

# CSCE 5222 - Feature Engineering

**Github Link:**

<https://github.com/pranathi1997/Hand-Gesture-Human-Computer-Interaction>

**Project Title:**

Hand Gesture Human-Computer Interaction

**Team Members:**

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**Idea description:**

Natural user interfaces have become increasingly important in today's world, because of advances in ubiquitous computing. The existence of computers and the usage of human-computer interaction tools in our society will undoubtedly have a beneficial influence on our civilizations. Whether it was back in the day when technology was less advanced or today when technology has advanced so much that we spend the majority of our time communicating, playing, doing our jobs with machines, and so on, human beings have used and continue to use a wide range of gestures to communicate and interact with one another. Human gestures are a type of nonverbal interaction that can be the most natural, intuitive, and creative method to engage with computers. Our primary objective is to make human-computer connection seem as natural as human-human contact. The goal of this study is to detect static hand gesture pictures (i.e. frames) based on hand shapes and orientations taken from an input video captured under steady illumination and with a basic background.

**Goals and Objectives:**

Our primary objective is to make human-computer connection seem as natural as human-human contact. We may utilize Computer Vision and Convolutional Neural Networks for Hand Gesture Recognition based on the description to communicate information from a human to a computer.

**Motivation:**

The motivation of this study is to create a human-computer connection by targeting simple forms generated by hand at various apps running on a computer. When we communicate with other people, our hand gestures play a crucial role because they express a lot of information in a variety of ways. Hand gestures, according to this theory, would be an appropriate choice for conveying sentiments or operating dynamic computer applications with simpler hand gestures.

**Significance:**

It has the potential to improve customer pleasure. For example, a user can control a Computer with only hand gestures.

**Literature Survey:**

1. GestIA: Control your computer with your hands.
2. Sixth Sense Technology: Life Beyond Physical Sciences.

**Features:** Convolutional Matrices can be used as features

**Related Work:**

Most of the prominent hand gesture systems stick to this approach of recognition. For example, in the operation of a well-established remote control system based on hand gestures, the hands are distinguished from the background by the skin's coloring and movement features. Similarly, data from the skin and color pores are utilized to segment in another well-known hand-based remote control system, though the Pyroelectric Infrared (PIR) sensor is used to activate the digital sensor to save energy. Another interface employing the approach of visual based hand gesture detection for televisions, the solution entails inferring the hand area from trajectory data using a framework including particle filters. Furthermore, numerous instances are presented that are purely based on deep learning approaches and demonstrate superior overall performance in recent years.

**Dataset:**

For the model's training, it was decided to use six different hand gestures. These were picked based on the criterion of ease of use and simplicity. Because the final application was not bound, it was important to make sure that the motions chosen were distinct and useful for a wide range of front end applications

The chosen gestures are:

1. Fist
2. Palm closed
3. Palm open
4. Thumbs up
5. Thumbs down
6. index finger up

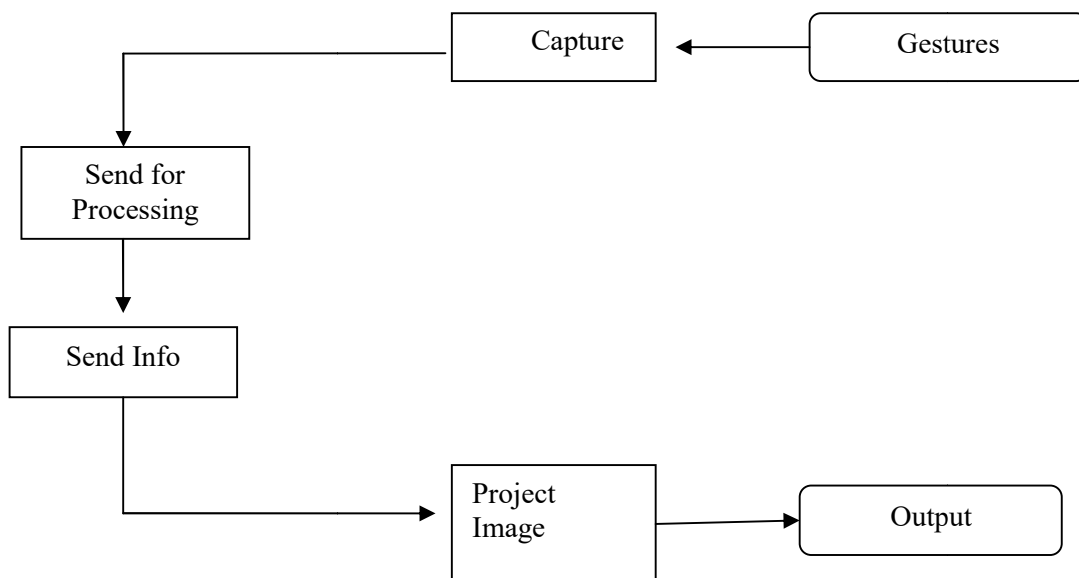
We created a python script to capture frame photos from a camera, allowing each team member to create a set of images that included all of the desired hand movements in various backgrounds and lighting setups. The model's capacity to recognize other scenarios should increase as a result of this.

The team intended a versatile application that could be used with a variety of programs. This necessitates attempting to account for as much variation as feasible. All of the little variations from the "ideal" hand gesture that we could supply as training data would aid in improving hand identification accuracy. This entailed photographing the hands at various distances from the webcam, as well as with various inclinations and lighting conditions. The program should, for example, be able to recognize the winning hand gesture (two fingers up) even if the spacing between the fingers is changed.

The total number of photographs obtained for the collection is in excess of 4000. Using labeling software, each of them had to be properly labeled. This software would allow the user to pick a part of the image with a feature (in this case, a hand gesture) and label it with a custom label. The program then creates a \*.xml file for each of the labeled images.

## Implementation:

A revolutionary hand-gesture based recognition system is used in the suggested approach. Without the use of any algorithm including area proposal or sliding window approach, the gesture in the hand region is directly understood from the entire shot. This approach takes advantage of bestrew's advantage in terms of recognizing a pattern with relevantly tiny dimensional and stochastic placed spots. The answer is based on the notion of a deep convolutional neural network, which can effectively read hand gestures in subjective positions. In comparison to the surrounding background, which contains the own human face and body, the aforementioned procedure occupies a smaller image region. Regarding the aforementioned reason, the CNN has a design problem when dealing with probable overfitting scenarios that occur during preconditioning, whereas the DCNN does not generalize the new data and just remembers the training data. Another advantage of the proposed system is that there is no necessity for bounding boxes during the training stage, which simplifies the collection process involving the own training method and the training sample system. Because of the inadequacies of the sliding window or region idea's impossible computing capabilities, the notion of hand gesture recognition has prevailed in real-time use.



## Implementation status report

- **Work completed**
  - **Description:** Referred various research journals and related articles to this. Each approach may differ and there are lots of challenges which are bit complex.. Mostly pre processing stage is completed

- **Responsibility (Task, Person):**  
Literature survey, Python Programming & documentation pre processing – Lakshmi Priya Kalapala  
Python Programming& feature extraction - Gagan Sai Ram Anvesh Achanta  
Python Programming, documentation& feature extraction - Sai Pranathi Karedla  
Python Programming & post processing - Nikhil Reddy Vemireddy
- **Work to be completed**
  - **Description:** Some Technical Challenges in Preprocessing Stage and in feature engineering are to be overcome. Post-processing to be done.
  - **Responsibility (Task, Person):**  
Literature survey, Python Programming & documentation pre processing – Lakshmi Priya Kalapala  
Python Programming& feature extraction - Gagan Sai Ram Anvesh Achanta  
Python Programming, documentation& feature extraction - Sai Pranathi Karedla  
Python Programming & post processing - Nikhil Reddy Vemireddy
  - **Issues/Concerns**  
Attaining accuracy is one of the technical challenges and pre-processing is the most important task

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