SIGN LANGUAGE RECOGNISER

Team Members

Akshitha Pattapu - CSE
S V Manikanta - CSE
Kakarla Meghana - CSE
S Sai Mahesh - CSE
Sai Pranay Ganta - CSE

1. ABSTRACT

The "Sign Language Recognizer" project pioneers a cutting-edge real-time American Sign Language (ASL) detection system by seamlessly integrating advanced computer vision technologies. Leveraging OpenCV for high-quality image capture, MediaPipe for precise hand tracking, and a Random Forest classifier for robust model training, the project envisions an innovative platform facilitating interactive communication through sign language, using a standard webcam. The primary objective is to enhance accessibility for individuals with hearing impairments by harnessing the synergy of machine learning and computer vision. The system's focus on the dynamic and intricate nature of ASL offers users a responsive and efficient means to express themselves through sign language gestures in real-time, translating movements into recognizable symbols. The technical implementation involves OpenCV capturing foundational webcam input, and MediaPipe ensuring accurate hand tracking for nuanced interpretation. The Random Forest classifier contributes robustness and adaptability to diverse signing styles, demonstrating efficacy in real-world scenarios. The practical application holds significant promise in fostering inclusive communication environments, enabling seamless engagement for individuals with hearing impairments in various aspects of daily life. The interactive, real-time capabilities of the system open avenues for more immersive and spontaneous sign language communication through commonly available hardware. Overall, this project exemplifies the transformative potential of interdisciplinary approaches, showcasing the positive impact that the integration of computer vision, machine learning, and accessible technology can have on the lives of individuals with specific needs, ultimately contributing to a more inclusive and communicative future.

2. INTRODUCTION

2.1 INTRODUCTION

Imagine a world cloaked in silence, where conversations are muted whispers and information a distant echo. For 466 million people worldwide, living with disabling hearing loss means navigating this reality every day. Traditional communication methods, built around spoken language, often leave them feeling isolated and disconnected. This project seeks to shatter those barriers by developing a real-time ASL detection system. Sign language, with its vibrant tapestry of hand gestures is more than just a communication tool for the deaf community; it's a cultural bridge, a window to a world brimming with emotion and expression.

This ASL detection system holds the potential to revolutionize communication. Imagine live conversations seamlessly translated into text, educational lectures understood without interpreters, and social interactions flowing freely. It's not a futuristic fantasy; it's the promise of inclusivity, of empowering the deaf community to break free from limitations and participate in every aspect of life. But the impact goes beyond technology. This project is about fostering empathy and understanding, about tearing down communication walls and building bridges of connection. It's about celebrating the beauty and depth of sign language, recognizing it not as a handicap, but as a rich and powerful language in its own right.

In this endeavor, we don't just build technology; we build a more inclusive future. We envision a world where every voice is heard, every story shared, and every individual empowered to connect, contribute, and thrive. With dedication, innovation, and unwavering commitment, we can break the chains of silence and expand the world for millions, allowing them to not just be heard, but to truly be seen. This is not just a project; it's a revolution in the making. Let's join hands and create a world where sign language isn't just understood, but embraced, a world where communication flows freely, and where every individual, regardless of hearing ability, can truly belong.

2.2 OBJECTIVE OF THE PROJECT

Objective is to create an innovative platform that translates ASL gestures into recognizable symbols in real-time, facilitating seamless and immersive communication through sign language using standard webcams.

2.3 SCOPE OF THE PROJECT

The scope of the "Sign Language Recognizer" project is comprehensive, encompassing the development of an advanced American Sign Language (ASL) detection system. This system utilizes Open CV for capturing high-quality images, Media Pipe for precise hand tracking, and a Random Forest classifier for robust model training. The project's goal is to establish a responsive and efficient means for individuals with hearing impairments to express themselves through ASL gestures in real-time. The practical application of this technology extends to fostering inclusive communication environments, enabling users to engage seamlessly in various aspects of daily life using standard webcams. The project's interdisciplinary approach exemplifies its transformative potential, showcasing the positive impact of integrating computer vision, machine learning, and accessible technology on the lives of individuals with specific needs.

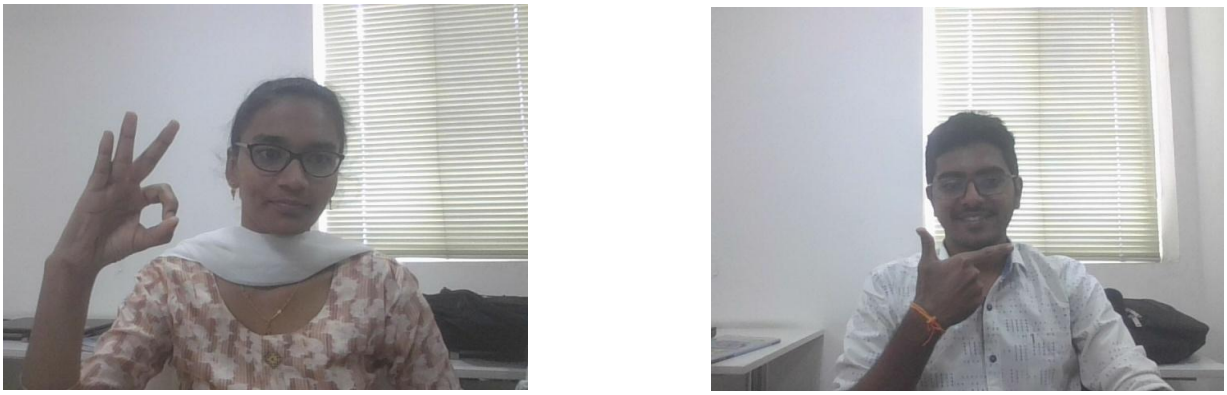


Figure 1.1: (a) and (b) shows input considered

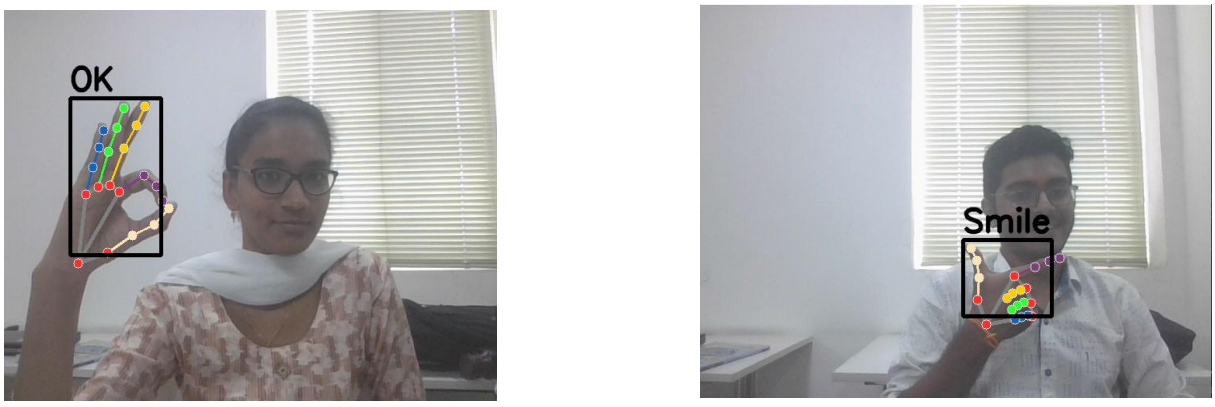


Figure 1.2 : (a) and (b) shows the output expected

3. LITERATURE SURVEY

1.1 Indian Sign Language Recognition using Mediapipe Holistic. AUTHOR: Kaushal Goyal, Assistant Professor, Vellore Institute of Technology, CSE, Chennai
YEAR OF PUBLICATION: 2023
This study presents project involves reviewing existing research and publications related to sign language recognition, particularly focusing on Indian Sign Language (ISL) and the utilization of the MediaPipe Holistic framework.

1.2 Enhanced Facial Emotion Recognition by Optimal Descriptor Selection with Neural Network. AUTHOR: P M Ashok Kumar, Jeevan Babu Maddala, K Martin Sagayam. H.M. YEAR OF PUBLICATION :2021 involves exploring existing research and publications related to facial emotion recognition, with a specific focus on methods that incorporate optimal descriptor selection and neural networks.

1.3 Sign Language Recognition. AUTHOR: Satwik Ram, YEAR OF PUBLICATION :2021 This involves examining existing research and publications in the field to gain insights into methodologies, challenges, and advancements in sign language recognition systems.

1.4 Structured Featured Network for Continous Sign Language Recognition. AUTHOR: Zhayoyang Yang, Zhenmei Shi, YEAR OF PUBLICATION: 2019. Researchers should explore academic databases, recent conference proceedings, and relevant journals, considering variations of keywords to ensure a comprehensive review. Additionally, engaging with expert communities, monitoring updates in conferences, and investigating preprints in research repositories can provide valuable insights. The objective is to gather technical knowledge that informs the design and implementation of an effective structured feature network for continuous sign language recognition.

4. PROPOSED METHODOLOGY

4.1 DATASET DESCRIPTION

The dataset used is a American Sign Language(ASL) dataset. The creation of a dataset for machine learning purposes, specifically for training a sign language recognition system. The dataset is structured to accommodate multiple classes, with each class representing a distinct sign gesture. The code captures images from a video stream, with the number of images per class specified by the variable dataset_size. Users are prompted to perform gestures corresponding to each class while images are captured and saved to the designated directory. This process is repeated for each class, resulting in a diverse dataset that encompasses various sign gestures. The dataset's flexibility allows for the incorporation of additional classes as needed, contributing to the robustness and versatility of the sign language recognition model.

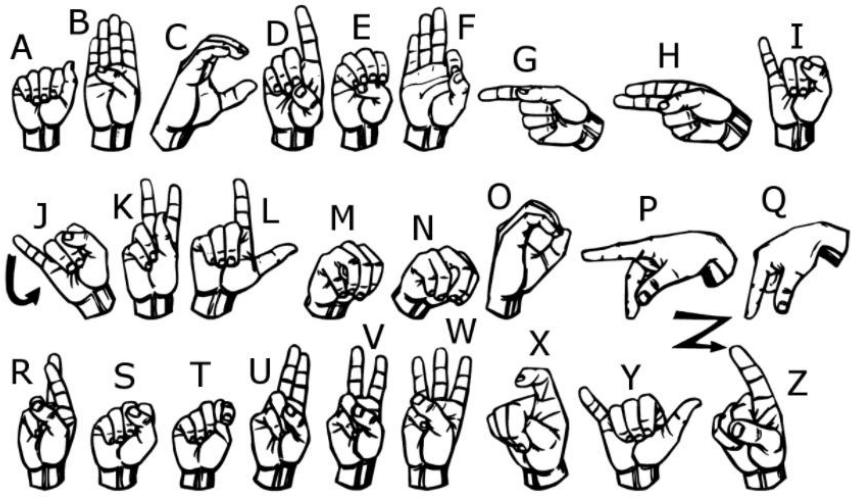
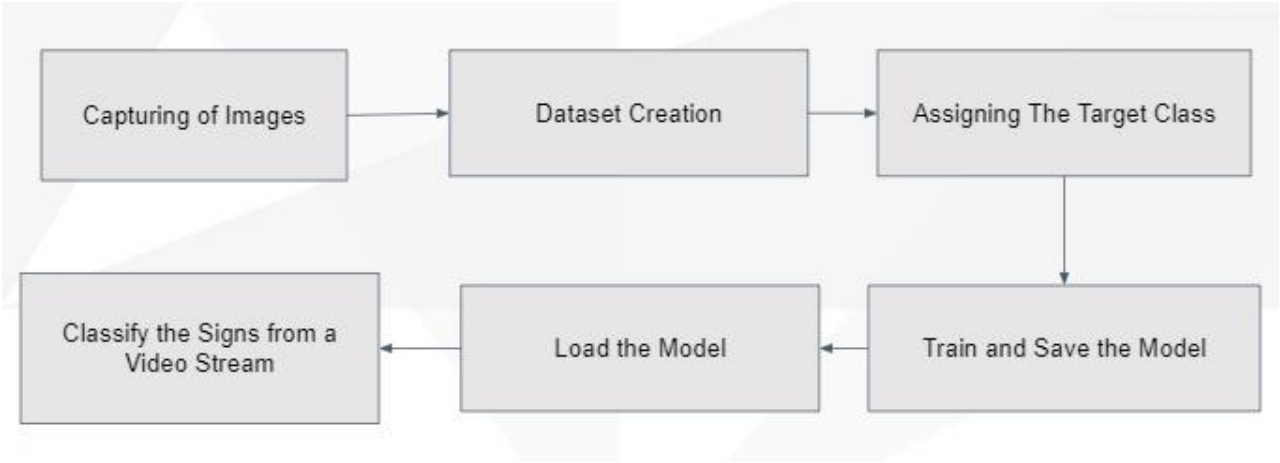


Figure 3.1: Example of hearing impaired signs as input

4.2 WORKFLOW



This project involves a systematic process of capturing, processing, and interpreting sign language gestures using computer vision and machine learning techniques. The project begins with the utilization of OpenCV for capturing high-quality images from a standard webcam, forming the foundational input for subsequent processing. These images are then preprocessed to enhance their quality and normalize features. The core of the system lies in the implementation of MediaPipe for precise hand tracking, allowing the system to capture and analyze the intricate movements inherent in sign language. Simultaneously, the MediaPipe Holistic framework is employed for a comprehensive understanding of facial expressions, hand gestures, and body posture. The project incorporates a Random Forest classifier for model training, ensuring the robustness and adaptability of the system to diverse signing styles. The workflow emphasizes real-time capabilities, allowing users to express themselves seamlessly through sign language using commonly available hardware. Continuous refinement, testing, and user feedback are integral components of the workflow, ensuring that the system meets the diverse needs of its users and remains effective in real-world scenarios. The interdisciplinary approach, combining computer vision, machine learning, and accessible technology, is central to achieving the project's objective of fostering inclusive communication environments for individuals with hearing impairments.

4.3 ADVANTAGES OF THE PROPOSED SYSTEM

1. The proposed scheme is very accurate in classification of signs.
2. The proposed system gives accurate outputs for the hearing impaired.

4.4 MODULE DESCRIPTION

In this section we try to discuss the proposed model which is used to identify the signs using pre-trained models.

The Application is mainly divided into 4 modules.They are as follows:

1. Pickle module
2. Media pipe

3. OpenCv
4. Random Forest Classifier

A) PICKLE

Pickle, a module in Python, plays a pivotal role in our Sign Language Recognizer project as it facilitates the serialization and deserialization of Python objects. We leverage Pickle to save and load trained machine learning models, ensuring persistent access to our Random Forest classifier. This capability is essential for the seamless integration and deployment of the model, allowing users to access a pre-trained, optimized Random Forest classifier without the need for repeated training sessions.

B) MEDIAPIPE

MediaPipe is a robust and versatile framework that significantly contributes to the success of Sign Language Recognizer project. Its holistic capabilities enable the simultaneous tracking of facial landmarks, hand movements, and body posture, offering a comprehensive understanding of the user's gestures. Specifically, we employ MediaPipe for precise hand tracking, allowing our system to capture the intricate details of sign language gestures. This framework enhances the accuracy and richness of our model's interpretation, ensuring that the nuances of sign language are accurately captured in real-time.

C) OPENCV

OpenCV, the Open Source Computer Vision library, serves as the foundation for our Sign Language Recognizer project by providing essential tools for image capture and preprocessing. Through OpenCV, we capture high-quality images from a standard webcam, forming the basis of input for subsequent processing. The library's image processing capabilities enable us to enhance the quality of captured images, perform resizing, normalization, and other preprocessing tasks, ensuring that the input data is optimized for accurate interpretation by our recognition model.

D) RANDOM FOREST CLASSIFIER

At the core of our Sign Language Recognizer lies the Random Forest classifier, a powerful machine learning algorithm employed for model training. This classifier is adept at handling the complexities and variations inherent in sign language gestures, providing robustness and adaptability to diverse signing styles. Trained on carefully curated datasets, the Random Forest classifier becomes a key component in our system, translating hand movements into recognizable symbols in real-time. The utilization of this classifier ensures the effectiveness and accuracy of our Sign Language Recognizer across various real-world scenarios, contributing to the project's overall success in fostering inclusive communication environments.

5. RESULTS

6. CONCLUSION

In conclusion, the "Sign Language Recognizer" project represents a significant stride towards fostering inclusive communication environments for individuals with hearing impairments. Through the synergistic integration of OpenCV, MediaPipe, and a Random Forest classifier, our system achieves a robust and efficient platform for real-time American Sign Language (ASL) detection. The project's emphasis on capturing intricate hand movements and facial expressions using MediaPipe, coupled with the adaptability of the Random Forest classifier, ensures a responsive means for users to express themselves seamlessly through sign language. The interdisciplinary approach, combining computer vision, machine learning, and accessible technology, underscores the transformative potential of collaborative efforts in the realm of assistive technologies. The real-time capabilities of our system, operating with a standard webcam, open avenues for spontaneous and immersive sign language communication, enhancing accessibility in various aspects of daily life. As the project progresses, continuous refinement based on user feedback and thorough testing will be pivotal to ensuring its effectiveness and adaptability to diverse signing styles. The positive impact of the "Sign Language Recognizer" extends beyond technological innovation, exemplifying the capacity of technology to empower and enhance the lives of individuals with specific needs. In summary, the project exemplifies the transformative potential of technology in bridging communication gaps and creating more inclusive environments. By providing a reliable and responsive means for individuals with hearing impairments to express themselves through sign language, the "Sign Language Recognizer" project contributes to a more accessible and inclusive future.

7. REFERENCES

[1] Indian Sign Language Recognition using Mediapipe Holistic. AUTHOR: Kaushal Goyal, Assistant Professor, Vellore Institute of Technology, CSE, Chennai
YEAR OF PUBLICATION: 2023 [Google Scholar] [CrossRef]

[2] Enhanced Facial Emotion Recognition by Optimal Descriptor Selection with Neural Network. AUTHOR: P M Ashok Kumar, Jeevan Babu Maddala, K Martin Sagayam. H.M. YEAR OF PUBLICATION :2021. [Google Scholar]

[3] Structured Featured Network for Continous Sign Language Recognition. AUTHOR: Zhayoyang Yang, Zhenmei Shi, YEAR OF PUBLICATION: 2019.

[4] Sign Language Recognition. AUTHOR: Satwik Ram, YEAR OF PUBLICATION :2021 This involves examining existing research and publications in the field to gain insights into methodologies and advancements in sign language recognition systems. [Google Scholar]