Speaker Diarization & Recognition for Multi-Speaker Indian Conversations

Aryan Kumar M23CSA510 & Abhilash Aggarwal M23CSA502

Department of Computer Science, Indian Institute Of Technology, Jodhpur
GitHub Repository:
https://github.com/Aryank47/speaker-diarization-recognition-for-multi-speaker-indian-conversations

Introduction

The goal of this project is to address the challenges posed by multi-speaker Indian conversations, which often involve code-switching and overlapping speech. Traditional speech systems struggle in such environments, and thus, the need for robust speaker diarization and recognition becomes critical. Our system integrates several key components:

- **Voice Activity Detection (VAD):** Identifies speech segments in noisy audio.
- **Speaker Embedding Extraction:** Uses pre-trained models to extract embeddings for speaker identification.
- **Diarization and Clustering:** Segments audio into speaker-specific portions using Agglomerative Clustering.
- **Speaker Recognition:** Matches speaker embeddings with enrolled templates.
- **Automatic Speech Recognition (ASR):** Transcribes speech using Whisper.

Proposed Methodology

- **Voice Activity Detection (VAD):** Uses the **Silero VAD** model with a threshold of 0.4 and minimum speech duration of 1.04 seconds.
- **Speaker Embedding and Clustering:** Uses SpeechBrain **ECAPA-TDNN** with Agglomerative Clustering and a distance threshold of 0.015.
- **Speaker Recognition:** Matches embeddings with AMI dataset templates using cosine similarity.
- **ASR with Whisper:** Transcribes speech using OpenAI **Whisper**, merging segments when they belong to the same speaker.

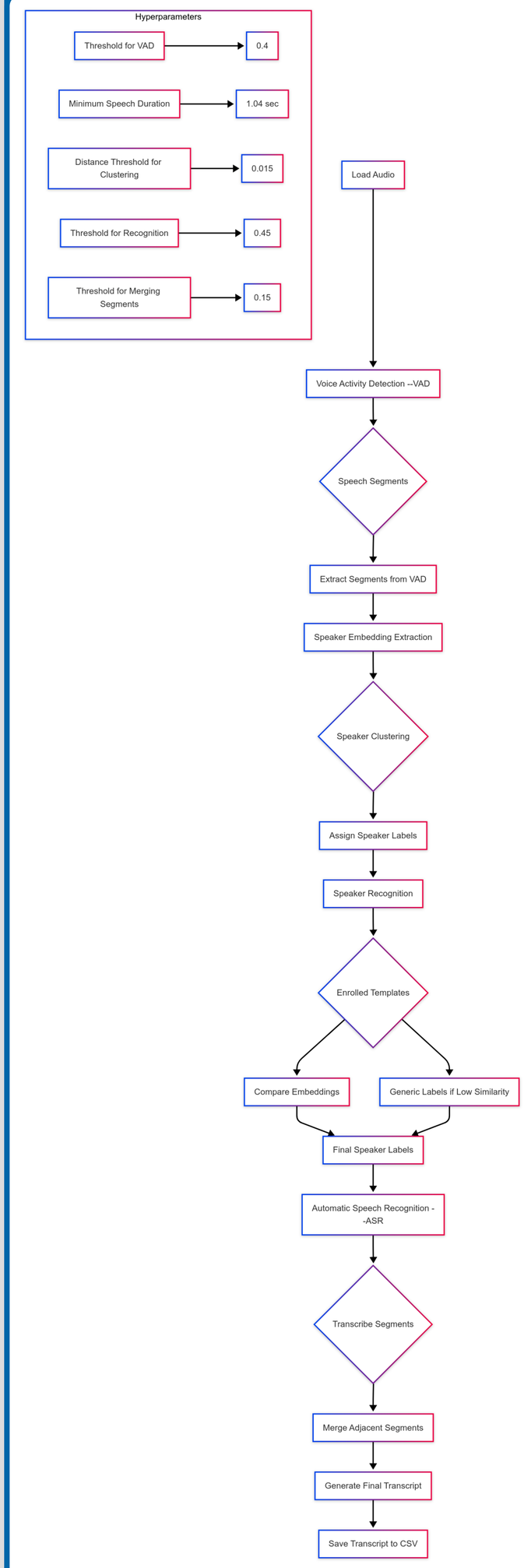
Datasets Used

- **AMI Meeting Corpus:** Provides multi-speaker meeting recordings with speaker annotations.
- **Custom Hinglish Audio:** A custom dataset for testing code-switched speech.

Results and Evaluation

- **VAD F1-Score:** 0.812
- **Diarization Error Rate (DER):** 38.75%
- **Number of Speech Segments Detected:** 192
- **Number of Clusters (Speakers):** 194
- **Number of Clusters after merging:** 179

System Flow Diagram



System Pipeline for Speaker Diarization and Recognition

Conclusion

We have presented a approach for speaker diarization and recognition tailored to the complexities of multi-speaker Indian conversations. The system performs well on both the AMI dataset and custom Hinglish audio, but future work will focus on refining performance, especially for handling code-switching and real-time processing.

References

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