



NeuroTrack

— MEDICAL TECHNOLOGY —



Patient Population Size:

> 3 Billion Worldwide

Over 1 in 3 People

are affected by neurological conditions, the leading cause
of illness and disability worldwide

They are the most difficult to diagnose, manage, and monitor

The Problem: Neurological Disease Progress Management

“The identification and treatment of Parkinson’s Disease is hindered by the lack of early-detection methods and the inability to closely track either the disease progression or the therapeutic response.”

- MIT Museum

NeuroTrack aids doctors in diagnosis and monitoring conditions by tracking patient reaction speeds over time.

Existing Solutions

Clinical/Hospital Documentation



50 % of goals met

Met Needs:

- Patient data is very protected
- Accessible to patients
- Standardized and centralized

Unmet Needs:

- Manual and time-consuming
- Prone to error
- Does not include compiled tracking over time or predictions for future care

Neurological Exam



66 % of goals met

Met Needs:

- Patients can report symptoms
- Doctors get direct data and can suggest solutions

Unmet Needs:

- May not take into account external factors or biomarkers
- Patient cannot perform test remotely
- Not suited for constant tests, can't obtain long-term/consistent data

Our Solution

Home Page

Healthcare professionals can monitor and access multiple patients' files

01

Account Authorization

Ensures all patient data is safe and secure, and only accessible to their doctor

02

Reaction Time Test

Hardware-integrated reaction test, real time latency and reaction times displayed and saved

03



Progress Visualization

Patient data is stored and graphed for understanding of long-term progress

04

Results Analysis

Use neural network to analyze patient reaction times and external contributing factors to provide predictions about disease prognosis

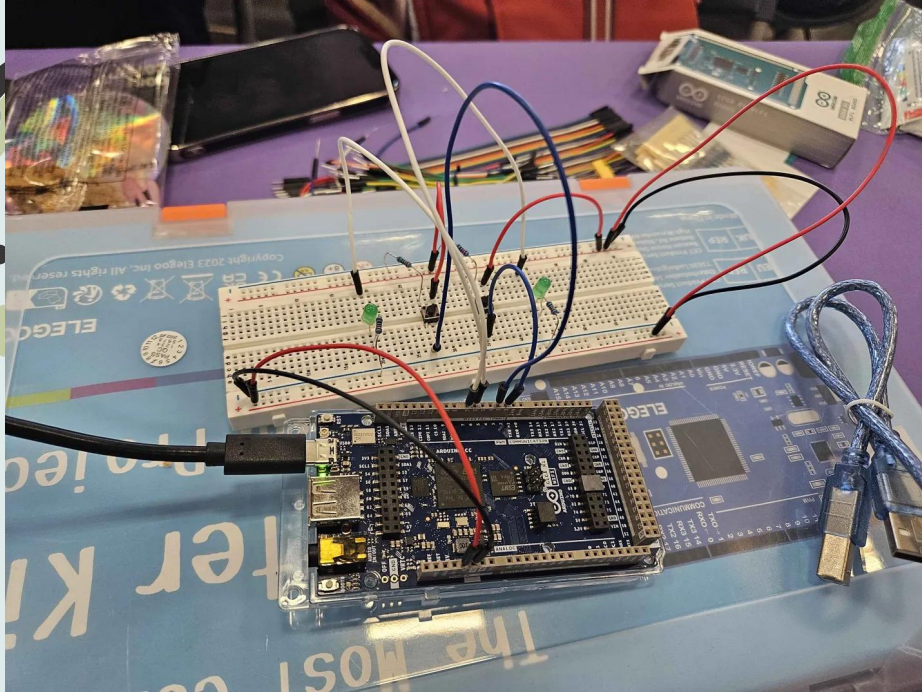
05

User Interface

Simple, easy to use, and pleasant to look at

06

Hardware



2 buttons
2 LEDs
Arduino Giga R1

Performs a
10-sequence
reaction test,
where buttons
are hit when the
LEDs light up.

Press Times

1669

528

620

464

677

556

419

372

567

644

Hold Times

131

146

112

179

131

167

162

166

160

138

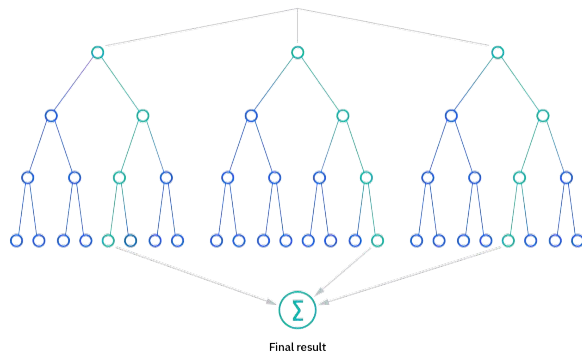
Problem-Solving Methods

- Created a **Naive Bayes model** to calculate the probability of developing Parkinson's Disease given the results of our reaction-time test, the patient's medical history, the patient's lab results, and the patient's symptoms
 - When this model is incorporated into our website, doctors can see a prediction of whether the patient is on track to develop Parkinson's Disease or if the patient's existing disease condition has worsened



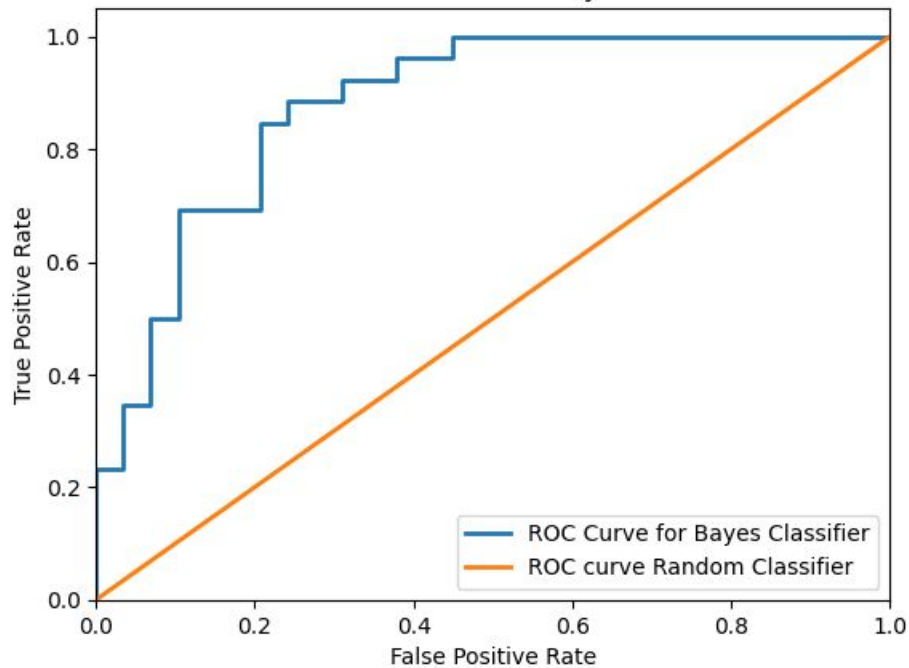
Problem-Solving Methods

- Created a **RandomForest classifier** to calculate the probability of developing Parkinson's given a set of symptoms
 - More robust, able to handle non-linear relationships, better feature importance evaluation
 - Does not require features to be independent

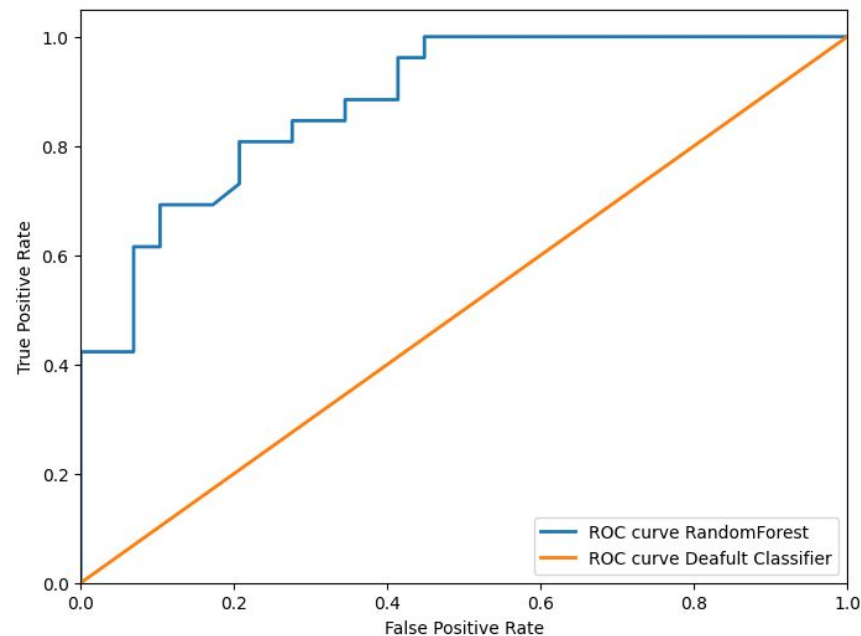


86% Accuracy!

ROC Curve for Naive Bayes Model



ROC Curve for RandomForest



Patient Reaction Time

Reaction Time Over Visits

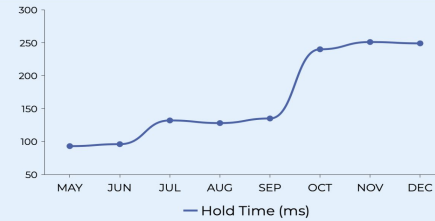


The time it takes the patient to react to stimuli has increased over time. This suggests a decreased motor function over time.

Made with VISME

Button Press Duration

How the Patient's Duration of Button Press Changed Over Time

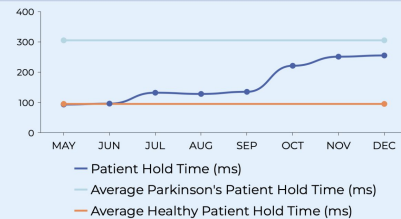


The time that the patient holds down the button upon clicking the button has increased over time. This suggests a decreased motor function over time.

Made with VISME

Button Press Duration

How the Patient's Duration of Button Press Changed Over Time

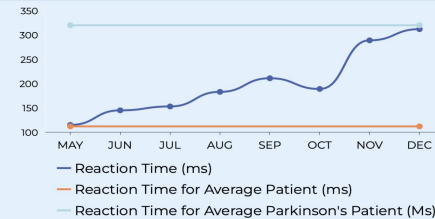


The time that the patient holds down the button upon clicking the button has increased significantly above the average hold time of a healthy individual, but it has not yet reached the threshold for a Parkinson's diagnosis.

Made with VISME

Patient Reaction Time

Reaction Time Over Visits



The patient's reaction time is significantly above the normal range of reaction times for healthy individuals.

Made with VISME

The Solution

[Home](#) [Patient Analytics](#) [Dashboard](#)

NeuroTrack
The solution to testing patient reaction
times for accurate diagnosis

[Create Account](#)

[Log In](#)

[Home](#) [Patient Analytics](#) [Dashboard](#)

Dashboard

[+ Add Patient](#)

G., Helen

[View Data](#)

[Run Test](#)

M., Ronald

[View Data](#)

[Run Test](#)

S., Wendy

[View Data](#)

[Run Test](#)

Beaver, Tim

[View Data](#)

[Run Test](#)

U.S. Market Size

\$145,000,000

$$1,000,000 \text{ hip \& knee surgeries} \times \frac{10 \text{ post op ED visits}}{100 \text{ hip \& knee surgeries}} \times \frac{1 \text{ unnecessary visit}}{2 \text{ post op ED visits}} \times \frac{\$2,900 \text{ cost}}{1 \text{ visit}} = \$20,000,000$$



Stakeholder Analysis



Doctors

Want a way to **monitor patient progress** and want to **centralize information** for easy **analysis of data**



Hospital

Reduced redundant hospital visits with increased patient information



Patients

Want to **know recovery status** and get **immediate answers**

Next Steps and Scalability

Upgraded Hardware Interface

Currently limited by what is available, but strive to scale up in size, increase ease of use, and increase

Suggest Treatment Options Based on Patient Data

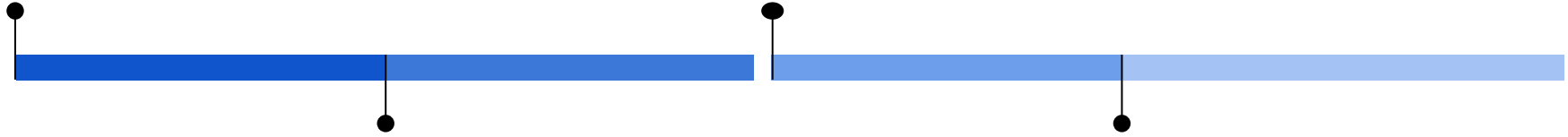
Analyze patient information to suggest optimal medication, exercises, and further testing which will lead to potential improvement in condition

Continued Learning from Databases

We strive to have the most accurate analysis and predictions. As such, our neural network will use more profound databases for patient outcomes

Feedback Iterations + Expand with New Customers

Based on client feedback, we will improve upon the interface as well as expand for further biomarker inputs and tests





Sruthi Magesh

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Summer Royal

Stanford, Senior,
Biomedical Computation &
Computer Science



Radia Wong

MIT, Junior, Computer Science

Thank You!



Apurva Varigonda

MIT, Freshman,
Intended major
Mathematics

Citations

WHO, “Over 1 in 3 people affected by neurological conditions, the leading cause of illness and disability worldwide,” *www.who.int*, Mar. 14, 2024.
<https://www.who.int/news/item/14-03-2024-over-1-in-3-people-affected-by-neurological-conditions--the-leading-cause-of-illness-and-disability-worldwide>

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A. W. Demsash *et al.*, “Health professionals’ routine practice documentation and its associated factors in a resource-limited setting: a cross-sectional study,” *BMJ Health & Care Informatics*, vol. 30, no. 1, p. e100699, 2023, doi: <https://doi.org/10.1136/bmjhci-2022-100699>.