Sign Language Recognition System (SLRS)

Problem Statement

Communication barriers between hearing-impaired individuals and the general public remain a significant challenge in Tanzania due to limited understanding of Tanzanian Sign Language (TSL). In key sectors such as healthcare, education, and public services, deaf individuals often face difficulties in accessing services, leading to exclusion and misunderstandings. Reliance on human interpreters is often impractical because of their limited availability and associated costs.

Although various sign language recognition systems exist globally, most are designed for foreign sign languages and do not support Tanzanian Sign Language, which has distinct gestures and structures. The lack of localized technological solutions highlights the need for a system that can recognize TSL gestures and translate them into readable text to improve communication and social inclusion in Tanzania.

Objectives of the Project

Main Objective

To design and implement a Sign Language Recognition System that recognizes selected Tanzanian Sign Language (TSL) gestures and translates them into text to enhance communication between hearing-impaired and hearing individuals.

Specific Objectives

i. To study and identify commonly used Tanzanian Sign Language gestures suitable for system implementation.
ii. To collect and prepare a dataset of selected TSL hand gestures.
iii. To develop a computer vision-based gesture recognition model using Python.
iv. To implement a real-time gesture recognition system using a webcam.
v. To evaluate the performance of the system in terms of accuracy and usability.

Literature Review

Sign Language Recognition has been widely studied using computer vision and machine learning techniques; however, most existing solutions focus on non-African sign languages and lack localization for African contexts.

Starner, Weaver, and Pentland (1998) developed one of the earliest real-time sign language recognition systems using video input and Hidden Markov Models. Their study demonstrated the feasibility of recognizing sign language gestures in real time and laid the foundation for subsequent SLR research. However, the system focused exclusively on American Sign Language and did not consider regional or cultural variations in sign languages[1].

Koller et al. (2015) conducted an extensive study on vision-based sign language recognition using deep learning techniques. Their work addressed challenges such as signer variability and hand occlusion, significantly improving recognition accuracy. Despite its technical strength, the study relied on datasets from European and American sign languages and did not address the adaptation of models to low-resource sign languages such as Tanzanian Sign Language[2].

Camgöz et al. (2018) proposed a neural sign language translation system capable of translating continuous sign language videos into spoken language sentences. This work represented a major advancement by moving beyond isolated gesture recognition. Nevertheless, the approach requires large, well-annotated datasets that are currently unavailable for Tanzanian Sign Language, limiting its applicability in the Tanzanian context[3].

Identified Research Gaps

From the reviewed literature, the following gaps are identified:

- Most existing sign language recognition systems focus on ASL, ISL, or European sign languages, with very limited attention to Tanzanian Sign Language.
- There is a lack of locally collected and annotated TSL datasets suitable for machine learning applications.
- Existing studies emphasize recognition accuracy but often overlook practical deployment in local community environments, such as schools and health facilities in developing countries.

Bibliography

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