Predicting Impulse Control Disorders in Parkinson's Disease: A Challenging Task

Objective

To predict the onset of impulse control disorders (ICDs) in Parkinson's disease (PD) in several scenarios of interest for clinicians.

Background

Impulse control disorders are common in PD with an estimated cumulative incidence of 46% after 5 years.[1] A couple of publications tackle the issue of predicting ICDs in PD, but the lack of replication of these results deserve further investigations [2,3].

Methods

We used the Parkinson's Progression Markers Initiative (PPMI) dataset in which ICDs were assessed using the Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease (QUIP) at each visit. Three scenarios were investigated for predicting the presence or absence of ICDs (1) at one given visit for each patient, (2) in a given range of years after baseline, and (3) at each visit for each patient. Clinical predictors consisted of age at PD onset, gender, psychological scores and treatment. Predictive performance of machine learning classifiers (logistic regression, support vector machine and random forest) was evaluated using cross-validation.

Results

The three scenarios resulted in datasets consisting of 87 cases with ICDs and 261 without ICDs, 24 cases with ICDs and 196 without ICDs, and 80 (patient, visit) pairs with ICDs and 1285 without ICDs respectively. The mean area under the receiving operating curve was equal to 0.71, 0.66 and 0.65 for each scenario respectively for the best classifier.

Conclusions

Predicting ICDs in PD is challenging. Using clinical modalities only resulted in a decent predicting performance that may be improved with other predictors such as genetic data. Evaluating the predictive performance unbiasedly is necessary to avoid any use of a model that performs much lower than expected in a clinical routine.

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[1] Jean-Christophe Corvol et al., "Longitudinal Analysis of Impulse Control Disorders in Parkinson Disease," *Neurology* 91, no. 3 (July 17, 2018): e189–201, https://doi.org/10.1212/WNL.0000000000005816.

[2] Julia Kraemmer et al., "Clinical-Genetic Model Predicts Incident Impulse Control Disorders in Parkinson's Disease," *Journal of Neurology, Neurosurgery, and Psychiatry* 87, no. 10 (October 2016): 1106–11, https://doi.org/10.1136/jnnp-2015-312848.

[3] Aleksander H. Erga et al., "Dopaminergic and Opioid Pathways Associated with Impulse Control Disorders in Parkinson's Disease," *Frontiers in Neurology* 9 (2018), https://doi.org/10.3389/fneur.2018.00109.