Spam or not spam?

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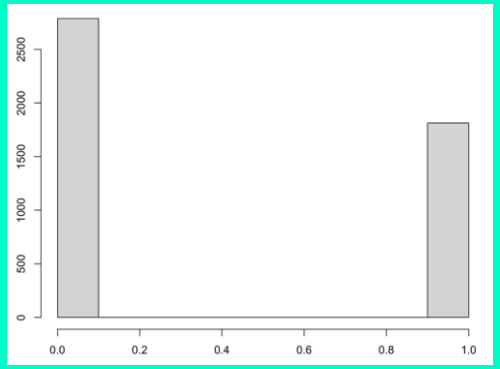
https://github.com/nikakondzhariya/STA-9891-Project-Spam-Or-Not-Spam

Project Description

Goal: classify emails for spam and non-spam

Techniques used: Lasso, Elastic-Net, Ridge and Random Forest



Data Structure

Dataset: The email Spam dataset collected from the UC Irvine Machine Learning Repository https://archive.ics.uci.edu/ml/datasets/Spambase

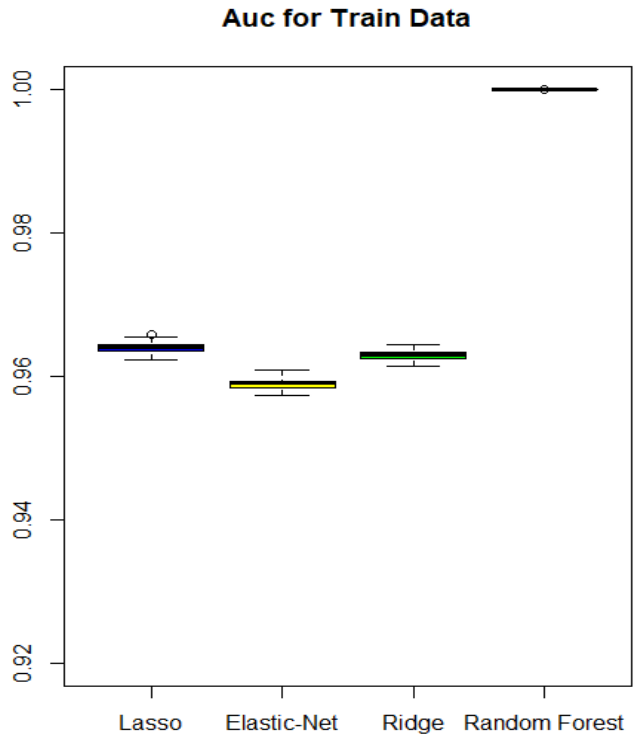
Target Class Variable: denotes whether the e-mail was considered spam (1) or not (0)

Dimension:
- p = 57
- n = 4601:
  n1(spam) = 1813 (39.5%)
  n0(non-spam) = 2788 (60.5%)

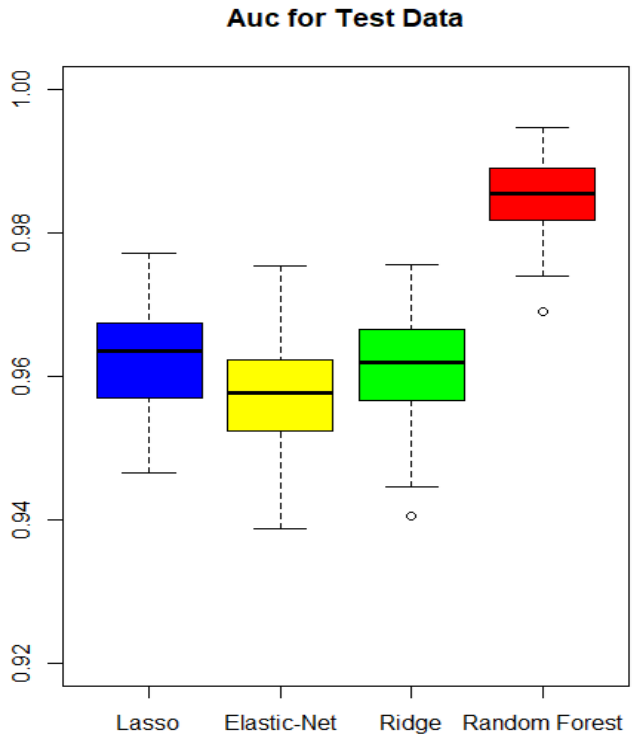
Features:
- % of a particular **word** occurring in the e-mail: “free”, “credit”, “money”, “receive”, “remove” and etc.
- % of a particular **character** occurring in the e-mail: “;”, “(“, “[“, “!”, “$”, “#”
- length of sequences of consecutive **capital** letters

AUC RESULT COMPARISON FOR TRAIN AND TEST SET

Train Data (n=4141)

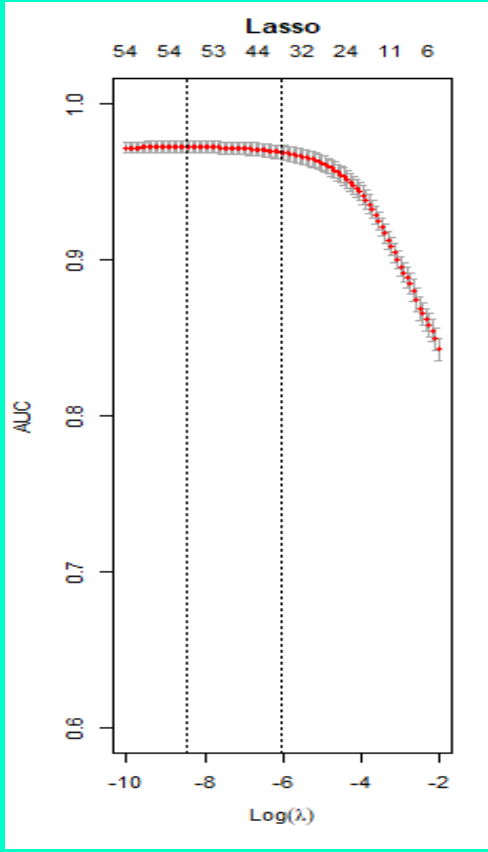


Test Data (n=460)

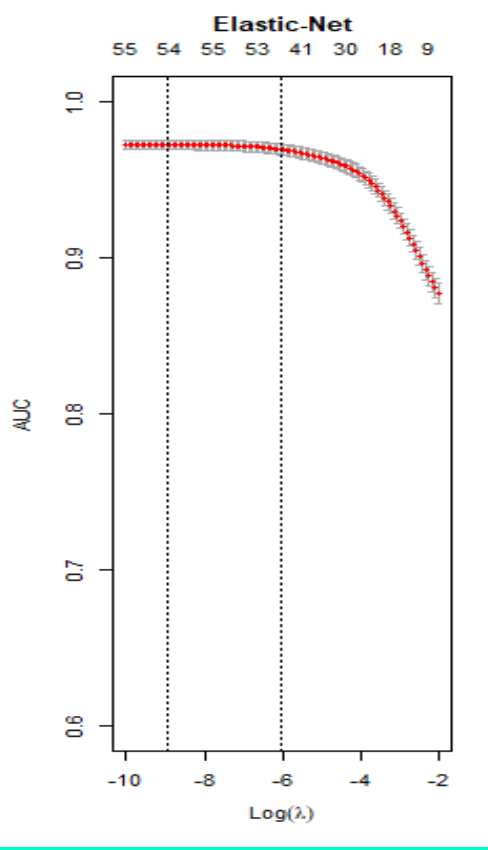


10 fold cross validation curves for one of the 50 samples

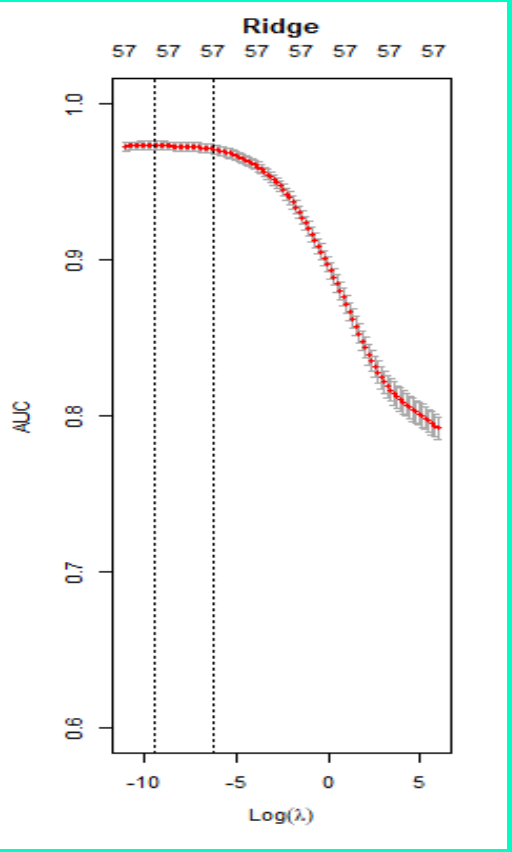
4.62 sec



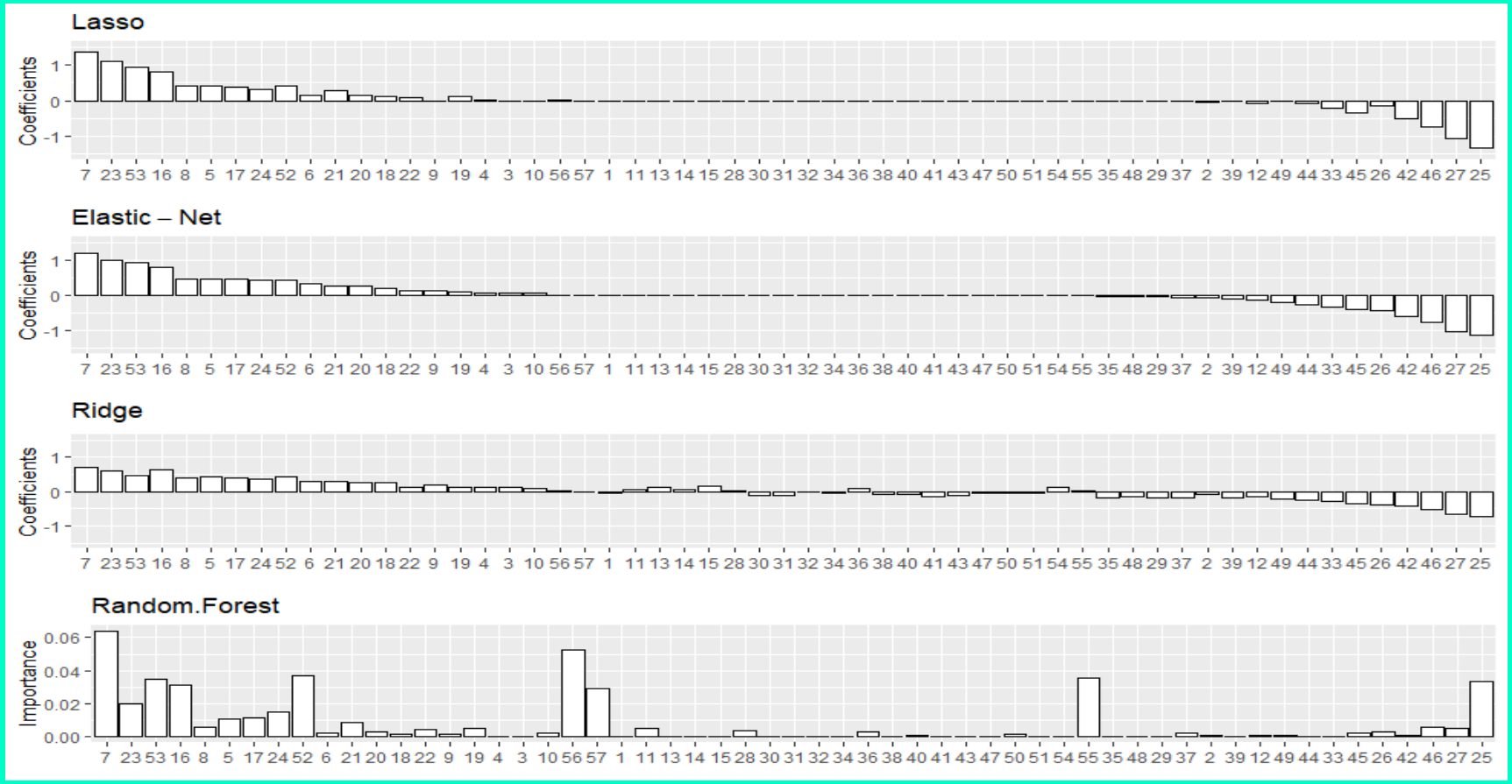
4.38 sec



6.83 sec



Bar Plots of Estimated coefficients

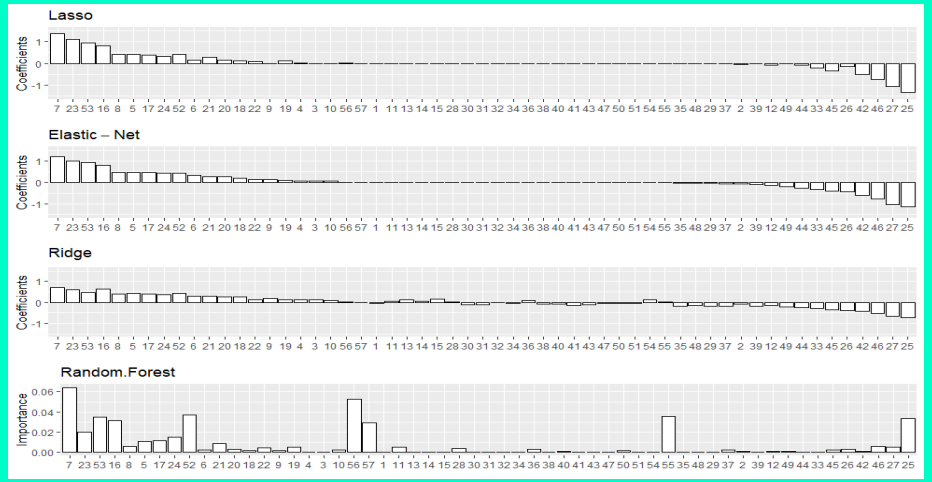


More on coefficients

Lasso/Elastic-Net/Ridge:

- **Positive - spam:**
  - Word frequency “Remove”
  - Word frequency “000”
  - Word frequency “Free”

- **Negative - non spam:**
  - Word frequency “HP”
  - Word frequency “George”
  - Word frequency “Edu”



Random Forest:

- Length of longest uninterrupted sequence of capital letters
- Average length of uninterrupted sequences of capital letters
- Sum of length of uninterrupted sequences of capital letters

Model accuracy and run time

Model	90% CI on 50 Test AUCs*	Median of 50 Test AUCs	Time**
Random Forest	[0.977, 0.993]	0.992	23.31 sec
Lasso	[0.951, 0.972]	0.963	4.98 sec
Ridge	[0.949, 0.971]	0.961	7.12 sec
Elastic Net	[0.944, 0.968]	0.958	4.87 sec

Trade-off: The better performance - the more time required to build

Thank you for attention! Do you have any questions?

* - 90% test AUC based on the 50 samples with 90% confidence interval
** - The time it takes to fit the model on full dataset