Implementing a Machine Learning Model in an Effective and Low-Cost Parkinson's Disease Diagnosis Algorithm

Pamidimukkala, Sanjita (School: Dougherty Valley High School)
Chan, Dennis (School: Dougherty Valley High School)

Parkinson’s Disease (PD) is a disorder that inhibits the dopaminergic neurons in the brain. Currently, there is no accurate non-clinical way to diagnose PD, forcing medical professionals to resort to subjectivity. Doctors utilize interviews, motor tests, and neurological examination using infrastructure such as DaTscan technology. This places a heavy financial burden on patients and costs the USFG over 25 billion dollars. Even if diagnosis is accurate, it is subject to months of delays and 60% of the time it comes after substantial neuron loss. This research aimed to develop an effective, low cost, and quick way to objectively diagnose PD. The UCI Machine Learning Repository was used to obtain data collected from Archimedean Spiral Tests. Two machine learning classifiers were tested: Deep Neural Network and Random Forest. The algorithm implemented a DNN with 2 hidden layers with 10 nodes in each. Additionally, a RF classifier was also evaluated. RF is a collection of decision trees that each make its own prediction and will collectively sway towards a class prediction. Four attributes were used to prepare data to be trained: x-position, y-position, time stamp, and test ID. Mean speed, skew of speed, radial velocity, and coefficient of variance of speed were extracted from the attributes using mathematical formulas. Each model was trained with the data and evaluated. The DNN had an average accuracy of 90.8% and the RF had an 85.2% average. Although RF had less spread, the DNN was classified as the best model because DNNs are stochastic and use randomness to their advantage. Overall, this algorithm proved to be over 15% more accurate than current rudimentary diagnosis methods. It reduces delays by months, reduces costs by thousands, and increases accessibility.