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Editorial

Artificial Intelligence and Parkinson's Disease

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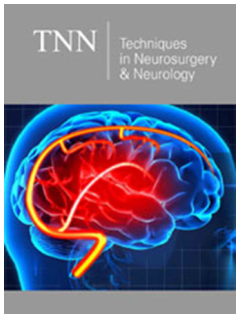

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Introduction

Computer-aided diagnosis is emerging to improve treatment strategies for neurological diseases. Multiple Artificial Intelligence systems (AIS) have been developed to classify patients with diseases such as epilepsy, Alzheimer's disease and recently Parkinson's disease [1].

The goal of AIS is to provide a more precise diagnosis and assessment of patients with PD. AIS extract the features unique to various neurological diseases from the data and surpass human ability to classify that data. This AIS system will improve the treatment of neurological diseases by reducing the doctor's burden and increasing the accuracy of diagnosis using a large volume and high dimension of gait analysis data.

Scientists has shown that gait analysis [2] as shown in Figure 1 and simple wearable instrumentation as shown in Figure 2 in combination with supervised machine learning algorithms such as Artificial neural networks can provide significant diagnostic support and discriminate between PD patients and healthy subjects with accuracy above 90% and can assess response to current treatment and advice change in medications dosage and timing.

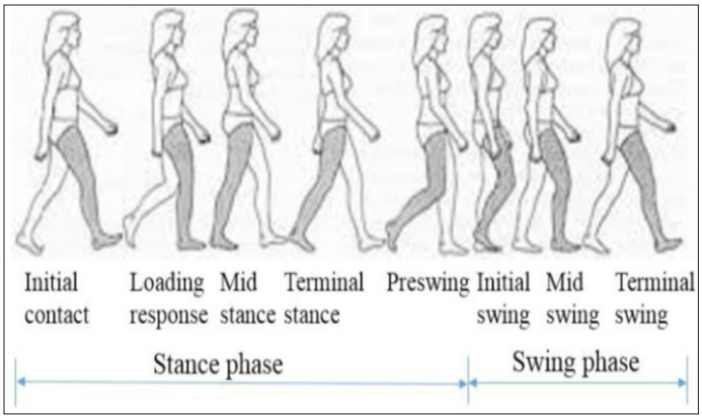

Figure 1: A typical gait cycle.

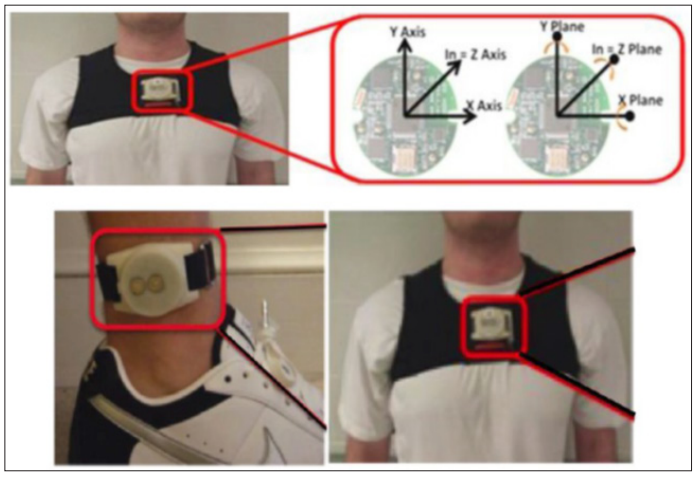

Figure 2: Picture of sensor located on one participant.

Artificial neural networks [3] (Figure 3) are computing systems that are inspired by the normal brain network. Machine learning applications in this field can be divided into two subgroups:

A. Diagnostic support and

B. Disease monitoring and assessment.

Artificial Neural Network proved to be the most successful algorithm for early diagnostics, reporting accuracy above 95% using features extracted from gait force patterns. This is especially important, since in early disease stages motor symptoms are not clearly visible and with delayed diagnostics the progression of the disease is unbridled High-accuracy results are also obtained for detection of motor symptoms, disease stage and severity. Prediction of symptoms severity was successfully applied using various algorithms and sensors.

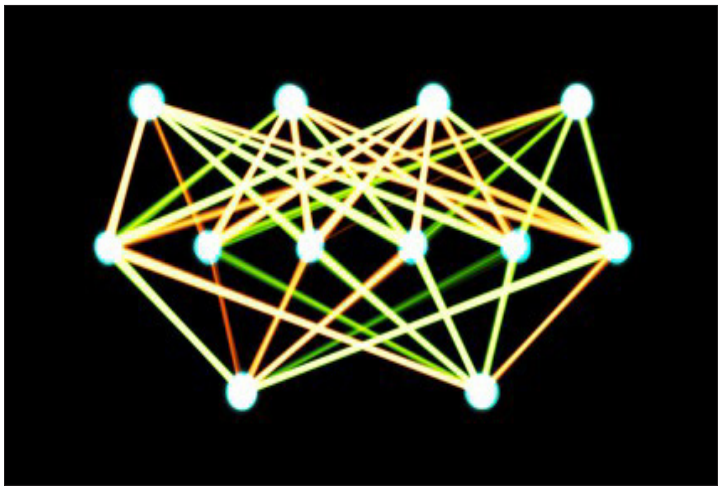

Figure 3: The ANN "learn" to perform tasks and solve problems in the same way that a human brain would.

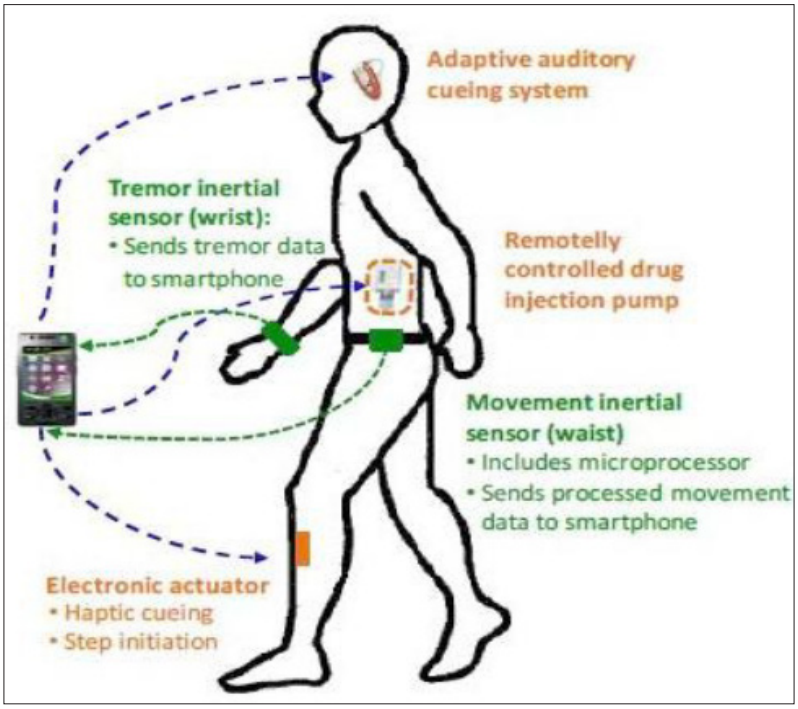

Figure 4: The ultimate goal is to develop a closed loop detection at two levels.

At the first level, (Figure 4) the wearable monitoring system consisting of a waist belt, a wrist band and patch electrodes on the leg all connected by Wifi to an iphone application .The Neurologist will be able to process in real time the motor status of the PD patients, and evaluate the ON/OFF/Dyskinesia status during ambulatory conditions and will also perform a gait guidance system able to direct the patient in real time during their daily activities.

At a second level, the AIS provided by the first level, supported with a disease management protocol will allow the monitoring

neurologist in charge to access accurate and reliable information to decide about the treatment that best suits the patient at different time during the day and improve the management of their disease, in particular to adjust the so called therapeutic window thru a remotely controlled subcutaneous injection pump.

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