

Dementia Classification

Clayton Young



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01

14,000,000

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

01

Mini Mental State 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)

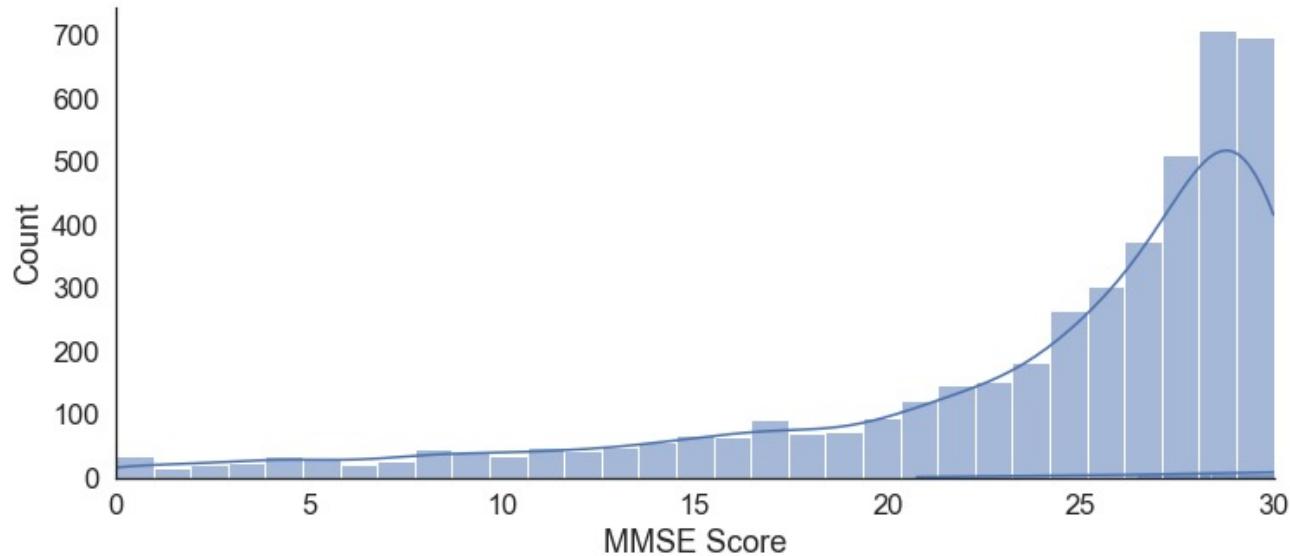
MMSE Items and total score (28)

Target:

Dementia (CDR > 0.5)

EDA-MMSE

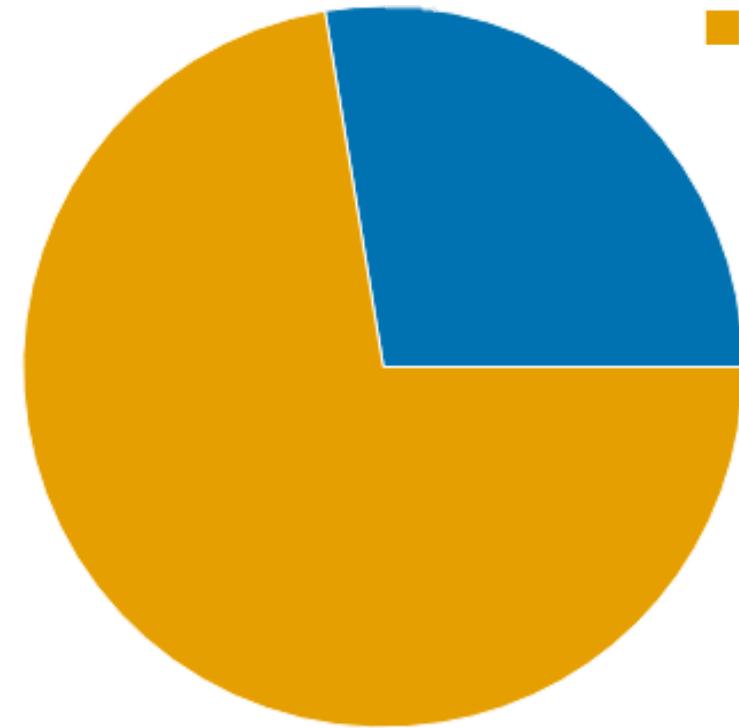
02



Scores above 23 indicates cognitively normal

EDA

02



Engineering

Majority have clinical dementia rating above 0.5, 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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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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Tuning

Model
comparisons

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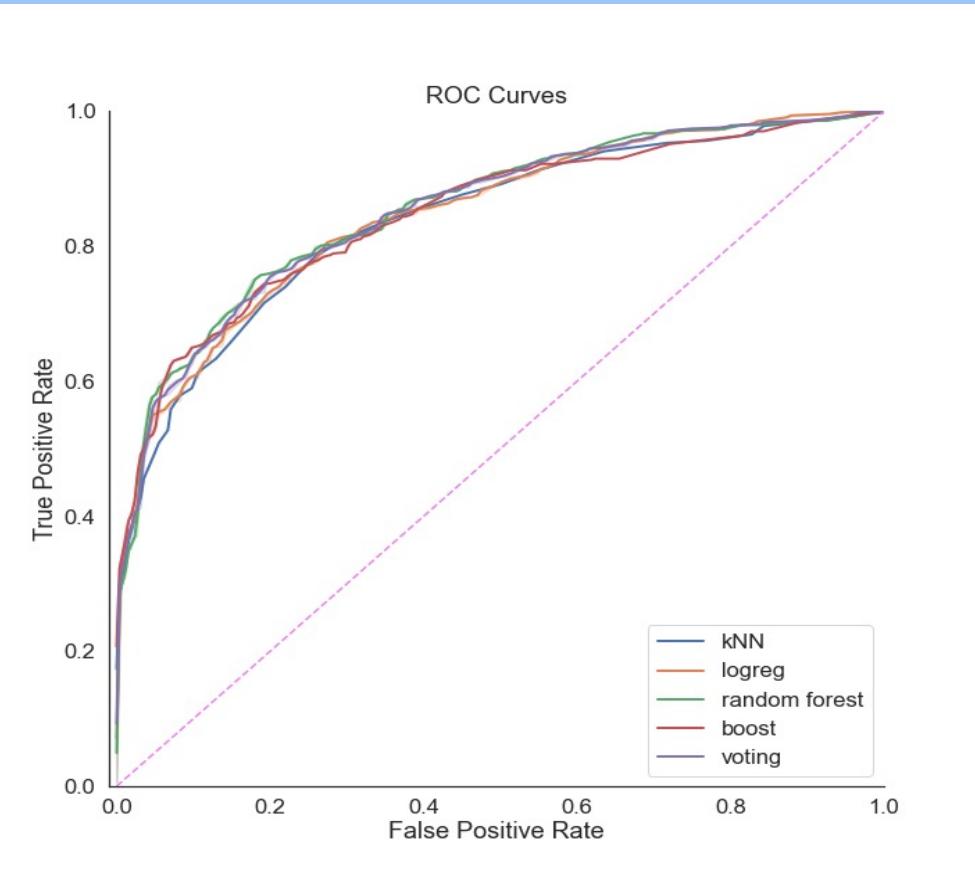
~~Baseline tests on selected metric~~

~~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

Comparisons

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~~Baseline tests on selected metric~~



~~Tuning~~



Model comparisons

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~~Tuning~~

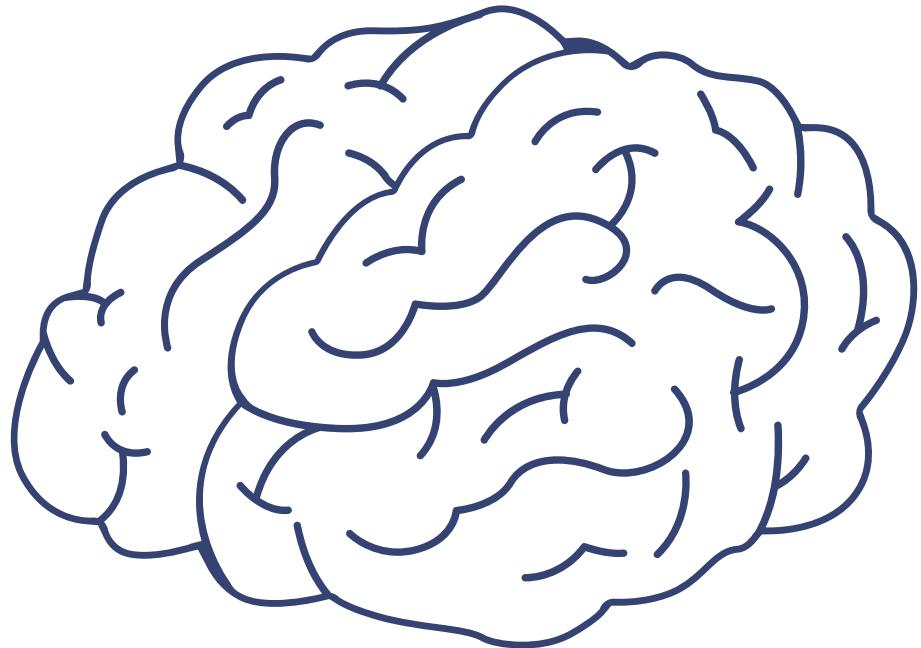


~~Model comparisons~~

04

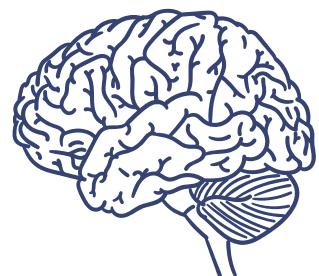
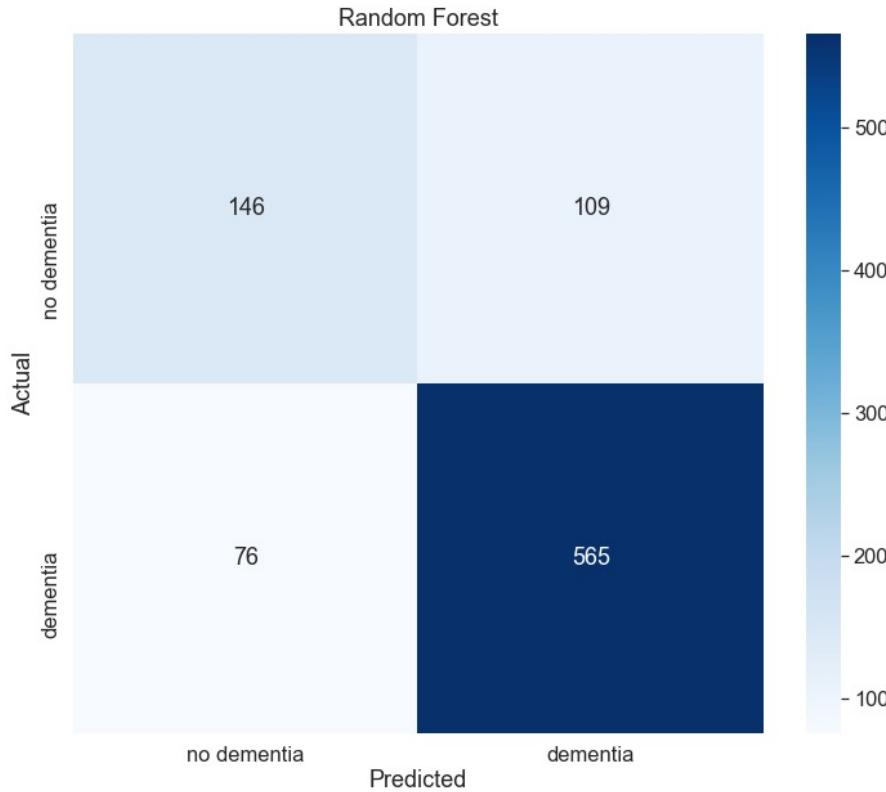
Random Forest Performance

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



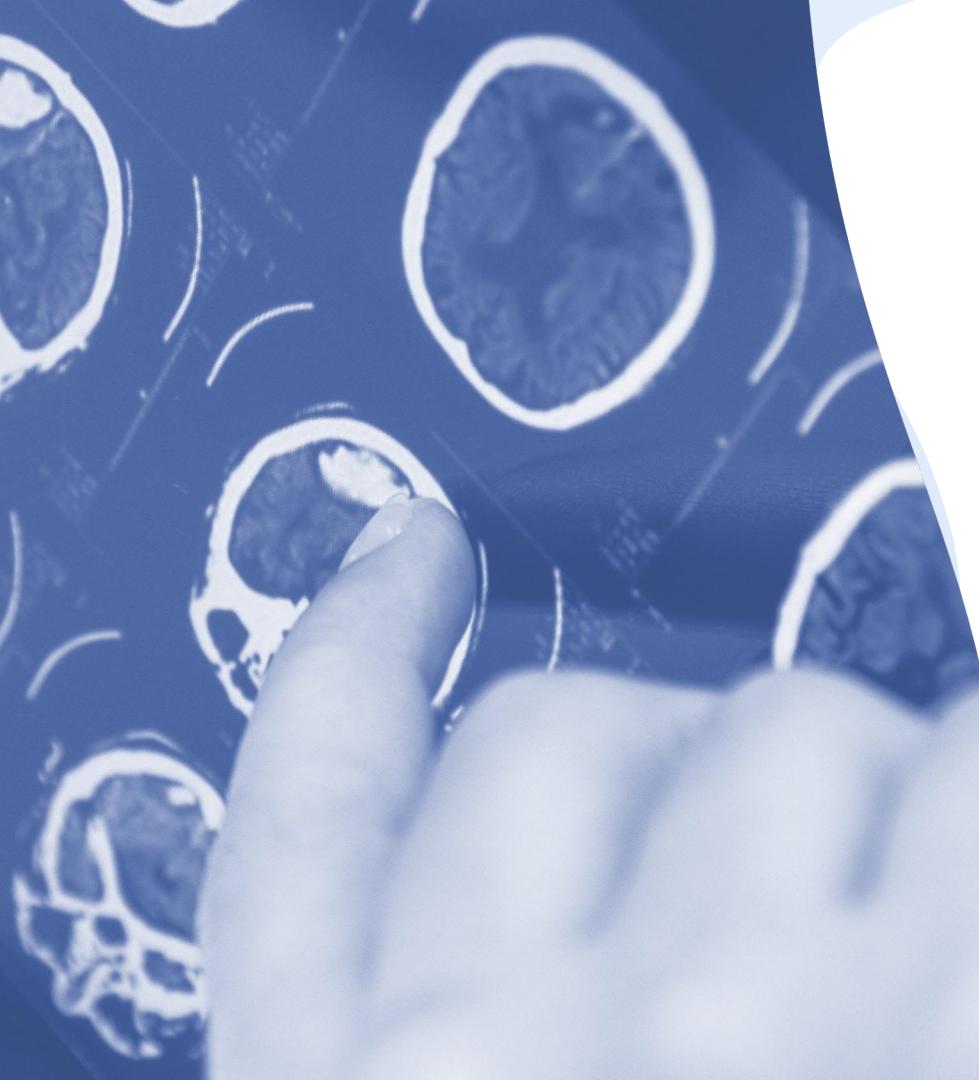
Tuned

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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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
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~~Baseline tests on selected metric~~

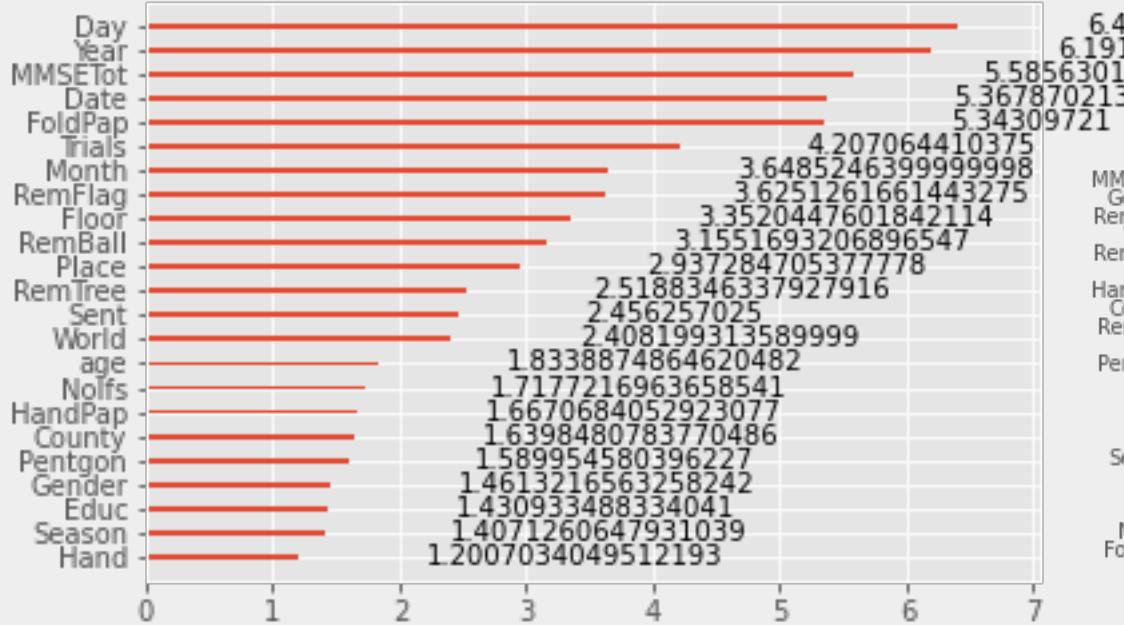
~~Tuning,
Oversampling,
Feature Selection~~

Feature Selection

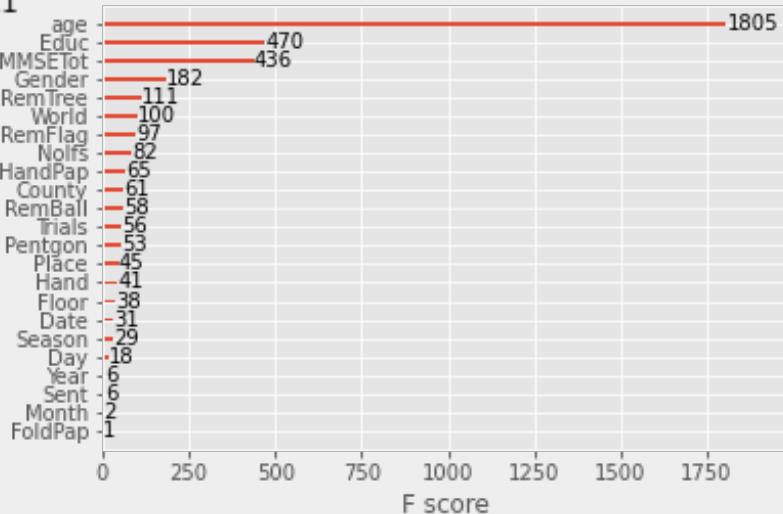
XGBoost	F2 Training	F2 Validation
Tuned w/all features	0.868	0.859
Recommended features	0.818	0.807

Model comparisons

Feature importance



Feature importance



Random Forest Feature importance (mean decrease in impurity)

