

https://dspace.org/

Gait classification in parkinson's disease using signals from walker mounted sensors

Beder, David

2019

https://hdl.handle.net/10539/28376

Beder, David Alon (2019) Gait classification in Parkinson's disease using signals from walker mounted sensors, University of the Witwatersrand, Johannesburg, <http://hdl.handle.net/10539/28376>

Downloaded from a DSpace repository. https://dspace.org/

Abstract

Currently, there is no cure for Parkinson's Disease (PD), however, treatments and medications exist that can lessen PD symptoms. The assessments of PD patients' response to these treatments are mostly subjective and existing PD status scales are inadequate to measure small changes, especially where short-term treatments are concerned. This research presents a quantitative measurement system that was able discriminate between three subject groups viz. patients who received a set dosage of medication (treatment patients), patients who received no medication (non-treatment patients), and control subjects. The system also was able to discriminate between the treatment patients according to their pre-assigned clinical scores (such as the Hoehn and Yaer scale), based on their responses to the treatments. The study involves the secondary analysis of encoder and accelerometer signals acquired in a trial conducted at the Rambam Medical Centre, in Israel. Signal pre-processing was used to denoise the signals, identify the movement segments and detect walking footfalls through newly proposed algorithms. Feature extraction and feature selection was implemented to determine feature subsets that could enhance the classifier's performance. A Bagged Decision Trees was applied to differentiate between the subjects according to the subject groups as well as discriminate the treatment patients according to their clinical scores. Results indicated that the three subject groups could be discriminated with an overall accuracy of 92.16% ± 3.92%, a sensitivity of 82.35%, and a specificity of 93.38%. Additionally, key features that were able to classify the three subject groups were identified and have an accuracy of 90.20% ± 4.26%, a sensitivity of 81.37%, and a specificity of 91.64%. However, further examination of these results suggests that this is owing to the systems' ability to differentiate between patients with PD versus controls as opposed to its ability to differentiate between treatment patients and non-treatment patients. Further testing of *only* the treatment patients indicated that the system was able to discriminate treatment patients according to clinical scores with an overall accuracy of 79.41% ± 4.12%, a sensitivity of 85.00%, and a specificity of 73.43%, based on their response to treatment. Across all experiments, the control subjects were correctly classified with an accuracy of at least 90%. Conversely, 50% of non-treatment patients were misclassified as treatment patients. This may indicate that the system is too sensitive trying to discern subtle changes between the treatment patients and non-treatment patients' response to medication that may not be present within the short test frame. Moreover, it may suggest that treatment patients with different clinical scores should receive different dosages of medication to assess the full effects of the treatment.