

Real Time Hand Gesture Recognition for Human Computer Interaction

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ABSTRACT

Human Computer Interaction can acquire several advantages with the introduction of different natural forms of device free communication. Gestures are a natural form of actions which we often use in our daily life for interaction, therefore to use it as a communication medium with computers generates a new paradigm of interaction with computers. This paper implements computer vision and gesture recognition techniques and develops a vision based low cost input device for controlling the VLC player through gestures. VLC application consists of a central computational module which uses the Principal Component Analysis for gesture images and finds the feature vectors of the gesture and save it into a file. The Recognition of the gesture is done by CNN algorithm. The theoretical analysis of the approach shows how to do

recognition in static background. The Training Images are made by cropping the hand gesture from static background

by detecting the hand motion using CNN algorithm. This hand gesture recognition technique will not only replace the use of mouse to control the VLC player but also provide different gesture vocabulary which will be useful in controlling the application.

INTRODUCTION

WIMP (windows, icons, menus, pointers) prototypes, together with the keyboard and the mouse, have been definitive in providing the flexibility for use of computers machine. It provides users a clear objective model of what task, instructions to perform and their possible outcomes. These paradigms permit a user a sense of achievement and obligation about their interaction with computer application.

By the underlying prototype, users express their significance to the computer user's using their hand to perform button clicks, positioning the mouse and key presses. This is a rather unnaturally a restrictive way of interaction with end user systems. In our everyday life, computers are comely more and more pervasive. It is highly worthy that the interaction with the systems does not essentially differ from the natural interaction taking place between different users. Perceptual User Interfaces (PUI) is the basis in which they are interested with extending Human Computer Interaction (HCI) to use all modalities of human perception. Early development of PUI, it uses vision-based interfaces which perform online hand gesture recognition and also one of the finest approaches. High precision and speed is the major advantages of hand gesture. The most successful tools like mice, joysticks and keyboards are capable for HCI, as they have been thoroughly certified. Humans learn easily how to perform them, accomplish the most divers and complex tasks. These interfaces based on computer vision techniques are also modest and economical, making them perfect.

LITERATURE SURVEY

Literature survey is the most important step in software development process. Before developing the tool it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need lot of external support. This support can be obtained from senior programmers, from book or from websites. Before building the system the above considerations are taken into account for developing the proposed system. A literature review is a body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. Literature reviews are secondary sources, and as such, do not report any new or original experimental work. Also, a literature review can be interpreted as a review of an abstract accomplishment.

EXISTING SYSTEM

- Thresholding method
- PCA
- Edge detection

Manual analysis - time consuming, inaccurate and requires intensive trained person to avoid diagnostic errors.

Principal Component Analysis

The main idea of principal component analysis (PCA) is to reduce the dimensionality of a data set consisting of many variables correlated with each other, either heavily or lightly, while retaining the variation present in the dataset, up to the maximum extent. Importantly, the dataset on which PCA technique is to be used must be scaled.

DISADVANTAGES

Difficulties are there to find optimal gradient

- Poor Edge detection.
- Manual segmentation
- Time consuming

PROPOSED SYSTEM

- Preprocessing
- Clustering

- Feature extraction

ADVANTAGES

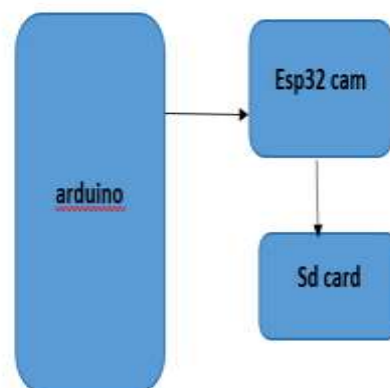
Better efficiency and less sensitive to noise

- Highly Security
- Automated recognition.
- High accuracy

FUNCTIONAL REQUIREMENTS

- 1.Data Collection
- 2.Data Preprocessing
- 3.Training And Testing
- 4.Modeling
- 5.Predicting

BLOCK DIAGRAM



HARDWARE REQUIREMENTS

- Arduino
- ESP32 cam
- SD Card

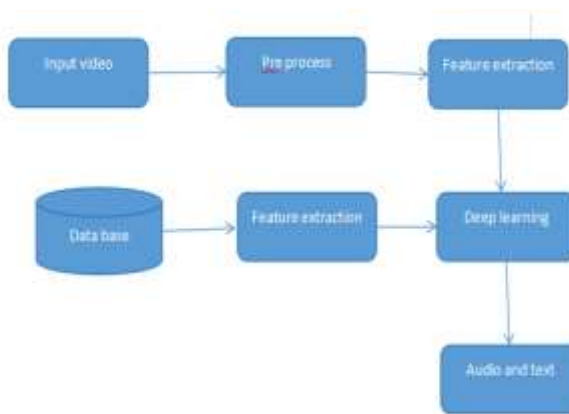
SOFTWARE REQUIREMENTS

Arduino IDE

SOFTWARE ENVIRONMENT

➤ OpenCV

SYSTEM ARCHITECTURE

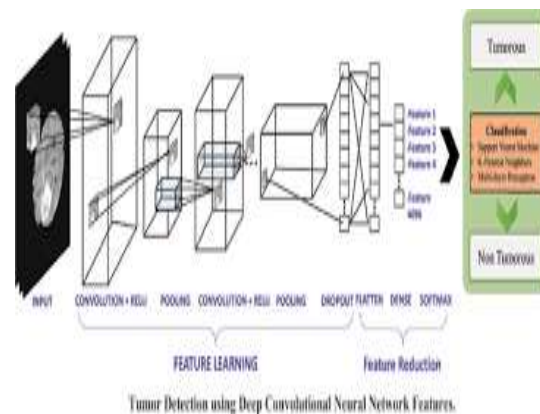


ALGORITHMS

CNN (CONVOLUTION NEURAL NETWORK)

Convolutional neural networks. Sounds like a weird combination of biology and math with a little CS sprinkled in, but these networks have been some of the most influential innovations in the field of computer vision. 2012 was the first year that neural nets grew to prominence as Alex Krizhevsky used them to win that year's ImageNet competition (basically, the annual

Olympics of computer vision), dropping the classification error record from 26% to 15%, an astounding improvement at the time. Ever since then, a host of companies have been using deep learning at the core of their services. Facebook uses neural nets for their automatic tagging algorithms, Google for their photo search, Amazon for their product recommendations, Pinterest for their home feed personalization, and Instagram for their search infrastructure.

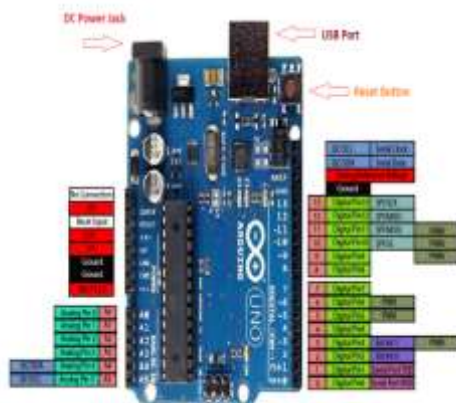


HARDWARE DESCRIPTION

Arduino

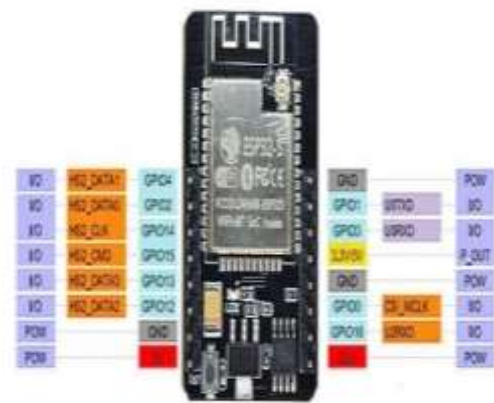
The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and

programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.



Esp32 cam

The ESP32 Camera Module is an extension of the ESP32 microcontroller that includes a camera sensor. This module allows you to capture images and video with the ESP32, making it suitable for various applications, including surveillance cameras, IoT projects, and image processing applications. Here are key features and details about the ESP32 Camera Module.



SOFTWARE DESCRIPTION

Arduino Software (IDE)

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),^[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital

and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

CONCLUSION

This project presents gesture recognition and classification based on features analysis and feature matching techniques. The results will be better identification of gesture it is fully based on feature extraction, image processing techniques and it gives much better accuracy with lesser algorithmic complexity than other recognition approaches.

FUTURE SCOPE

In the near future, more sensors can be embedded to recognize full sign language with more perfection and accuracy and most of the units can be embedded together on a single board resulting in a

compact model. The system can also be designed such that it can translate words from one language to another. In the future, the accuracy can be improved and more gestures can be added to implement more functions.

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