

Chapter 5

Early Detection of Parkinson's Disease: An Intelligent Diagnostic Approach

Debashree Devi

National Institute of Technology Silchar, India

Saroj K. Biswas

National Institute of Technology Silchar, India

Biswajit Purkayastha

National Institute of Technology Silchar, India

ABSTRACT

Parkinson's disease (PD) is a neurodegenerative disorder that occurs due to corrosion of the substantia nigra, located in the thalamic region of the human brain, and is responsible for transmission of neural signals throughout the human body by means of a brain chemical, termed as "dopamine." Diagnosis of PD is difficult, as it is often affected by the characteristics of the medical data of the patients, which include presence of various indicators, imbalance cases of patients' data records, similar cases of healthy/affected persons, etc. Through this chapter, an intelligent diagnostic system is proposed by integrating one-class SVM, extreme learning machine, and data preprocessing technique. The proposed diagnostic model is validated with six existing techniques and four learning models. The experimental results prove the combination of proposed method with ELM learning model to be highly effective in case of early detection of Parkinson's disease, even in presence of underlying data issues.

INTRODUCTION

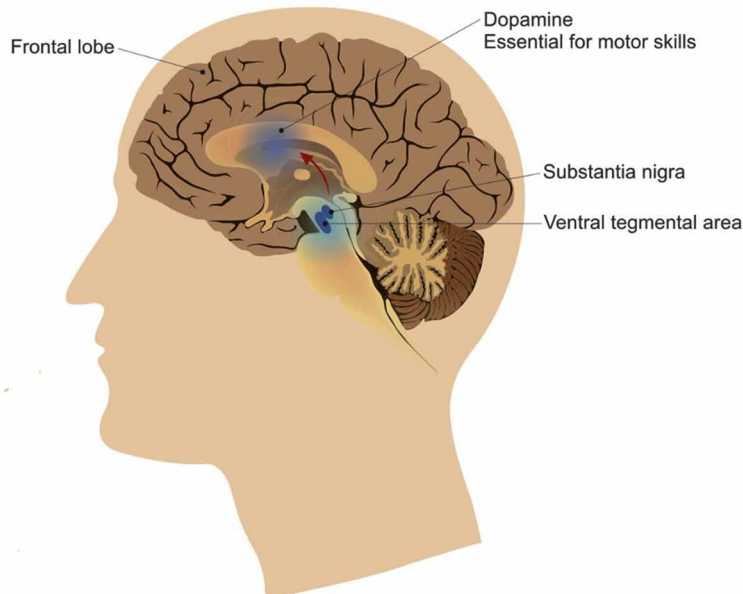
Parkinson's Disease (PD) is a progressive, neurodegenerative disorder that basically effects the motor system of a human being which causes physical problems such as shaking, stiffness, and difficulty in walking, balancing and coordinating movements (Parkinson's disease) (Mohamed, 2016). PD is basically central nervous system oriented disease, occurred due to disintegration of a region called "substantia nigra" in the thalamic region of human brain (Figure 1).

This substantia nigra secretes a neurochemical named "dopamine" which is responsible for transmitting of neural signals to the different organs and parts of the human body (Figure 2).

With increase of dopamine loss in the course of time, the PD progresses gradually which ultimately leads to mental disorder such as thinking and behavioral disability, dementia, depression and anxiety, sleep disorder, lack of emotions etc. (Olanrewaju, Sahari, Musa, Hakiem, 2014). The various movement-difficulties experienced by PD-suffered individuals are collectively addressed by the term "Parkinsonism". It has been revealed in a recent survey in 2015 that approximately there are 7-10 million people are suffering from PD in the worldwide. The occurrence of PD is much higher in case of elderly people, typically over the age of 60 years; with a male-to-female ratio of 3:2 (Parkinson's disease) (Mohamed, 2016).

Parkinsonism is defined by "Bradykinesia", a spectrum of movement disorder, commonly known as hypokinesia. Bradykinesia refers to a situation when a person's movement or initiation of voluntary body-movement has slowed down, due to disruption in basal ganglia of human brain, with an increasing reduction of speed and range of repetitive actions (Parkinson's disease). Bradykinesia is considered to be one of the four key symptoms of PD, along with rigidity, tremor, and postural instability (Pahwa and Lyons, 2013).

Figure 1. Location of Substantia nigra in human brain (Parkinson's disease)



33 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:
www.igi-global.com/chapter/early-detection-of-parkinsons-disease/230111

Related Content

Cultivating Self-Esteem: Exploring the Intersection of Culture, Neurocognition, and Behavior Among Female Media Professionals

Biju Kunnumpurath, Aswathi Prasad, Vishnu Achutha Menon and Juby Thomas (2024). *Cognitive Behavioral Neuroscience in Organizational Settings* (pp. 65-82).

www.irma-international.org/chapter/cultivating-self-esteem/349323

Role of Graph Theory in Computational Neuroscience

Hitesh Marwaha, Anurag Sharma and Vikrant Sharma (2022). *Futuristic Design and Intelligent Computational Techniques in Neuroscience and Neuroengineering* (pp. 86-97).

www.irma-international.org/chapter/role-of-graph-theory-in-computational-neuroscience/294593

The Future of Eating Disorder (ED) Treatments: A Neuroscientific Perspective

Rahul R. Verma, Biswajit Dash, Roshan Kumar Mahat, Aniket Jaiswal and Abhishek K. Singh (2024). *Neuroscientific Insights and Therapeutic Approaches to Eating Disorders* (pp. 356-364).

www.irma-international.org/chapter/the-future-of-eating-disorder-ed-treatments/351705

First Episode Psychosis and Cognition

Gilberto Sousa Alves, Romulo Kunrath Pinto Silva, Marielia Barbosa Freitas Leal, Bianca de Melo Ferro and Leandro de Oliveira Trovão (2024). *Advances in Neuroscience, Neuropsychiatry, and Neurology* (pp. 88-107).

www.irma-international.org/chapter/first-episode-psychosis-and-cognition/342885

The Role of Medications in the Treatment of Binge Eating

Ranjit Singha (2024). *Neuroscientific Insights and Therapeutic Approaches to Eating Disorders* (pp. 196-214).

www.irma-international.org/chapter/the-role-of-medications-in-the-treatment-of-binge-eating/351692