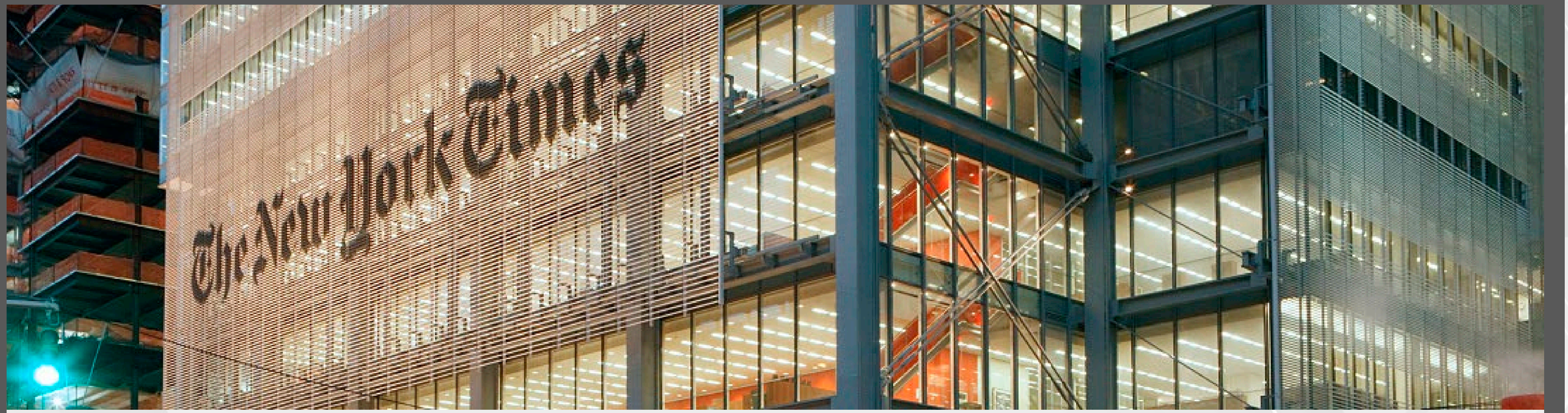


Online News Popularity

Final Regression Project

STA 9890 UWA
May 5, 2021

Statistical Learning for Data Mining
Prof. Kamiar Rahnama Rad

Group 4:

Michael S. Bonetti
https://github.com/mbonetti-nyc/Online-News-Popularity

ZICKLIN BUSINESS 100 YEARS

BRIEF DESCRIPTION

ONLINE NEWS POPULARITY | UCI ML REPOSITORY

About this dataset

Summarizes heterogenous set of features

- About published Mashable articles over a 2-year period
  - Datapoints: 39,797 *(stated)*, 39,644 *(observed)* (n)
  - Response ($shares$): the goal is to predict the number of shares in social networks (popularity)

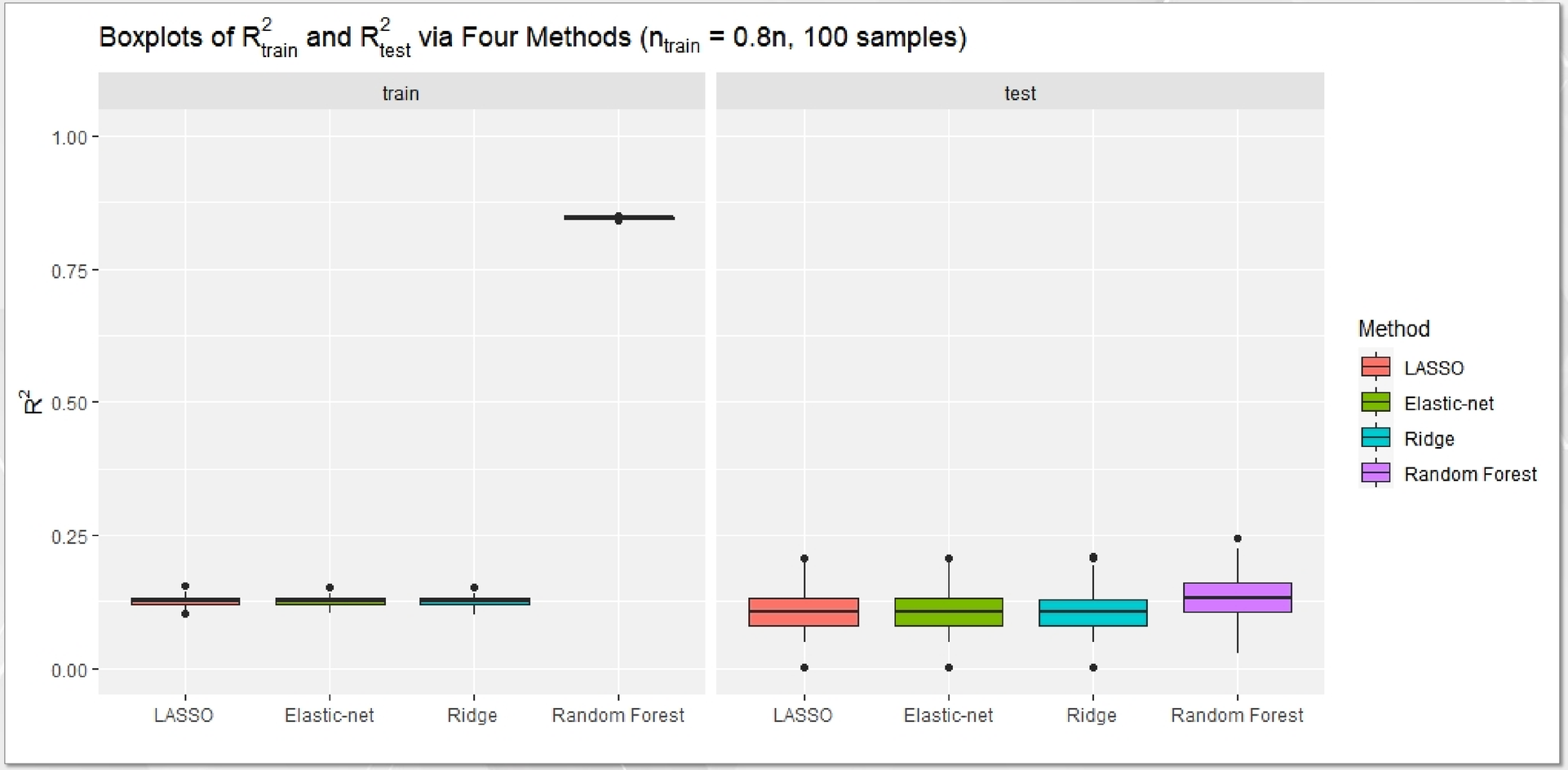
Attributes

- 61 attributes (p)
  - 58 predictive attributes (19 categorial & 39 numerical), 2 non-predictive, 1 target
  - Predictors
    - 6 data channels: lifestyle, entertainment, business, social media, tech, & world
    - Days of the week, and closeness to LDA *(Latent Dirichlet allocation)*
- No missing values were found upon preliminary analysis

For this project

- 25% random sample taken
  - 9,911 observations (n): 25% of 39,644
  - 57 predictive attributes (p): 3 attributes removed ($url, timedelta, is\_weekend$)

BOXPLOTS OF R^2



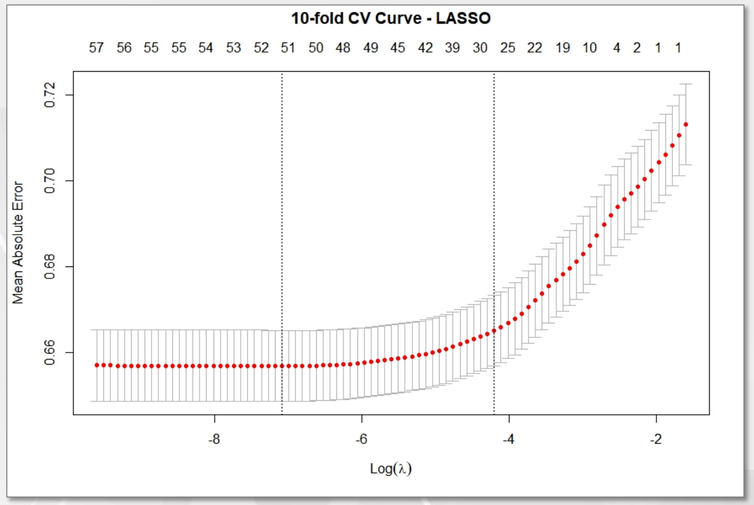
CROSS-VALIDATION CURVES

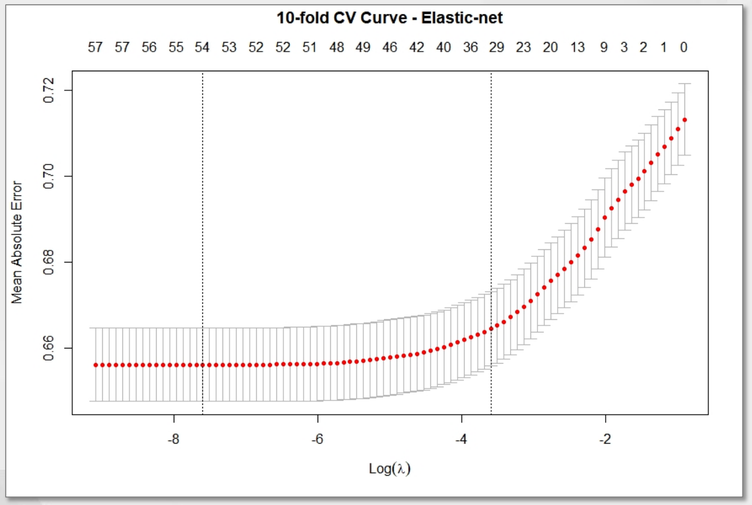
VIA 10-fold | LASSO, ELASTIC-NET (EN), RIDGE

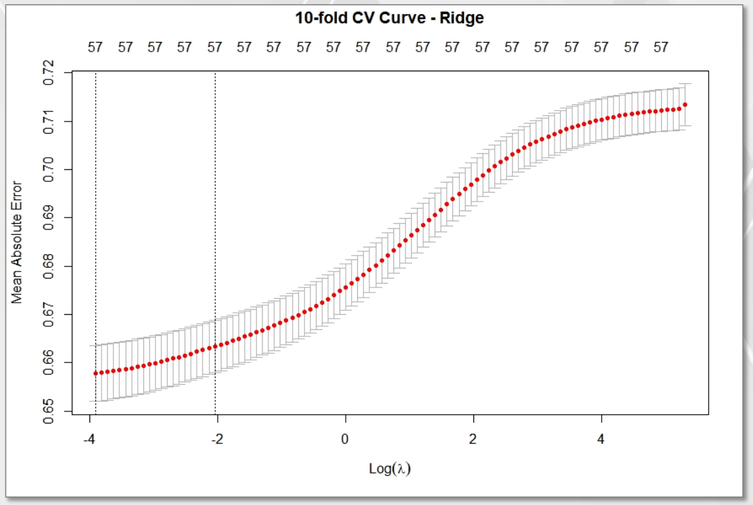
LASSO Runtime 1: 1.98 secs.
LASSO Runtime 2: 2.31 secs.

EN Runtime 1: 1.32 secs.
EN Runtime 2: 1.74 secs.

Ridge Runtime 1: 1.03 secs.
Ridge Runtime 2: ~ 26.61 hrs.







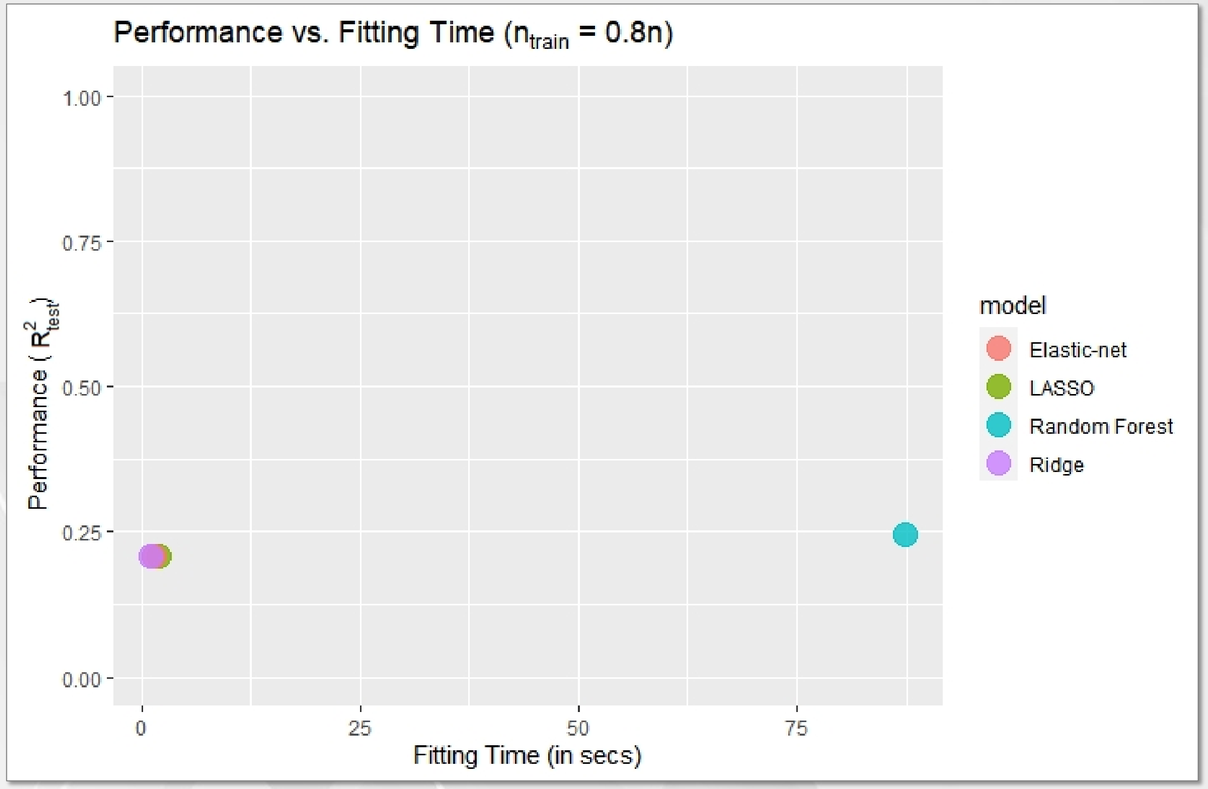
Runtime 1: Using 25% random sample dataset
Runtime 2: Using complete dataset (all 39,644 obs.)

BOXPLOTS OF RESIDUALS

Observations:

- Residual medians near zero
- LASSO, EN, & Ridge have similar residual variance in training and testing sets
- Random Forest (RF)
  - Has smaller residual variance when compared against LASSO, EN, and Ridge in training set
  - RF training variance is smaller than its testing variance
  - Has similar variance against other methods in testing set

PERFORMANCE *vs.* RUNTIME

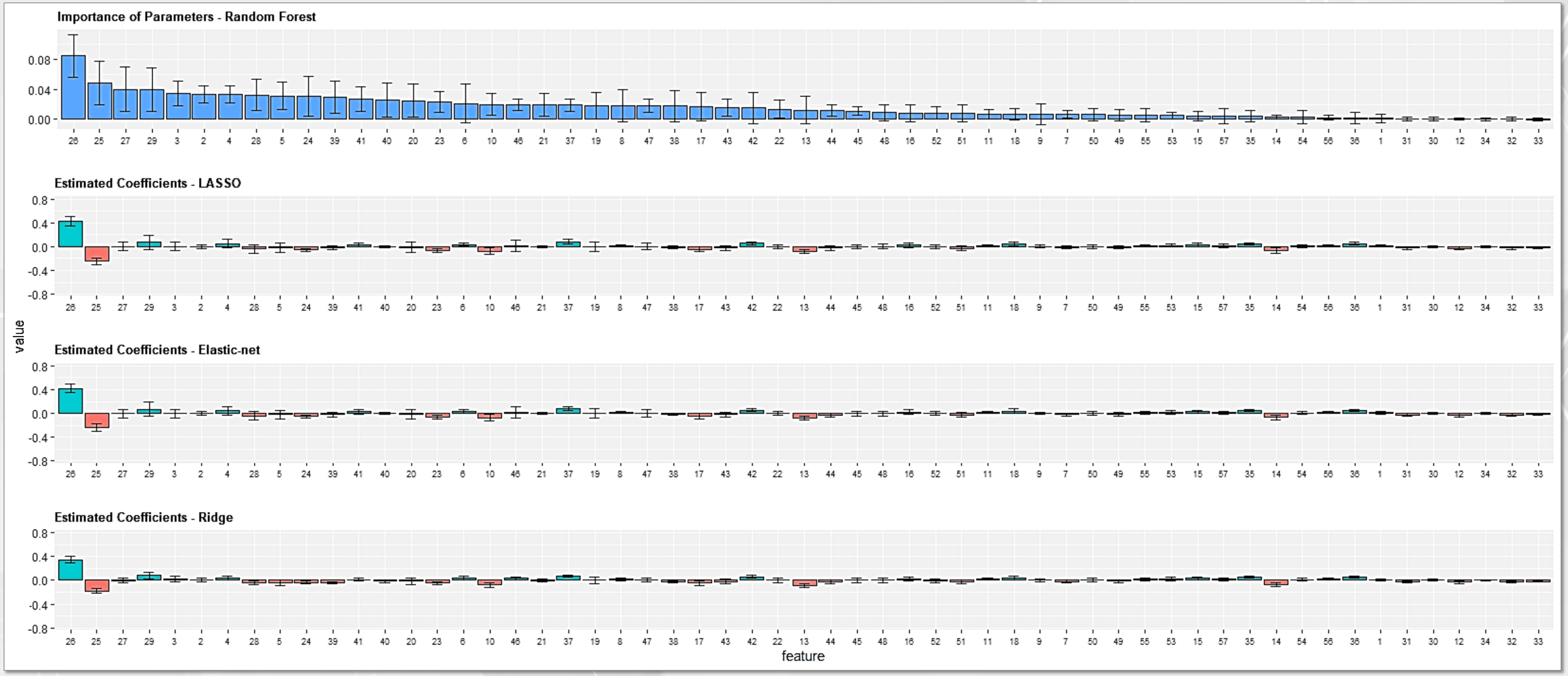


Method	Performance (R^2_{test})		Runtime *(in secs)*	
			CV	Full 25%
LASSO	*90% CI:*	{0.101, 0.113}	1.98	1.01
	Best:	0.2066		
Elastic-net	*90% CI:*	{0.101, 0.113}	1.32	0.93
	Best:	0.2068		
Ridge	*90% CI:*	{0.100, 0.112}	1.03	1.17
	Best:	0.2091		
Random Forest	*90% CI:*	{0.127, 0.139}	87.4	136.8
	Best:	0.2453		

Observations:

- **Avg. Performance (Best R^2s): 0.217 (21.7%)**
- **Trade-off? *Slightly*.**
  - RF consistently takes longer, but has improved performance
  - However, the additional runtime provides minimal performance improvement

VARIABLE IMPORTANCE



CLOSING REMARKS

ONLINE NEWS POPULARITY | UCI ML REPOSITORY

Variable Importance (Top 3)

- Positive influence ↗
  - 26 - *kw_avg_avg* (Avg. keyword (avg. shares))
  - 29 - *self_reference_avg_shares* (Avg. shares of referenced articles in Mashable)
  - 37 - *LDA_00* (Closeness to LDA topic 0)
- Negative influence ↙
  - 25 - *kw_max_avg* (Avg. keyword (max. shares))
  - 10 - *average_token_length* (Avg. length of words in content)
  - 13 - *data_channel_is_entertainment* (Is data channel 'Entertainment'?)

Table 5: Ranking of features according to their importance in the RF model.

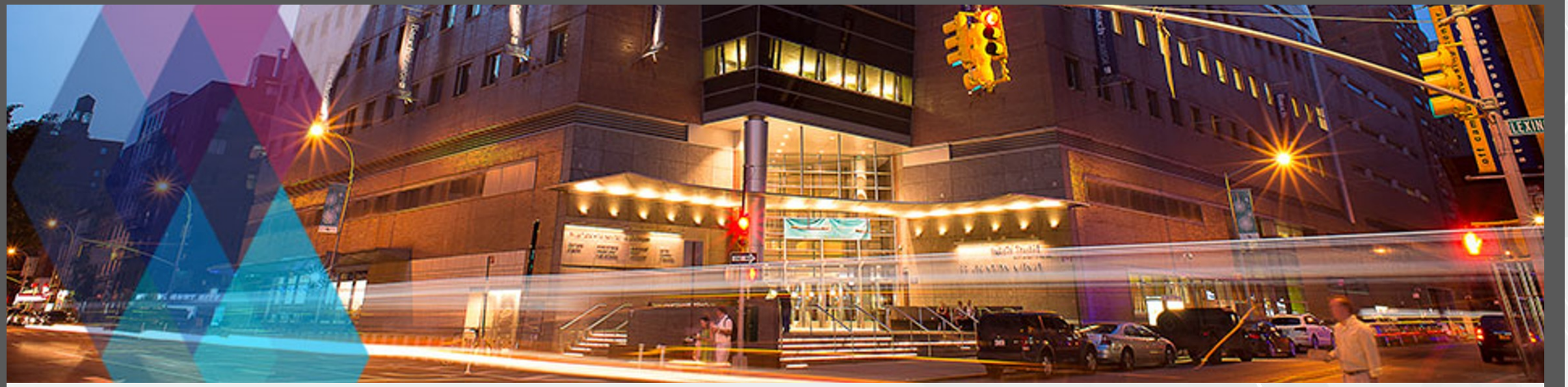
Feature	Rank (#)	Feature	Rank (#)
Avg. keyword (avg. shares)	0.0456 (1)	Closeness to top 1 LDA topic	0.0287 (11)
Avg. keyword (max. shares)	0.0389 (2)	Rate of unique non-stop words	0.0274 (12)
Closeness to top 3 LDA topic	0.0323 (3)	Article text subjectivity	0.0271 (13)
Article category (Mashable data channel)	0.0304 (4)	Rate of unique tokens words	0.0271 (14)
Min. shares of Mashable links	0.0297 (5)	Average token length	0.0271 (15)
Best keyword (avg. shares)	0.0294 (6)	Number of words	0.0263 (16)
Avg. shares of Mashable links	0.0294 (7)	Day of the week	0.0260 (18)
Closeness to top 2 LDA topic	0.0293 (8)	Number of words in the title	0.0161 (31)
Worst keyword (avg. shares)	0.0292 (9)	Number of images	0.0142 (34)
Closeness to top 5 LDA topic	0.0288 (10)	Number of videos	0.0082 (44)

25% Random Sample vs. Full Dataset Comparison

- Results were generally the same
  - Performance decreased, and Ridge / RF caused runtimes to substantially increase
  - CV curves had same shapes, while boxplot variances shrank

Improvements can be made…

- RF (still the best performer), AdaBoost, SVM, kNN, NB
- … but human behavior is unpredictable!
  - Therefore, R^2 between 10 – 20% for social sciences is acceptable



THANK YOU!

Q&A

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