# Using Multi-Feature Fusion for Detecting Freezing of Gait Episodes in Patients with Parkinson's Disease

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## Abstract

ô This paper proposes a model for detecting Freezing of Gait (FoG) episodes in patients with Parkinson's Disease (PD) using multi-feature fusion. Vjgrtqrqugfcrrtqcejcrrᴎkguᴠyquejgoguhqthgcᴠwtg"gzᴠtceᴠkqp0"Vjg"Łtuᴠ"qpg"ku"ᴠkog/ domain statistical feature engineering and the second one is spectrogrambasedtime-frequencyanalysisbyConvolutionalNeural Network (CNN) feature learning. The two extracted feature sets are fused with applying Principal Component Analysis (PCA) algorithm for dimensionality reduction. Benchmark dataset of three tri-axial accelerometer sensors for patients with PD is tested in both principle-axes and angular-axes. Moreover, performance of the proposed approach is characterized on experiments considering several Machine Learning (ML)algorithms.Experimentalresultsshowthatusing multi-feature fusion with PCA dimensionality reduction outperforms using typical single feature sets. The uᴋipᴋŁecpeg"qh"ᴠjku"uᴠwf{"ku"ᴠq"jkijᴎkijᴠ"ᴠjg"ᴋorceᴠ"qh"wukpi"owᴎᴠk/hgcᴠwtg"hwukqp"qp" the performance of FoG episodes detection. Index Terms ô Freezing of Gait (FoG), Parkinson's Disease(PD),MachineLearning,ConvolutionalNeural Network (CNN), Angular-axes, Spectrogram, Principal Component Analysis (PCA), Multi-Feature Fusion