APPLYING ADVANCED DATA SCIENCE TO STUDY THE PROGRESSION OF PARKINSON'S DISEASE

To secure an NIH grant, RDSC demonstrated how advanced AI can be applied to identify biomarkers for cognitive decline in people living with Parkinson's disease.

PARTNER

Center for Health + Technology (CHeT)

INDUSTRY

Medical Research

GOAL

Grant support from National Institutes of Health (NIH) to study cognitive progression in people living with Parkinson's disease.

APPROACH

- Sequential Machine Learning
- Explainable AI
- Data Imputation
- Generative Modelling

THE OPPORTUNITY

RDSC teamed up with the University of Rochester's Center for Health + Technology (CHeT) to apply for a $1.1 million grant from the National Institutes of Health (NIH) to develop biomarkers for the progression of Parkinson's Disease. Although Parkinson's disease is classically defined as a movement disorder, patients may often experience some cognitive decline ranging from mild impairment to dementia. The severity of one's cognitive impairment has a major impact on quality of life, cost of care, and survival.

> *"We were able to demonstrate competency in several different advanced data science techniques that are critical for the NIH to achieve its research objectives."*

Edgar A. Bernal,
RDSC Senior Research Scientist

THE CHALLENGE

The purpose of the NIH grant is to shed light on how cognitive impairment in Parkinson's disease progresses and to identify biomarkers that may indicate early on which patients will develop the most severe cognitive dysfunction and disabilities. To secure grant funding, the applicants had to demonstrate several advanced data science capabilities:

- Sequential Machine Learning: Develop algorithms that can analyze longitudinal data from clinical trial patients whose condition is tested periodically and identify biomarkers that measure disease progression.
  - The analysis must be able to distinguish among short, mid-term and long-term effects.
- Explainable AI: In addition to predicting disease progression, the algorithms must also be able to explain how the prediction was made.
- Data Imputation: The Parkinson's studies gather data over years from 1000's of patients. The study requires techniques to fill in missing data.
- Generative Modelling: Diagnosis of Parkinson's disease involves subjective human assessment and equipment that may not be calibrated properly or consistently. RDSC had also to demonstrate the capability to understand patterns and separate true signals from noise.

THE SOLUTION

For the grant application, RDSC demonstrated its capabilities in applying sequential ML, explainable AI, and generative modeling, by applying these techniques to Alzheimer's disease, another neurodegenerative disease. The team developed custom predictive algorithms based on recurring neural networks to predict the level of cognitive impairment (normal vs. mild vs. dementia). The performance of RDSC models surpassed that of existing off-the-shelf solutions. At the same time, explainable AI models identified which of the pieces of data gathered in the longitudinal study were more predictive of future cognitive state. The team also applied state-of-the-art generative techniques to fill in missing data.

RESULTS

RDSC and CHeT in 2020 were awarded the $1.1 million NIH grant. RDSC will apply advanced machine learning and deep learning techniques to shed light on disease progression in Parkinson's patients. The use of advanced data science to pinpoint patients most at risk enables targeted interventions or trials and accelerates the process of developing therapies.