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Department of Information Science & Engineering

Presentation on:

ASL Communication System

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ASL Communication System

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ABSTRACT

1. **Objective:**

- Develop an application that recognizes and translates ASL alphabets into text.

2. **Approach:**

- Utilizes a Convolutional Neural Network (CNN) for image recognition.
- Implements a Flask web interface for user interaction.

3. **Dataset:**

- Preprocessed ASL dataset with 87,000 images covering 26 alphabets.

4. **Performance:**

- Achieved 96% accuracy on the validation set.

5. **Impact:**

- Provides a reliable, real-time tool to bridge communication gaps for the deaf and hard-of-hearing.

INTRODUCTION

1. **Background on ASL:**

- American Sign Language is the primary mode of communication for many in the deaf and hard-of-hearing community.
- Despite its importance, many mainstream communication systems lack support for ASL, creating accessibility challenges.

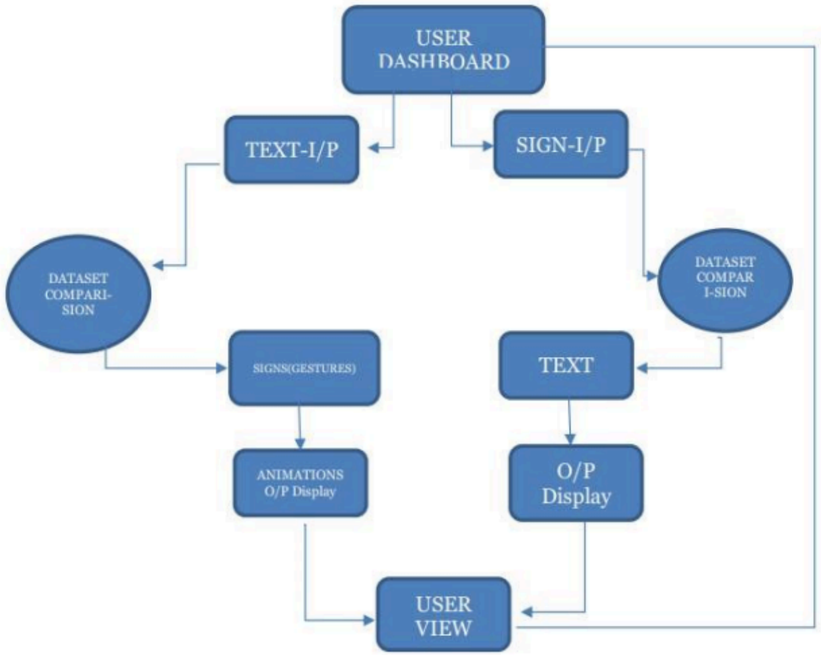
2. **Communication Challenges:**

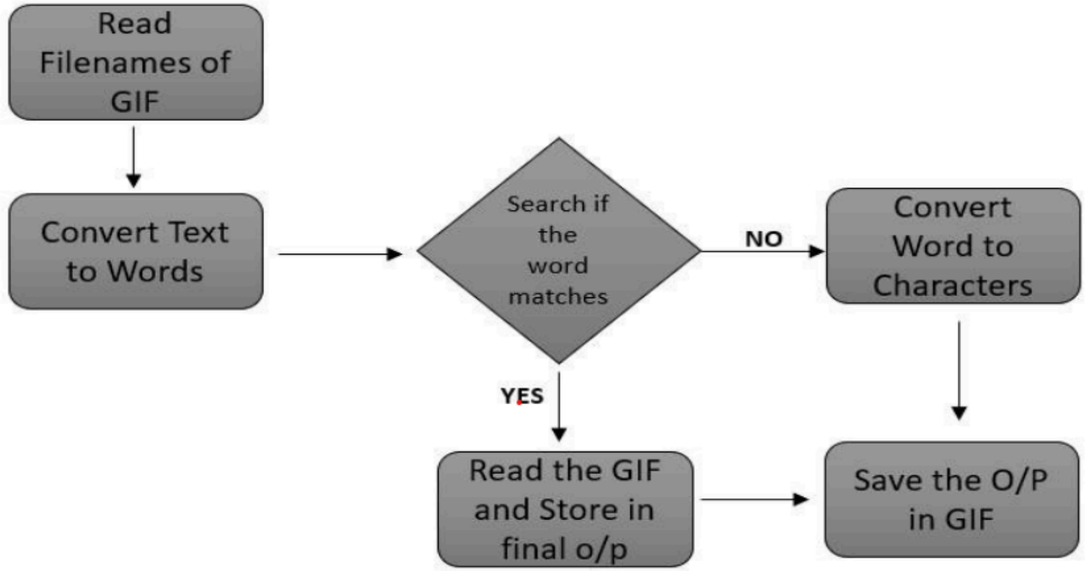
- Reliance on human interpreters can be costly, limited in availability, and subject to human error.
- Traditional systems often fail to capture the nuances of sign language, such as subtle hand gestures and movements.

3. **Project Goals:**

- Develop a dual-function system that converts text to ASL (via animated gestures) and ASL to text using live inputs.
- Improve accuracy and responsiveness to serve as a practical tool for everyday use by the deaf community and their interlocutors.

Architecture and Dataflow





Technical Aspects

1. **System Architecture:**
- Two main modules:
- Voice/Text to Sign Language Conversion
- Sign Language to Voice/Text Conversion

2. **Design Elements:**
- Block Diagrams:
- For text-to-sign: Data scraping, GIF filtering, and Tkinter interface.
- For sign-to-text: Real-time webcam feed, Region of Interest (ROI) detection, and CNN prediction.

3. **Algorithm Details:**
- Uses a CNN with three convolutional layers, two fully connected layers, and an output layer for 26 letters.
- Preprocessing steps include image resizing to 64×64 pixels, grayscale conversion, and normalization.

4. **Technologies:**
- Python (TensorFlow, Keras), Flask, Tkinter, and MediaPipe Holistic for key point extraction.

Case Study/Real - Time Examples

1. **Live Demonstration:**

- **User Interaction:**
- A user initiates the system by either typing a text or showing a hand gesture via webcam.
- The system immediately processes the input, demonstrating rapid recognition and translation.

2. **Detailed Walkthrough:**

- **For sign-to-text conversion:**
- The webcam captures a user's hand.
- The system identifies the hand's ROI, preprocesses the image, and feeds it into the CNN model.
- The predicted ASL letter is then displayed on the interface with minimal delay.
- **For text-to-sign conversion:**
- The user inputs a text phrase, which is broken down into individual letters or words.
- Corresponding GIFs (sourced and filtered from online repositories) are fetched and animated sequentially to represent the phrase in sign language.

3. **User Experience Enhancements:**

- Intuitive controls such as "Clear" (to reset the input) and "Learn More" (for additional instructions or background information) ensure ease of use.
- The interface is designed for accessibility, with large icons and clear labels.

Applications

1. **Communication Aid:**
- Enables real-time translation for the deaf community, facilitating smoother interactions in public spaces such as hospitals, government offices, and educational institutions.
- Reduces dependency on human interpreters, making communication faster and more cost-effective.
2. **Educational Tool:**
- Serves as a dynamic teaching aid in schools and universities to educate both deaf students and those learning ASL.
- Can be used in language labs and training centers to simulate real-life communication scenarios.
3. **Integration into Public Services:**
- Potential for integration with mobile applications and kiosks in public areas to provide on-the-spot sign language translation services.
- Enhances inclusivity by enabling non-signers to understand and communicate with sign language users.
4. **Broader Impact:**
- Promotes social inclusion and independence among individuals with speech or hearing impairments.
- Paves the way for future innovations in assistive technologies that harness machine learning for accessibility.

Results

1. **Performance Results:**

- – Accuracy:
- The model achieved a validation accuracy of 96% after training with 80% of the ASL dataset over 30 epochs.
- Confusion matrix analysis indicates high true positive rates and minimal false negatives/positives, attesting to the model's robustness.
- – System Responsiveness:
- Real-time processing of input images from the webcam with minimal lag, crucial for live communication scenarios.

2. Future Enhancements:

- Dataset Expansion: Incorporating a larger and more diverse dataset to improve the model's generalization.
- Extended Language Support: Adapting the system for other sign languages and potentially integrating full-sentence recognition.
- Mobile Integration: Developing mobile applications to make the technology accessible on-the-go.
- Enhanced Features: Integrating facial expression analysis to capture more nuanced communication cues.

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Conclusion

- The ASL Communication System effectively translates sign language into text, thereby enhancing communication for the deaf community.
- The use of a CNN model combined with a user-friendly Flask interface provides a scalable, reliable solution for real-time sign language recognition.
- Despite the high accuracy, the system currently focuses only on individual letters rather than full-sentence recognition or facial expressions, which offers avenues for future improvements.

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THANK YOU