# ParkinSensor: Computer Vision and Ensemble Machine Learning-Based Incipient Diagnosis for Parkinson's Disease using Neuromuscular Biomarkers

Peddinti, Sidhya (School: Plano East Senior High School)

Parkinson's disease (PD) is a neurodegenerative disorder that affects 10 million people worldwide. Current diagnostic measures consist of ambiguous surveys or are extremely invasive, and incipient diagnosis is not clinically implemented. As a result, 1 in 4 patients is misdiagnosed, which can lead to worsening of the disease. The Parkinsensor is a noninvasive device that performs an accurate diagnosis for PD patients based on machine learning analysis of neuromuscular biomarkers, specifically eye blinking patterns and voice analysis. In order to optimize a machine learning (ML) algorithm to perform a diagnosis based on voice patterns, 3 ensemble ML algorithms were trained with 435 Parkinson's voice samples and 773 control samples from the UC-Irvine Database. All methods yielded a high accuracy rate for identifying PD data versus control data, with the Random Forest algorithm having the highest percentage at 98.7%. In order to perform a diagnosis based on eye blinking, a training set of 56 Parkinson's eye movement videos and 85 control videos were used. Haar cascades, histogram of oriented gradients, and support vector machine techniques were used for computer vision and feature extraction. Using this data, the device's algorithm was able to identify 98.6% of testing subjects correctly. The accuracy rates for this device's neuromuscular-based method outperformed current clinical methods by over 25%, indicating the effectiveness of ML techniques for PD diagnosis. The device can be used in a clinical setting to prevent patient misdiagnosis, which revolutionizes neurodegenerative disorder diagnostic processes by providing a non-invasive, low-cost solution for incipient diagnosis.

**Awards Won:**

Third Award of $1,000