Hand Gestures Detection and Recognition for Paralytic Person using Neural Network

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Abstract: *According the World Health Organization (WHO) reports in 2010, there are more than 17,000,000 people infected with stroke yearly in all countries of the world as a result of the brain injury and prevent damage to the blood supply to the brain which leads to the injury that the patient is suffering of total paralysis or paraplegia.The researchers in the field of technology asserted to find solutions for Paralyzed patients who cannot move parts of their bodies due to injury , help to create an easy of paralyzed patients to perform daily functions easily using Hand Gesture . The Hand Gesture (HG) has become an alternative to traditional input devices such as a mouse and keyboard and etc.The proposed model is built by using supervised neural networks (SNN). The idea of this algorithm is reading hand signals (HS) by high resolution camera and processed by the computer after supervised neural networks applied .*

1. Introduction

Hand gesture recognition system is used for interfacing between computer and human using hand gesture. This project is a combination of live motion detection and gesture identification. This application uses the webcam to detect gesture made by the user and perform basic operations accordingly. The user has to perform a particular gesture. The webcam captures this and identifies the gesture, recognizes it (against a set of known gestures) and performs the action corresponding to it.

The main aim to develop this kind of system is, to focus on such group of people who are physically challenged or paralyzed. As this group of people are physically challenged they rely on other people's assistance. Even, they have to rely on someone else for day to day tasks. Therefore, any innovative and effective hand gestures recognition technologies can be a great help for the senior citizen, disabled people and paralysis patient.

The main priority of this system is to develop simple, easy and user friendly system without using any special hardware.

2. Literature Review

Basically, the unwell person is weak that can't press any button and most of them can't walk and many researchers with researches to helpthese persons to do his daily jobs. Many interesting applications of hand gesture recognition have been introduced in many latest years. Below , review some of them:

Christopher Lee and Yangsheng Xu developed a glove-based gesture recognition system that was able to recognize 14 of the letters from the hand alphabet, learn new gestures and able to update the model of each gesture in the system in online mode, with a rate of 10Hz.

Chan Wah Ng, Surendra Ranganath presented a hand gesture recognition system, they used image furrier descriptor as their prime feature and classified with the help of RBF network . Their system's overall performance was 90.9%. Claudia Nölker and Helge Ritter presented a hand gesture recognition modal based on recognition of finger tips, in their approach they find full identification of all finger joint angles and based on that a 3D modal of hand is prepared and using neural network.

Etsuko Ueda and Yoshio Matsumoto presented a novel technique a hand-pose estimation that can be used for vision-based human interfaces, in this method, the hand regions are extracted from multiple images obtained by a multiviewpoint camera system, and constructing the "voxel Model." Hand pose is estimated.

S.NO	TITLE	CREATED BY	DISCRIPTION	HARDWARE &SOFTWARE USED	DRAWBACKS
1	Stephen Hawking's Wheelchair	Intel® Corporation, Words Plus Inc	It selects a character by recognizing chick movement, and make a whole sentence.	Lenovo Thinkpad X220 tablet computer, Intel Core i7-262OM CPU at 2.7 Ghz processor, Intel, 150 GB Solid-State Drive 520 Series, Window OS, Speech Synthesizers (3 variants)	Costly and Specifically built only for Stephan hawking.
2	Hand Gesture Recognition and Patient Monitoring System with Automated Bed and Voice Control	Mr. Bejoy Antony Asst.prof1, Anju Anna Wilson2, Amalnath H3, Angitha Vijayan4, Akshay Pramod5 from *St. Thomas College Of Engineering and Technology, Chengannur, Kerala*	The bed positioning is controlled by different hand gestures. It also monitors various parameters such as temperature and pulse rate. If any of these parameter crosses safe minimal level, this unit sends an alert signal to the doctor by sending an SMS.	Aurdino, Temperature sensor, Flex sensor, Pulse sensor, DC motorand driver, SD card, audio amplifier and speaker.	Mostly used for adjusting bed movements. For creating and detecting hand gesrtures it uses gloves(person can't wears gloves always).
3	Hand Gesture Recognition Application for Physically Disabled People	D. Vishnu Vardhan1, P. Penchala Prasad2 1Assistant Professor, Department of ECE, JNTUA College of Engineering Pulivendula, Andhra Pradesh, India	In this model, a communication system which converts signal languages, used by disabled person. It is done by hand gesture recognition technique. The gesture recognition is done with the help of a sensor glove. the gesture is recognized by comparing the acceleration values with the stored templates.	MEMS Accelerometer, PIC16F88 Microcontroller, Flux Sensor, Micro controller, ISD1700 Voice chip, Speaker.	Hardware cost is high. It uses gloves which are connected through cabels.

3. System Methodology

System detection and recognition of HG is a classification system which distinguishes HG of allowed gestures of SP. This methodology uses processing of digital image technique for the classification purpose. The input system is specific HG Images saved in private database which are in digital format. This database can be add new images of HG by agreement of doctor according patients need . This system depends on the denoise (noise reduction or removal) images, where the images are processed in advance , even before adding them to the assigned database . The proposed system depend on GUI or called vision interface [4][5][14].

Vision interfaces are based on feasibility and popularity because the computer machine is able to communicate with user using camera or webcam. In this way, the user can be able to give commands (hands commands or gestures) to the computer by just showing some actions (hand movements) in front of the webcam without typing keyboard and clicking mouse button. Then , the interaction is occur between user and computer [6].

User interface for the hand gesture recognition was developed using MATLAB GUI (Graphical User Interface). During run the application handles video streaming from the webcam and timing of frame processing. Frame rate can exceed 20 fps which is more plenty for reliable human gesture detection. Hand movements are the key points in hand gesture recognition modeling in the human hand model. This approach is based detection and recognition on applying a learning model to reconstruct the hand model[6][10].

4. Artificial Neural Network

ANN is a computational model which similar to the way human brain works. Human brain is consist of billions of neurons interconnected by synapses, the neural networks can be form as a network of computational nodes connected with each other through links. This networks needs to be trained continuously with set of data before it can be used to produce the desired output. Because of neural network are adaptive nature , the structure of these networks can changed easily depend specific information that that enter to the network during the learning phase. The links these networks are assigned during training phase . ANN are used to model complex relation between input signals and

output signals .Neural networks can find various patterns in input signals [7] . neural networks can be very helpful in modeling complex systems due to its flexible construct ,that is to be very difficult in traditional modeling. ANN are very useful in image processing fields ,speech recognition , pattern recognition and various that requirement information extraction. neural network can be classify into two main categories: the input and the output. ANN is consist of many nodes or neurons called processing elements (PE) and interconnect between them, set of nodes represent the input nodes of neural network that take data from external environment. A set of nodes represent output nodes that produce intermediary hidden nodes or not. These hidden nodes connect with each other by links called connections, connect with input or output nodes or other hidden nodes. Any ANN consist of 3 main parts: (1) Input layer nodes
(2) Output layer nodes (3) Hidden layer nodes (internal nodes) [8],[9] . Figure (1). show the block diagram of neural network with 12 nodes: 3 nodes in the input layer, 7 nodes in the hidden layer and 2 nodes in the output layer. The neural network can be used in actual production environment. The process of training of artificial neural networks is called learning of neural network, which is generally done by one of three ways:
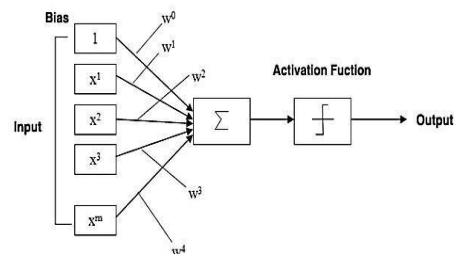(a)Supervised
(b)Unsupervised
(c)Reinforcement

Figure1. Block diagram of ANN_s .

5. Image Database

The HG images, which are used for training and testing the neural network within the system HG Recognition (HGR) , represent a various gestures that help a SP daily.There are a different kinds of data image , including medical images, and natural images and other. These images intended for training purposes and to extract the required results. Other group of HG images are used to training in supervised neural networks to obtain results, where they are taking these pictures through the internet or

high resolution digital cameras or webcam in different sizes and angles[11].

There are two main operation are made on the training images: (1) Images are converting to grayscale images , and (2) Uniform of the background images. The updating of Image database are continuous , then the supervised neural network training on different types of images. This means that database images is a dynamic, not static [12] . There are various types of HG, below in the figure (2), the most important HG using by SP.

Figure 2. The most common hand signals for SP with their

meanings.

6. Procedure of work

A main objective of Hand Gesture Recognition (HGR) is the ability to use HG for the general applications, aiming for the natural interaction between the human and computer.

Supervised Neural Networks (SNN) are used for gesture recognition and used for not fully explored gesture . The detection of human gestures in the human hand structure is an important issue in most hand model studies and in some gesture recognition systems[13]. HG have many possibilities in the field of Computer Vision and Human machine interaction. Gesture recognition could be based on probability, if the background is not fixed or image has other same kind of objects that would also lead to Inaccurate results. There are three main stages in Hand Gesture Recognition Process (HGRP):(1) Image Capture Phase (ICP).(2) Gesture Extraction (Feature Extraction) and(3) Gesture Recognition (GR).These stages are contain the below :(1) Designing of Algorithm.(2) Speed of processing.
(3) Architecture of system and(4) Interface Video.The activities of SP can detect and recognized by the camera or Webcam in the specific area . The results of these cameras can be analyzed and used to control the operation of devices in application

environments. we can analyze all the result of camera , histogram it and controlled on the operate of devices in the different areas e.gCar, a Plane, Room or Hospital and so on.

Away of the scientific complexities, we focused on 2D static Hand Gesture Recognition (HGR) only. The system started when the image captured from Camera or Webcam. The system dealing with high resolution images, because low resolution images lose many useful information when captured by camera. Next, the Preprocessing are begin to get the detection results of image processing . Gesture Histograms are used to compare test Hand Gestures (HG) with the actual images database . System used six HG are important and commonly used to training the supervised neural network .The system is very easy and flexibility . The system was built to train six HG using neural networks. So you can add other HG to the system help SP in daily jobs .The proposed algorithm of SPHG System have the below steps and showing in details in the figure (3):

Step1. Image capture from high resolution camera or webcam.

Step2. Images resizing 150 ×140 pixels fit (the desired size).

Step3. Edges detection (detect boundaries of HG).In this step we are using 2- filters. For the n direction n=[0 -1 1]. For the m direction m= [0 1 -1].

Step4. Divide two image matrices resulting dn and dm element by element and then taking the atan (tan−1) to get gradient orientation.

Step5 . Re-arrange the blocks of inputting image into columns by calling MATLAB function im2col
. This is optional step .

Step6. Converting the column matrix with the values to degrees. This way we can scan the vector for values ranging from 0 to 90. This can also be seen from the orientation histograms where values come up only on the first and last quarter.

During the training and learning in the proposed neural network, the Neural Network learning beginwith putting a HG image as iterations one by one, each iteration consist of 8×8 matrix elements (PE) by multi iterations to the suggested net . The

. first iteration put to the suggested net as an input block and applying feedforword NN(FFNN). First iteration input compare with desired output(supervised) if match or not, if there is an error(defects) ,then adjust weights of each node (PE) by applying backpropagation(BpNN) for the
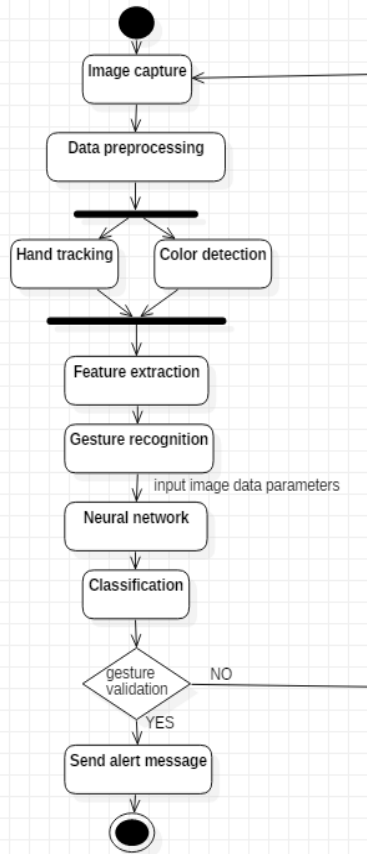

Figure 3. SPHG System Flowchart

same iteration until arrive to same desire output (i.e during the training process these weights are adjusted to achieve optimal accuracy and coverage).

7. Conclusion

In this papers, we present a new proposed model for SP, where this patients cannot move their bodies except hands. We build this system to read hands movements and translate this movements to requests carried out by doctors.The future HGDR is very bright especially for disabled patients and SP . This technique is natural and easy way to make a contact with a machine (simulation) , where the user not needing the training phase . This technique can be made a wireless technique, especially faraway patients . At this time ,

this technique can be controlled remotely. So in any case of disaster like fires or earthquake , if the person is in danger and can't get a help , he can show HG syntax to the system that will interpret it and send it as a signal to transceiver nearby and it will forward the signal further to the rescue team in the control room. This system can be development by adding Global Positioning System. This way help the persons to detect there locations by rescue team.

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