

# Dementia Classification

Clayton Young



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- Selected model performance
- Summary

01

14,000,000

Projected to be living with dementia in the United States by 2060.

# 01

## Mini Mental Status Exam

### Domains

- Working Memory
- Memory Recall
- Orientation
- Visuospatial
- Language
- Concentration

### Background

- 10 mins
- Assessment based
- One of many tests used

# 02

## ANALYSIS

CDR: 16662, 61

Demographics: 32796, 33

Diagnosis: 32808, 140

Neuropsychological: 17363, 35

Final: 4476, 33

### Features:

Age at testing (1)

Education (1)

Gender (1)

Handedness (1)

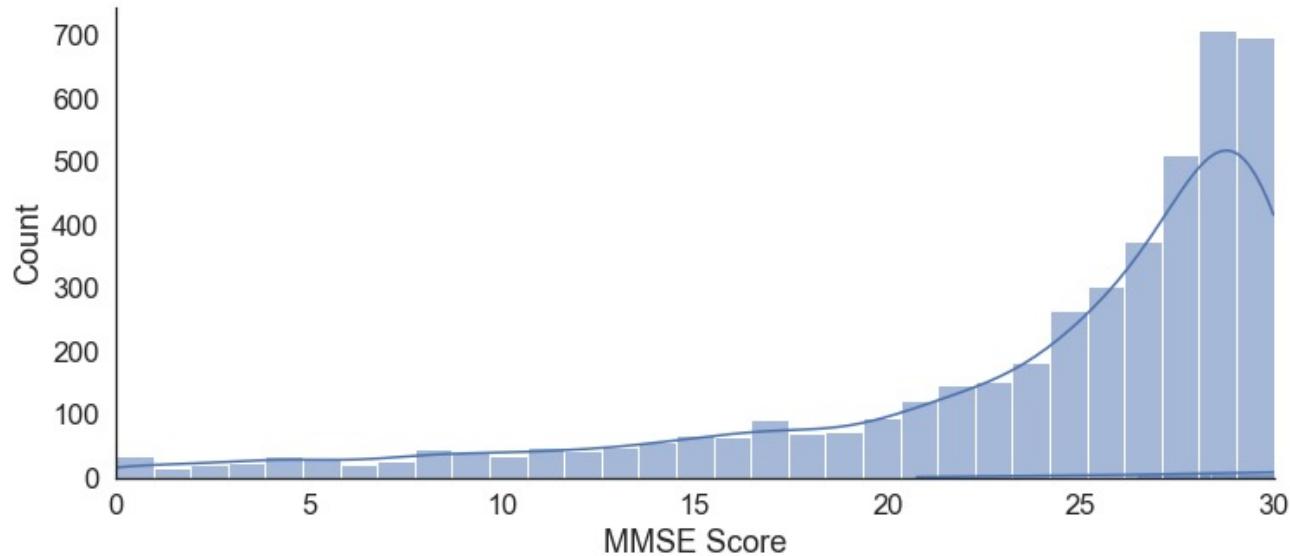
MMSE Items and total score (28)

### Target:

Dementia (CDR >= 0.5)

# EDA-MMSE

02



Scores above 23 indicates cognitively normal

# EDA

02



## Engineering

Majority have clinical dementia rating of 0.5 or above, indicating dementia

Binarized scores at 0.5 threshold

# 02

## F2 Baselines

Baseline tests on selected metric

| Model               | F2 Training | F2 Validation | Difference |
|---------------------|-------------|---------------|------------|
| kNN                 | 0.883       | 0.823         | 0.060      |
| Logistic Regression | 0.868       | 0.849         | 0.019      |
| Random Forest       | 1.000       | 0.866         | 0.134      |
| XGBoost             | 0.893       | 0.865         | 0.028      |

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~~Baseline tests on selected metric~~

# 03

## Tuning

| Grid/Randomized Hyperparameters | F2 Training | F2 Validation | Difference |
|---------------------------------|-------------|---------------|------------|
| kNN                             | 0.787       | 0.780         | 0.007      |
| Logistic Regression             | 0.877       | 0.865         | 0.012      |
| Random Forest                   | 0.881       | 0.873         | 0.008      |
| XGBoost                         | 0.868       | 0.859         | 0.009      |
| Voting Ensemble                 | 0.873       | 0.857         | 0.016      |

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Tuning

Model comparisons

# 03

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Baseline tests on  
selected metric

Tuning

Model  
comparisons

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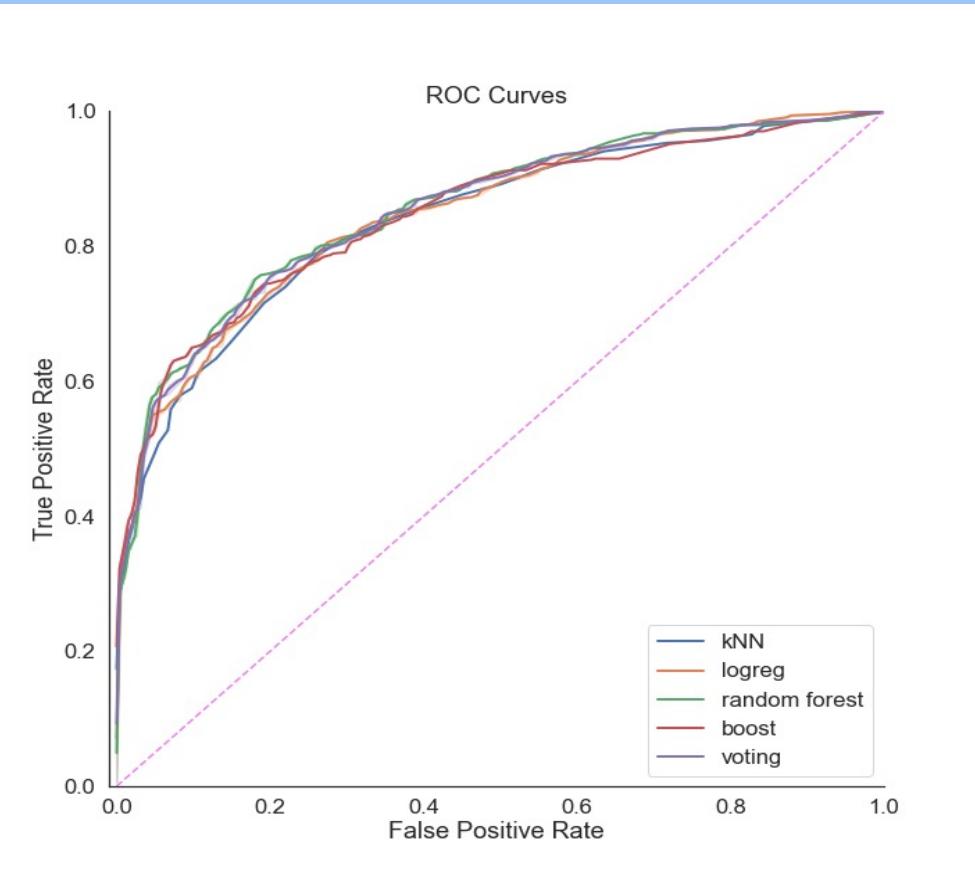
~~Baseline tests on selected metric~~

~~Tuning~~

Model comparisons

# 03

## Comparisons



~~Baseline tests on selected metric~~

~~Tuning~~

Model comparisons

# Comparisons

| Tuned Models        | ROC AUC Score |
|---------------------|---------------|
| kNN                 | 0.840         |
| Logistic Regression | 0.848         |
| Random Forest       | 0.856         |
| XGBoost             | 0.848         |
| Voting Ensemble     | 0.854         |



~~Baseline tests on selected metric~~



~~Tuning~~



Model comparisons

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Model comparisons

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~~Tuning~~

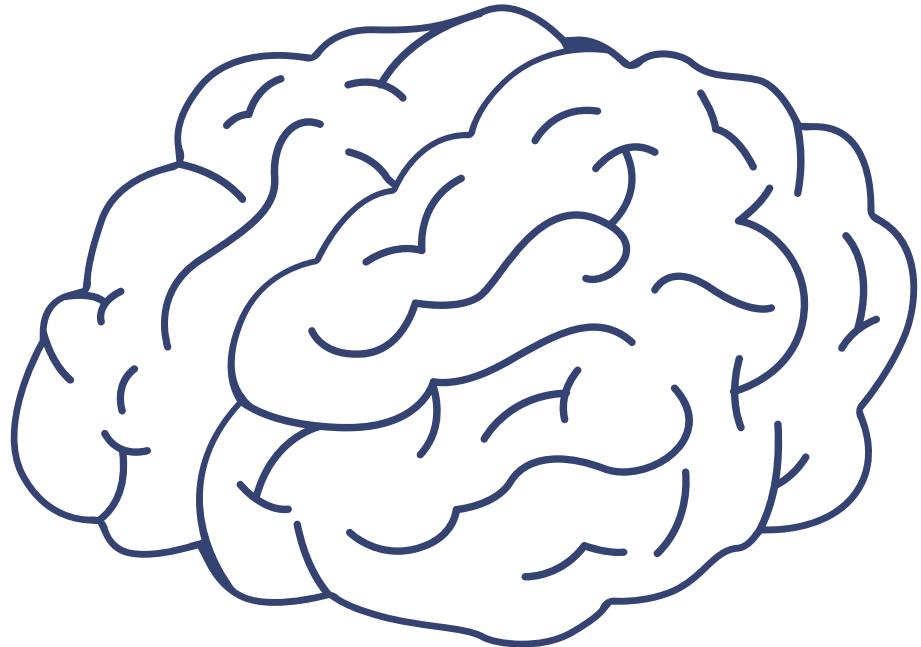


~~Model comparisons~~

# 04

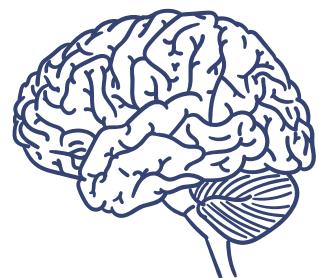
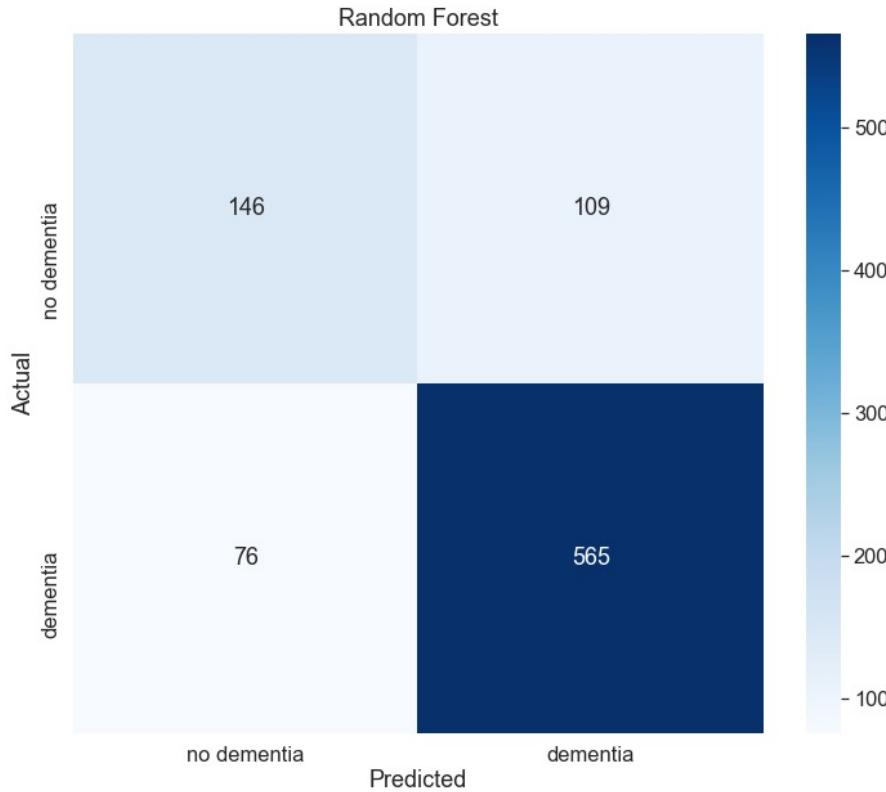
# Random Forest Performance

| Data Set   | F2 Score |
|------------|----------|
| Training   | 0.882    |
| Validation | 0.874    |
| Test       | 0.872    |



# 04

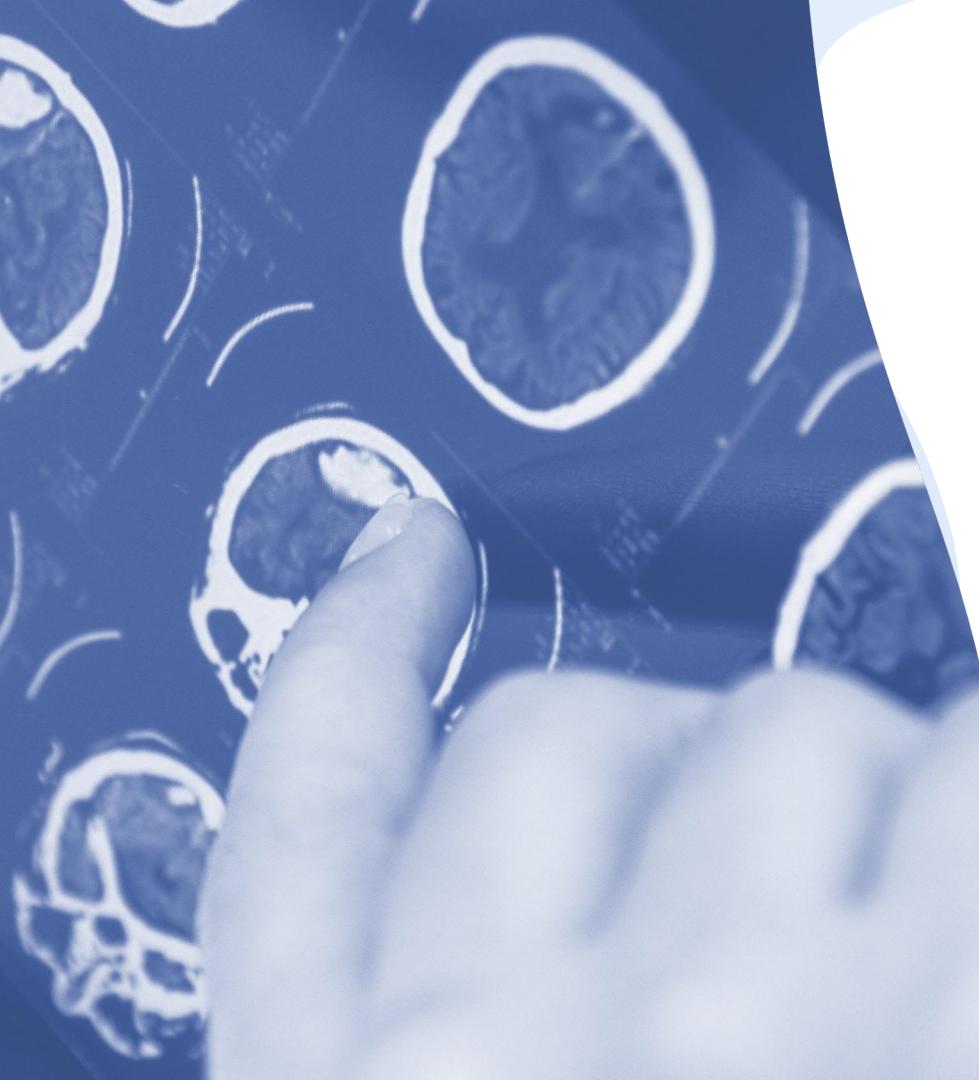
# Random Forest Performance



# 04

# Conclusion

- Purpose**  
Quick, objective measure for classifying dementia status
- Untuned**  
Logistic Regression outperforms
- Tuned**  
Tuned Random Forest has highest F2 score and greatest ROC AUC score
- Conclusion**  
This model can be used to screen for dementia using MMSE and demographic data



# THANKS!



Do you have any questions?

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# Supplementary

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# 03

## Tuning

### Oversampling

| kNN                    | F2 Validation |
|------------------------|---------------|
| Oversampling           | 0.747         |
| Smote                  | 0.759         |
| Tuned w/o oversampling | 0.780         |



~~Baseline tests on selected metric~~



~~Tuning,  
Oversampling,  
Feature Selection~~



Model comparisons

# 03

## Tuning

### Oversampling

| kNN                    | F2 Validation |
|------------------------|---------------|
| Oversampling           | 0.747         |
| Smote                  | 0.759         |
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~~Baseline tests on selected metric~~

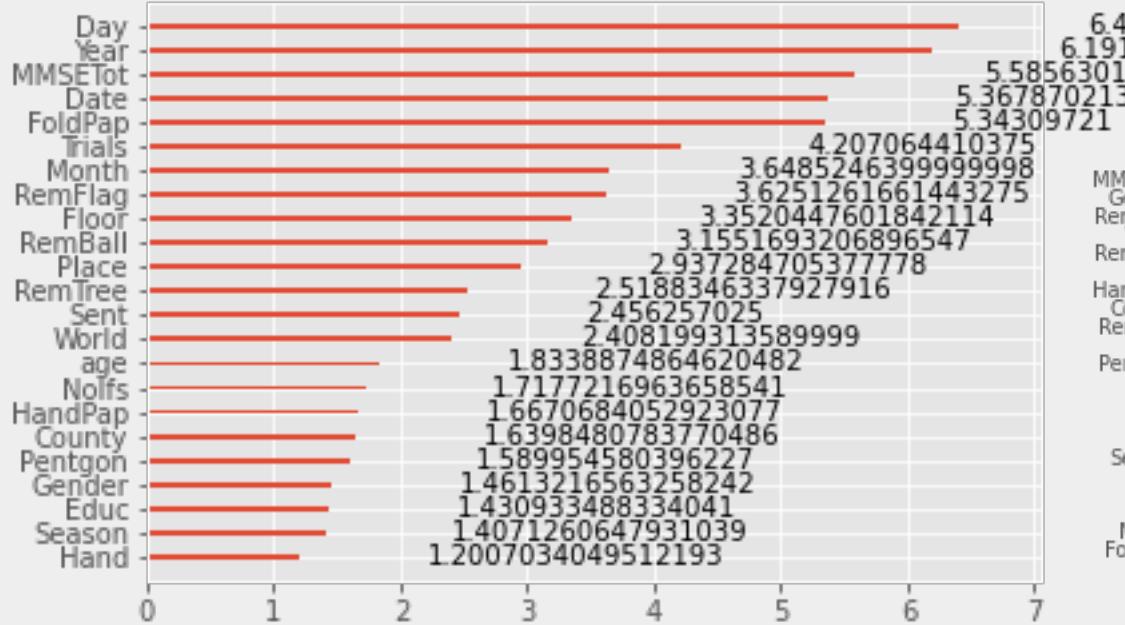
~~Tuning,  
Oversampling,  
Feature Selection~~

### Feature Selection

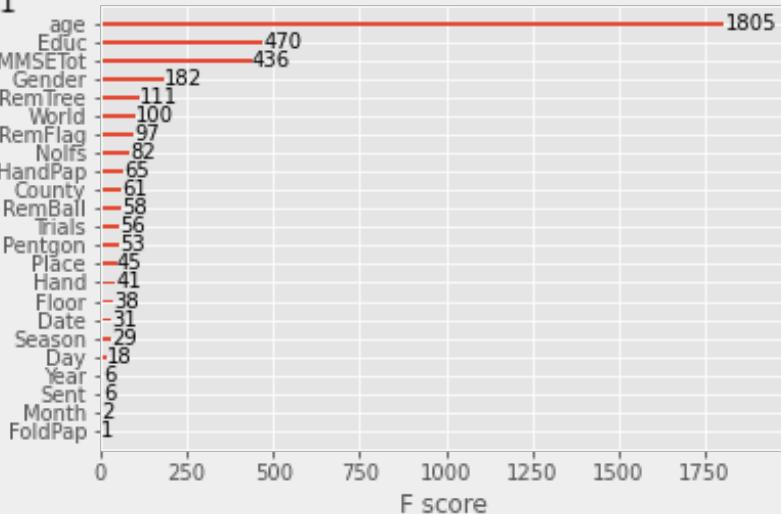
| XGBoost              | F2 Training | F2 Validation |
|----------------------|-------------|---------------|
| Tuned w/all features | 0.868       | 0.859         |
| Recommended features | 0.818       | 0.807         |

Model comparisons

## Feature importance



## Feature importance



# Random Forest Feature importance (mean decrease in impurity)

