

## PARKINSON'S DISEASE PATIENTS' EVALUATION BASED ON WEARABLE SENSORS DEVICE AND DEEP LEARNING

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### Abstract

**Introduction.** Despite the large available literature regarding the diagnosis and evaluation of tremor and bradykinesia and recognizing of their severity level, there is still a wide space left for a correct investigation. The main objective of this paper is to change the scenario of clinical diagnosis of tremor and bradykinesia by developing a wearable bracelet that helps in collecting the data from the subjects to obtain a more accurate and sophisticated diagnosis based on machine learning techniques which will eventually provide a clinical convenience to patients and doctors.

**Materials and methods.** This study presents a hand bracelet as a measurement unit that acquires data about the hand movements of the patients and healthy participants. The bracelet is developed using a small form-factor microcontroller, that reads real-time data from a special sensor module that contains an accelerometer and a gyroscope and writes its output values to a micro-SD card. This research also proposed a solution for an objective assessment of tremor and bradykinesia in subjects with PD and healthy older adults aged greater than 60 years. Physical movements were recorded by means of the bracelet developed using inertial sensors. Participants performed upper extremities motor activities as adopted by neurologists during the clinical assessment. For discriminating the patients from healthy controls, temporal and spectral features were extracted. Both supervised and unsupervised machine learning classifiers provide good results.

**Results.** Out of 40 individuals, neural net clustering discriminated 34 individuals in correct classes while KNN approach discriminated 91.7% accurately. In clinical environment the doctor can use the device to comprehend the tremor and bradykinesia ability of patients quickly and with higher accuracy.

**Conclusion.** The main benefit of this research study is the interpretation of the results connected to a low-cost and easy to use wearable bracelet offering a helpful evaluation of PD stages.