Hand-Crafted and Learned Features Fusion for Predicting Freezing of Gait Events in Patients with Parkinsonôs Disease

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Abstract

FreezingofGait(FoG)isacommonsymptomofParkinsonôs disease (PD) that causes intermittent absence of forward progression of patientôs feet while walking. Accordingly, FoG momentary episodes are alwaysaccompaniedwithfalls.Thispaperproposesanovelmulti-feature model for predicting FoG episodes in patients with PD. The proposed approach considers FoG prediction as a multi-class classiýcation problemwith3classes;namely,normalwalking,pre-FoG,andFoGevents.In this paper two feature extraction schemes have been applied, which are time-domain hand-crafted feature engineering and Convolutional Neural Network (CNN) based spectrogram feature learning. Also, after fusing the two extracted feature sets, Principal Component Analysis (PCA) algorithm has been deployed for dimensionality reduction. Data of three tri-axial accelerometer sensors for patients with PD, in both principleaxes and angular-axes, has been tested. Performance of the proposed approach has been characterized on experiments with respect to several Machine Learning (ML) algorithms. Experimental results have shown that using multi-feature fusion with PCA dimensionality reduction has outperformed using the other tested typical single feature sets. The signiýcance of this study is to highlight the impact of using feature fusion of multi-feature sets on the performance of FoG episodes prediction.

19th International Conference on Intelligent Systems Design and Applications 2019, December