

Advanced Computational Methods for Biomedical Data Integration and Analysis

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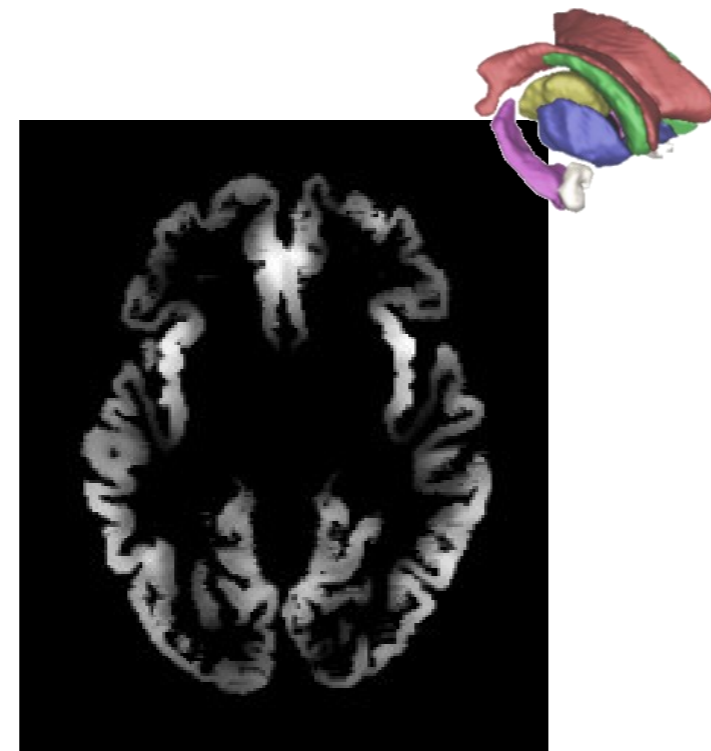
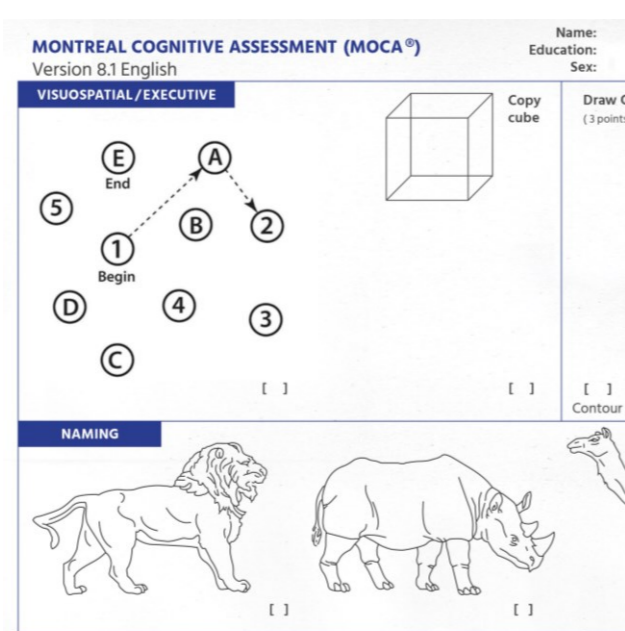
1. Context

Neurological degenerative pathologies such as Multiple Sclerosis and Alzheimer's Disease present an heterogeneous clinical profile. Disease diagnosis and monitoring rely on a variable number of clinical exams that include imaging (MRIs) and neuropsychological evaluations (NP tests). The early identification of disease progression is crucial: the application of computational methods can have a decisive impact on the extraction of information from heterogeneous sources of data, and on disease monitoring.

2. Goal

The **goal** of the research is the integration of heterogeneous sources of data for predicting disease evolution in time.

- Initial focus on Alzheimer's Disease;



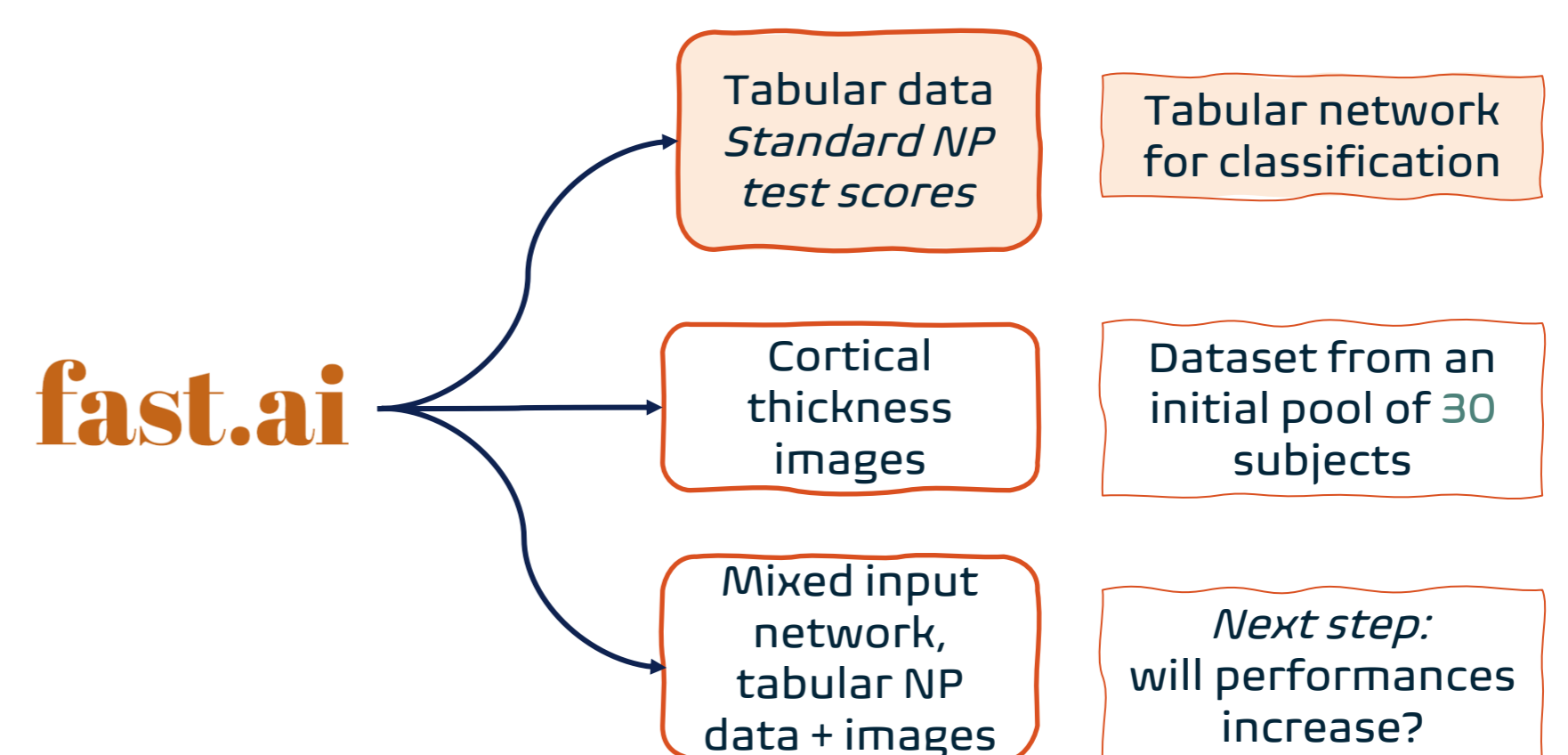
- Implementation of a Deep Learning framework for the integration of different sources of data (tabular and imaging data) in order to identify those subject in risk of conversion from a stable clinical profile to MCI, or from MCI to AD;
- Testing on real clinical data;
- Transfer learning (application on MS or other diseases with similar needs).

3. Methods

After the analysis of the ADNI Dataset, which is a public available dataset containing data of 2380 subjects screened over time, we constructed the data-set for the deep learning framework:

- A pure tabular data-set containing NP tests scores (SDMT, PASAT etc)
- T1-3D images data-set processed with *Volbrain*

Three different networks are tested and developed with FastAi Python library:



4. Results / Conclusions

The pure tabular model reached an accuracy of 0.7: we expect performances to increase when combining the tabular data and the imaging data.

5. References

- Ostellino, Benso, Politano A Deep Learning Framework for the Prediction of Conversion to Alzheimer Disease. In: IWBBIO - 9th International Work-Conference on Bioinformatics and Biomedical Engineering, Spain, pp. 395-403. ISSN 0302-9743. ISBN: 978-3-031-07703-6 (2022)
- Ostellino, Benso, Politano The integration of clinical data in the assessment of Multiple Sclerosis - a review. In: COMPUTER METHODS AND PROGRAMS IN BIOMEDICINE, vol. 221. ISSN 0169-2607 (2022)
- Ostellino, Benso, Politano Brain MRI Images Pre-processing of Heterogeneous Data-sets for Deep Learning Applications. In: Bioinformatics 2022, February 9 - 11, 2022, pp. 115-120. ISBN: 978-989-758-552-4 (2022)