**My Hand Sign Detection AI**

**Abstract**

Communication is an essential human requirement, but those with hearing or speech impairments tend to encounter obstacles in conveying their thoughts. This project tries to overcome such a limitation through the application of artificial intelligence by creating a system that identifies static hand signs (A-Z, 0-9) and translates them into text and voice. Utilizing MobileNetV2, a light-weight deep learning model, combined with image processing and text-to-speech technology, the system is able to facilitate real-time communication through sign language gestures.

**Introduction**

Now, in the era of digitalization, computer vision and AI provide great opportunities to enhance accessibility. Individuals with reliance on sign language for communication may experience difficulties while communicating with individuals who are not aware of it. This project emphasizes converting sign language hand gestures into speech through deep learning. The system identifies a hand sign from a webcam, classifies it into a predicted text and audio output based on a trained MobileNetV2 model, and allows interaction in an intuitive manner.

**Related Works**

There have been several studies and projects on sign language recognition with machine learning and computer vision:

ASL Recognition with CNNs: American Sign Language datasets have been used extensively to train CNN classifiers.

Real-time Hand Gesture Recognition: OpenCV and neural networks-based projects with real-time detection have been encouraging.

Text-to-Speech Converters: pyttsx3 and Google Text-to-Speech are popular tools used to convert the recognized text to audio output.

But most of these projects have no real-time performance, or high computational overhead, or do not implement a complete pipeline from detection to voice synthesis.

**Problem Statement**

Sign language is not common knowledge, which restricts interaction between hearing-impaired people and the general population. There exists a requirement for a low-cost, real-time solution that interprets hand signs and translates them into comprehensible text and speech to facilitate communication.

**Contribution**

The following contributions are made by this project:

Real-Time Gesture Recognition: Records live hand signs through a webcam and processes them effectively.

Deep Learning Model: Employs MobileNetV2 for correct classification of static hand signs.

Text and Audio Output: Converts generated characters to speech with TTS.

Custom Dataset Compatibility: Compatible with a user-sorted dataset of black-and-white images, categorized by hand sign.

**System Architecture**

Image Capture: Webcam records hand sign images.

Preprocessing: Images are resized and normalized for input to the model.

Prediction: MobileNetV2 predicts the image as a letter or digit.

Text-to-Speech: Output is read aloud using pyttsx3 or equivalent library.

**Conclusion**

This project demonstrates an efficient, real-time AI system that is lightweight and can help remove the communication barrier between hearing/speech-impaired people and the rest of society. It opens doors for more accessible and inclusive technology as it detects hand signs and translates them into sound. Dynamic sign recognition (sentences), mobile deployment, and multilingual support for TTS are potential avenues of future development.

### **References**

1. Howard, A. G., et al. "MobileNets: Efficient Convolutional Neural Networks for Mobile Vision Applications." arXiv preprint arXiv:1704.04861 (2017).
2. TensorFlow & Keras Documentation -<https://www.tensorflow.org>
3. OpenCV Library -<https://opencv.org/>
4. Pyttsx3 Text-to-Speech -<https://pypi.org/project/pyttsx3/>
5. ASL Alphabet Dataset (Kaggle) - https://www.kaggle.com/grassknoted/asl-alphabet