

Hand Gesture Mobile Communication Using Neural Networks

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Abstract: Hand Gesture mobile communication system using neural networks with voice conversion is a complex device based on Raspberry Pi that can help to express feelings of a dumb person. With this tiny hand held tool a normal man can interact easily with a dumb person. The proposed system consists of a transceiver device in which one end has a normal person and at the other end a person with disability. This system is a process of recognizing hand gestures captured using web camera and a Raspberry Pi, developed and implemented using the OpenCV and Python. A pattern recognition program can use a transform that transforms an image into a feature vector that is then compared to feature vectors of a series of movements in training. Visual recognition based hand motions may give a progressively characteristic natural computer interface, permitting individuals to point, or rotate a CAD model by their hands. Singing language belongs to one of the more formal group of gestures. In sign language, each gesture has an assigned meaning (or meaning) or corresponding voice generated using OpenCV algorithms. The gesture voice is transmitted via GSM MODEM. A default number is programmed, plus manual dialing using a graphical user interface built with Python and tkinter Person on the receiver side, via this changed device, can hear dumb person's voice. This program will be introduced using a powerful little machine, Raspberry Pi. The program even lets rational people make a phone call to a crazy person. Thus contact is possible in two levels.

Keywords: Neural Network, ANN, Gesture recognition, Raspberry Pi.

1. Introduction

One can create life - but no one has the rights to destroy it. The expression goes as it were. While some people are physically disabled, this does not mean that they must miss all worldly pleasures, fun, etc. Here in our project we will take up this issue to create a mobile communication device that will be able to translate the special sign language through voice output by dumb people. The system has the feature of identifying hand gestures and produce speech (voice) output accordingly.

Sign language is an articulate and natural way of communicating between normal and dumb people (information is often conveyed through the movement of the hand). The intension of the sign language translation system is to translate normal gesture sign language into speech or voice and to make

easy communication with the dumb people. In order to improve the life style of the differently abled people the system is developed. The sign language uses visible communication as well as non-verbal contact. The first consists of hand gesture conveying respective meaning, the second is head gestures, facial body language expression and this is distinct in orientation and place from country to country. Sign language is not universal. America has developed American Sign Language, Britain has developed a British sign language system, and Thailand has developed a Thai sign language system. Using a camera, the image processing techniques capture the image / video and analyze the data with static images and recognize the image using algorithms and produce voice signals as output. Vision-based sign language recognition system uses mainly hidden markov mode, Artificial Neural Networks(ANN) and Sum of Absolute Difference(SAD) algorithms to extract image and eliminate undesirable background noise. There are drawbacks of existing methods using super gloves for capturing the image by hand gesture. It needs a special glove that is a supplementary hardware tool. Another disadvantage is that, there is a delay between input and output too. To address these drawbacks a neural network-based system is designed. This will have the features of efficient generalization capability, manual color detection tolerance to input noise, reduced delay, parallel processing, and no mathematical modeling is needed.

2. Recognition of Hand Gesture Using Neural Network

Hand gesture recognition, like a paper or digital objects, has no limitations. This applies to the third dimension too. This subject receives many researches and attention.

Owing to the computational, learning algorithms and camera efficiency difficulties. Rapid developments over the last few years are being made. Entanglements emerge from the identification of static movements. Recognition of movements is the synthesis of various figure states, finger angles and their orientations [1].

A. Artificial Neural Network

The use of neural network understands movements here. This is an information processing model inspired by the biological nervous system. For example, it functions like how the information is interpreted by a human brain. The main factor is the novel IT and data processing framework structure. Through working together, a large number of highly interconnected processing components it solves a specific problem. It learns from examples, as do humans. The impressive benefit is that it can better identify movements than humans or by other computer techniques, even if it is a sophisticated trained neural network that can be named as an expert in the data category it was provided to analyze. It solves the problem by itself and this cause the problem of unpredictability which is one of the disadvantages.

B. Hand Colour Detection

Background noise is one of the major problems in hand gesture recognition. The noise in the background can also be converted to speech output if the dumb person using the device is in a public place such as railway station, airport etc. This will generate contact difficulties. Method of detection of hand skin color can be used to resolve this. Dumb person's skin colour can be extracted from the image taken by camera. By using this method accurate result can be produced. Another solution includes identifying the hand's boundary contours, and is robust in size, translation, and rotation, but computationally highly challenging. In a multi-system camera, the center of gravity of the hand is chosen, and points with maximum distances from the center provide the positions of the fingertips, which are then used to obtain a skeleton image, and lastly, for particle filter gesture recognition.

C. Present System

Several technical devices have been created to console the dumb people and ease their lives. In the case of glove-based technique the user requires to wear a specially made glove. The movements are understood only when the person uses the glove, otherwise this device would not be of use.

It is an extra hardware burden and adds to certain people's frustration, and there is also a gap between input and output. In order to overcome such drawbacks, we have in here a solution using new system to overcome all the issues of previously system.

D. Proposed system for dumb people

Mobile dumb communication system should be built to provide better contact between dumb and normal people. The architecture is modeled using OpenCV and simulated and implemented using Raspberry Pi. Raspberry Pi is a device measured by credit cards that can do many of the things your desktop PC does. It can play video in high definition, too. This system contains an ARM1176JZFS, running at 700Mhz; and a video core 4 GPU. The Graphical Processing Unit, using H.264 at 40Mbits / s, is capable of BluRay image playback. It has a

fast 3D core accessed OpenGL ES2.0 and OpenVG libraries. The performance of the suggested system's operation should satisfy the theoretical specifications and can be verified through simulation results.

E. Design implementation methodology

1) Phase-1: Capturing the Image

When the user gives the order using his hand gesture, a video/web camera records the gestures. This is to be developed in both OpenCV and Python.

2) Phase: Processing Captured Image

A gesture pattern recognition system can use transform that transforms image taken into a feature vector that will then be compared to all feature vectors of a collection of gestures in training.

3) Phase-3: Recognizing Different Gestures

Use of neural network to recognize gestures. Artificial neural network is commonly defined as an interconnected neuron system that can compute values from inputs and is capable of pattern recognition [2].

4) Phase-4: Speech Transmission

The converted voice gesture is transmitted via DTMF coder/MODEM application. Configure a default number; in addition to manual dialing using a graphical user interface built using OpenCV and Python. Through this device the person at the receiver side can hear dumb person's voice.

5) Phase-5: Implementation

The framework shall incorporate Open Source Computer Vision (OpenCV) and Python language in the Raspberry Pi board. Raspberry Pi 's voice output is connected to a DTMF coder or a MODEM. One or two default numbers are programmed and there is also a manual dialing option for easy implementation.

3. Application

- Provides a medium for communicating between a dumb person and a regular person who is not familiar with the sign language.
- It can be used for sign language communication in media.

4. Future Scope

- Telephone system for dumb people with video conferencing facility
- Share same system for multiple people.
- Recognition of moving movements can be achieved by the use of accelerometer sensor at the wrist to detect changes in the wrist movement.

5. Conclusion

This paper presented an overview on hand gesture mobile communication using neural networks.

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