1 Conclusion

The Sign Language Translator system was successfully developed to recognize and translate static American Sign Language (ASL) gestures into text in real time. By utilizing computer vision and machine learning techniques, the project demonstrated how deep learning models, particularly Convolutional Neural Networks (CNNs), can effectively identify hand gestures with high accuracy. The implementation achieved a test accuracy of over 94

2 References

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Abstract

Communication is a fundamental aspect of human life, yet millions of individuals who are deaf or hard of hearing face daily challenges due to the communication gap between them and the hearing community. Sign language serves as a vital bridge for these individuals, but

its limited understanding among the general population often leads to social exclusion. This project, SignSpeak AI, aims to address this issue by developing a real-time sign language translator powered by artificial intelligence and computer vision.

SignSpeak AI captures hand gestures through a webcam and processes them using Convolutional Neural Networks (CNNs) for gesture recognition. It further employs sequence models like Long Short-Term Memory (LSTM) or Transformer architectures to convert gesture sequences into grammatically correct and contextually accurate sentences. This allows users to engage in fluid, meaningful conversations without requiring the other party to understand sign language.

A key differentiator of SignSpeak AI is its integration of Explainable AI (XAI) tools such as Grad-CAM and SHAP. These provide visual and analytical feedback on how gestures are interpreted, building user trust and improving system transparency. The platform is designed to be lightweight, non-intrusive, and accessible, requiring only a standard webcam and browser interface.

This project is intended for use in classrooms, healthcare facilities, public services, and personal interactions, promoting inclusivity and digital accessibility. Through the combination of gesture recognition, natural language processing, and explainability, SignSpeak AI stands as a robust solution to empower the hearing-impaired community and foster barrier-free communication in society.