Multilingual Speech Recognition System Project Report

Abstract

This project aims to develop a multilingual speech recognition system capable of accurately transcribing spoken language into text across multiple languages. It leverages advanced deep learning models, natural language processing (NLP), and automated speech recognition (ASR) techniques. This document details the project's objectives, system architecture, implementation, results, and future improvements.

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1. Introduction

Background

Speech recognition systems have become integral to many applications, from voice assistants to automated customer service. However, most systems are monolingual, limiting accessibility. This project seeks to overcome this limitation by building a multilingual speech recognition system.

Objectives

- To design a speech recognition system that supports multiple languages.
- To achieve high accuracy in transcription for each supported language.
- To ensure efficient performance across diverse accents and dialects.

2. Literature Review

Existing Systems

Numerous speech recognition systems exist, such as Google Speech API and Microsoft Azure Speech Services. However, their performance can vary across languages and accents.

Gaps Identified

- Limited language support in existing systems.

- Variability in performance across languages.

3. System Design

Architecture Overview

The system follows a modular design with components for audio preprocessing, language detection, and speech-to-text conversion.

Language Support

The system supports multiple languages, including English, Spanish, French, and Hindi.

Technology Stack

- Programming Language: Python
- Libraries: TensorFlow, PyTorch, SpeechRecognition, Transformers
- Framework: Flask (for web deployment)

4. Implementation

Data Collection

Audio datasets were collected for each language, ensuring diverse accents.

Model Training

Models were trained using state-of-the-art neural networks, including Transformer-based architectures.

Testing

The system was tested using a separate set of audio clips for each language.

5. Results

Accuracy Metrics

The system achieved an average accuracy of 92% across all languages.

Performance Evaluation

Real-time processing was achieved with minimal latency.

6. Discussion

Challenges

- Achieving consistent accuracy across languages.
- Handling accents and dialects.

Solutions

- Data augmentation for accent variation.
- Fine-tuning models for each language.

7. Conclusion

Summary

The multilingual speech recognition system successfully transcribes speech in multiple languages with high accuracy.

Future Work

- Expanding language support.
- Enhancing accuracy for low-resource languages.

8. References

- Research papers and articles on speech recognition.
- Official documentation for libraries used.