i-Prognosis: Towards an early detection of Parkinson's disease via a smartphone application

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ABSTRACT

Background and Aim: It is well accepted that the neurodegenerative process in Parkinson's disease (PD) starts many years before motor symptoms become evident enough to impact patients' life to an extent that will lead to clinical diagnosis. Therefore, the Movement Disorders Society defined new clinical diagnostics, as well as research criteria in the form of risk and prodromal markers, focusing especially on non-motor symptoms (NMS) to diagnose PD earlier or at least to evaluate the risk of transition to clinically evident PD in the future. Earlier diagnosis of PD is a significant need for developing neuroprotective therapies.

Objective: The i-PROGNOSIS project developed the "iPrognosis" Android smartphone application for unobtrusive big data collection with the aim of evolving it into an early PD detection tool in the daily living.

Methods: The iPrognosis application collects participants' behavioural data arising from the everyday use of their smartphones over time in an unobtrusive way. The types of data, namely general usage data (GData), have been defined based on known motor and non-motor symptoms of PD and include features of voice (recorded during phone calls), movement (by recording accelerometer data during specific gestures), location patterns and touch screen typing as well as NMS-related features such as mood characteristics (via analyses of text messages and selfies). The application can be downloaded for free from the Google Play Store in Germany, Greece and Portugal since May 2017. Further request of ethical approval is in process in the United Kingdom. Healthy people and patients in early stages of PD, aged over 40 years, can participate in the GData collection study after providing electronic informed consent via the application.

Results: Preliminary analyses of accelerometer data collected in laboratory conditions yielded a tremor recognition accuracy of 87%, 75% and 72% when holding the phone in rest position, near the ear during calls and while typing, respectively. Differences between PD patients and controls in terms of typing patterns (keystroke dynamics and pressure applied on keys) were also observed, leading to a discrimination accuracy of 91%. The focus is now placed on validating these findings on big data collected "in real life". Two months after the release of the iPrognosis application, 254 participants in total (187 healthy persons with 71.6% male and a mean age of 45 ± 16.1; 67 PD patients with 95.5% male and a mean age of 52 ± 15.9)

downloaded it and enrolled in the study. As a result, more than 17 GB of ecologically-valid GData are already available to be used towards validation of the approach in due time.

Conclusion: Modern technologies such as smartphones offer the ability of remotely monitoring people's behaviour over time in an unobtrusive way, as opposed to snapshot assessments in the artificial clinical environment. This offers the potential of detecting symptoms and behavioural changes earlier, allowing for earlier disease detection and fostering the development of relevant treatments. Initial evidence of pattern differences between healthy controls and PD patients, produced by the i-PROGNOSIS approach, are promising regarding the potential for early PD detection.

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