feature extraction and nearest neighbour classifier is used to recognize the sign language. The experimental results show that the proposed hand gesture recognition system achieves maximum 99.23% classification accuracy while using cosine distance classifier.

An Automated System for Indian Sign Language Recognition in [2]: In this paper a method for automatic recognition of signs on the basis of shape based features is presented. For segmentation of hand region from the images, Otsu's thresholding algorithm is used, that chooses an optimal threshold to minimize the within-class variance of thresholded black and white pixels. Features of segmented hand region are calculated using Hu's invariant moments that are fed to Artificial Neural Network for classification. Performance of the system is evaluated on the basis of Accuracy, Sensitivity and Specificity.

Design Issue and Proposed Implementation of Communication Aid for Deaf & Dumb People in [3]: In this paper author proposed a system to aid communication of deaf and dumb people communication using Indian sign language (ISL) with normal people where hand gestures will be converted into appropriate text message. Main objective is to design an algorithm to convert dynamic gesture to text at real-time. Finally after testing is done the system will be implemented on Android platform and will be available as an application for smartphone and tablet pc.

IV. Methodology

Gesture recognition is an active research field in Human-Computer Interaction technology. It has many applications in virtual environment control and sign language translation, robot control, or music creation. In this machine learning project on Hand Gesture Recognition, we are going to make a real-time Hand Gesture Recognizer using the Media Pipe framework and Tensor flow in OpenCV and Python packages.

OpenCV is a real-time Computer vision and image-processing framework built on C/C++. But we'll use it on python via the OpenCV-python package.

Planning Prerequisites for this project:

1. Python – 3.x (we used Python 3.8.8 in this project)
2. OpenCV – 4.5

Run “pip install open cv-python” to install OpenCV.

3. Media Pipe – 0.8.5

Run “pip install media pipe” to install Media Pipe.

4. Tensor flow – 2.5.0

Run “pip install tensor flow” to install the tensor flow module.

5. Numpy – 1.19.3

Steps to solve the project:

1. Import necessary packages.
2. Initialize models.
3. Read frames from a webcam.
4. Detect hand key points.
5. Recognize hand gestures.

Once gesture recognition begins, we continue to track the target and end gesture. To perform the task, we choose the convolutional neural network (CNN) model.

V. Result Discussions

The following questions were asked to some of the initial users and the answers are as follows:

Q What is the use of this program?

Interpretation: Out of 52 respondents 45 persons were not aware of the use of this program.

Q Are you comfortable using this program?

Interpretation: Out of 52 respondents 40 persons were comfortable using this kind of program.

After the research undertaken the following result came out:

- Most of the respondents were not aware of using the program.
- Most of the respondents were comfortable using such a program.

VI. Conclusion

Hand gesture recognition is of great importance for human-computer interaction (HCI) because of its extensive applications in virtual reality and sign language recognition etc. The human hand is much smaller with very complex articulations compared with the entire human body, so errors can be easily affected.

There can be no doubt that voice assistants are, and will continue to become, a great feat of human ingenuity and they are already creeping into our lives in some shape or form. With the eventual roll-out of 5G and the improvement in machine learning voice assistants may be setting themselves up to be a tool we cannot live without. However, before we get to that stage, there are hurdles to cross which include heavy investment, improvement in the technology, and confidence from consumers that this device that is in their lives does not pose a risk to their privacy.

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