Distinguishing Diagnostic Paradigms for Parkinson's Disease: An Advanced Exploration

Amjed Al Fahoum*

Biomedical Systems and Informatics Engineering Department, Yarmouk University, Irbid 21163, Jordan

Ala'a Zyout

Biomedical Systems and Informatics Engineering Department, Yarmouk University, Irbid 21163, Jordan

Abstract:

Parkinson's disease (PD) is a neurological disease affecting the elderly. The gradual degradation of dopamine-producing neurons is its hallmark. The lack of manual diagnosis protocols in poor nations leads to physician disagreements and insufficient healthcare resource allocation. As a result, there is an increased need for automated, artificial intelligence-powered diagnostic solutions. Electroencephalography (EEG) data is intriguing for this study of Parkinson's disease (PD) and its mysterious symptoms. EEG anomalies and interferences impair diagnostic interpretation. Noise disrupts the brain's rhythm, requiring precise signal processing to extract authentic material. However, despite the noteworthy exhibition of the signal, definitive biomarkers continue to be challenging to identify, thus requiring the integration of artificial intelligence to harmonize current methodologies and innovative strategies. In the present study, a total of 168 individuals diagnosed with Parkinson's disease (PD) and 39 individuals classified as Healthy Controls (HC) taken from two different databases were included. The combination of EEG signals, frequency distribution, and phase dynamics processing methodology, guided by the unique distinguishing properties of a Convolutional Neural Network, demonstrated a remarkable accuracy of 100 % in identifying individuals with Parkinson's disease, surpassing any other method in terms of precision and specificity. The experiment's robustness was confirmed by repeating the process 100 times achieving 99.8 +/- 0.2% accuracy. Additionally, the methods can accurately localize anatomical structures despite varied sampling resources and data durations. This study's discovery of convergence may improve Parkinson's disease diagnosis and patient well-being.

Keywords:

Parkinson's disease, Early diagnosis, Processed EEG, Reconstruction of phase space (RPS), Deep learning (DL).