

ABSTRACT

Sign language is the primary means of communication for individuals with hearing and speech impairments; however, the limited public understanding of sign language often creates communication barriers, thereby necessitating an automatic sign language gesture recognition system. This study aims to implement a Convolutional Neural Network (CNN) model with a transfer learning technique to recognize American Sign Language (ASL) alphabet gestures based on real-time hand gesture recognition. The dataset used consisted of 2,600 independently collected images of ASL alphabet hand gestures with a balanced distribution for each letter from A to Z. Preprocessing was carried out using OpenCV and cvzone to detect and crop the hand region as well as standardize the image size. Model training was conducted using the Teachable Machine platform with a MobileNet-based CNN architecture, which was then integrated into a Python-based system for real-time hand gesture classification using a camera. Model performance evaluation was performed using a confusion matrix and classification report with accuracy, precision, recall, and F1-score metrics. The results showed the best accuracy of 81% with an average F1-score of 0.83. Therefore, it can be concluded that the implementation of CNN with transfer learning is effective for real-time image-based sign language alphabet gesture recognition and has the potential to be further developed as part of a more complex sign language translation system.

Keywords: *American Sign Language, Convolutional neural network, Transfer Learning, Hand Gesture Recognition*