# SIGN LANGUAGE TO TEXT CONVERSION

**by**

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*Thesis submitted to*

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*of*

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*by*

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# DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Datla Krishna Karthik Varma ,

Roll No: 421132,

Date:

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Roll No:421174,

Date:

# CERTIFICATE

It is certified that the work contained in the thesis titled **Sign Language to Text Conversion**, by DATLA KRISHNA KARTHIK VARMA (421132) and KONANKI RISHITHA CHOWDARY (421174) has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

**Dr. Srilatha CH,**
**Department of Computer Science and Engineering,**
**National Institute of Technology, Andhra Pradesh,**
**April, 2023**

# ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people who made it possible, whose constant guidance and encouragement crowned our efforts with success. It is a pleasant aspect that I have now the opportunity to express my gratitude for all of them. We owe our sincere gratitude to our project guide Dr. Sri Latha C, Department of Computer Science, National Institute of Technology, Andhra Pradesh, who took keen interest and guided us all along, till the completion of our project work by providing all the necessary information. We avail ourselves of this proud privilege to express our gratitude to all the faculty of the department of Computer Science and Engineering at NIT Andhra Pradesh for emphasizing and providing us with all the necessary facilities throughout the work. We offer our sincere thanks to all our friends, fellow mates and other persons who knowingly or unknowingly helped us to complete this project.

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# LIST OF FIGURES

# ABSTRACT

We aim to build a model that could convert sign language to text, making communication between differently abled people and normal people easy. Along with the alphabet, we will also involve some common usage words so there is no need to sign each letter. This model can also be modified to display an entire sentence through Some series of signs. The proposed project uses computer vision to develop a sign language-to-text conversion system. The system will be capable of detecting hand gestures and translating them into respective text, allowing individuals who do not know sign language to communicate effectively with those who rely on it. To achieve this goal, we have created our own dataset and trained it using Sklearn, a popular open-source machine-learning platform. The dataset comprises several hand gestures used in American Sign Language (ASL). We used Sklearn to train the model to detect these gestures accurately.

We have thought to walk through this project around all the alphabet and also some of the commonly used signals like hello, thank you, etc., For this, we have used a hand tracking module to detect hands and then we have resized it to only the size of the hand. We then saved these images into a folder.

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# Chapter 1

## 1.1. Introduction

Sign language is a unique form of communication that is used by millions of people worldwide who are deaf or hard of hearing. However, for people who do not understand sign language, it can be challenging to communicate with individuals who use it. This is where computer vision can play a crucial role in bridging the communication gap between deaf and hearing communities.

Sign language to text conversion using computer vision is a fascinating area of research that involves using computer algorithms to recognize and interpret the gestures and movements of sign language users and convert them into written text. This technology can provide an efficient and accurate way for people who are deaf or hard of hearing to communicate with the hearing community, as well as enable hearing individuals to communicate with sign language users.

In this project, the goal is to develop a sign language-to-text conversion model using computer vision. This involves collecting a dataset of sign language manually, labeling the data, and using Computer Vision algorithms to train a model to recognize and interpret sign language gestures accurately. The project will require knowledge of computer vision as well as familiarity with sign language and its grammar and syntax.

The project's expected outcome is a working prototype that can recognize and translate sign language gestures into text in real time, providing an efficient and effective communication tool for people who use sign language. This project has the potential to make a significant impact in improving the lives of people who are deaf or hard of hearing by breaking down communication barriers and promoting inclusivity.

# Chapter 2

## 2.1. Motivation

We communicate with each other by speaking, but when a dumb person wants to talk or a deaf person wants to listen traditional conversation is not possible. So, then there arises a need for sign language. Although this sign language acts as a boon to these challenged people, this on the other hand causes difficulty for normal people to understand. So, the main motivation behind choosing this project is to implement a model which could convert sign language to text.

## 2.2. Technology Stack

### Modules used:

OpenCV

Numpy

Hand tracking module

Sklearn

Media pipe

# Chapter 3

## 3.1. Problem Statement

The problem addressed by this project is the communication barrier faced by people who are deaf or hard of hearing when communicating with the hearing community. Sign language is the primary means of communication for many deaf individuals, but it is not always understood by those who do not know the language. This results in limited communication and can lead to social isolation and exclusion.

To address this problem, this project aims to develop a sign language-to-text conversion system using computer vision. The goal is to create a system that can accurately recognize and interpret sign language gestures and convert them into written text in real time. This will provide an efficient and effective communication tool for people who use sign language and enable them to communicate with the hearing community more easily.

# Chapter 4

## 4.1. Sign Identification

To Examine the Hand Signature the traditional method of handpicking is not feasible thus it required the help of machines i.e. computers and special algorithms and detection models are needed for better results. Thus Computer Vision came into the picture and using the Background Subtractor algorithm technique to solve this problem.

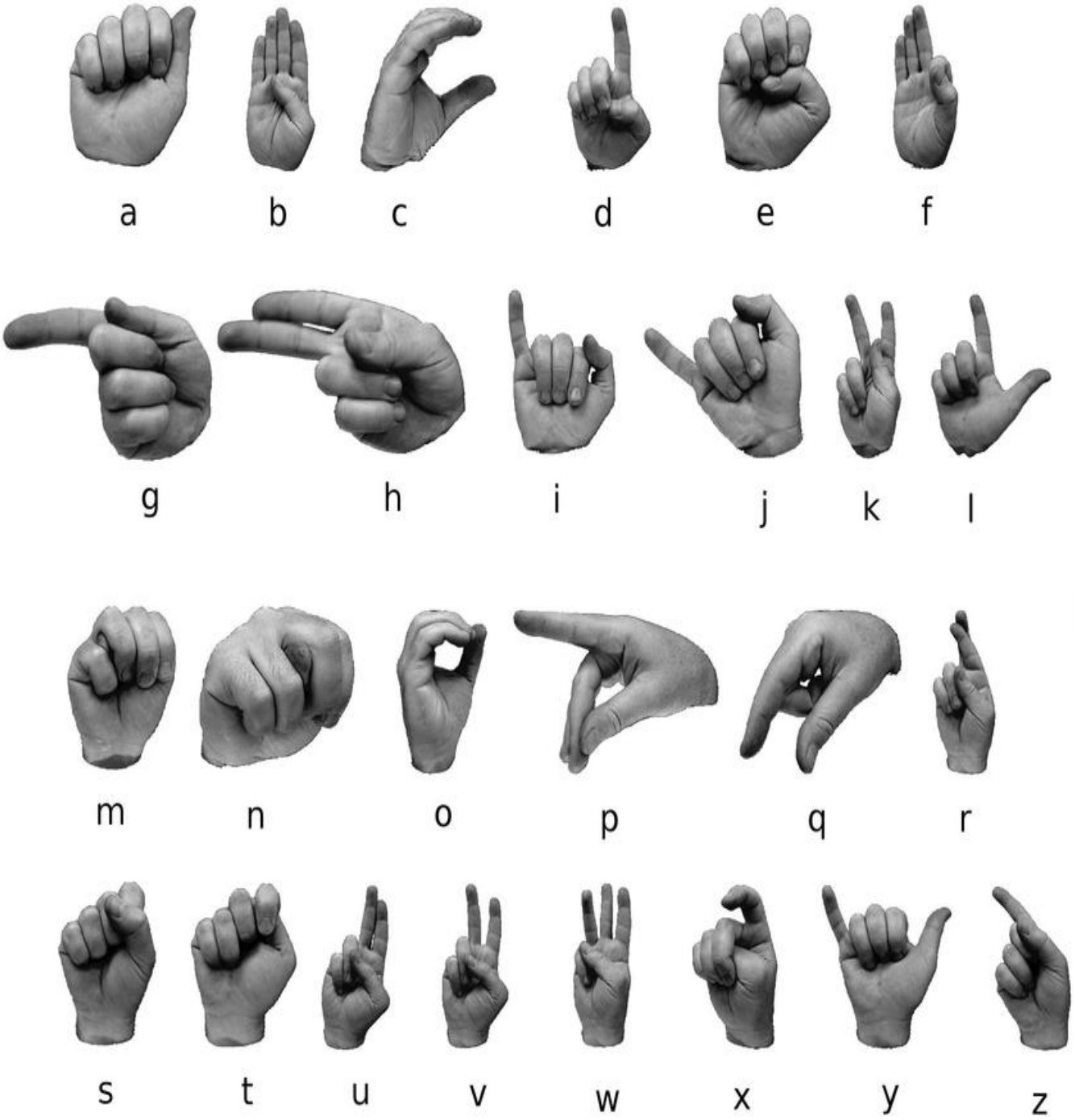
## 4.2. Data Collection

For collecting data, we first created a new directory called 'data' using the OS module in Python. Then we have set the no of classes and also the data set size. For every class, we have created a separate folder in the directory and have collected images equal to the data set size, and joined them to the folder. We should also make sure that we have given images in all possible orientations in order to train the model better.

## 4.4. Data Labelling

We stored all images of same sign in to one sub folder and named that sub folder with its text. its been done in both train and test folders.

## 4.4. ASL Dataset Signs



# 4.4 Building the Model

The data(images) is encoded into feature representations based on these parameter values, these are for initial segregation and to gives better results i.e. fast and accurate results.

## Importing Libraries :

```
import pickle
import numpy as np
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from tensorflow.keras.preprocessing.sequence import pad_sequences
```

## Opening data file :

```
data_dict=pickle.load(open('./data.pickle','rb'))
```

## Data file parameters :

```
print('Shape of data:', np.shape(data_dict['data']))
print('Data type of data:', type(data_dict['data']))
print('Format of data in data_dict[\'data\']:', type(data_dict['data'][0]))
```

## Fetching data and values:

```
data = pad_sequences(data_dict['data'], padding='post', dtype=object)
labels=np.asarray(data_dict['labels'])
```

## Training model :

```
x_train,x_test,y_train,y_test=train_test_split(data,labels,test_size=0.2,shuffle=True,stratify=labels)

model=RandomForestClassifier()

model.fit(x_train,y_train)
y_predict=model.predict(x_test)

score=accuracy_score(y_predict,y_test)

print('{}% of samples were classified correctly !'.format(score*100))
```

## Saving model to disk:

```
f=open('model.p','wb')
pickle.dump({'model':model},f)
f.close()
```

# Chapter 5

## 5.1 Experimental Procedure

The system is designed to use a camera to capture video of a person signing, and then use OpenCV algorithms to recognize the signs being made. They are trained using a large dataset of sign language images, which includes examples of a wide range of signs and gestures. The system uses a sklearn-based model that is trained on images of sign language gestures. The model is trained to identify the signs being made in real-time video feeds. The system first detects the hand, then tracks the movement of the hand, and determines the sign being made. The system then outputs the corresponding text in real-time.

Data Collection:

Collect a large dataset of sign language Images with accompanying text translations. This dataset should include a variety of signs, signed by different people in different lighting and background conditions.

Data Preprocessing:

Preprocess the collected dataset by extracting individual sign gestures from the images, normalizing the lighting conditions, and segmenting the signs based on the Image annotations.

Model Training:

Train a deep learning model, such as a sklearn, to classify the sign gestures based on the extracted features. Use the sign language text translations as labels for the training data.

Real-time Conversion:

Implement the sign language-to-text conversion system in real-time using a camera or webcam. This system should use the trained model to recognize sign gestures from live Video input and output the corresponding text translations in real-time

User Testing:

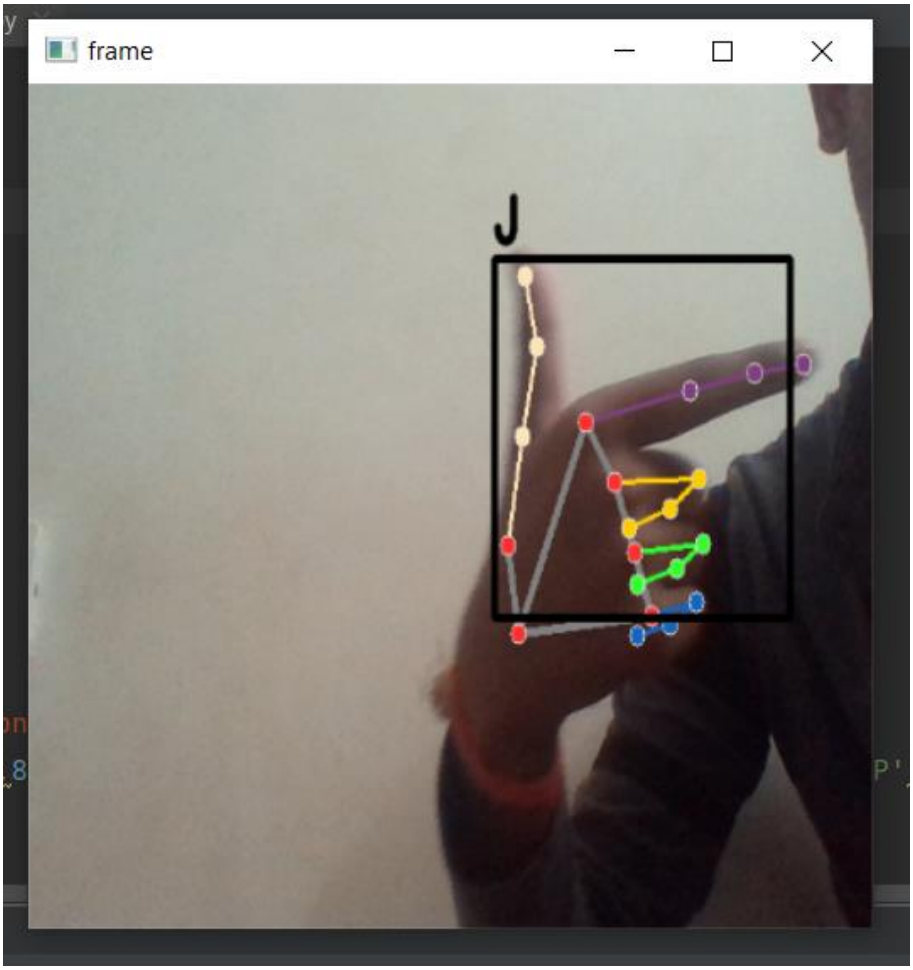
Conduct user testing to evaluate the usability and effectiveness of the sign language-to-text conversion system. This testing should involve users who are proficient in sign language and users who are not. Collect feedback from the users and use it to improve the system.

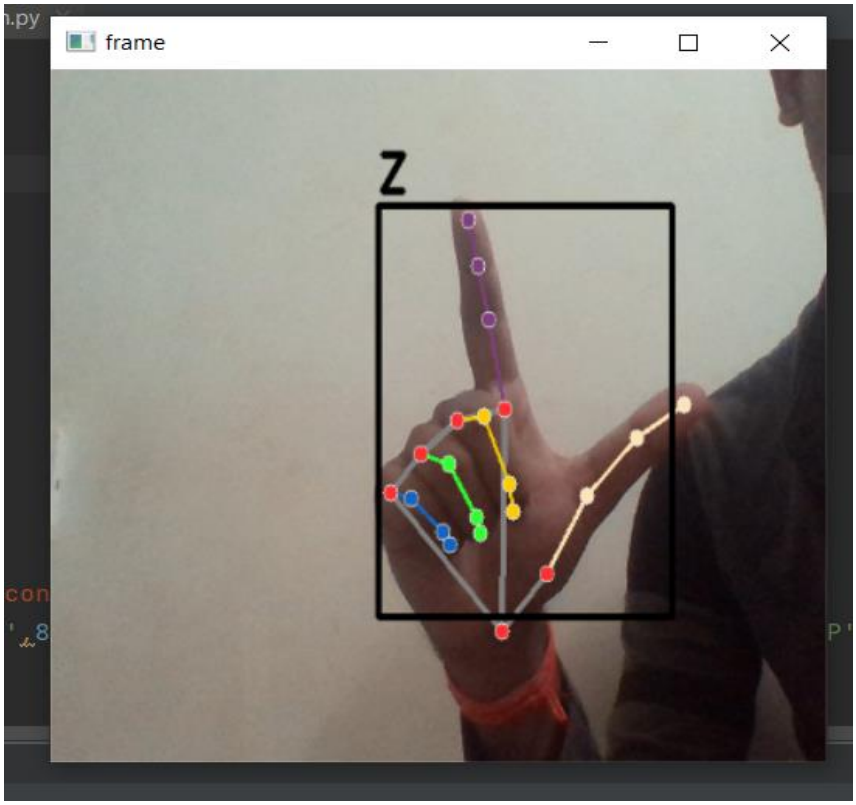
Deployment:

Once the sign language-to-text conversion system is fully tested and optimized, deploy it in real-world settings, such as schools, offices, and public spaces. Monitor its performance and collect user feedback to continuously improve the system.

# Chapter 6

## 6.1 Results and Discussion

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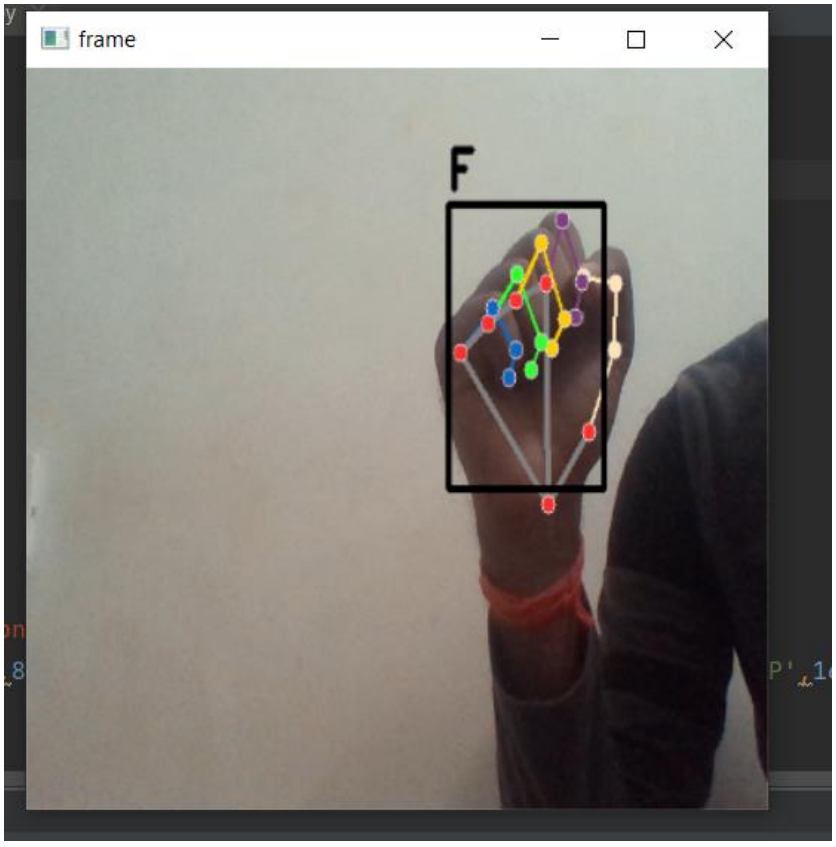
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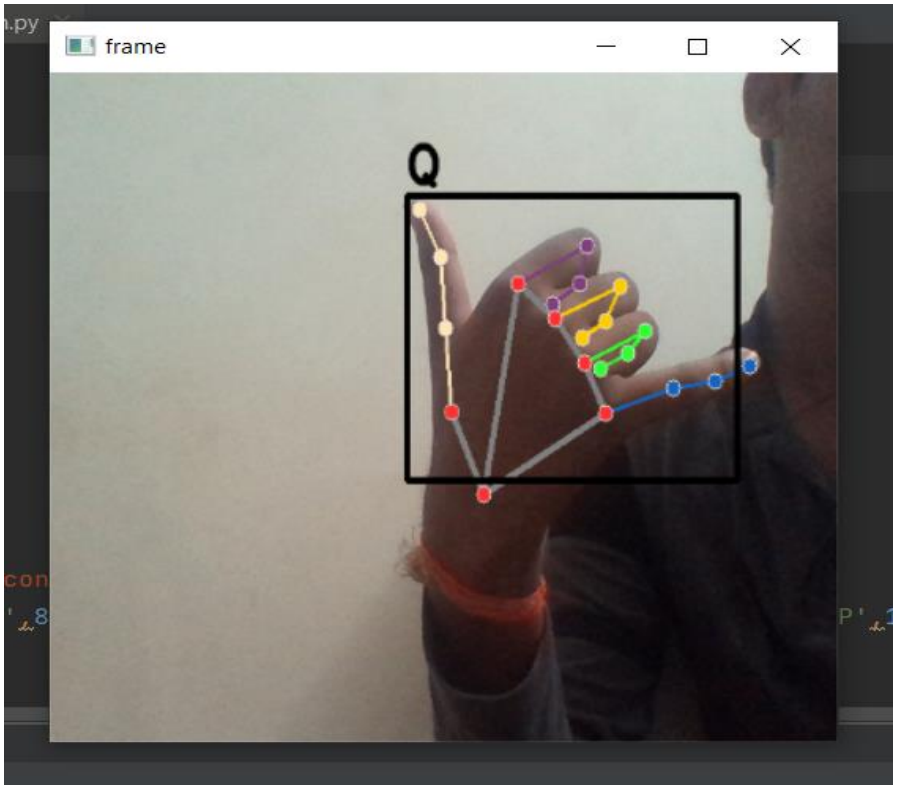
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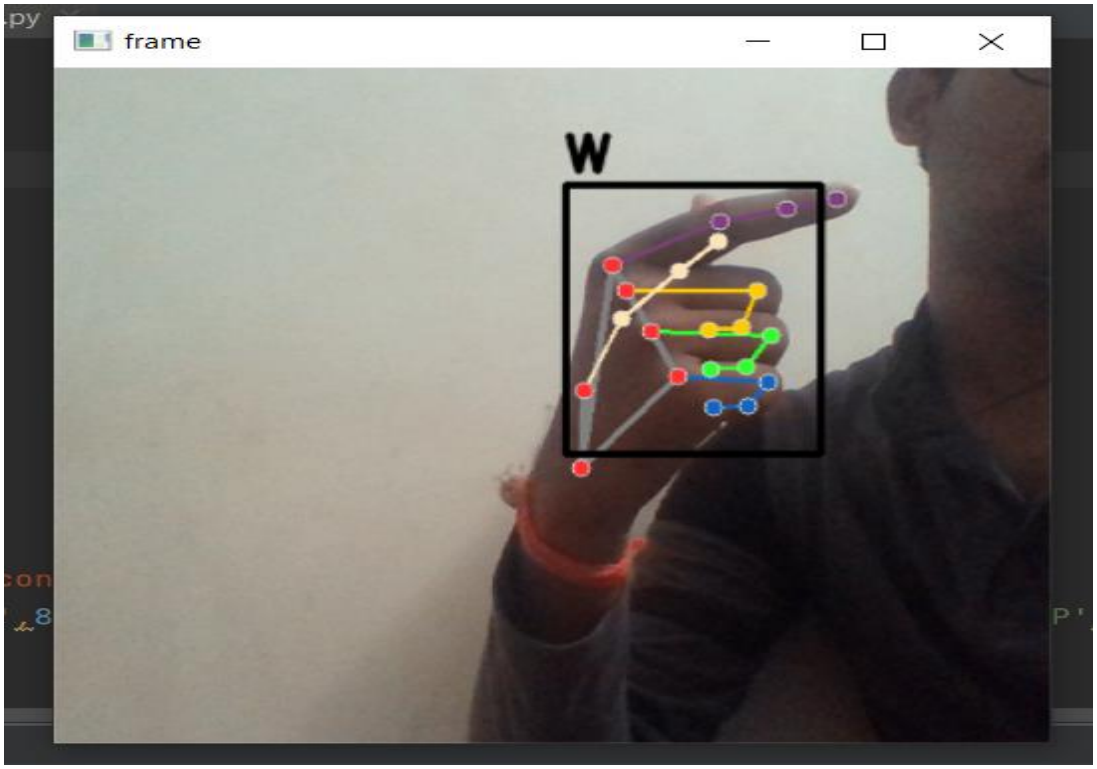
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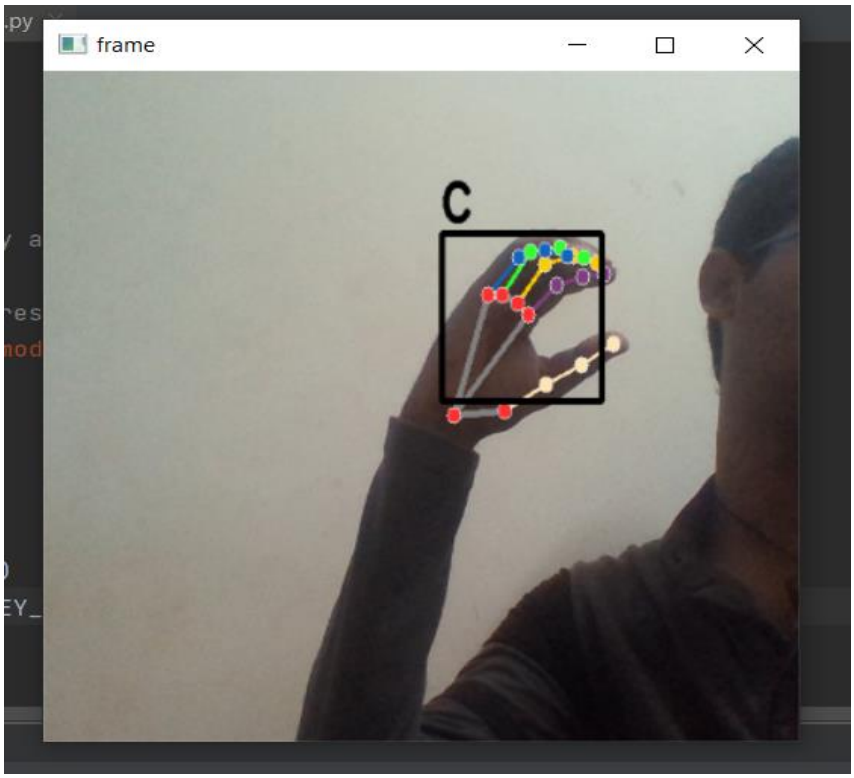
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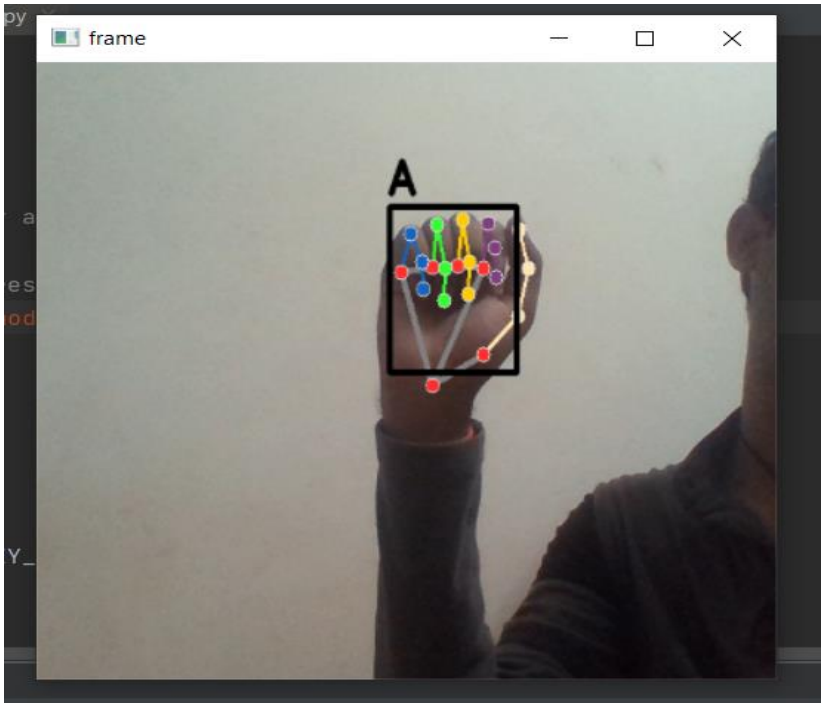
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# Chapter 7

## 7.1 Conclusions and Future Scope

The system for converting sign language into text is a promising technology that could help improve communication for deaf and dumb individuals. The system uses OpenCV algorithms and a Sklearn model to recognize signs being made in real-time video feeds. The system has been shown to have a medium level of accuracy when tested using American Sign Language. Further research and development are necessary to make the system more robust and accurate for use in a wide range of settings and languages.

The future scope of a sign language-to-text conversion project using computer vision is vast and has the potential to impact millions of people who are deaf or hard of hearing. Here are some potential future directions for this project:

Improving Accuracy:

Although the accuracy of current sign language recognition systems has improved significantly, there is still room for improvement. Future research could focus on developing more advanced computer vision techniques and machine learning models that can better recognize subtle variations in sign language gestures.

Expanding to Other Sign Languages:

Sign languages are not universal, and there are over 300 different sign languages in use worldwide. Future research could focus on developing sign language recognition systems for other sign languages, such as British Sign Language, French Sign Language, or Japanese Sign Language.

Incorporating Facial Expressions and Body Language:

Sign language is not just about hand gestures; facial expressions and body language play an important role in conveying meaning. Future research could focus on developing computer vision techniques that can recognize and interpret facial expressions and body language in sign language videos.

Developing Sign Language Translation Systems:

Sign language recognition systems are only one part of the puzzle. Future research could focus on developing sign language translation systems that can automatically translate sign language to spoken or written language in real-time.

Integration with Augmented Reality:

Augmented reality (AR) technology can overlay virtual objects onto the real world, creating an immersive and interactive experience. Future research could focus on integrating sign language recognition systems with AR technology to create a more engaging and interactive communication experience for people who are deaf or hard of hearing.

Overall, the future scope of sign language to text conversion using computer vision is vast and has the potential to improve the lives of millions of people who are deaf or hard of hearing. With continued research and development, this technology could revolutionize the way we communicate and interact with each other.

# Chapter 8

## 8.1. References


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2. https://scikit-learn.org/stable/