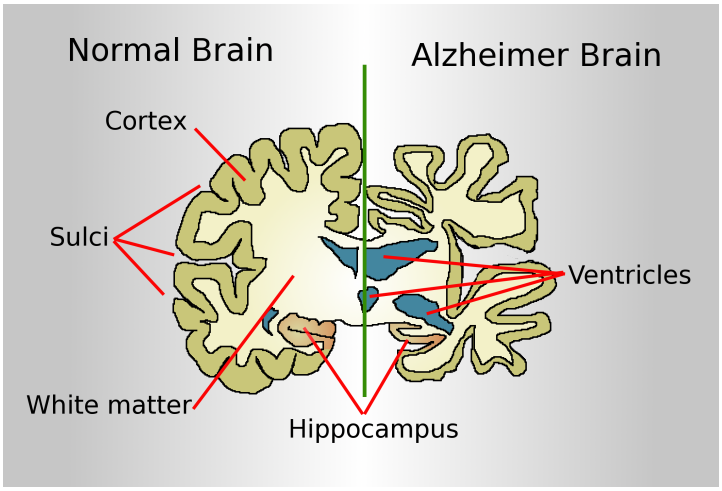
Can Dementia be predicted?



https://en.wikipedia.org/wiki/Alzheimer%27s_disease

Context

Dementia is the loss of thinking, remembering, and reasoning and behavioral abilities. The aim of this project is to detect dementia by exploring the interactions between the features collected from people who suffer from Dementia and healthy subjects.

Data

The data from OASIS project will be used for this study which include two sets of data:

- Cross-sectional MRI Data in Young, Middle Aged, Nondemented
- Demented Older Adults and Longitudinal MRI Data in Nondemented and Demented Older Adults.

In total there were data from 809 subject

Features:

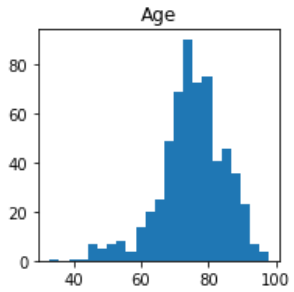
Decline in mental ability(Dementia); Age ; education; gender; socioeconomic status (SES); Mini-Mental State Exam (MMSE); eTIV - estimated Total Intracranial Volume; *brain volumes* (nWBV), and Atlas Scaling Factor (ASF)

Approach:

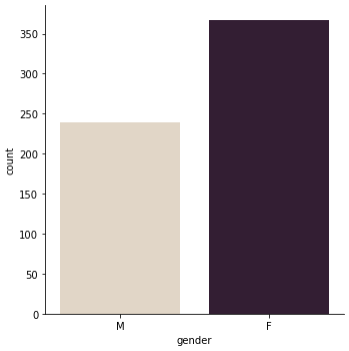
Implementing different supervised machine learning models including Decision tree, Logistic regression, Random forest, and gradient boosting and evaluating their performance using confusion matrix

Results:

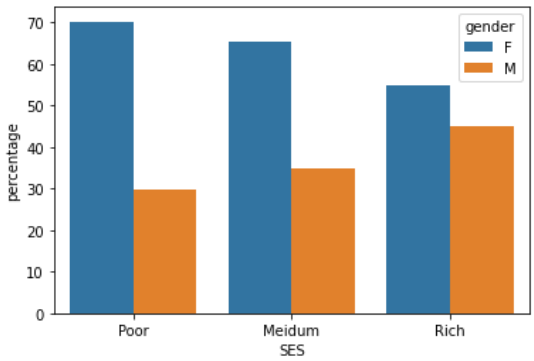
The average age of subjects is 75 years old.



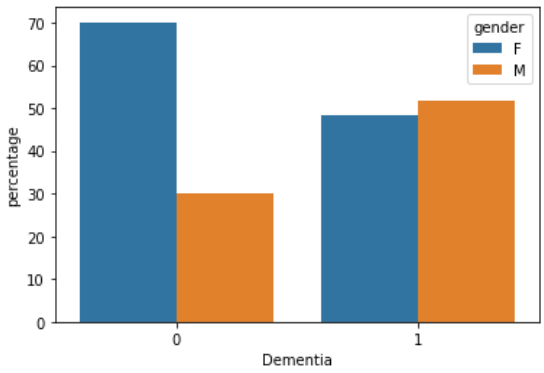
There are 20% more females in the data than males.



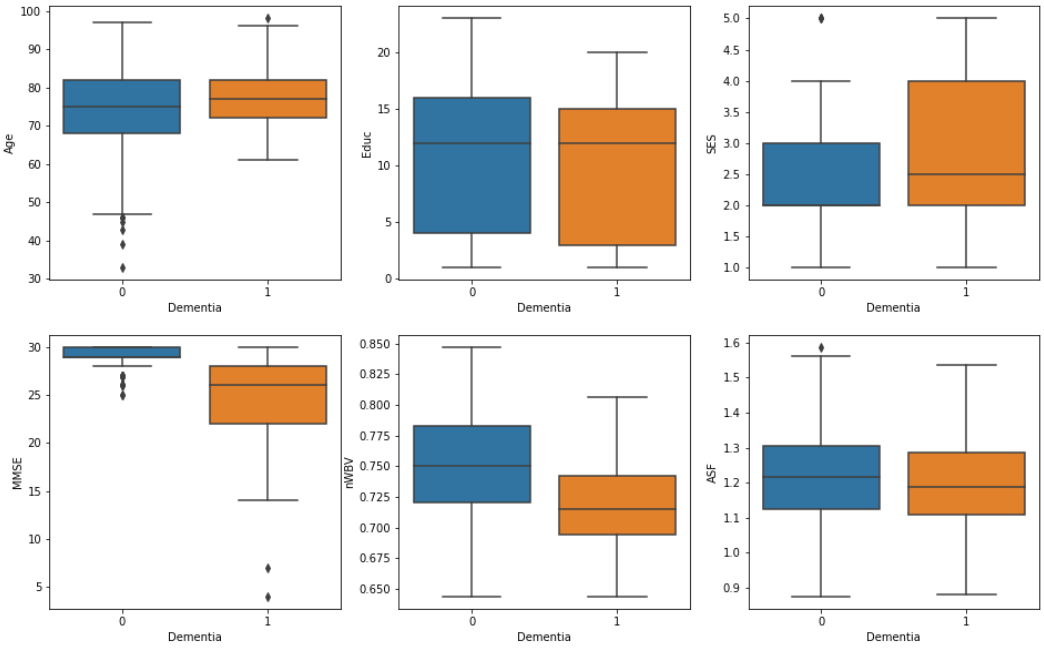
Male subject has higher social status in the study



40 % percent of subjects sufferers from Dementia



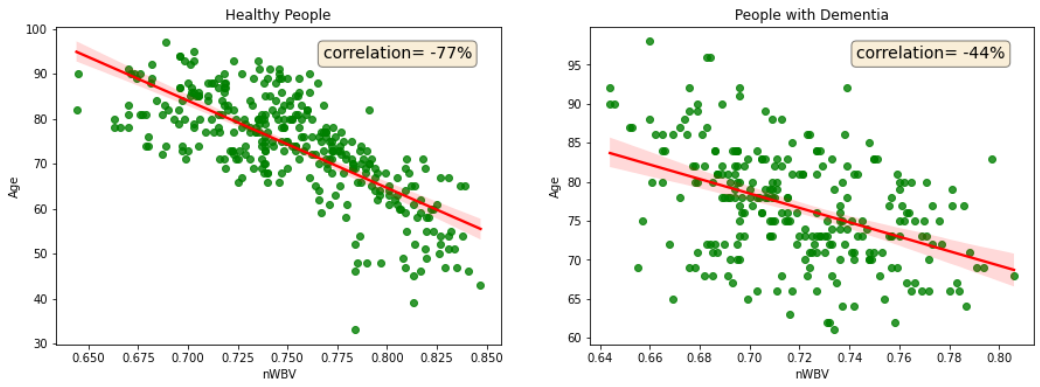
Features in Dementia versus healthy subjects



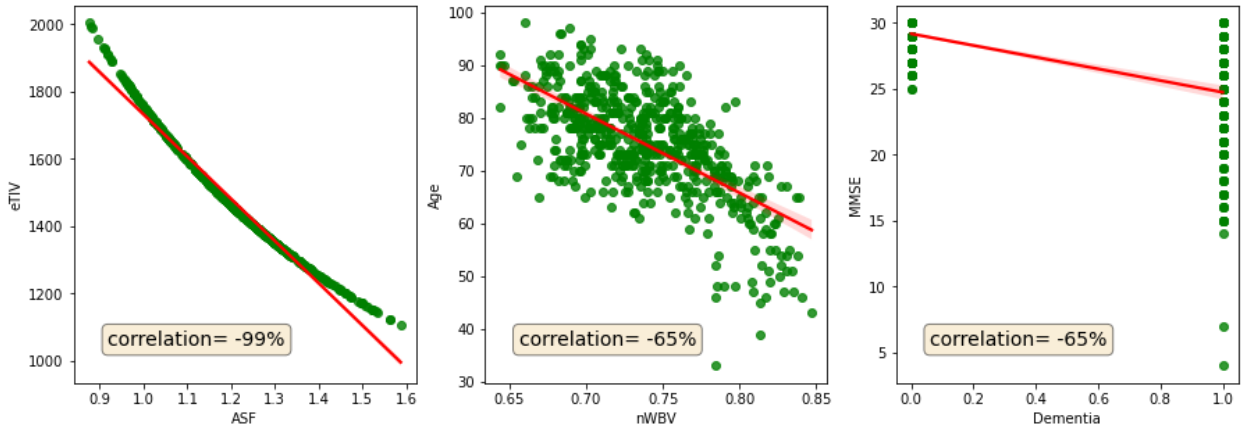
There is a significant difference between ctrl group and Dementia group in following features: MMSE,Age, SES, nWBV

Features	Age	SES	MMSE	nWBV
p-value	4.0e-4	4.0e-4	9.6e-59	1.5 e-23

Significant change of correlation between Age&nWBV in Healthy people versus people with Dementia

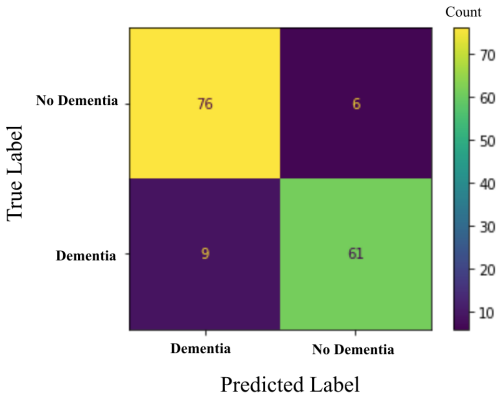


Significant correlation between features:

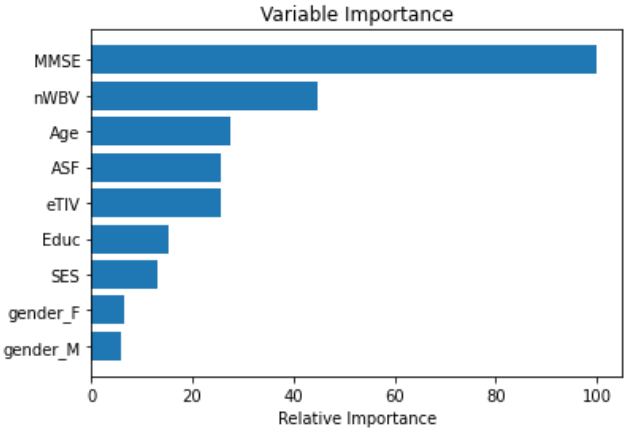


Prediction of Dementia

- Random Forest has the best performance in predicting dementia with precision of 91% and recall of 87 %



Feature importance from Random forest



Recommendation :

- Mini-Mental State Exam (MMSE) is the most important feature in predicting dementia.

- Random forest models resulted in highest precision(91%) and recall(87%). Since this study was about the diagnosis of Dementia, it is very important to have less false diagnosis of Dementia or in other word less false positive.

- The outcome of the work can be used in basic and clinical neuroscience and as a supplement for clinical dementia rating

Constraints

The proposed model works for quantifying AD only from numeric input values. Therefore, the MRI image-based methods need to be pre-processed and useful information extracted in the form of numeric values and used as input to our proposed model for better results.