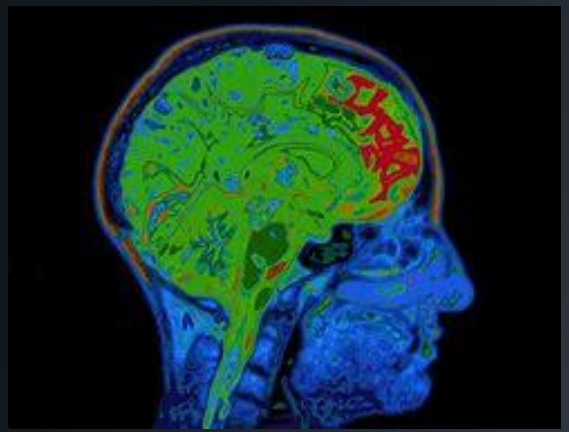
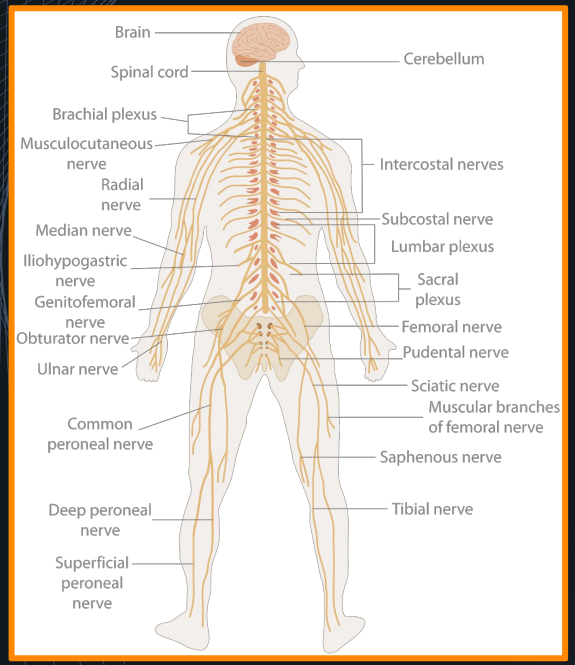
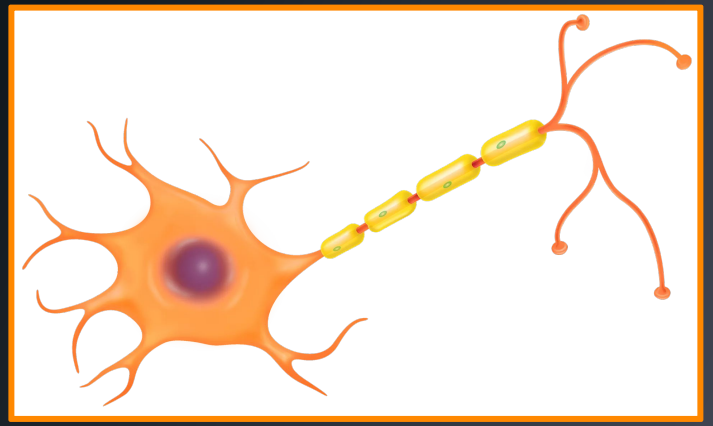
Predicting Parkinson's Disease

Tri Cao & Faith Kennedy

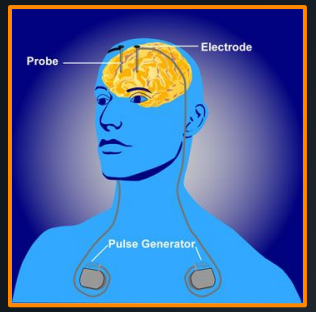


What is Parkinson's Disease?





Treatments



Symptoms and Stages

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
				

Nonmotor Symptoms

Nonmotor Symptoms

Speech Problems!

Speech can become…

- **Soft**
- **Breathy**
- **Slurred**
- **Monotone**

Nonmotor Symptoms

Speech Problems!

Good diagnostic criteria because…

- **Present in 90% of cases**
- **One of the first symptoms**
- **Detectable without Dr's visit**

Dataset

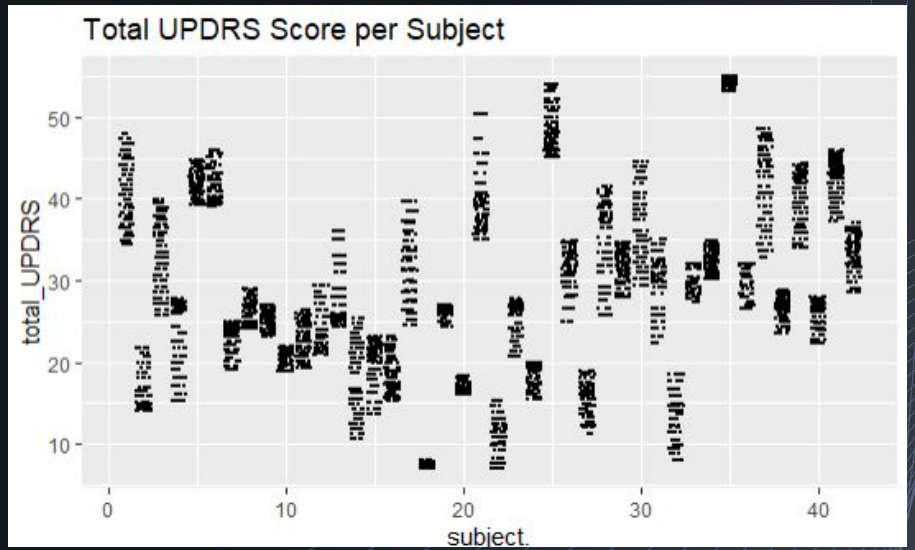
- 42 Individuals with early stage Parkinson's
- Recorded at home over six months
- Patient traits:
  - Age
  - Sex
  - Time since recruitment
  - Unified Parkinson's Disease Rating Scale (UPDRS)
  - Various measures of speech patterns

Speech Measures

- Jitter - variation in pitch
- Shimmer - variation in amplitude
- NHR & HNR - ratios between noise and harmonics
- RPDE & DFA - randomness in speech
- PPE - randomness from secondary factors

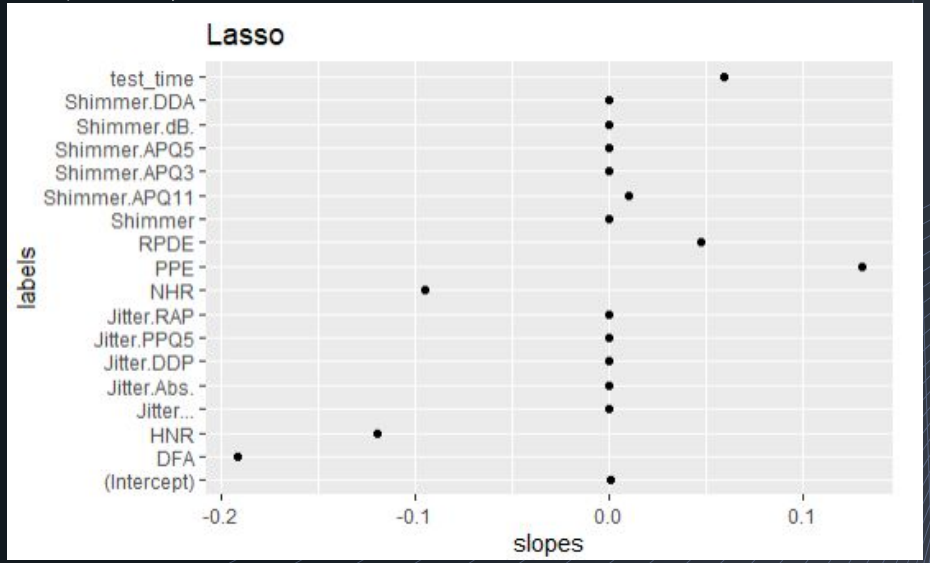
Initial Findings

- Total UPDRS score measures the severity of Parkinson's in a patient.

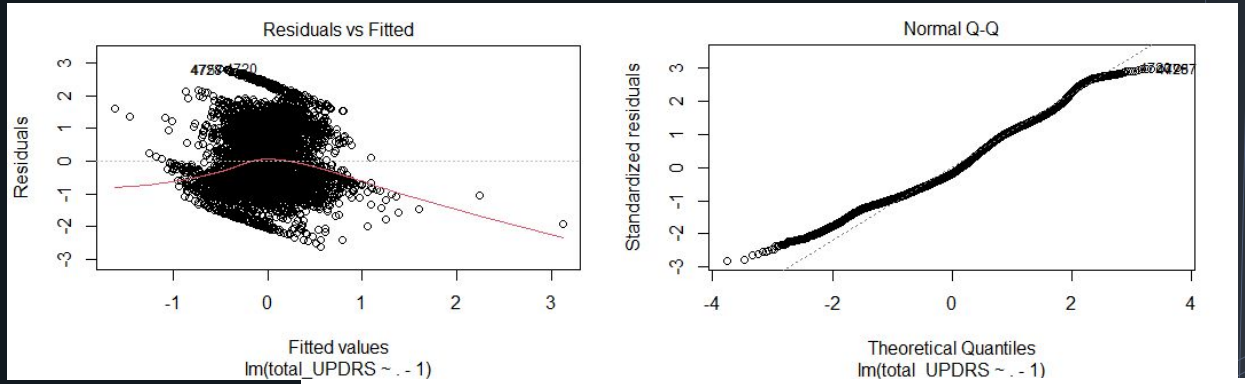


Basic Analysis

- Variable Selection: (Test_time, Shimmer.APQ11, RPDE, PPE, NHR, HNR, DFA)

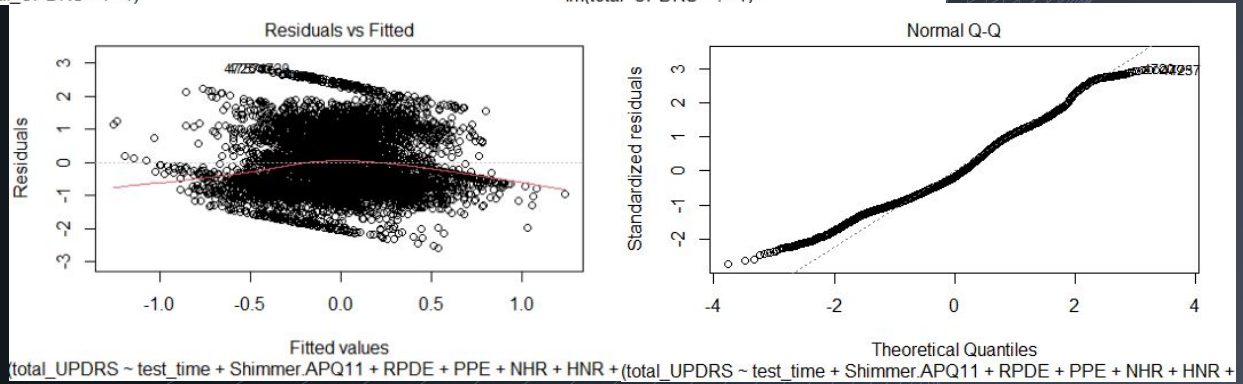


Basic Analysis



Full Model

Reduced Model



Basic Analysis

- Analysis on Shimmer.APQ11 since it's slope was very close to 0 in the reduced model.
- H0: Shimmer.APQ11=0 ; Ha: Shimmer.APQ11 != 0
- t = 0.05281/0.02152 = 2.454 on 5686 df ----> p-val = 0.01966
- We therefore reject the null hypothesis at the alpha level of 0.05, and the slope that we got in the model should be non-zero.

Basic Analysis

- total_UPDRS score = (0.08513)(test_time) + (0.05281)(Shimmer.APQ11) + (0.05668)(RPDE) + (0.19601)(PPE) - (0.23690)(NHR) - (0.17864)(HNR) - (0.26997)(DFA)

```
Call:
lm(formula = total_UPDRS ~ test_time + Shimmer.APQ11 + RPDE +
    PPE + NHR + HNR + DFA - 1, data = tot_df)

Residuals:
    Min      1Q  Median      3Q     Max
-2.5971 -0.7127 -0.1682  0.7171  2.8278

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
test_time     0.08513    0.01243   6.848 8.24e-12 ***
Shimmer.APQ11 0.05281    0.02152   2.454 0.014156 *
RPDE          0.05668    0.01676   3.382 0.000725 ***
PPE           0.19601    0.02053   9.547  < 2e-16 ***
NHR          -0.23690    0.01981 -11.959  < 2e-16 ***
HNR          -0.17864    0.02678  -6.670 2.79e-11 ***
DFA          -0.26997    0.01451 -18.601  < 2e-16 ***
---
Signif. codes:
0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.9505 on 5868 degrees of freedom
Multiple R-squared:  0.09745,   Adjusted R-squared:  0.09638
F-statistic: 90.51 on 7 and 5868 DF,  p-value: < 2.2e-16
```

LMER Analysis

- Currently in the works :)
- Will be looking at the Variance of each patient's UPDRS score.
- It will be in our research paper if you want to find out more.

References

- Mayo Foundation for Medical Education and Research. (2020, December 8). *Parkinson's disease*. Mayo Clinic. Retrieved December 6, 2021, from https://www.mayoclinic.org/diseases-conditions/parkinsons-disease/symptoms-causes/syc-20376055.
- Tsanas, A., Little, M. A., McSharry, P. E., & Ramig, L. O. (2010). Accurate telemonitoring of Parkinson's disease progression by noninvasive speech tests. IEEE transactions on bio-medical engineering, 57(4), 884–893. https://doi.org/10.1109/TBME.2009.2036000
- **UCI Machine Learning Repository: Parkinsons telemonitoring data set. (n.d.). Retrieved December 6, 2021, from https://archive.ics.uci.edu/ml/datasets/Parkinsons+Telemonitoring.**

Thank You!