Human Computer Interaction Using Hand Gestures

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***Abstract*—The need for interaction is growing. Hand gesture recognition is widely used in controlling devices and computers in different fields like in the automobile industry, and the marketing industry where like in big presentations people every time cannot go to the keyboard or a mouse and change to the next slide the similar happens in different fields. The purpose of this project is to learn hand gestures so that you can follow these gestures to draw or write on your computer screen. To do this, use the "Hand Recognition" module together with the "Open CV" module. Building information transmission and device control systems using gesture recognition technology. Differences in lighting, lack of consistent background, variability in user hand sizes and shapes, and high similarity of hand gesture poses between classes are major obstacles to creating effective hand gesture recognition algorithms. Real-time recognition of the range of recognized hand gestures. Research shows an accuracy of 97.3%.**

Keywords— Hand Gesture recognition technology, Tracking, and Identification Using convolution Neural Networks A system that classifies and measures the popularity of gestures helps translate gestures.

I. INTRODUCTION

An important tool in human-computer interaction is the category of hand gestures. Virtual reality programs can use these movements to update traditional input devices such as mice and keyboards, as well as devices in the admin center. The hand gesture class consists of two basic operations. The first strategy is a comprehensive strategy based on our vision. To do this, a camera must be used to record the hand pose and movement, and an algorithm must be used to process the captured images. Although this technique is well known, it is computationally intensive as it requires extensive pre-processing of the photos to blend their features such as colors, pixel values and handwriting. Moreover, the current geopolitical environment has hindered widespread implementation of this technology. This is because customers are less receptive to having cameras installed in private rooms, especially for programs that require continuous weapon surveillance, as the most practical and common way to improve human-computer interaction One of the methods is hand gesture recognition.

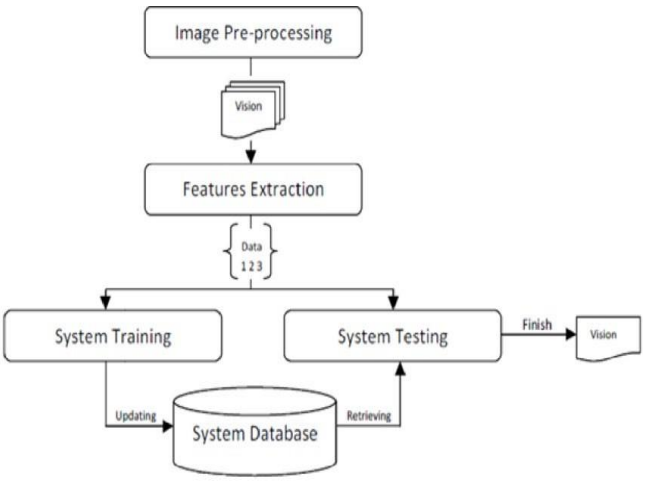

Fig.1 Architecture of interactive system

II. HAND GESTURE SEGMENTATION

Currently, hand gesture segmentation can be accomplished in a variety of methods. In order to segment hand gestures based on the difference between the skin color of hand gestures and the external environment, the skin color model, which is based on wide range of skin color, is designed, and it is not affected by hand postures, but it is unable to exclude objects that look similar to the skin color, such as a man's face, but it is sensitive to noise interruptions and has strict background requirements.. Hand gesture segmentation based on movement information, on the other hand, can segment the hand gestures according to the discontinuity of grey value in the margin area of the image region, such as the frame difference method and backdrop difference method, using the knowledge of hand gesture movement to segment hand motions based on a static background. The impact works efficiently in a static setting however poorly in a dynamic one; by means of the usage of a schooling classifier of the gesture template feature, the segmentation approach of hand gestures based on statistical template matching is capable of quickly distinguishing among the hand location and non-hand region, however, because it can simplest apprehend one or greater hand gestures, it can't meet our requirements. The hand gesture segmentation within the article includes picture preprocessing, the established order of a Gaussian mixture model primarily based on skin tones,

and the segmentation of hand motions via combining an

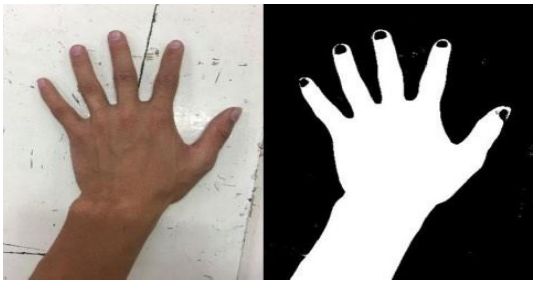

Fig.2 Skin Color recognition

A. Hand gesture recognition based on model features

a) In process of differentiating the movements of the hand based on the color of the skin is subject to interruption from objects with hands that are comparable in hues, such as human faces and other such items. After detecting skin color, hand motion based on model attributes is used to address the aforementioned problems. The classifiers are trained after using these features, which are helpful in differentiating the hand region from the non-hand area, once the hand gesture features have been retrieved from a large sample of hand motions.

b) Haar feature

Variations in the grayscale values of an image are reflected by Haar features. Feature models are created using black and white rectangular areas. Object features are represented in the feature model by subtracting the sum of pixels under the white region from the sum of pixels under the dark region.

c) Convolutional layer

The convolution layer enables the convolution process between the convolution kernel and the bottom layer feature map.

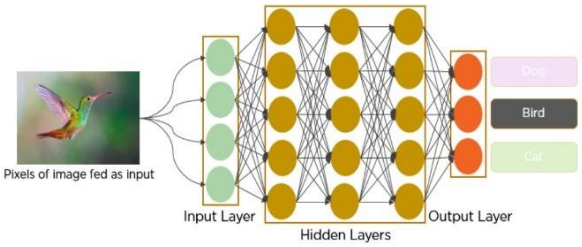

Fig.3 CNN structure

1.1 OBJECTIVES

1.1 Purpose

Computer-assisted handheld and gesture recognition techniques have been successfully applied in real-world applications, but need to be solved for larger-scale human-computer interaction (HCI). There were still many problems. application. Separating (identifying) meaningful gestures from an endless stream of hand gestures is one of the problems that arises in real-time hand gesture evaluation. Another problem arises from the fact that the exact gesture shape, direction, and length can vary, even for the same man or woman. Gestures are static, dynamic, or a combination of AdaBoost classifier with Haar based totally capabilities both spatio-temporal patterns. Static arm morphs are called postures and hand movements are called gestures. The interpretation of gesture is intended to bring human-computer communication closer to the level of human-human interaction. Signal language symbol recognition and software for his HCI communication with computer systems place in the popularity of signal language.

1.2. DATA SET

A computer vision software program called RECORD CV ZONE simplifies the performance of AI and image processing operations. I mainly use the OpenCV and Mediapipe libraries. It supports Windows, Linux, Android, and Mac OS and offers C++, Python, Java, and MATLAB interfaces. Where available, OpenCV uses MMX and SSE instructions and leans heavily toward real-time vision applications. A CUDA and OpenCL interface with all available features is currently under active development. There are over 500 algorithms, and about 10 times as many functions that make up or support each algorithm. Designed entirely in C++, OpenCV's template-based interface is fully integrated with STL containers. A framework called -series data such as audio and video. Desktop/server, Android, iOS, and embedded devices like Raspberry Pi and Jetson Nano all support this cross-platform framework.

2.1 EXISTING SYSTEM

gesture recognition for presentation is used in very few applications. These programs are not very effective on low-end systems. Therefore, it needs more RAM to work. It's also possible that poor lighting prevents the system from accurately distinguishing between the hand and the background. If the user's machine is slow, there is a noticeable delay between input and output.

2.2 PROPOSED SYSTEM

The application must be run by the user and once the camera is turned on, the action must be demonstrated using hands. To analyze certain movements and perform corresponding actions, the user has to demonstrate them to the camera. Stick your index finger up for a quick sketch. Pointer allows you to move the cursor to a specific location on the screen by pointing with two fingers. You can erase characters with three fingers. You can scroll to the previous slide with your thumb and move to the next slide with your little finger. This makes it easy to enter data into the system without having physical contact with the hardware.

3. FUNCTIONAL REQUIREMENTS

1. Open CV(Hand Recognition)
2. Python interpreter

3.1 PERFORMANCE REQUIREMENTS

1. Stable internet connection.

3.2 SOFTWARE REQUIREMENTS

- Python version 3.6 and above (although lower version should also work).
- Python requests module should be installed.
- It works on any operating system.
- Python Open CV module should be pre-installed.
- Hand Recognition module should be installed.

- Numpy module should be installed.
- A fully working camera driver

3.3 HARDWARE REQUIREMENTS

- RAM: 4GB OR MORE.
- Python Interpreter.
- Windows 7 or later versions.
- Stable Internet connection
- Full HD camera

4. MODULES
    - Cvzone
    - Mediapipe
    - Numpy
    - Opencv.python
5. Language/Technology Used
    - Python
    - Machine Learning

Experiments:

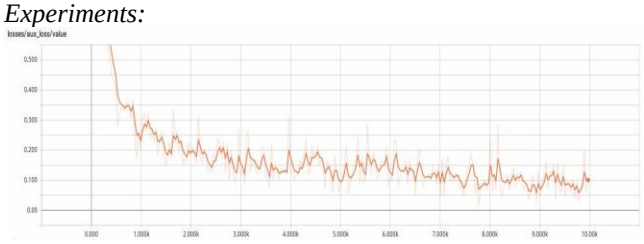

Fig.4 loss curve

The average accuracy of hand gesture recognition is 98.3%.

III. CONCLUSION

The gesture recognition algorithm is fairly reliable and accurate. Convolution can be slow, so there is a trade-off between accuracy and speed. In the future, we will look for alternative strategies to obtain feature vectors that do not use costly convolution techniques.

IV. FUTURESCOPE

This hand gesture popular tool effectively solves the challenge of removing and processing frames from a movie. Future plans include the ability to recognize and use various hand gestures as laptop input. Hand gestures used to display numbers can also be transformed into real-time instructions for relevant tasks. In the future, we can work on extending the functionality for different lighting situations, which is the challenge of this project. There are very few places or situations where gesture recognition technology can be used, but it's clear that it can completely change the way we interact with the world around us, whether at home or in public.

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