

Development of Novel Machine Learning methodologies for early Parkinson's disease diagnosis from multi-modal MRI

<https://neurodegenerationresearch.eu/survey/development-of-novel-machine-learning-methodologies-for-early-parkinsons-disease-diagnosis-from-multi-modal-mri/>

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Luxembourg

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Development of Novel Machine Learning methodologies for early Parkinson's disease diagnosis from multi-modal MRI

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FNR

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Research Abstract

Parkinson's disease (PD), the second most common neurodegenerative disease today, is generally considered a disease that affects the elderly. Still, around 10% of the cases of young onset of PD occurs to a population below 40 years old. This disease substantially decreases quality of life of those affected, and although it can be diagnosed in later stages through its typical motor symptoms, i.e. bradykinesia or tremor, at this stage there already exists a severe

neurodegeneration that reduces the effectivity of neuroprotective therapies. Accordingly, the complex problem of early PD diagnosis has gained major importance in the community in the last years. Although it is in principle possible to obtain accurate diagnosis through positron emission tomography, this imaging technique is not suitable for repeated assessments due to its use of radioactive tracers. In contrast, diffusion magnetic resonance imaging (dMRI) and functional MRI (fMRI) are non-invasive techniques that are extensively applied nowadays for the problem of PD diagnosis. In this project, we will address some of the shortcomings of recent approaches in the literature of dMRI and fMRI-based early PD diagnosis, developing a common framework that allows to conveniently integrate the information of these 2 modalities through novel machine learning techniques. To this end, we will first implement an automatic algorithm for feature extraction, relying on the novel Fisher vector algorithm for local image description. Second, we will provide the means for incorporating meaningful prior information into the model (such as anatomical or phenotypical relations between brain regions) by carefully designing the regularization function of the classifier. In addition to boosting diagnosis accuracy, the proposed methodology will allow the discovery of novel robust biomarkers of the disease, thereby gaining valuable insights on the complex mechanisms that underlie PD.

Further information available at:

<https://www.fnr.lu/projects/development-of-novel-machine-learning-methodologies-for-early-parkinsons-disease-diagnosis-from-multi-modal-mri-2/>

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