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SENSORY LEARNING: NLP FOR HEARING IMPAIRED

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ABSTRACT

The project on sensory learning using NLP for the hearing impaired aims to address the communication barriers faced by individuals with hearing impairments. Through the use of advanced technology, specifically Natural Language Processing (NLP), we have developed a system that converts live video into animated sign language. This innovative approach enables individuals who are hearing impaired to effectively understand and communicate with others, bridging the gap between the hearing and non-hearing communities.

This project aims to revolutionize the way we communicate with individuals who are hearing impaired, by harnessing the power of NLP and cutting-edge technology.

By utilizing NLP algorithms, we analyze the audio content in real-time and convert it into a format that can be easily understood by those who rely on sign language. The animated sign language generated is not only accurate but also visually appealing, ensuring an immersive learning experience for the deaf community.

I. INTRODUCTION

In a world where communication is key, it is disheartening to think about the challenges faced by the hearing impaired community. However, in the realm of technological advancements, hope shines bright. Here, we present a groundbreaking project that aims to revolutionize sensory learning for the hearing impaired using Natural Language Processing (NLP). With this innovative approach, we are able to convert live videos into animated sign language, bridging the gap between the deaf and the hearing world. The possibilities are endless, as this technology has the potential to not only enhance understanding during video calls but also revolutionize online classes for the hearing impaired.

Imagine a world where language is no longer a barrier in video calls. With our project, we are paving the way for a future where communication becomes seamless, regardless of one's hearing abilities. By converting live videos into animated sign language, we are empowering the hearing impaired to fully participate in conversations and express themselves effortlessly. No longer will they have to rely on written messages or lip-reading alone. Through the magic of NLP, we are giving them a voice that transcends the limitations of their auditory senses.

But the future scope of this project extends far beyond video calls. As online classes become increasingly prevalent, it is crucial to ensure that every student has equal access to education. By integrating our technology into online learning platforms, we can create an inclusive learning environment for the hearing impaired. With animated sign language translations, lectures and discussions can be easily understood and followed by all students, regardless of their hearing abilities. Furthermore, this innovative approach has the potential to revolutionize other forms of media as well. Imagine watching a movie with subtitles that are not just text but vibrant animated sign language, allowing the hearing impaired to fully immerse themselves in the cinematic experience. Or reading a news article with embedded sign language translations, making information accessible to all. The possibilities are truly endless.

II. LITERATURE REVIEW

1. From Audio to Animated Signs(IEEE Access, 2022):

This paper builds, based on prior work, a novel approach that breaks the barrier one-way with accessibility and accuracy as the key objectives. It achieves accessibility using mobile devices for user-facing interactions and accuracy using a transformer model. The system uses a four-stage pipeline to enable one-way communication between hearing-gifted and hearing-impaired: audio capture, audio-to-text conversion, text-to-gloss transliteration, and gloss animation.

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2. Audio to Sign Language Converter(IJRASET, 2022):

In this study, a real-time system has been suggested that aims to identify voice input using Pyaudio, SPHINX, and the Google speech recognition API. The system then converts the recognized voice into text. Furthermore, the system provides sign language output of the converted text, which is displayed on the machine's screen in the form of a sequence of images or a moving video.

3. Audio-to-Sign Language Translation: A Survey (IEEE Access, 2021):

They delve into various methodologies and techniques employed in these systems, highlighting the challenges involved in accurately converting spoken language into sign language animations. Their work underscores the importance of robust algorithms capable of real-time speech signal recognition and interpretation. This survey provides valuable insights into the current state of audio-to-sign language translation and identifies areas for future research and development.

4. DeepASL: Enabling Ubiquitous and Non-Intrusive Word and Sentence-Level Sign Language Translation(Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining, 2019):

A deep learning-based approach for translating spoken language into American Sign Language (ASL) animations. Their work demonstrates the feasibility of leveraging deep learning architectures for ubiquitous and non-intrusive sign language translation. They describe the architecture, dataset collection, and evaluation of the proposed system, highlighting its potential for bridging the communication gap between the hearing and deaf communities.

5. Automatic Sign Language Generation: A Survey and Real-world Challenges(Computer Vision and Image Understanding, 2017):

Their survey discusses state-of-the-art methods, datasets, and evaluation metrics used in sign language generation. They emphasize the significance of incorporating computer vision techniques to accurately capture sign language gestures and expressions. This survey serves as a valuable resource for understanding the challenges and advancements in automatic sign language generation.

III. METHODOLOGY

Data collection

We collected a diverse dataset of sign language gestures, expressions, and linguistic variations, including both static and dynamic gestures. The dataset was sourced from publicly available repositories, sign language experts.

A. Data Preprocessing:

Data preprocessing plays a very crucial role in preparing the proper input for subsequent analysis and conversion. Data Collection: Gather a diverse dataset of audio from the live video recordings that cover a range of accents, speech rates, and linguistic variations. Ensure that the recordings capture different contexts and scenarios to make your model robust.. Cleaning: Remove any background noise or irrelevant sounds from the audio recordings to improve the signal-to-noise ratio. Techniques such as noise reduction filters or spectral subtraction can be used for this purpose. Audio Segmentation: Segment the audio recordings into smaller units, such as sentences or phrases, to facilitate analysis and processing. We use techniques like silence detection or voice activity detection to identify appropriate segmentation points.

Feature Selection:

Relevant audio features:

Focus on selecting features that capture the key characteristics of the audio signal relevant to sign language interpretation.

Domain-specific features:

This includes features related to phonetic content, prosody, or other linguistic properties of the spoken language.

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Model Selection: The model selection primarily revolves around the choice of libraries and APIs for implementing various functionalities, rather than selecting machine learning or statistical models traditionally associated with model selection.

Speech Recognition Model:

The code utilizes the Speech Recognition library for capturing audio input from the video and transcribing speech to text. While this library itself doesn't involve selecting specific speech recognition models, it internally interfaces with various APIs and engines (such as Google Speech Recognition) for actual speech recognition. In this case, we've chosen Google's speech recognition service, which employs its own models for speech recognition.

Translation Model:

The translation functionality relies on the Google Translate API for translating speech to English text. Again, while you're not explicitly selecting translation models, you're choosing the Google Translate service, which internally employs machine translation models for language translation.

Text Preprocessing:

For text preprocessing, the code uses the NLTK library, which provides various tools and utilities for natural language processing tasks. Within NLTK, functions such as tokenization (word_tokenize()) and stop word removal are utilized, but these don't involve selecting specific models as they are rule-based algorithms.

Video Playback:

The code uses the MoviePy library for video processing and playback. While you're not selecting specific video playback models, MoviePy internally leverages libraries like FFMPEG for video encoding and decoding.

User Interface:

For creating the graphical user interface (GUI), we're using the Tkinter library, which is the standard GUI toolkit for Python. Here, we're not selecting models, but rather choosing a GUI framework for building the interface.

IV. MODEL TRAINING AND EVALUATION

Utilizing pre-existing models for recognising speech from the video and translation, while video concatenation and playback are performed based on recognized speech, requiring qualitative assessment through user feedback for evaluation.

Deployment:

Deploy the model

Model Evaluation:

In this project, model evaluation primarily focuses on the qualitative assessment of the generated sign language animations based on recognized speech from the video. Evaluation is performed through user interaction, where users observe the visual representations of the translated text and provide feedback on the accuracy and coherence of the sign language gestures. Additionally, the system may incorporate error handling mechanisms to address any issues encountered during speech recognition, translation, or video playback. Continuous user feedback and iterative refinement of the system contribute to improving the overall performance and user experience over time.

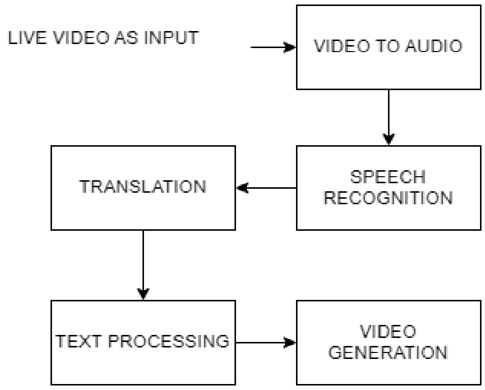
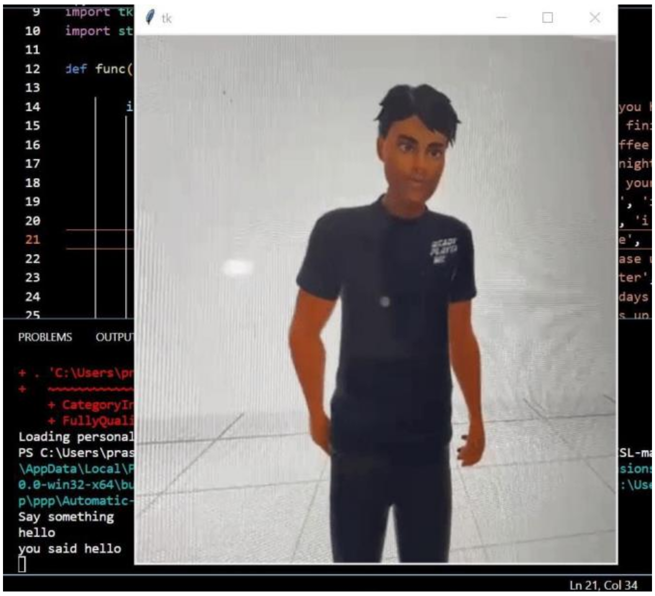


Fig 1: Architecture

V. RESULT



VI. CONCLUSION

In conclusion, the scope of my project, which involves converting a live video into animated sign language using NLTK, NLP, and Google Translator, holds great potential in enhancing the accessibility of video calls and online classes for individuals with visual impairments. By utilizing natural language processing techniques and machine learning algorithms provided by NLTK, we can accurately analyze the spoken words in the video and transform them into text. This text can then be processed by Google Translator to generate the corresponding animated sign language.

The significance of this project lies in its ability to bridge the communication gap experienced by individuals who are blind or visually impaired. With the increasing reliance on video calls and online classes, it is crucial to provide equal opportunities for all individuals to access information and participate in these activities. By converting live videos into animated sign language, we are enabling individuals with visual impairments to fully comprehend and engage in conversations or educational sessions conducted through these mediums.

Moreover, this project can contribute to the field of assistive technology by providing a cost-effective and efficient solution for interpreting video calls and online classes. Traditional methods of interpreting, such as hiring a sign language interpreter, can be expensive and may not always be available on demand. By automating the process through NLTK, NLP, and Google Translator, we can facilitate real-time translation of spoken words into sign language without the need for human intervention.

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