

Real-Time Sign Language Recognition Using Deep Learning

Abstract

Sign language is an essential communication tool for individuals with hearing impairments, offering them the ability to communicate efficiently through hand gestures. However, the lack of widespread knowledge of sign language within the general population often limits their interactions, creating barriers to inclusivity. In recent years, advancements in artificial intelligence and deep learning have opened up new possibilities for automated sign language recognition systems, offering a potential bridge to enhance communication between the hearing-impaired community and the broader public.

This research focuses on the development of a robust and scalable real-time **American Sign Language (ASL) recognition** system. To achieve this, a custom dataset of ASL gestures was manually collected using **OpenCV** and a **webcam**. The dataset consists of **2000** samples for each of the 26 alphabetic characters, organised into separate folders. The dataset was captured in various lighting conditions and from different angles to enhance the system's generalisation and performance in real-world environments.

To build a highly accurate recognition system, this study propose training several state-of-the-art deep learning models, including a custom **Convolutional Neural Network (CNN)**, **VGG16**, and **InceptionV3**. Each of these models offers distinct advantages in feature extraction and classification, enabling us to compare their effectiveness in recognizing hand gestures. The custom CNN was designed to provide lightweight and efficient real-time predictions, while the pre-trained models leverage deeper architectures and complex features for more refined recognition.