

American Sign Language (ASL) Hand Gesture Recognition Report

1. Introduction

This project aims to build a deep learning model that recognizes American Sign Language (ASL) hand gestures for both alphabets and numbers. It involves a complete pipeline from data preprocessing to CNN-based model training and evaluation.

2. Dataset Information

2.1 Datasets Used

The project utilizes two publicly available datasets along with a preprocessed version:

- ASL Alphabet Dataset (Raw):

<https://www.kaggle.com/datasets/grassknoted/asl-alphabet>

- Synthetic ASL Numbers Dataset (Raw):

<https://www.kaggle.com/datasets/lexset/synthetic-asl-numbers>

- Combined and Preprocessed Dataset:

<https://drive.google.com/drive/folders/1jG2cFf8ONSbiZOjyyBLx4cHtxlszYKVQ>

3. Image Processing Pipeline

3.1 Preprocessing

- Background removal was performed manually using custom DIP methods.
- Image resizing and grayscale conversion were applied to standardize input dimensions.
- Normalization of pixel values to the range $[0, 1]$ was conducted.
- Data was split into training and testing sets for each class.

3.2 Postprocessing

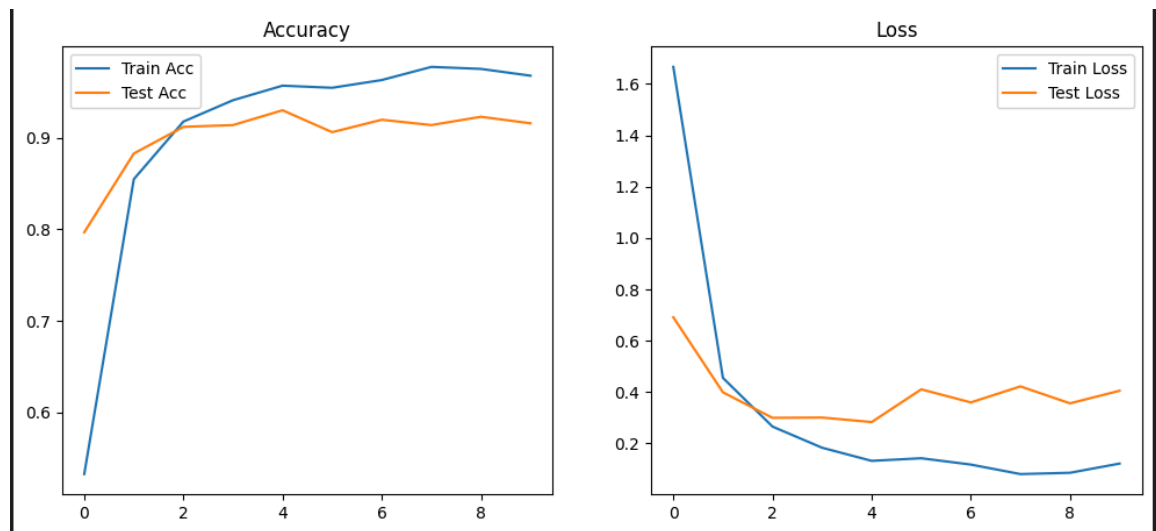
- Output predictions were decoded into corresponding labels.
- Evaluation metrics such as accuracy, confusion matrix, and F1-score were computed.

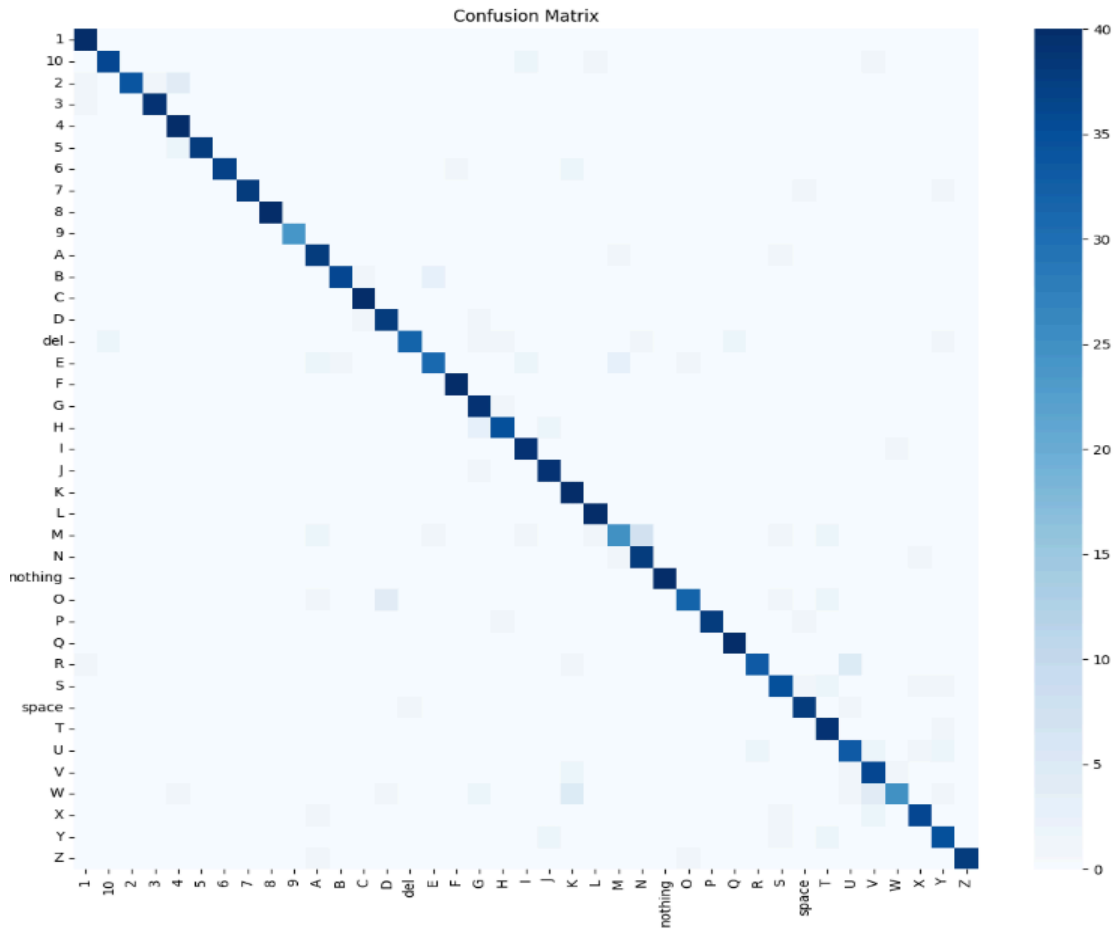
4. Additional Functions and Features

- Manual implementation of background removal using pixel intensity segmentation.
- Data balancing by equalizing sample counts across classes.
- Random image selection and renaming for demonstration purposes.

5. Results and Evaluation

Model accuracy and evaluation results will be added here after training completion.





6. Future Work

- Expand to real-time webcam input classification.
- Introduce data augmentation for better generalization.
- Improve accuracy on darker skin tones and varied lighting conditions.

7. Conclusion

The project successfully establishes a foundational ASL hand gesture recognition system. With enhanced preprocessing and further training, it can be extended to real-time applications.