

Internship:

Automated Detection of Speech Impairments in Awake Brain Surgery: Development of Synthetic Data and Comparative Model Analysis

Keywords:

Speech Impairment Detection, Synthetic Speech Data, Clinical Deep Learning, Transformer-Based Analysis

Born from the complementarity between the field of health and communication sciences, the LaTIM is a research lab which leads multidisciplinary research driven by scientists, engineers, and physicians from the University of Brest, IMT Atlantique, INSERM and the University Hospital of Brest. Medical information is at the heart of our research projects; being by nature multimodal, complex, heterogeneous, shared and distributed, it is integrated into methodological solutions and transferred into the clinical community with the sole aim of improving the medical benefit.

Interested to be involved in a research project combining deep learning and medicine?

Context

This internship will take place at LaTIM, in collaboration with the neurosurgery department of the University Hospital of Brest. The project focuses on developing methods for the automatic detection of speech impairments during Awake Brain Surgery (ABS). In ABS, the patient remains awake to perform language-related tasks, such as picture naming and counting, while the neurosurgeon applies Direct Electrical Stimulation (DES) to the brain. This stimulation can lead to temporary, reversible speech deficits, which must be assessed in real-time. Currently, this evaluation relies heavily on the experience of the clinician, making it subjective and resource-dependent. The objective of this internship is to support neurosurgeons by developing automated, objective methods for detecting and quantifying speech impairments.

Due to the lack of French-specific databases for speech impairments, this internship will focus on creating synthetic speech data and comparing the effectiveness of Transformer-based and spectrogram-based deep learning models to detect language deficits.

This internship will thus involve:

1. Carrying out a state of the art Identifying different language impairments occurring in Awake Brain Surgery and modeling methodologies to identify them.
2. Strategies for data augmentation and performance enhancement in limited dataset scenarios, along with validated models that demonstrate practical utility for objective speech impairment assessment.
3. Comparative analysis of Transformer-based and spectrogram-based deep learning models in the detection of speech impairments, with insights into each approach's strengths and limitations.

Profile

- 5th-year student in Computer Science and/or Machine Learning.
- Proficiency in Python/C++ and experience in signal or speech processing.
- Ability to deliver documented code and present results to the team.
- Ability to read scientific articles and extract relevant information.

Conditions

Start date: February / March 2025

Duration: 6 months, indemnities

Localization: LATIM – University Hospital of Brest – 2, avenue Foch – 29200 BREST – France

Supervisors: Guillaume DARDENNE, research scientist, and Chinmayi Kanthila, Post.Doc.

Applications to be sent to: guillaume.dardenne@univ-brest.fr

References:

1. I. Maoudj, C. Garraud, C. Panheleux, V. Saliou, R. Seizeur, and G. Dardenne, "A modular system for the synchronized multimodal data acquisition during Awake Surgery: towards the emergence of a dedicated clinical database*," in *2023 45th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, Sydney, Australia: IEEE, Jul. 2023, pp. 1–4. doi: [10.1109/EMBC40787.2023.10340545](https://doi.org/10.1109/EMBC40787.2023.10340545).
2. P. Guiraud *et al.*, "An Introduction to the Speech Enhancement for Augmented Reality (Spear) Challenge," in *2022 International Workshop on Acoustic Signal Enhancement (IWAENC)*, Bamberg, Germany: IEEE, Sep. 2022, pp. 1–5. doi: [10.1109/IWAENC53105.2022.9914721](https://doi.org/10.1109/IWAENC53105.2022.9914721).
3. M. A. Garcia-Barrera and J. H. Davidow, "Anticipation in stuttering: A theoretical model of the nature of stutter prediction," *Journal of Fluency Disorders*, vol. 44, pp. 1–15, Jun. 2015, doi: [10.1016/j.jfludis.2015.03.002](https://doi.org/10.1016/j.jfludis.2015.03.002).
4. I. Maoudj *et al.*, "Classification of Speech Arrests and Speech Impairments during Awake Craniotomy: a multi-databases analysis," May 09, 2024. doi: [10.21203/rs.3.rs-4359067/v2](https://doi.org/10.21203/rs.3.rs-4359067/v2).