Development and testing of a pipeline for Digital Linguistic Biomarker extraction (PRIN 2022 - ReMind)

Premise: The research activities will be carried out within the *ReMind project - an ecological, cost-effective AI platform for early detection of prodromal stages of cognitive impairment*, founded by MUR with the PRIN 2022 grant (CUP J53D23008380006).

supervisor: Gloria Gagliardi

Research project

A timely diagnosis of the prodromal stages of dementia remains a big challenge for the healthcare system. Of late, many tools for the automatic assessment of dementia have been proposed, but they are unreliable for detecting subtle changes in cognition. The scientific literature contains a number of reports about language disturbances at the earliest stages of dementia (the clinical syndrome known as Mild Cognitive Impairment, MCI), but the clinically-controlled collection of language data at scale remains a significant bottleneck for progress in this area [Gagliardi 2023].
Building upon previous findings of the involved Research Units [Beltrami et al. 2018, Calzà et al. 2021], *ReMind* aims to develop an innovative prototype platform that uses Natural Language Processing (NLP) technology for non-intrusive, cost-effective screening of dementia, based on a large array of Digital Linguistic Biomarkers (DLBs).

The research fellow will contribute to the development and testing an innovative and cost-effective ICT platform prototype that classifies elicited/spontaneous verbal productions of subjects with MCI through a highly ecological, non-invasive protocol. In particular, he/she will make a re-engineering the FICLIT DLB-Pipeline [Gagliardi & Tamburini 2022], also implementing new linguistic features formalized by the project ‘s partners.

Research plan

In detail, the research fellow's activities, who should have a strong background in corpus linguistics, machine learning and natural language processing, will encompass the following areas:

- DLB pipeline reengeneering;
- DLB Literature review;
- Definition and implementation of novel DLB;
- Dissemination of project results, through attendance as a speaker at national/international seminars and conferences and the publication of scientific articles in journals or edited volumes.

References

Beltrami D., Gagliardi G., Rossini Favretti R., Ghidoni E., Tamburini, F. Calzà L. (2018). Speech Analysis by Natural Language Processing Techniques: A Possible Tool for Very Early Detection of Cognitive Decline? *Frontiers in Aging Neuroscience*, 10: 369.

Calzà L., Gagliardi G., Rossini Favretti R., Tamburini F. (2021). Linguistic features and automatic classifiers for identifying mild cognitive impairment and dementia. Computer Speech & Language, 65: 101113.

Gagliardi G. (2023). Natural language processing techniques for studying language in pathological ageing: A scoping review. *International Journal of Language & Communication Disorders.* DOI: 10.1111/1460-6984.12870

Gagliardi G., Tamburini F. (2022). The Automatic Extraction of Linguistic Biomarkers as a Viable Solution for the Early Diagnosis of Mental Disorders. In *Proceedings of the Thirteenth Language Resources and Evaluation Conference*. Paris: European Language Resources Association, pp. 5234 – 5242.