Daily-life accelerometer monitoring of bradykinesia in Parkinson patients for the evaluation of adaptive Deep Brain Stimulation

abstract

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Abstract

Introduction: In the early phase of Parkinson's Disease (PD), motor symptoms are typically well-treated by dopaminergic medication. After 5 - 10 years, the majority of patients experiences a decrease in effectiveness of dopaminergic-therapy, leading to motor fluctuations, or increased side-effects due to necessarily higher medication dosages. Motor fluctuations typically occur both within days, as well as between days.
Currently, narrative patients' feedback is crucial to obtain an impression of motor fluctuations. To decrease this burden on, often neuropsychological impaired, Parkinson-patients, and to improve therapy evaluation, motor symptom monitoring via movement sensors is explored. These sensors measure acceleration and hold potential to monitor motor-symptoms continuously and unobtrusively during daily life activities. With a special interest in monitoring bradykinesia-fluctuations during closed-loop neurostimulation, we developed a model to detect bradykinesia in daily-life based on single wrist-accelerometer data.
Methods: 20 PD patients collected minimally 40 minutes of unscripted daily life activities during 'off'- and 'on'-state, respectively deprived from dopaminergic-medication and thus symptomatic, vs. well-treated on dopaminergic-medication. They showed at least 1-point difference on hand-bradykinesia in the Unified Parkinson's Disease Rating Scale (UPDRS) between their 'on'- and 'off'-state.
A classification model was trained to differentiate on- vs off-periods based on accelerometer-features from the temporal and the spectral domain.
We compared whether the model performed better when trained on individual data, compared to trained on group data. Further, we analysed the additional value of feature selection.
Results: Preliminary results show that individual models have better mean predictive results (accuracy, roc auc, f1-score) compared to group models ($p<0.05$). A more specific sub analysis has to show whether we can identify a subgroup which benefits from individual model training, or a sub group which shows similar results for both models.
Conclusion: We analysed the potential additional value of individual model training in daily life monitoring of PD patients.