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Phd computational
cognitive
neuroscience.★



Background



Bachelor degree : Biochemistry



Master degree : Neuroscience



Phd : Computational cognitive neuroscience



Main Question!

How can voice, linguistic, and text analysis techniques be applied to discern the emotional dynamics within human interactions ?

★ Data



Describe what data you are aiming to use?

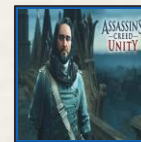
Friends tv show episodes



Why it fits with your research question ?

It has the parameters needed for my study:

- Audio
- Transcript
- Video



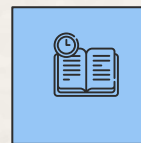
Where will you obtain the data?

MarieSTL from Pierre Bellec's Lab

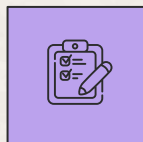
Tools & methods



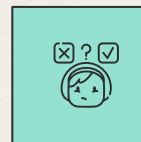
Voice analysis



Text analysis



**Linguistic
analysis**



Emotion detection



Voice Analysis



Feature Extraction:

Algorithm: Linear Predictive Coding (LPC), Mel-Frequency Cepstral Coefficients (MFCCs)

Tool: Librosa, Praat

Description: Extracts acoustic features like spectrograms, pitch, and formants from speech signals.

Example: Analyzing a voice recording to extract pitch and formant frequencies.

Speaker Tagging:

Algorithm: Gaussian Mixture Models (GMMs)

Tool: Sci-kit Learn

Description: Identifies different speakers in a conversation using extracted features.

Example: Classifying different speakers in a group discussion

Speech-to-Text:

Algorithm: Transformer-based models (e.g., Wav2Vec 2.0)

Tool: Hugging Face Transformers

Description: Converts speech to text for further analysis.

Example: Transcribing a recorded dialogue to text.





Sentiment Analysis:

Algorithm: VADER, TextBlob, BERT

Tool: NLTK, TextBlob, Hugging Face
Transformers

Description: Determines sentiment in text.

Example: Identifying a review as positive or negative.



Topic Modeling:

Algorithm: Latent Dirichlet Allocation (LDA)

Tool: Gensim

Description: Discovers topics within a text corpus.

Example: Finding topics like “technology” and “sports” in news articles.



Text analysis



Named Entity Recognition (NER):

Algorithm: Conditional Random Fields (CRF), BERT

Tool: SpaCy

Description: Identifies entities within text.

Example: Recognizing “New York” as a location



Keyword Extraction:

Algorithm: TF-IDF, RAKE

Tool: Scikit-Learn, Gensim

Description: Identifies important words or phrases.

Example: Extracting keywords like “machine learning” from a research paper.



Linguistic Analysis



Phonological Features

Algorithm: Intonation, Stress Analysis

Tool: Praat

Description: Analyzes intonation, stress patterns, and pauses in speech.

Example: Identifying rising intonation in questions.

Tokenization and parsing

Algorithm: Tokenizers and Parsers

Tool: (NLTK)

Description: Splits text into words or phrases and identifies grammatical structure.

Example: Splitting "I love programming" into ["I", "love", "programming"] and identifying grammatical roles.

Syntactic Analysis

Algorithm: Dependency Parsing, Constituency Parsing

Tool: SpaCy

Description: Analyzes grammatical relationships between words in sentences.

Example: Understanding the structure of "The cat sat on the mat."

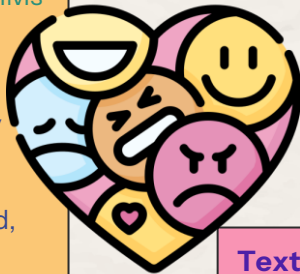


Emotion Detection



Vocal Emotion Recognition:

- **Algorithm:** OpenSMILE feature extraction, GMMs
- **Tool:** OpenSMILE
- **Description:** Extracts vocal features to classify emotions.
- **Example:** Detecting anger from a high-pitched, loud voice



Text-based Emotion Detection:

- **Algorithm:** Transformer- based models (BERT)
- **Tool:** Hugging Face Transformers
- **Description:** Identifies emotions in text.
- **Example:** Analyzing a tweet to determine if the sentiment is joyful or sad



Summary of the used Tools:



1. Librosa
2. Praat
3. Scikit-learn
4. NLTK (Natural Language Toolkit)
5. SpaCy
6. Stanford NLP
7. OpenSMILE
8. Hugging Face Transformers
9. TextBlob
10. Gensim
11. ELAN
12. Inception



Objectives



Holistic Analysis

Emotion Detection

Social Dynamics Understanding

Tool Integration

Dataset Creation

Model Development

*Visualization and
Interpretation*





Deliverables :

will ensure that the project is well-documented, reproducible, and accessible to other researchers and stakeholders who may be interested in understanding or building upon the analysis.

01

Code Scripts

Python scripts or Jupyter notebooks implementing the algorithms and analysis pipelines for voice analysis, emotion detection, text analysis, and linguistic analysis.

02

GitHub Repository:

A public GitHub repository containing all project-related materials, including code scripts, documentation, and data files.

03

Documentation:

Detailed documentation outlining the project goals, methodology, algorithms used, and instructions for running the code and replicating the analysis.

04

Markdown Files:

Markdown files documenting specific aspects of the project, such as data preprocessing steps, algorithm descriptions, and analysis results.

05

Containerization:

Docker containers or similar containers encapsulating the project environment, dependencies, and code, ensuring reproducibility and portability of the analysis.

06

Evaluation Reports:

Reports summarizing the performance and outcomes of the analysis, including any insights or findings derived from the data.



References



Voice Analysis

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- 2 Librosa: A python package for music and audio analysis. Retrieved from <https://librosa.org/doc/main/index.html>

Emotion Detection

- 1 Eyben, F., Wöllmer, M., & Schuller, B. (2010). Opensmile: the Munich versatile and fast open-source audio feature extractor. In Proceedings of the international conference on multimedia (pp. 1459-1462).
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- 3 Schuller, B., & Batliner, A. (2013). Computational Paralinguistics: Emotion, Affect and Personality in Speech and Language Processing. Wiley.

Text Analysis

- 1 Bird, S., Klein, E., & Loper, E. (2009). Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit. O'Reilly Media.
- 2 Gensim: Topic Modelling for Humans. Retrieved from <https://radimrehurek.com/gensim/>
- 3 Manning, C. D., Raghavan, P., & Schütze, H. (2008). Introduction to Information Retrieval. Cambridge University Press.
- 4 Jurafsky, D., & Martin, J. H. (2019). Speech and Language Processing (3rd ed.). Pearson.

Linguistic Analysis

- 1 SpaCy: Industrial-strength Natural Language Processing in Python. Retrieved from <https://spacy.io/>
- 2 Manning, C. D., & Schütze, H. (1999). Foundations of statistical natural language processing. MIT press.
- 3 Crystal, D. (2008). A Dictionary of Linguistics and Phonetics (6th ed.). Wiley-Blackwell





Unlocking the communication Tapestry