Election Results Prediction

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Data Types

Independent Features

- 1 continuous numerical feature - age
- 1 nominal categorical feature - gender
- 6 ordinal categorical features - economic.cond.national, economic.cond.household, Blair, Hague, Europe, political.knowledge

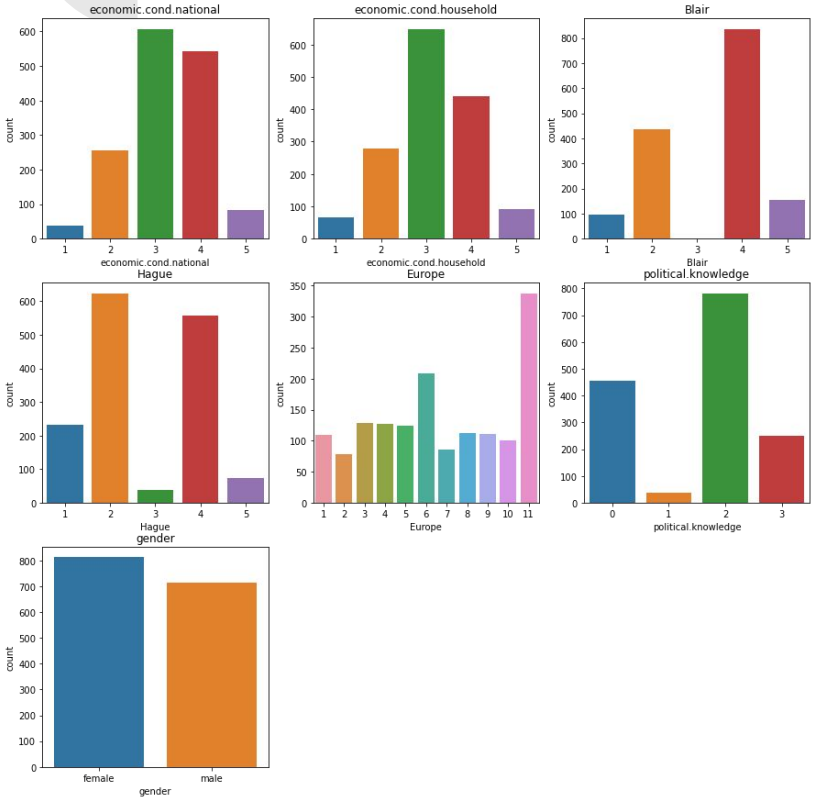
Dependent Feature

- nominal categorical

Shape: (1525, 9)

	vote	age	economic.cond.national	economic.cond.household	Blair	Hague	Europe	political.knowledge	gender
0	Labour	43	3	3	4	1	2	2	female
1	Labour	36	4	4	4	4	5	2	male
2	Labour	35	4	4	5	2	3	2	male
3	Labour	24	4	2	2	1	4	0	female
4	Labour	41	2	2	1	1	6	2	male

Detecting Outliers using Countplot



economic.cond.national, economic.cond.household

- 1 & 5 are outliers as they have very low percentage. We can replace 1 with 2 and 5 with 4.

Blair

- 1 & 3 are outliers. We can replace 1 with 2 and 3 with 4.

Hague

- 3 & 5 are outliers. We can replace 5 with 4 and 3 with 2.

Political.knowledge

- 1 is a outlier. We can replace 1 with 2.

Distribution & Box plot of Numerical Features

Outliers Percentage

economic.cond.national - 7.80%

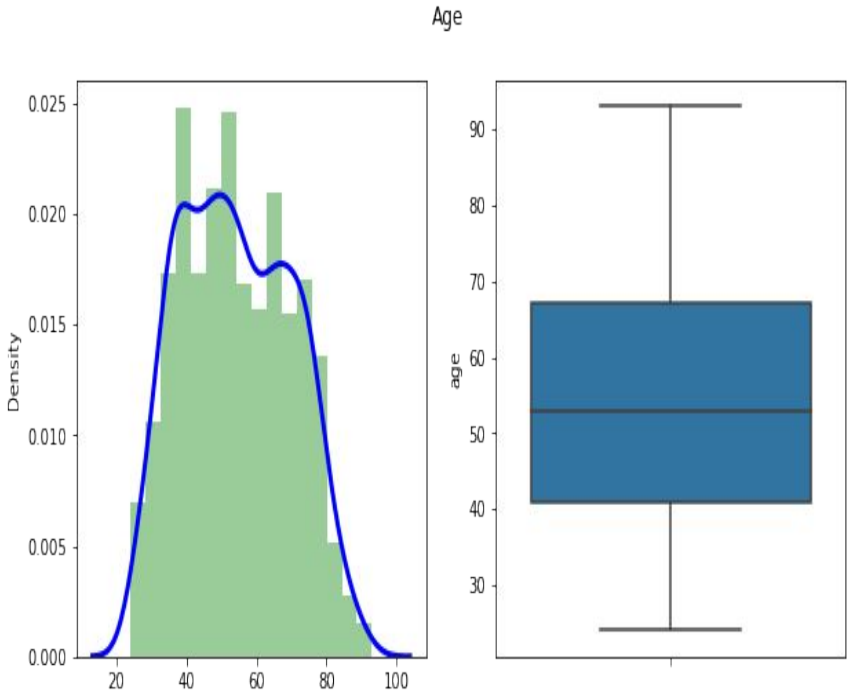
economic.cond.household - 7.74%

Blair - 4.92%

Hague - 5.11%

political.knowledge - 1.77%

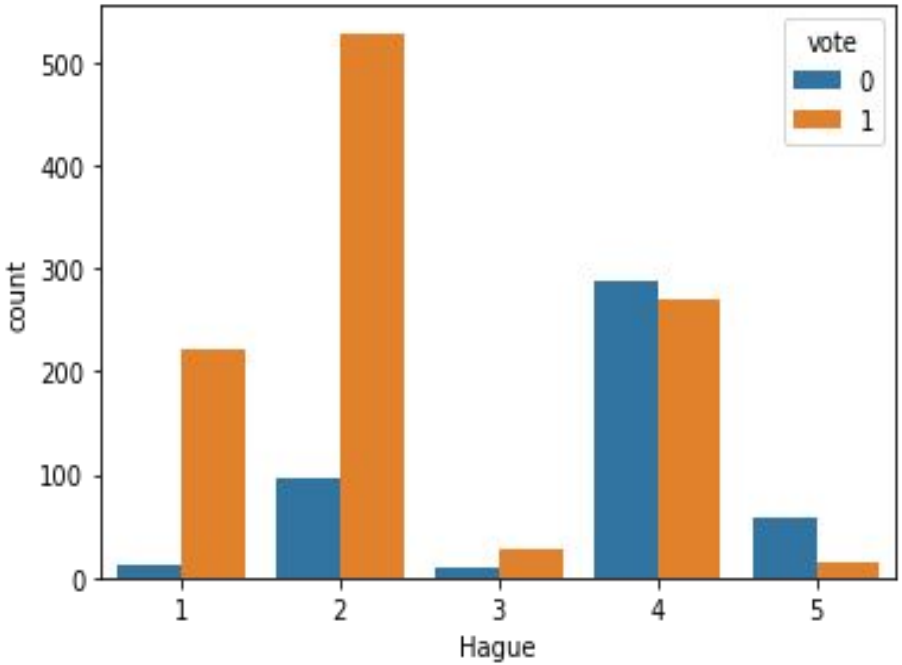
27.3% of Outliers are detected in the dataset. We are not handling them as Decision Tree and Random Forest are not sensitive to outliers.



Descriptive Statistics

- The assessment of current national economic condition is either 3 or 4 for 75% of the data.
- The assessment of current national household condition is either 3 or 4 for 70% of the data.
- The assessment of labour leader is either 2 or 4 for around 80% of the data.
- The assessment of conservative leader is either 2 or 4 for around 75% of the data.
- Around 22% of the data is very eurosceptic with a measure of 11 on a 1 to 11 scale.
- The knowledge of the parties positions for around 50% of the data is 2 and is 0 for around 30% of the data.
- We have almost balanced records for both male and female.
- Age ranges from 24 to 93 with a mean of 54 and a standard deviation of 16. The mean and median are close, hence the distribution may not be skewed.

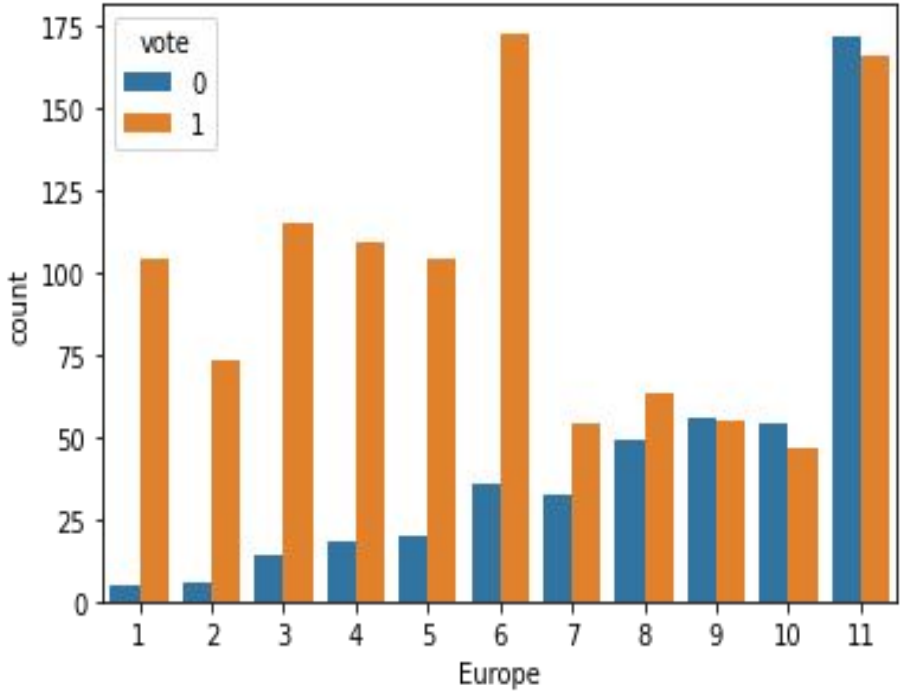
Hague Feature Importance



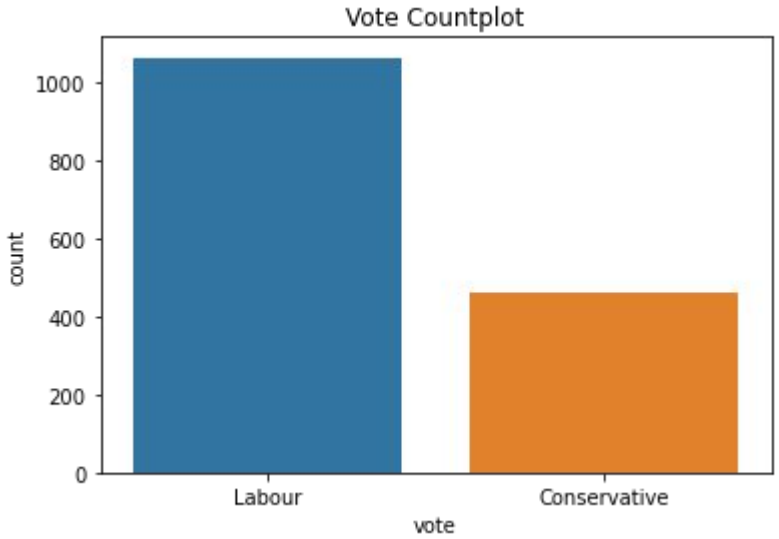
Except 4, all others count values differ heavily for Labour and Conservative. Hence we could say Hague is a good feature for building a model to classify the target variable.

Europe Feature Importance

There are heavy differences in the bar length for Labour and Conservative from 1 to 8. Hence we could say Europe is a good feature for building the model.



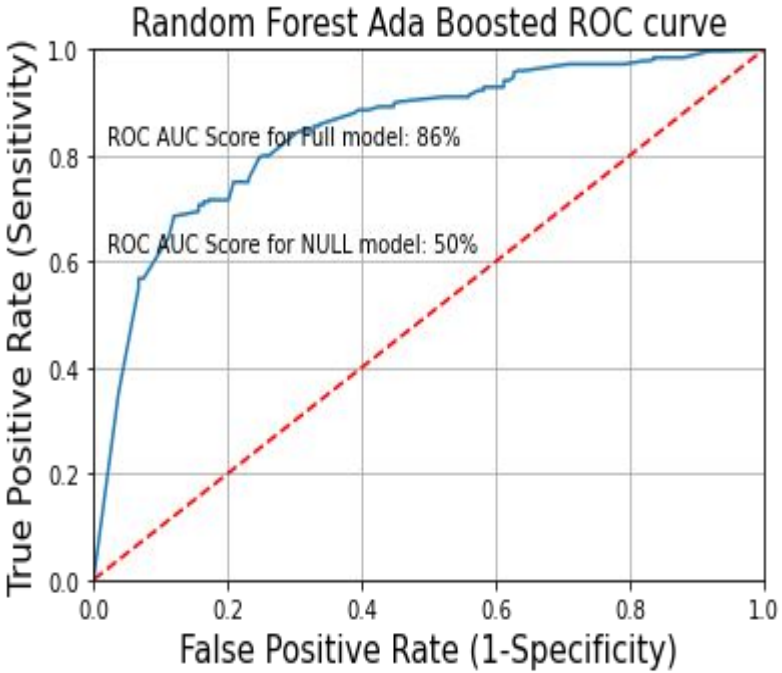
Data Pre-processing Steps



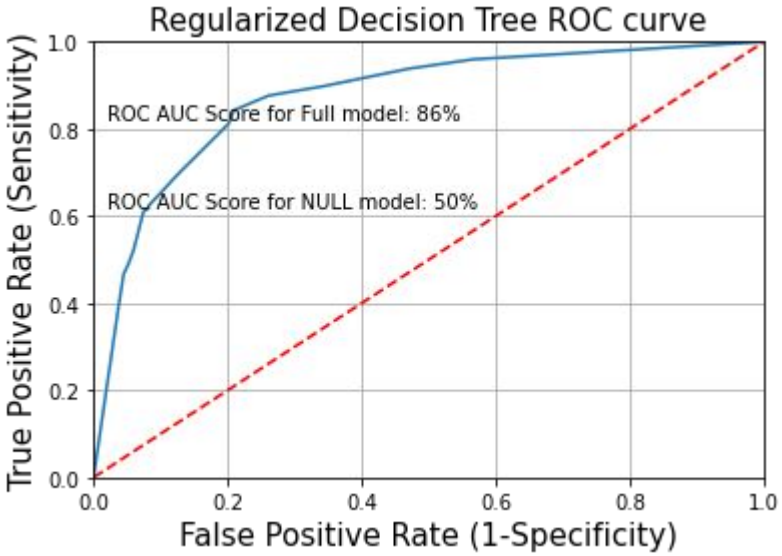
- Balanced dataset (70-30%)
  - Performance Metric: ROC AUC Score
- Encoding Techniques
  - Vote & Gender: LabelEncoder
- Scaling is not performed as scaling is not necessary for Decision Tree & Ensemble Algorithms
- Train-Test Split Ratio: 70:30

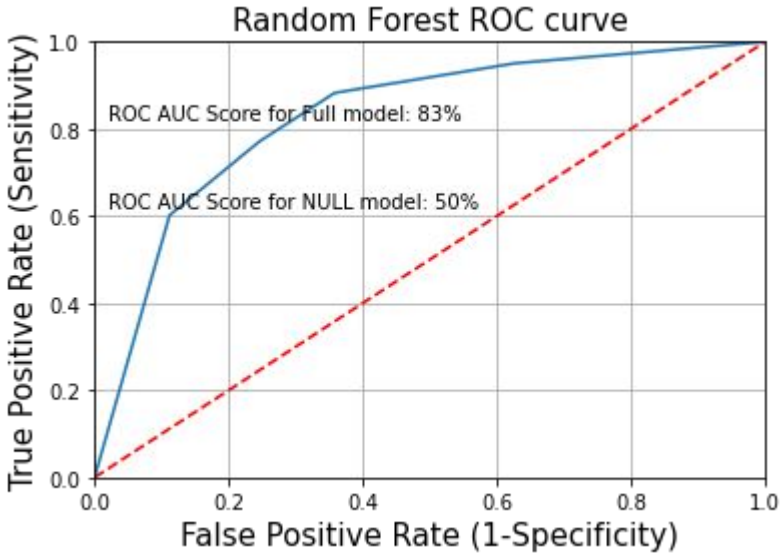
ML Models Used

- **Fully Grown Decision Tree**
  - Avg ROC AUC Score: **71.7%**
- **Regularized Decision Tree**
  - Best Params: Criterion - Gini & Max Depth - 4
  - Avg ROC AUC Score: **86.3%**
- **Random Forest**
  - Minimum Variance Error: 0.92
  - Best Params: NEstimator - 4, Criterion - Gini
  - Avg ROC AUC Score: **83.2%**
- **Random Forest Ada Boosted**
  - Minimum Bias Error: 14.33%
  - Best Params: NEstimator - 3
  - Avg ROC AUC Score: **85.7%**



ROC Curves


Regularized Decision Tree ROC curve
ROC AUC Score for Full model: 86%
ROC AUC Score for NULL model: 50%
True Positive Rate (Sensitivity)
False Positive Rate (1-Specificity)
0.0
0.2
0.4
0.6
0.8
1.0


Random Forest ROC curve
ROC AUC Score for Full model: 83%
ROC AUC Score for NULL model: 50%
True Positive Rate (Sensitivity)
False Positive Rate (1-Specificity)
0.0
0.2
0.4
0.6
0.8
1.0

Classification Report - RF Ada Boosted

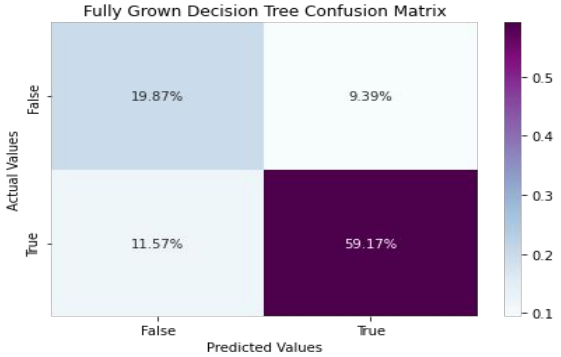
	precision	recall	f1-score	support
0	0.66	0.66	0.66	134
1	0.86	0.86	0.86	324
accuracy			0.80	458
macro avg	0.76	0.76	0.76	458
weighted avg	0.80	0.80	0.80	458

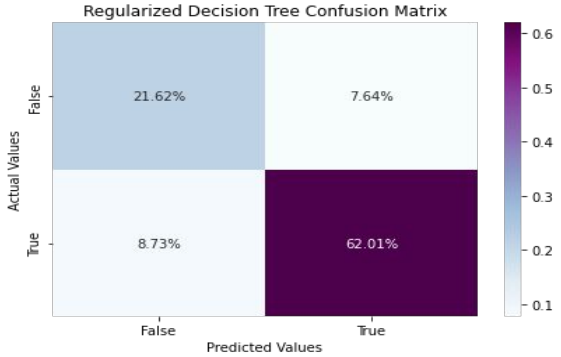
- The weighted average F1 score is 80% for Random Forest Ada Boosted, which is a good score. Hence we could say the model built is not underfitting.
- The precision and recall scores for Labour class are higher than Conservative Class by 20%.

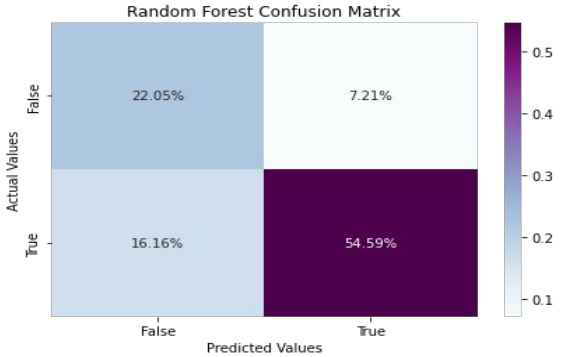
Confusion Matrices

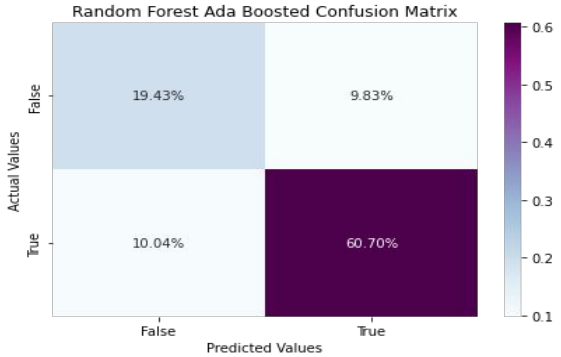
Random Forest Ada Boosted

- 60.7% of the data is correctly predicted as Labour
- 19.43% of data is correctly predicted as Conservative
- 10.04% of data is wrongly predicted as Conservative
- 9.83% of data is wrongly predicted as Labour.









Inference

- Though the Regularized Decision Tree has the highest average score of 86.3%, the variance error is higher for it.
- Hence we have used Random Forest to reduce the variance error to .99% from 3.26%, for which we had to sacrifice on the bias error little bit of around 3%.
- Still to compensate this sacrifice in the bias error, we decided to Boost the Random Forest model using the Ada Boost Classifier, and we successfully achieved almost a similar Average Score of Regularized Decision Tree upto 85.7%.
- Hence we were able to successfully build a Random Forest Ada Boosted Machine Learning model with 85.67% Average ROC AUC Score and a variance error of .99% in predicting the overall win as Labour with 71% of votes.