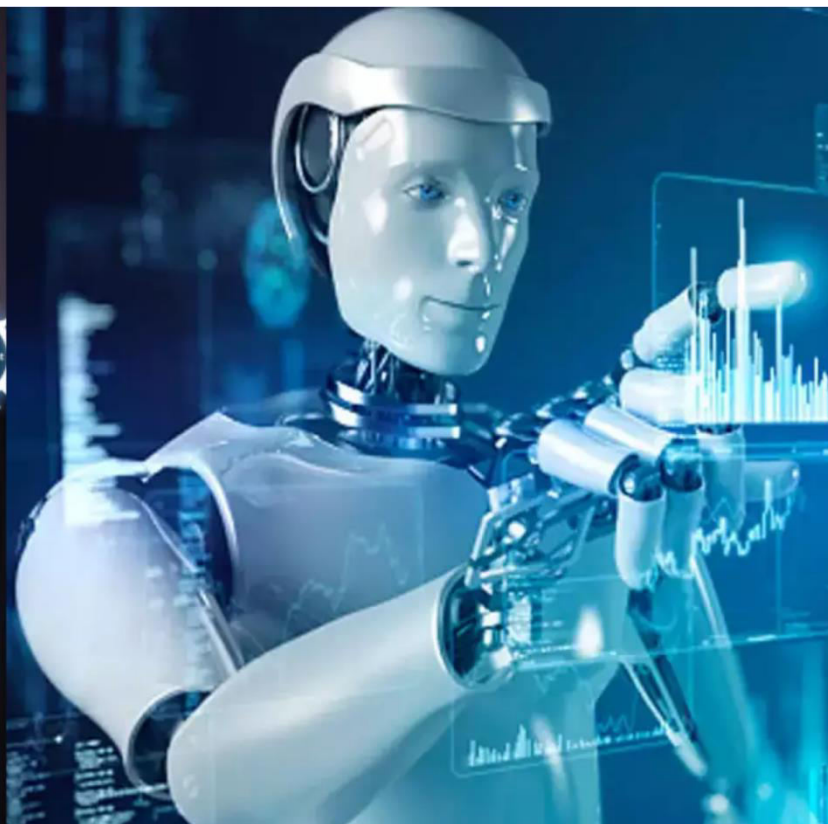




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Real Time Sign Language Translator

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ABSTRACT: This paper presents a deep learning-based system for recognizing American Sign Language (ASL) alphabet letters to enhance communication accessibility for people who are deaf or hard of hearing. The project employs a Convolutional Neural Network (CNN) to classify hand gestures representing English alphabet letters (A–Z) from a dataset of images. The system is designed to accurately interpret visual hand signs, enabling real-time translation of gestures into text. By leveraging image processing and AI techniques, this project provides an interactive and reliable solution to bridge communication gaps, facilitating greater inclusivity and accessibility in daily interactions.

KEYWORDS: American Sign Language, ASL recognition, Convolutional Neural Network, Deep Learning, Hand Gesture Classification, Communication, Image Processing

I. INTRODUCTION

Communication is an essential part of human interaction, but people with hearing or speech impairments often face difficulties in expressing themselves effectively to others. Sign language serves as a vital medium for communication among the hearing-impaired community. However, most people are not familiar with sign language, which creates a communication gap between the deaf and hearing populations.

To bridge this gap, a Sign Language Translator System has been developed using modern technologies such as computer vision, machine learning, and deep learning. The system captures hand gestures through a camera and translates them into corresponding text or speech output in real time. This not only helps hearing-impaired individuals communicate more easily but also promotes inclusivity and accessibility in society.

II. LITERATURE SURVEY

In recent years, several researchers have explored the development of sign language translation systems to enhance communication between the hearing and hearing-impaired communities. Various techniques such as image processing, machine learning, and deep learning have been implemented to recognize hand gestures and convert them into meaningful text or speech.

Early studies focused on glove-based systems, where sensors were attached to gloves to detect hand and finger movements. Although these systems achieved good accuracy, they were expensive and uncomfortable for users, limiting their practicality. Later, researchers shifted towards vision-based approaches using cameras to capture hand gestures without the need for additional hardware. With the advancement of computer vision and artificial intelligence, modern sign language translation systems began using Convolutional Neural Networks (CNNs) and deep learning models for gesture recognition. These models analyze features such as hand shape, motion, and orientation to accurately identify different signs.

III. METHODOLOGY

The proposed system uses computer vision and machine learning to translate sign language gestures into text or speech. The process begins with capturing hand gestures using a webcam. Each frame is then processed using OpenCV to detect and segment the hand region from the background.

The collected gesture images are preprocess by converting them to grayscale, resizing, and normalizing pixel values to improve accuracy. These images are then fed into a Convolutional Neural Network (CNN) model, which learns unique features like hand shape and position .This process is fully automated, requiring no user intervention beyond initial inputs, ensuring a seamless and educational experience throughout the interview simulation .For example, when the user shows the “A” sign, the model recognizes the gesture and outputs the letter “A” on the screen along with a voice saying “A.” This process makes real-time communication between hearing and speech-impaired individuals and others easier and more natural.

IV. EXPERIMENTAL RESULTS

Figures show the results of the Sign Language Translator system, illustrating the interface functionality and performance metrics. Figs. 1, 2, 3 (a) show the original interface of the landing page, input page respectively. (b) is the image obtained after initiating the translation module the hand gesture detection applied. (c) and c show Results page and output with accuracy. Users whose gesture detection confidence exceeds and verifying considered valid sign inputs, with the system achieving a translation accuracy rate of 100%. Users can upload no of inputs by restart the process. Still, some minor issues, such as occasional frame lag and misclassification of similar gestures, are observed.

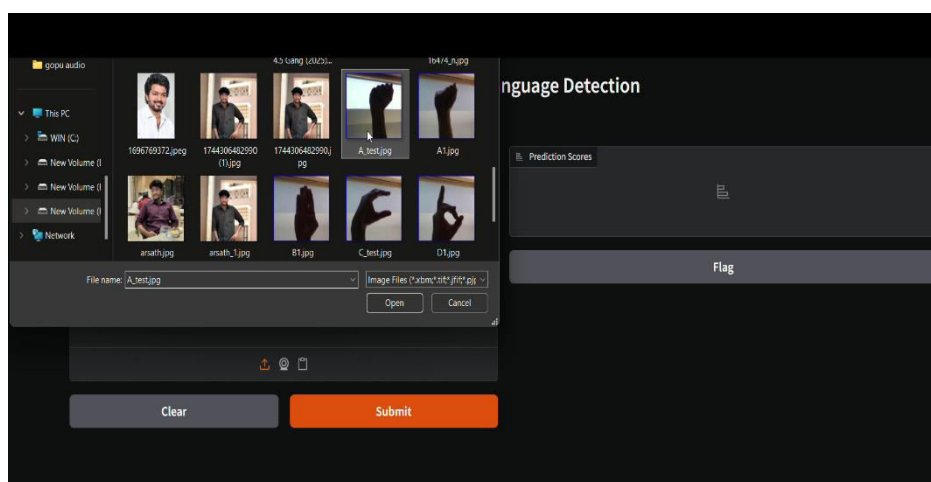


Fig 1: (a) “Start Translation” by uploading the input

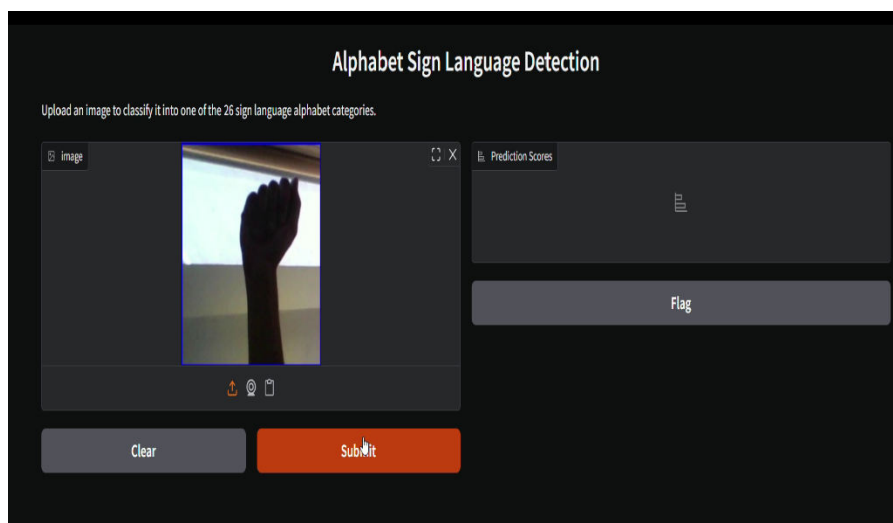


Fig 2: (b)By clicking the submit button to translate the Image to Text

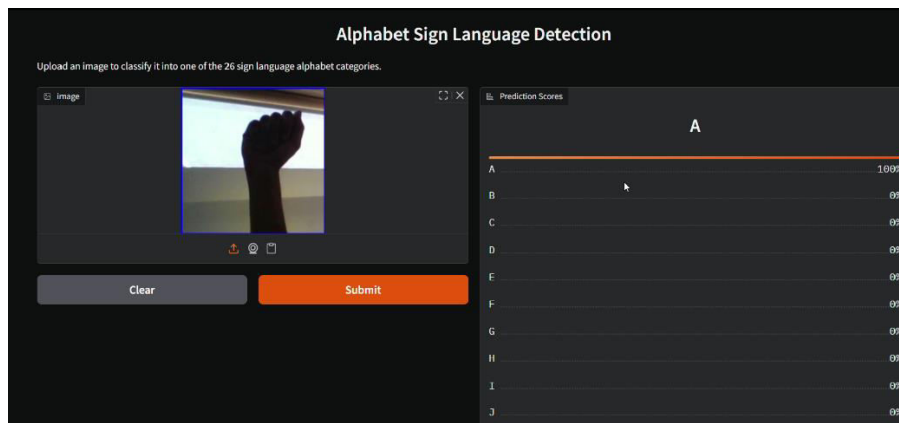


Fig 3: (c) Results page shows output with accuracy.

V. CONCLUSION

The Sign Language Translator system offers an efficient AI-driven solution for bridging the communication gap between hearing-impaired individuals and non-signers. It features a responsive interface, real-time webcam input, and hand gesture detection powered by deep learning models, ensuring accurate translation of signs into corresponding text or speech. Developed using Python, OpenCV, and TensorFlow, the system provides a seamless and interactive experience that enhances accessibility and inclusivity. Future enhancements could include support for a wider range of sign languages, improved gesture recognition accuracy through larger datasets, and integration with mobile platforms. Addressing minor challenges such as frame delays and similar gesture misinterpretation would further refine performance. The Sign Language Translator thus serves as a valuable tool in promoting inclusive communication through intelligent technology.

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