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Prediction of STN-DBS Outcome in Parkinson's Disease using Machine Learning

Poster number: 13
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Aims, research questions and working hypothesis
Deep Brain Stimulation (DBS) targeting the subthalamic nucleus (STN) is an effective treatment for advanced Parkinson's disease (PD), although outcomes and risks vary, necessitating precise candidate selection. This study uses machine learning (ML) to predict the effects of STN-DBS therapy on PD patients based on preoperative clinical markers, aiming to refine patient selection and outcome prediction.

Means/methods implemented by the consortium
Retrospective data from 1105 PD patients who underwent STN-DBS were analyzed. ML regression models were developed to predict outcomes on the Movement Disorders Society Unified Parkinson's Disease Rating Scale part III (MDS UPDRS-III) and subscores for Tremor, Axial symptoms, and Bradykinesia & Rigidity, with sample sizes ranging from 326 to 336 patients. The methodology included feature selection, outlier removal, model training, hyperparameter optimization, cross-validation, and evaluation on a testing set.

What are the outcomes of the project?
The ML models demonstrated error values on the MDS UPDRS scale of up to 9 points for Total MDS UPDRS-III, 3 points for Tremor, 2 points for Axial symptoms, and 5 points for Bradykinesia & Rigidity. Most predictions fell within the variance belt, indicating the model's effectiveness and accuracy, with a minority of cases outside this belt highlighting PD's heterogeneity.

Significance and impact of the work on the field
This study provides evidence for the capability of ML algorithms in predicting the effect of STN-DBS for PD patients based on preoperative clinical markers. Our models offer a methodological advancement in predictive medicine, holding potential for accompanying clinical decisions and thus improving personalized health care.

Next steps and future challenges
Future work will aim to incorporate broader predictors and further enhance the predictive accuracy.