# AI Powered Sign Language Translator

**Prof. Aradhana Pawar[1], Shital Kale[2], Riya Kamble[3] , Kiran Misal[3]**

*[1]Computer Department, Dr. D. Y. Patil college of Engineering and Innovation, Varale.*
*[2]Computer Department, Dr. D. Y. Patil college of Engineering and Innovation, Varale.*
*[3]Computer Department, Dr. D. Y. Patil college of Engineering and Innovation, Varale.*
*[4]Computer Department, Dr. D. Y. Patil college of Engineering and Innovation, Varale.*

---

**Abstract -** This work proposes an AI-based sign language translator that aims to establish equal surroundings and enable people with hearing handicaps to communicate in their native language. In order to translate sign language into text, we used a transformer neural network, which can analyse more than 500 data points from a person's face and motions. Our machine learning pipeline allows the translator to grow, create new datasets, and develop models for sign language recognition. We created a sign language interpreter with over 200 phrases for an emergency call as a proof of concept. Encouraging those with hearing impairments to engage in social, political, economic, and cultural aspects of life is the overarching objective.

***Key Words*:** Sign Language, Inclusion, Social Development, Artificial Intelligence, Machine Learning.

## 1. INTRODUCTION

A deaf person's computer-assisted visual gesture and sign language system that uses the concept of human-computer interaction to automate communication between hearing and deaf people. Since many people with hearing impairments are unable to speak, hear, or even write spoken language, the development of sign language applications is growing quickly. An innovative use of computer vision, machine learning, and artificial intelligence is the AI-powered Sign Language Translator. It is a transforming instrument that promotes inclusivity and equal opportunity for those with hearing impairments, in addition to facilitating communication between the deaf and the hearing. This research aims to explore the idea, evolution, and applications of this innovative technology, emphasizing how it could completely change how we understand and use sign language.

## 2. Body of Paper

Think about conversing with a person who is deaf. If you're not familiar with sign language, this may already seem like a difficult assignment. Millions of deaf people struggle with this issue since it prevents them from interacting and communicating with hearing people. We suggested a system to address this issue for both vocal and deaf individuals who use sign language to communicate with one another. We came up with this idea because we felt that something needed to be done to assist these people who were physically challenged. The AI-powered Sign Language Translator project aims to assist the deaf and hard-of-hearing communities by removing communication barriers.

### 2.1. Methodology

Convolutional neural networks, also known as CNNs, are deep learning network architectures that derive their knowledge directly from data. When looking for patterns in photos to identify objects, classes, and categories, CNNs are very helpful. They can also be very useful in the classification of signals, time series, and audio data. One kind of artificial deep learning neural network is the convolutional neural network. It is used in image recognition and computer vision. Convolution, pooling, normalization, and fully connected layers are all combined to form the hidden layers. Multiple convolution layers are used by CNNs to filter input volumes to higher abstraction levels.

1. Data Collection: Compile a varied collection of gestures and expressions in sign language that reflect regional variations, dialects, and sign languages. To train and validate the AI model, this dataset should contain videos and annotations of sign language gestures.

2. Preprocessing: To ensure accurate labeling and synchronization between the signed phrases and their corresponding translations, preprocess the collected data by segmenting and annotating the sign language gestures.

3. Model Selection for Machine Learning: To process and interpret sign language gestures, select the proper machine learning and computer vision models, such as recurrent neural networks (RNNs) and convolutional neural networks (CNNs). Investigate cutting-edge

models for sign language recognition, such as deep learning architectures.

4. Model Training: Using the preprocessed dataset, train the chosen model, aiming for real-time accuracy and robustness.

5. Real-time Data Acquisition: Put in place a system that uses cameras to record hand gestures in sign language in real time. Combine this data with the AI model that has been trained to interpret it.

6. Natural Language Processing (NLP): Depending on the user's preference, use NLP techniques to translate recognized sign language gestures into written or spoken language.

7. User Interface and Accessibility: Create an AI-powered sign language translator with an easy-to-use interface that can be used by hearing and deaf users alike. Take into account a variety of platforms, such as specialized devices, web applications, and mobile apps.

## 2.2. Requirements

i. RAM: 8 GB
ii. Hard Disk: 40GB
iii. Processor: Intel i5 Processor
iv. IDE: spyder
v. Coding Language: Python Version 3.5
vi. Operating System: Windows 11

## 2.3 Data Flow Diagram

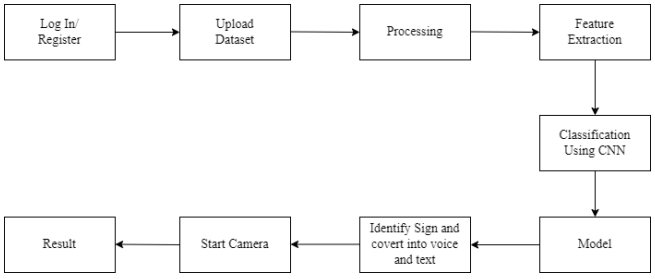


**Fig -1**: Data Flow

The DFD diagram depicts the project's work flow, as seen in Fig. 1.

1) Log In/ Register
The user will need to do the registration or login to get expected results.
2) Upload dataset
In this step, the Kaagle dataset will be uploaded during the development of the project.
3) Processing
We must process the dataset after uploading it in order to obtain the desired results.
4) Feature extraction
Here we are taking raw data and converting it into a format that a machine learning model can use and understand.
5) Classification Using CNN
Using convolutional neural networks (CNNs) for classification is similar to using uploaded datasets for image recognition.
6) Identify sign and convert into the text/ audio
This project will display output in the form of text and audio whenever a user provides input.
7) Start Camera
In order to provide input, the user must start the camera.
8) Result
Outcome The project will generate both textual and audio output.

## 2.4. System Architecture

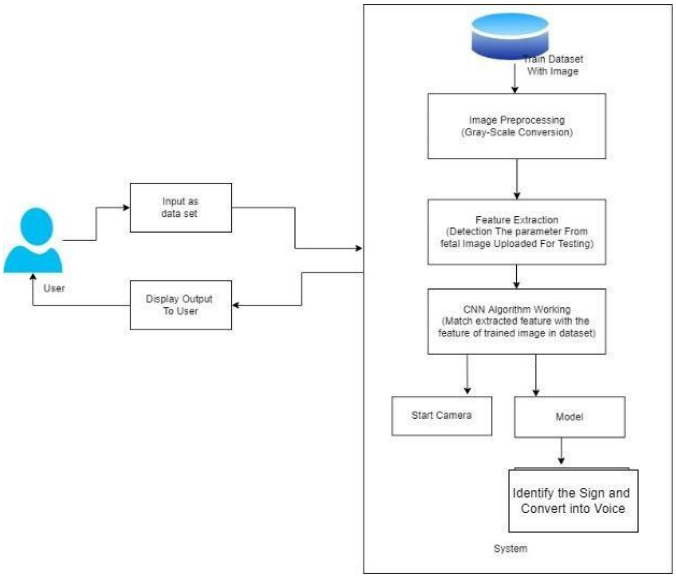


**Fig -2**: System Architecture

## 3. CONCLUSIONS

A robust foundation for training the model has been established by the collection of a diverse dataset of sign language gestures. Promising models for gesture interpretation include convolutional neural networks (CNNs). A user interface has been created that enables cameras to capture sign language gestures in real time. In the future, efforts will be focused on improving the model's accuracy and implementing natural language processing methods to ensure smooth translation. The project's development will also continue to prioritize

stakeholder engagement, ethical considerations, and adherence to privacy measures. This development lays a strong foundation for the next phases of the Sign Language Translator project.

**ACKNOWLEDGEMENT**

We would like to extend our heartfelt gratitude to every employee who has given up their precious time, especially when it comes to answering my unclear questions about their areas of expertise. We would like to thank Prof. Aradhana Pawar for her assistance in seeing the project through to completion.

**REFERENCES**

1. Artificial Intelligence for Sign Language Translation – A Design Science Research Study (2023) Gero Strobel Thorsten Schoormann, Germany Leonardo Banh, Frederik Möller
2. Multimedia technologies to teach Sign Language in a written form (2021) Myasoedova M.A, Myasoedova Z.P, Farkhadov M.P.
3. Data collection of 3D spatial features of gestures from static peruvian sign language alphabet for sign language recognition(2021) Robert Nurenajana, Cristopher Ramos-Carrion, Pedro ShiguiharaJuarez.
4. Recognition of Bengali Sign Language using Novel Deep Convolutional Neural Network(2021) Md. Jahangir Hossein, Md. Sabbir Ejaz
5. Research on Dynamic Sign Language Algorithm Based on Sign Language Trajectory and Key Frame Extraction (2019) Yufei Yan, Zhijun Li, Qunzhu Tao, Chenyu Liu
6. Real-Time Translation of Indian Sign Language using LSTM. (2019) Ebey Abraham, Akshatha Nayak, Ashna Iqbal.
7. Glove Based American Sign Language Interpretation Using Convolutional Neural Network and Data Glass (2020) Galib Ibne Haidar, Hasin Ishraq Reefat.
8. Creation of Image Segmentation Classifiers for Sign Language Processing for Deaf and Dumb(2020) Pushan Kumar Dutta, Abhishek Biswas. Ahona Ghosh, Nilanjana Chaudhary.
9. Towards Multilingual Sign Language Recognition (2020) Sandrine Tornay, Marzieh Razavi, Mathew Magimai.-Doss.
10. Recognition of Sign Language Symbols using Templates (2020) Deepika Pahuja, Sarika Jain
11. Chinese Sign Language Key Action Recognition Based on Extenics Immune Neural Network (2020) Yue Sun, Tiantian Yuan, Junfen Chen, Rui Feng.
12. Indian And English Language To Sign Language Translator- An Automated Portable Two Way Communicator For Bridging Normal And Deprived Ones (2020) Dr.L.Priya, A.Sathya S. Kanaga Suba Raja.
13. Russian Sign Language Dactyl Recognition (2019) Ilya Makarov, Nikolay Veldyaykin, Maxim Chertkov, and Aleksei Pokoev