Name: Pranay Rokade

Sign Language Detection Report

1 Introduction

The Sign Language Detection task focuses on developing a deep learning model to recognize and classify hand gestures used in sign language. The system leverages LSTM-based models trained on hand keypoints extracted using the MediaPipe Holistic model.

2 Background

Sign Language Detection is an essential application of deep learning in accessibility solutions, enabling real-time interpretation of sign gestures into text. The model detects hand movements and classifies them into predefined gestures, aiding communication for hearing-impaired individuals.

This task involves training a neural network using LSTM layers to recognize hand gestures in video sequences. The model processes hand keypoints and maps them to corresponding words or phrases.

3 Learning Objectives

- Understand the workflow of sign language recognition using deep learning.
- Train an LSTM model to classify hand gestures based on extracted keypoints.
- Develop a real-time detection system to recognize and display sign language interpretations.
- Enhance the model's accuracy and optimize training processes.

4 Activities and Tasks

- **Data Collection:** Captured sign language gestures and stored them as keypoints.
- **Preprocessing:** Normalized keypoints and prepared sequences for training.
- **Model Training:** Implemented an LSTM-based neural network for sequence classification.
- **Evaluation:** Tested the trained model for accuracy and reliability.
- **Real-Time Detection:** Integrated the trained model with OpenCV for real-time sign detection.

5 Skills and Competencies

- Proficiency in Python, TensorFlow, and Keras.
- Understanding of LSTMs for sequence classification.
- Experience with OpenCV and MediaPipe for keypoint extraction.
- Data preprocessing and augmentation techniques.

6 Feedback and Evidence

- Successfully trained a model to recognize common sign language gestures.

- Achieved real-time detection and classification of hand signs.
- Demonstrated the ability to extract and use hand keypoints efficiently.

7 Challenges and Solutions

- **Challenge:** Handling variations in hand gestures due to lighting and angles.
  - *Solution:* Applied data augmentation and normalization to improve robustness.
- **Challenge:** Training an accurate model with limited labeled data.
  - *Solution:* Used transfer learning and optimized hyperparameters to enhance performance.
- **Challenge:** Achieving smooth real-time detection.
  - *Solution:* Optimized model size and used efficient inference techniques.

8 Outcomes and Impact

- Developed a functional sign language recognition model.
- Improved accessibility through real-time gesture detection.
- Established a reusable pipeline for future sign language detection improvements.

9 Conclusion

This task successfully demonstrated the potential of deep learning in sign language recognition. By leveraging LSTMs and hand keypoint detection, the model can accurately interpret and classify sign gestures. Future improvements may include expanding the dataset and incorporating additional languages and gestures for broader accessibility.