Advanced Hand Gesture Recognition System for Sign Language Translation

by

Shivarathri Jayanth Rahul

21010120

Semester – VI

Under the supervision of

Dr.Rajkumari Bidyalakshmi Devi

Assistant Professor

Department of Computer Science and Engineering

Indian Institute Of Information Technology, Manipur

Introduction

- In today's rapidly evolving technological landscape, human-computer interaction has become increasingly important.
- Traditional input methods like keyboards and mice are being augmented, and sometimes even replaced, by more intuitive and natural interfaces.
- Hand gesture recognition is one such interface that holds immense potential for various applications ranging from sign language translation to virtual reality interaction.

- **1 Million** Deaf people who use American Sign Language as their primary language.
- **30 Million** Americans hear at 40 decibels (dB) or higher. "Normal" hearing ranges from 0 to 20 dB.
- **70 Million** Deaf people around the world use sign language
- **98%** of Deaf people this world do not receive education in sign language.
- **72%** of families do not sign with their Deaf children.
- **70%** of Deaf people don't work or are underemployed.
- **1 in 4** Deaf people have quit a job due to discrimination.

Problem Statement

- In existing approaches, certain limitations are evident. For instance, one model achieved an accuracy of only 65% due to a limited dataset, while another model demonstrated a test accuracy of 73%, but suffered from overfitting with a training accuracy of 89.5%.
- Notably, the LSTM model exhibited lower accuracy compared to the CNN model. Furthermore, when combining LSTM and CNN, the accuracy was lower than that achieved by either model individually.

Proposed method

- Developed an advanced hand gesture recognition system for sign language translation.
- Employed a Convolutional Neural Network (CNN) with three layers for processing input images.
- Utilized max-pooling to down sample features extracted by the CNN.
- Flattened the processed image into a vector for gesture label prediction.
- Achieved accurate recognition and interpretation of sign language gestures using this approach.

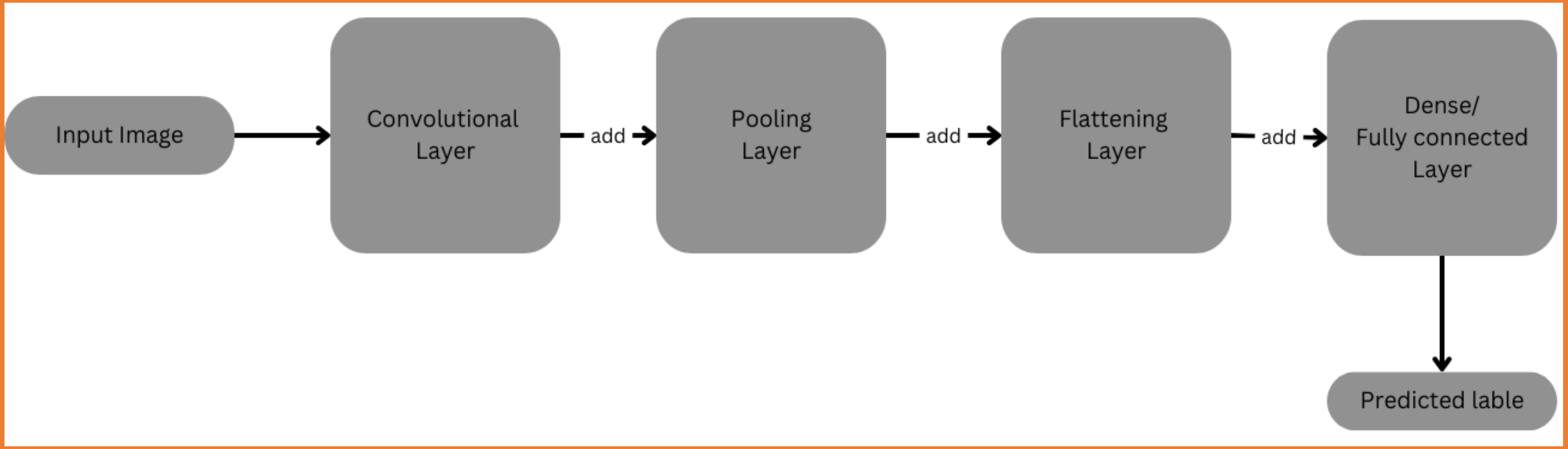


Figure 1: proposed method Flow diagram

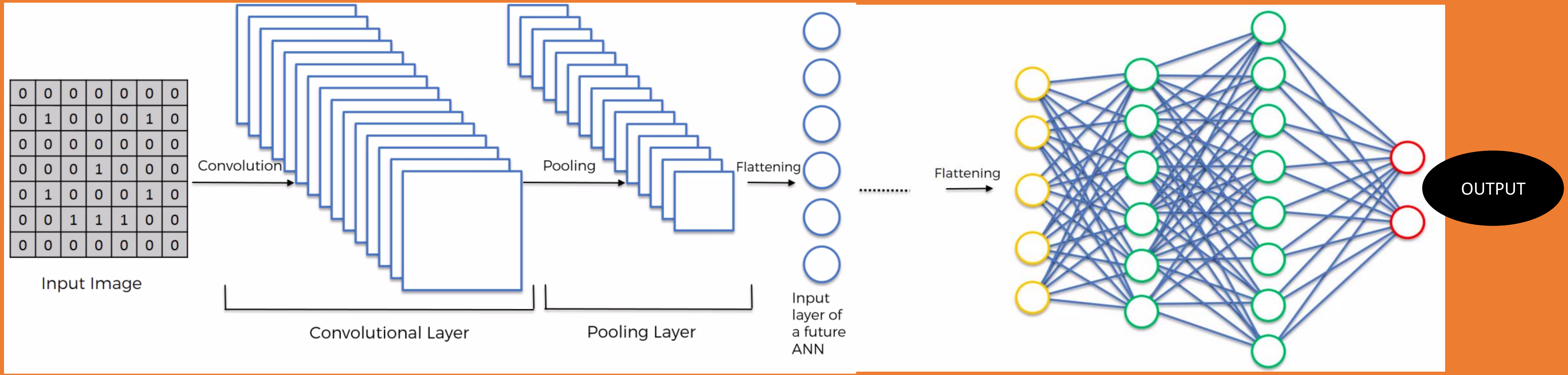
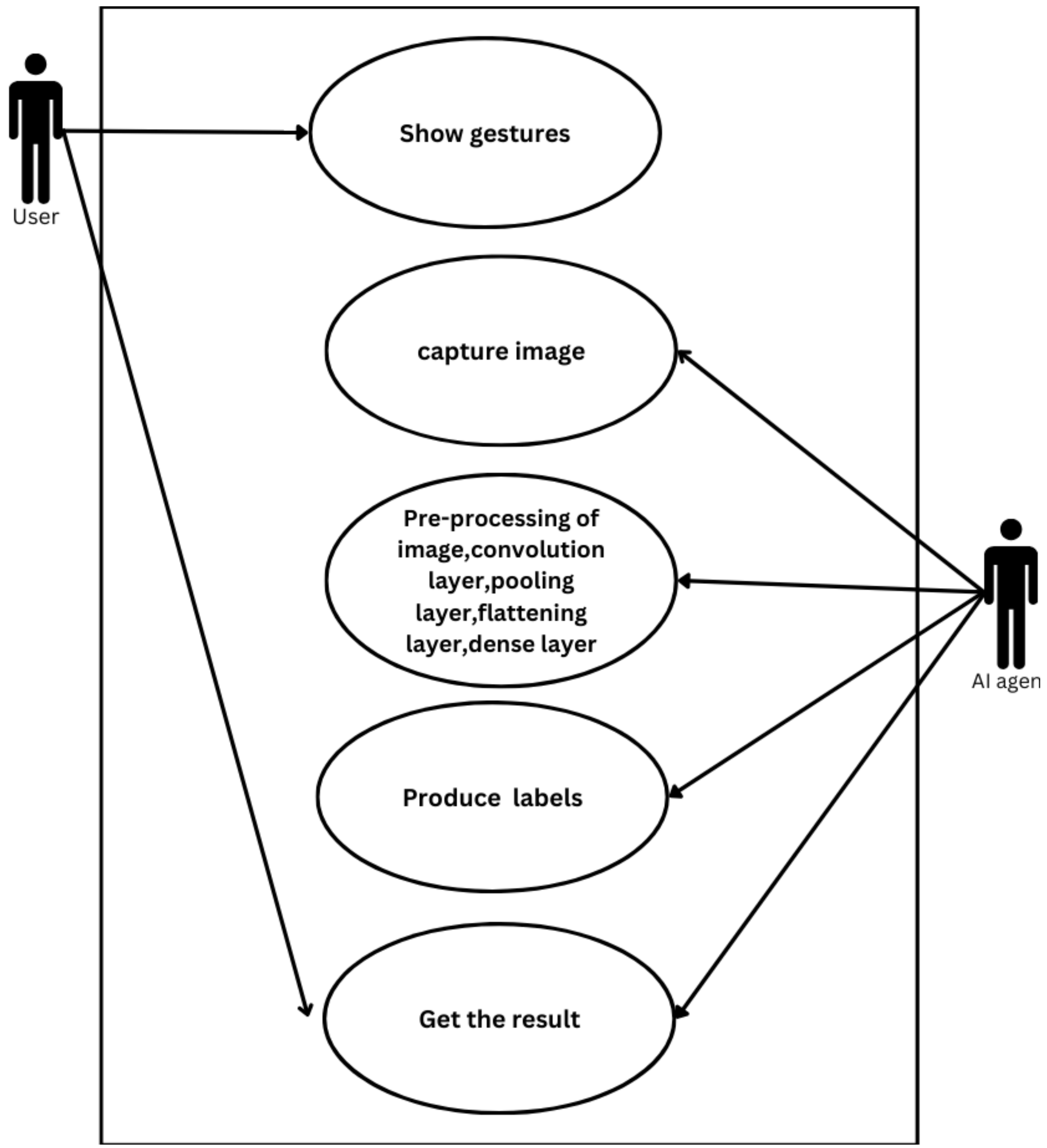
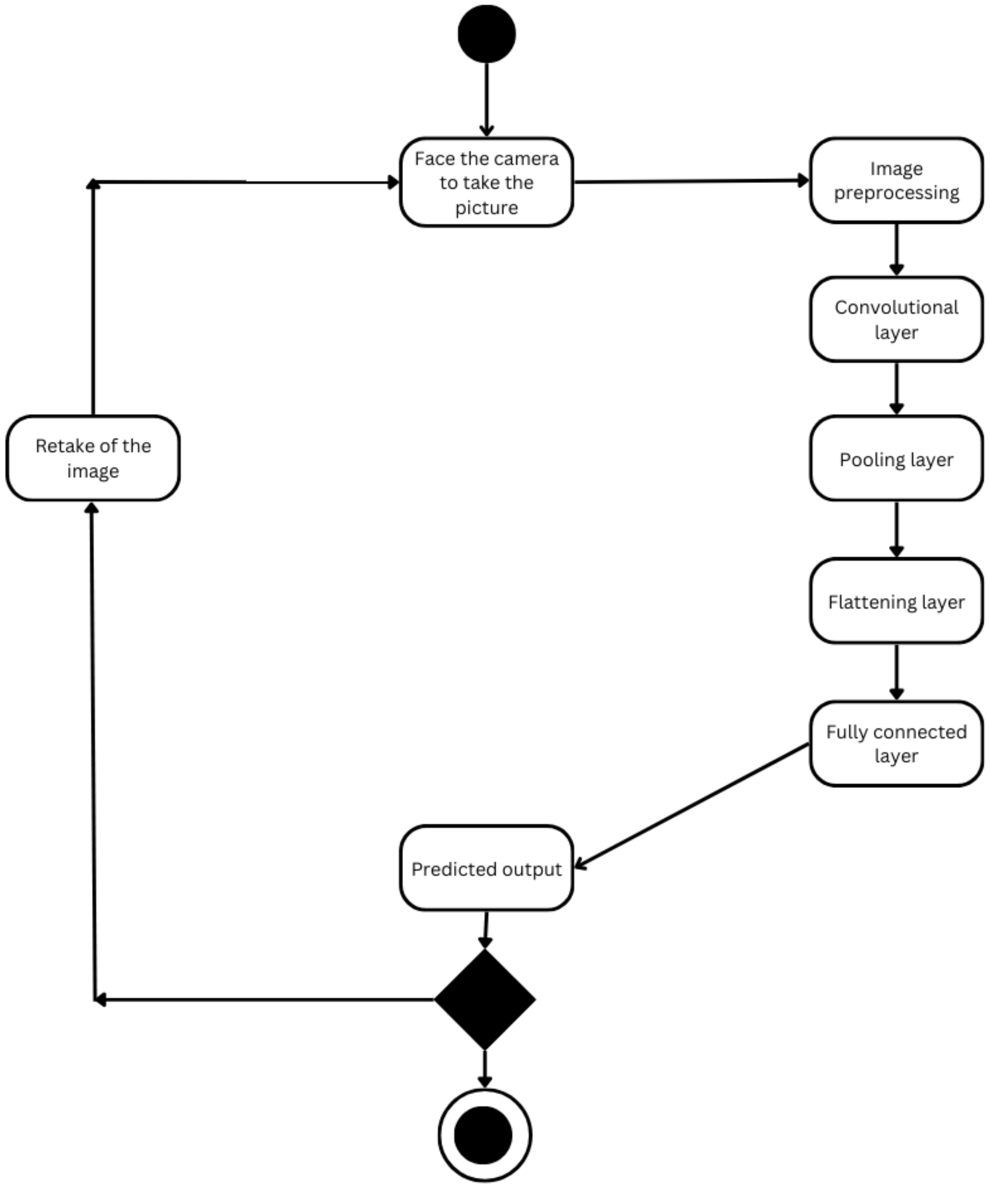


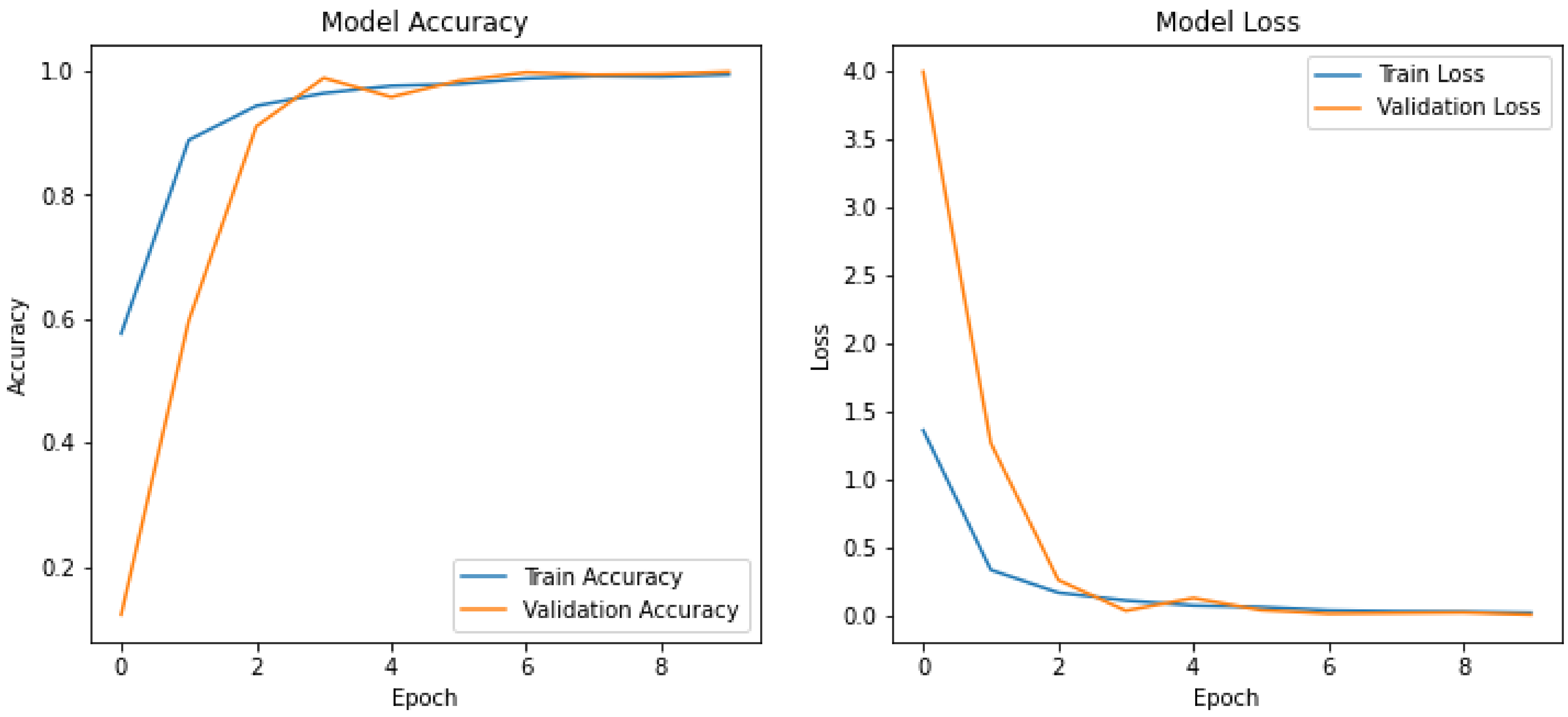
Figure 1: System architecture

Use case diagram



Activity diagram




Model Accuracy
1.0
0.8
0.6
0.4
0.2
Accuracy
0
2
4
6
8
Epoch
Train Accuracy
Validation Accuracy
Model Loss
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Loss
Train Loss
Validation Loss

Result Analysis:

Experiment 1:

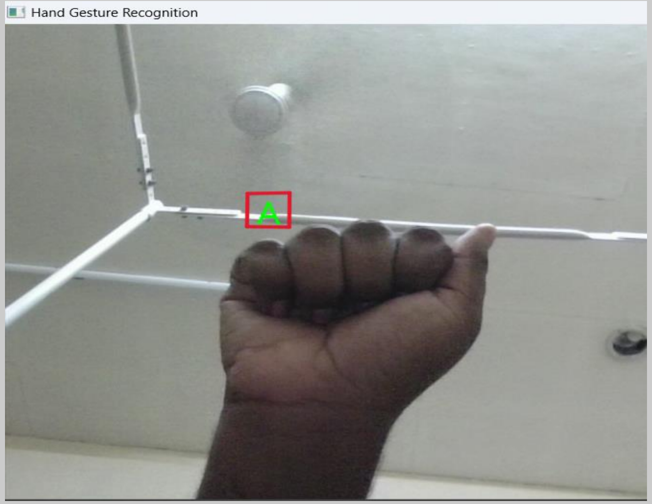
Sr.NO	Models	Accuracy
1.	LSTM[1]	90-96%.
2.	LSTM-CNN[2]	98.50%
3.	Approach(1) (LSTM+CNN)	>98.6%

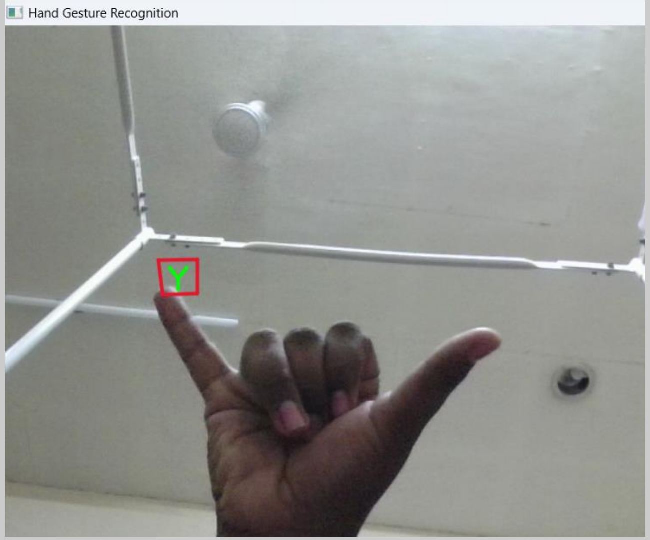
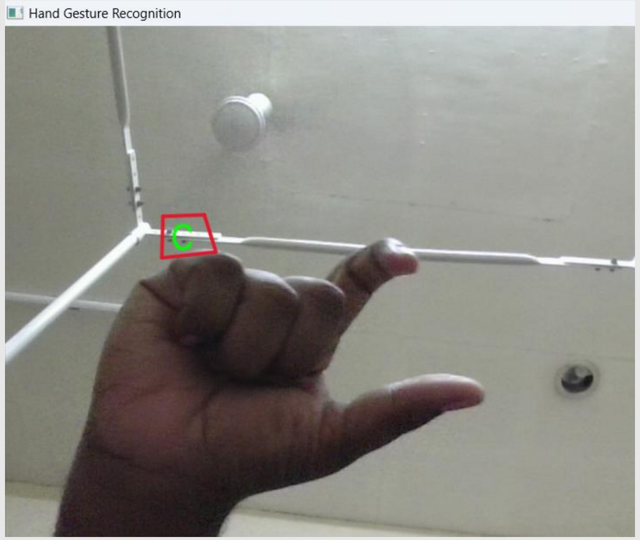
Experiment 2: Change dataset

Sr.NO	Dataset	Accuracy
1.	Kaggle[3]	78%.
2.	Collected dataset(Approach 1)	90.50%
3.	Approach(2) Mnist (std. dataset)	>98.6%

Note:

1. data set size matters in the improvement of accuracy or Feature extraction.
2. Accuracy also depends on the model architecture ie. CNN , LSTM.

Test ID	Testing letter	Expected result	Output
T1	Letter "A"	"A”	
T2	Letter “F"	“F"	

Test ID	Testing letter	Expected result	Output
T3	Letter “Y"	“Y”	
T4	Letter “C"	“C"	

Conclusion:

- In conclusion, our project represents a step forward in the advancement of human-computer interaction technologies. By combining the power of computer vision and machine learning, we can create more intuitive and accessible interfaces that benefit users across different domains.
- Throughout this presentation, I'll delve deeper into the technical aspects of our project, demonstrate its capabilities through live demonstrations, and discuss potential future enhancements and applications. Thank you for your attention, and I hope you find this presentation insightful and inspiring.

Future enhancements:

- Expanding the gesture vocabulary.
- Integrating the system into specific applications or devices.
- Design intuitive user interfaces for displaying recognized gestures, feedback, and instructions.
- Implement real-time feedback mechanisms to provide users with immediate responses to their gestures.

THANK YOU