Paper Title: Sign Language Recognition

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1. Summary:

1.1 Motivation : The research is fundamentally motivated by the need to bridge the communication gap faced by individuals with vocal and hearing disabilities. These individuals often rely on sign language, particularly American Sign Language (ASL), as their primary mode of communication. However, the limited understanding and use of ASL among the general population can lead to significant communication barriers. This project is driven by the desire to develop a technology that can recognize and interpret ASL, thereby facilitating more effective and inclusive communication between people with hearing disabilities and those without. The aim is to create a system that not only enhances the daily interactions of individuals with hearing and vocal disabilities but also promotes greater awareness and understanding of sign language in the broader community.

1.2 Contribution : The research makes several key contributions to the field of assistive communication technologies. Firstly, it introduces a novel communication aid designed specifically to assist individuals with speech and vocal disabilities. This system stands out for its ability to detect bare hands in real-time using advanced techniques in skin color segmentation and face detection, which significantly reduces noise and false positives in gesture recognition. Another major contribution is the improvement in gesture detection. The research team has developed methods to accurately distinguish and classify both static and dynamic gestures, thereby enhancing the system's overall accuracy and reliability. These advancements represent a significant step forward in developing effective communication tools for individuals reliant on sign language.

1.3 Methodology : The methodology employed in this research is comprehensive and multifaceted. It begins with skin color segmentation, where the system uses the HSV color space to isolate skin-colored objects, particularly the hands, for accurate gesture recognition. For the classification of gestures, the system employs Support Vector Machines (SVM), which are adept at distinguishing between static and dynamic gestures. Feature extraction plays a crucial role in this process, with the use of Zernike moments for static gestures and curve feature vectors for dynamic gestures. Additionally, the system incorporates a speech recognition component, using the Sphinx module to convert spoken alphabets to text. This text is then mapped to corresponding gestures, allowing for a seamless integration of speech and gesture recognition. This comprehensive methodology enables the system to function effectively in real-time, providing a user-friendly and efficient communication aid.

1.4 Conclusion : The system represents a novel approach to improve communication for people with speech and vocal disabilities. It is particularly effective in dynamic and minimally cluttered backgrounds and demonstrates high accuracy in gesture and speech recognition. The research shows potential for deployment as a low-cost application in various devices, making it accessible to a broad audience.

2. Limitations:

2.1 First Limitation (Environmental Sensitivity): The system's performance may degrade in robust or unfavorable environments, such as those with poor lighting or clutter.

2.2 Second Limitation (Limited Gesture Set**) :** Currently, the system is limited to recognizing gestures involving one hand and lacks the capability to interpret gestures that involve two hands or facial expressions.

3. Synthesis: The research introduces a significant technological advancement in the field of communication aids for individuals with hearing and vocal disabilities. By leveraging machine learning techniques such as SVM and innovative methods for hand gesture recognition, the system offers a real-time, efficient, and accessible solution. The combination of gesture and speech recognition broadens its applicability and usability. Despite its limitations in environmental adaptability and gesture range, the system holds promise for future improvements and wider application in assistive technologies.