An Application to Monitor Freezing of Gait in Parkinson's Disease

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Parkinson’s disease (PD) is the leading cause of disability worldwide. Indeed, PD cases are rapidly rising, especially in underdeveloped areas that don’t have ready access to therapeutic care. Over 70% of people with PD (PWP) experience potentially fatal falls attributed to freezing of gait (FoG), a sudden muscular stiffness. To address this, an end-to-end FoG detection and prevention system was built with the success criteria of real-time feedback, accuracy, and accessibility. A machine learning model (LSTM) was trained on upper-thigh triaxial accelerometer data from Daphnet in which 14 PWP experienced FoG episodes while completing daily tasks. A mobile application that continuously collects accelerometer data was developed; this data is then analyzed by the LSTM. The completed prototype was evaluated in multiple trials: (1) algorithmic, (2) live testing, and (3) navigability. (1) Algorithmically, the model had an accuracy of 90%. (2) When used by 10 PWP, the application was able to predict FoG 2 seconds before it occurred and subsequently play an auditory cue to reduce FoG severity. (3) All subjects reported the prototype to be navigable without assistance. The upper-thigh accelerometer data alone proved to be statistically significant when comparing FoG to unaffected walking, demonstrating that a smartphone can detect and prevent FoG while being discreetly placed in a patient’s pocket. Overall, the prototype can effectively monitor FoG changes in response to prescribed medication, suggesting potential for lowering PWP’s injury risk especially in under-resourced regions.

Awards Won:
Third Award of $1,000