

HAND GESTURE DETECTION AND RECOGNITION FOR STROKE PATIENTS USING MACHINE LEARNING

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Conflicts of interest: Nil

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Abstract

Gestures are the motion of the body or physical action form by the user in order to convey some meaningful information. The proposed system is used to detect and recognize the hand gestures which are especially designed for stroke patients. It uses the webcam to detect gesture made by the user and perform basic operations accordingly. The user has to perform a particular gesture and webcam captures this and identifies the gesture, recognizes it (against a set of known gestures) and performs the action corresponding to it[1].

Keywords: Machine Learning, Hand Gestures, Stroke Patients

1. Introduction

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 Stroke patients who cannot move parts of their bodies due to injury, help to create an easy of stroke 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 Machine Learning (ML). The idea of this algorithm is reading hand signals (HS) by high resolution camera and processed by the computer after Machine Learning (ML) applied[1].

Our motivation behind this project is that so many people facing this handicapped problem and it was very difficult for patients to do their daily work. So, our team researched more about it. We go through so many research papers where

we had lot many existing solutions to the problems of handicapped and heart stroke patients. But we thought that we can come up with more modified solution to the problem.

Our main motivation behind this project is that, in one of the previous projects they were using hardware in working like sensor gloves, flex sensors, contact sensors, 3 axis accelerometer and various devices that makes this project very costly but we are reducing cost make it cheap by making this project application based[2].

2. Literature Review

Basically, the person who can't press any button and most of the people can't walk and most of the researchers with researches to help these kinds of people to do their daily work. Many interesting applications of hand gesture recognition have been introduced in many latest years. There are some review mentions below[1]:

- Mitra and Acharya have done excellent work with hand gesture recognition where user made gesture and receiver recognized them[2].

Hand gestures recognition is the natural way of Human Machine interaction and today many

researchers in the academia and industry are interested in this direction. It enables human being to interact with machine very easily and conveniently without wearing any extra device. It can be applied from sign language recognition to robot control and from virtual reality to intelligent home systems. In this paper we are discussing work done in the area of hand gesture recognition where focus is on the soft computing based methods like artificial neural network, fuzzy logic, genetic algorithms, etc. We also described hand detection methods in the preprocessed image for detecting the hand image. Most researchers used fingertips for hand detection in appearance based modeling. Finally we are comparing results given by different researchers after their implementation[2].

- Chaudhary and Raheja has described designing for intelligent systems in his work[4].

Large Intelligent Systems are so complex these days that an urgent need for designing such systems in best available way is evolving. Modeling is the useful technique to show a complex real world system into the form of abstraction, so that analysis and implementation of the intelligent system become easy and is useful in gathering the prior knowledge of system that is not possible to experiment with the real world complex systems. This paper discusses a formal approach of agent-based large systems modeling for intelligent systems, which describes design level precautions, challenges and techniques using autonomous agents, as its fundamental modeling abstraction. We are discussing Ad-Hoc Network System as a case

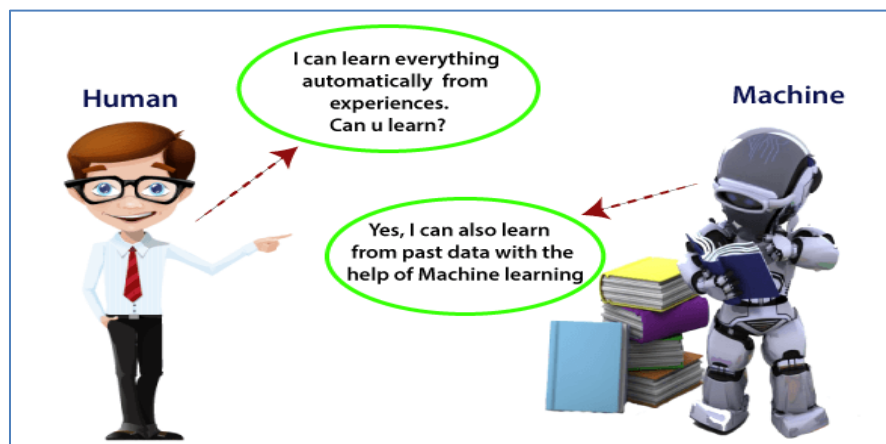
study in which we are using mobile agents where nodes are free to relocate, as they form an Intelligent Systems. The designing is very critical in this scenario and it can reduce the whole cost, time duration and risk involved in the project[4].

- “Hand Gesture Recognition based on Digital Image Processing using MATLAB” By Tahir Khan under supervision of Dr. Amir Hassan Pathan Faculty of Engineering, Sciences and Technology, IQRA University Karachi, Pakistan[6].

This research work presents a prototype system that helps to recognize hand gesture to normal people in order to communicate more effectively with the special people. Aforesaid research work focuses on the problem of gesture recognition in real time that sign language used by the community of deaf people. The problem addressed is based on Digital Image Processing using Color Segmentation, Skin Detection, Image Segmentation, Image Filtering, and Template Matching techniques. This system recognizes gestures of ASL (American Sign Language) including the alphabet and a subset of its words[6].

3. Machine Learning

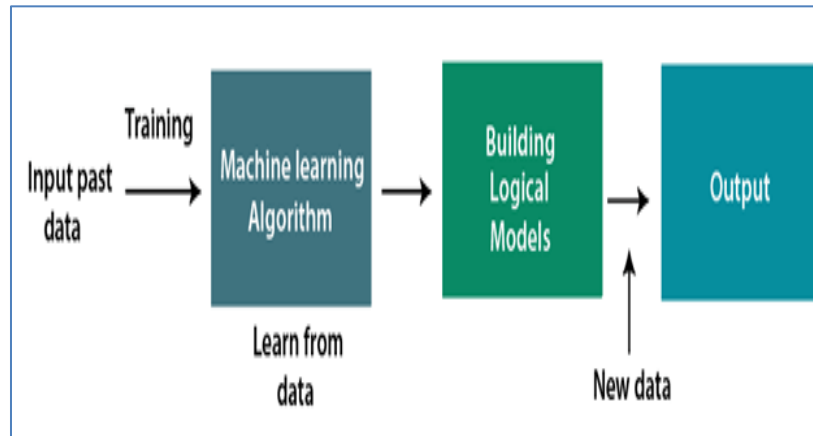
In the real world, we are surrounded by humans who can learn everything from their experiences with their learning capability, and we have computers or machines which work on our instructions. But can a machine also learn from experiences or past data like a human does? So here comes the role of **Machine Learning**[8].



How does Machine Learning work?

A Machine Learning system **learns from historical data, builds the prediction models, and whenever it receives new data, predicts the output for it.** The accuracy of predicted output depends upon the amount of data, as the huge amount of data helps to build a better model which predicts the output more accurately.

Suppose we have a complex problem, where we need to perform some predictions, so instead of writing a code for it, we just need to feed the data to generic algorithms, and with the help of these algorithms, machine builds the logic as per the data and predict the output. Machine learning has changed our way of thinking about the problem. The below block diagram explains the working of Machine Learning algorithm:



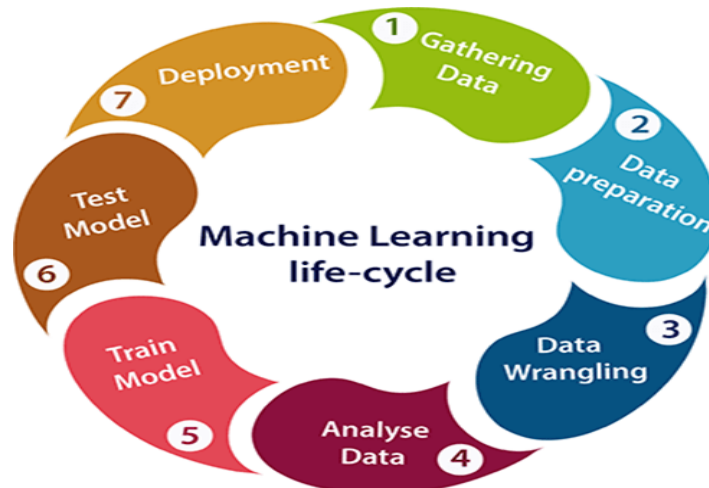
Features of Machine Learning:

- Machine learning uses data to detect various patterns in a given dataset.
- It can learn from past data and improve automatically.
- It is a data-driven technology.
- Machine learning is much similar to data mining as it also deals with the huge amount of the data.

Machine learning life cycle involves seven major steps, which are given below:

- **Gathering Data**
- **Data preparation**
- **Data Wrangling**
- **Analyse Data**
- **Train the model**
- **Test the model**
- **Deployment**

Machine learning Life cycle



4. Methodology

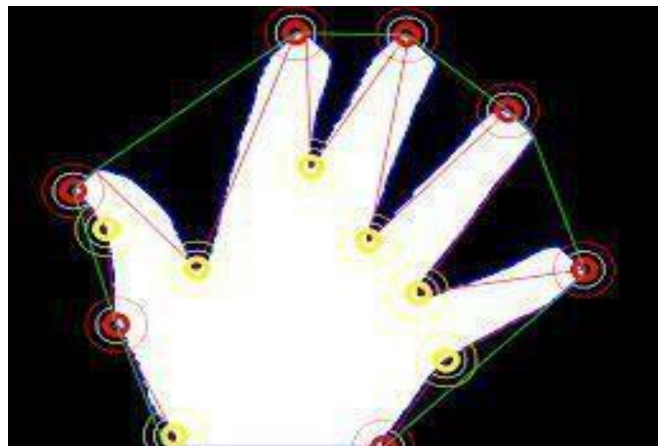
4.1 Convex Hull Algorithm

To calculate the convex hull of the given contour, the palm is considered with the fingers as the convexity defects. The complex structure can be simplified by this technique. The convex hull will

be the convex polygon which is surrounded by the vertices corresponding to the tip of the fingers. In gesture contour by all the convex vertices. The convex hull of the contour of the hand gesture is the convex polygon surrounded in gesture contour by all the convex vertices[11].



Convexity defects can be depicted as the calculated difference between the convex hull and the contour. The convexity defect is defined as the points farthest from the convex points. So, if the finger tips are considered as the convex points, the trough between the fingers can also be considered as convexity defects[11].



4.2 Procedure of work

Main objective of this project is to provide the physically challenged users a better way to interact with normal peoples.

Step1: Login

Step2: Camera Interfacing

Step3: Image Pre-Processing

Step4: Object detection

Step5: Convex hull implementation

Step6: Finger count

Step7: Perform operations

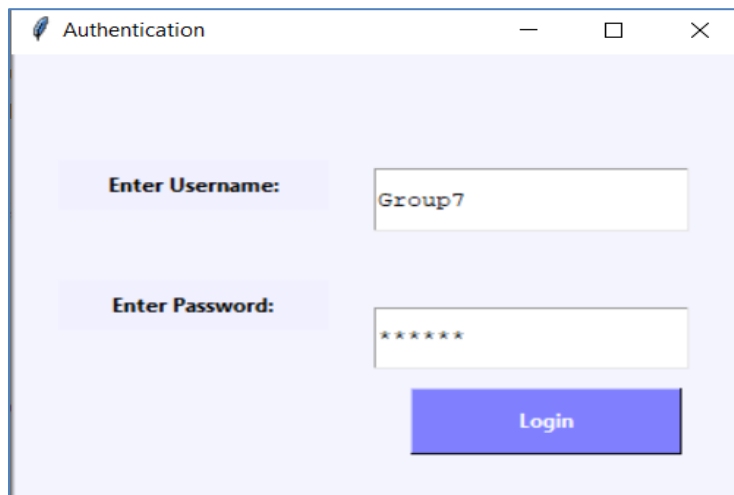
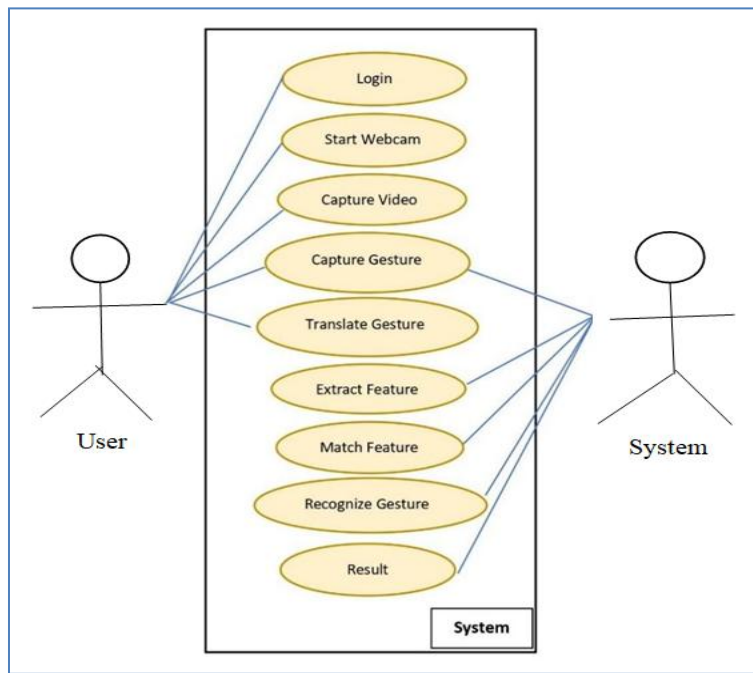


Figure: Login Page

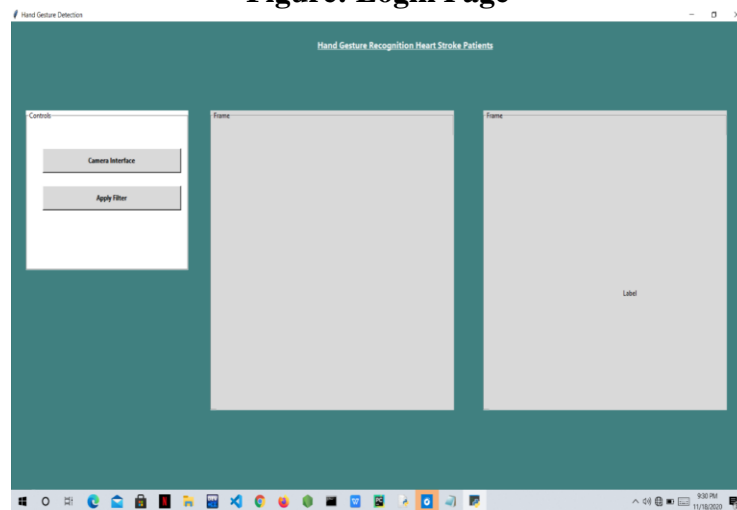


Figure: Software GUI

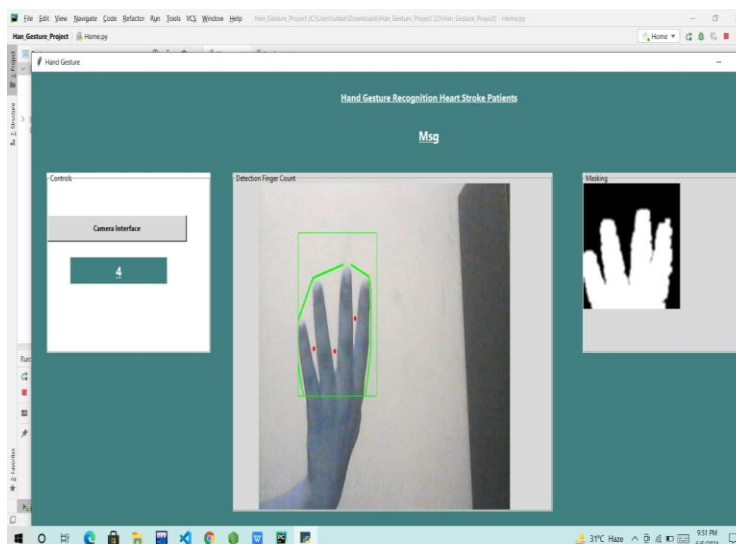


Figure: Object Detection

5. Conclusion

In this project, we are developing a software especially for stroke patients in order to perform their work effortlessly. We build this system to read hands movements and translate this movements to requests carried out by hospital attendants. The future Hand Gesture Detection & Recognition (HGDR) is very bright especially for disabled patients and Stroke Patients (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 software also helps patients in speedy recovery.

Our software also applicable for handicapped patients or any type of patients provided their hands properly so that they can show their fingers.

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