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PREDICTING SYMPTOM ONSET IN PARKINSON'S DISEASE WITH LATENT MIXED-EFFECT MODEL

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1 Objectives

Due to their slow evolution, neurodegenerative diseases can be observed on long periods with several measurements of various biomarkers. Statistical models can fit such longitudinal data to describe the disease's evolution. We show how such a model can predict the onset of symptoms in a study on Parkinson's disease.

2 Methods

We used data from patients included in the NS-PARK cohort collecting longitudinal motor and non-motor symptoms from patients with Parkinson's disease followed in the 25 expert centers in France and updated at each visit at the center. Only patients with at least 3 visits were included into the analysis. We modelled the observations with a non-linear mixed-effect model called Leaspy describing the latent evolution of the disease. The model is composed of population parameters which represent the average disease trajectory. This trajectory can then be personalized for each subject, with an individualized evolution of the disease which we used to predict the future onset of symptoms for new patients.

3 Results

2821 patients from the NS-PARK cohort were included into the analysis (mean age : 66+/-11; follow-up duration : 2.6+/-1.3). Analysis of the model helps us to understand the variability of each symptom and the prediction task separates symptoms in two groups : symptoms which we can roughly predict (dementia, postural instability...), and symptoms which are unpredictable (insomnia, impulse control disorders...).

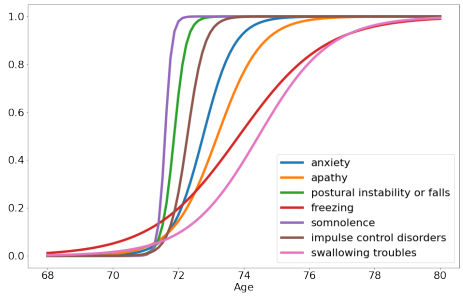


Figure 1: Average population model for latent evolution of symptoms

4 Conclusions

Our model allows to decipher between symptoms which are due only to the disease and symptoms which depend on external factors. In the first case we are able to partially predict symptom onset.