Development of a Practical Method to Identify Fall-prone Individuals among Parkinson's Disease Patients

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One in three adults of age greater than 65 falls each year. In 2008, emergency departments in the US treated 2.1 million fall injuries among older adults. Parkinson Disease (PD) impairs balance and has been shown to increase the risk of falls. Up to 68% of individuals with PD will fall in a 1-year period, which can lead to injuries and large personal and societal costs. Fall events have major financial implications. Ideally, individuals with PD who have impaired balance and increased risk for falls should be identified prior to a fall so that appropriate, proactive intervention can be carried out. However, the best predictor of falling, as of now, is a history of prior falls. We need methods, independent of prior history of falls, to identify fall-prone individuals. This can be achieved by using wearable sensors. Most of the algorithms used to differentiate "fallers" from "non-fallers" use multiple sensors and linear methods (threshold velocity or acceleration of different parts of the body). Wearing multiple sensors in daily life might be impractical and considered intrusive. Moreover, most daily life activities do not follow a linear pattern. There is a need for a method which is sensitive enough to identify "fallers" without having to use multiple sensors. In this study, we aim at developing an algorithm which uses a single sensor and a dynamic approach based on Maximum yapunov Exponent (MLE) and Floquet Multipliers (FM) to identify fall-prone PD patients. In this study we will use a single sensor (3-D accelerometer with 3-D gyroscope) to capture kinematics data of center of mass for Parkinson's patients. This kinematics data will be collected while subjects simulate Activities of Daily Life (ADLs). MLE and FM calculated from the kinematics data will used to categorize PD patients as fallers and non-fallers. Using our method, fall-prone individuals can be identified at an early stage. This will help us design appropriate interventions to reduce their risk of falls and improve their quality of life. Our method to identify fall-prone people can be used in other populations like workers with manganese-induced parkinsonism and older workers.

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