# Comparing ML models for single-label text classification

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# Outline

- Problem statement, goals and success criteria
- Explain data and run statistical analysis
- Apply ML models to data
- Summary and future work

# Problem statement, goals and success criteria

- How well do different Machine Learning models perform on single-label text classification tasks?

- Goals: reproduce part of my PhD work using state-of-the-art libraries in Python, assess how this area evolved in 10 years.

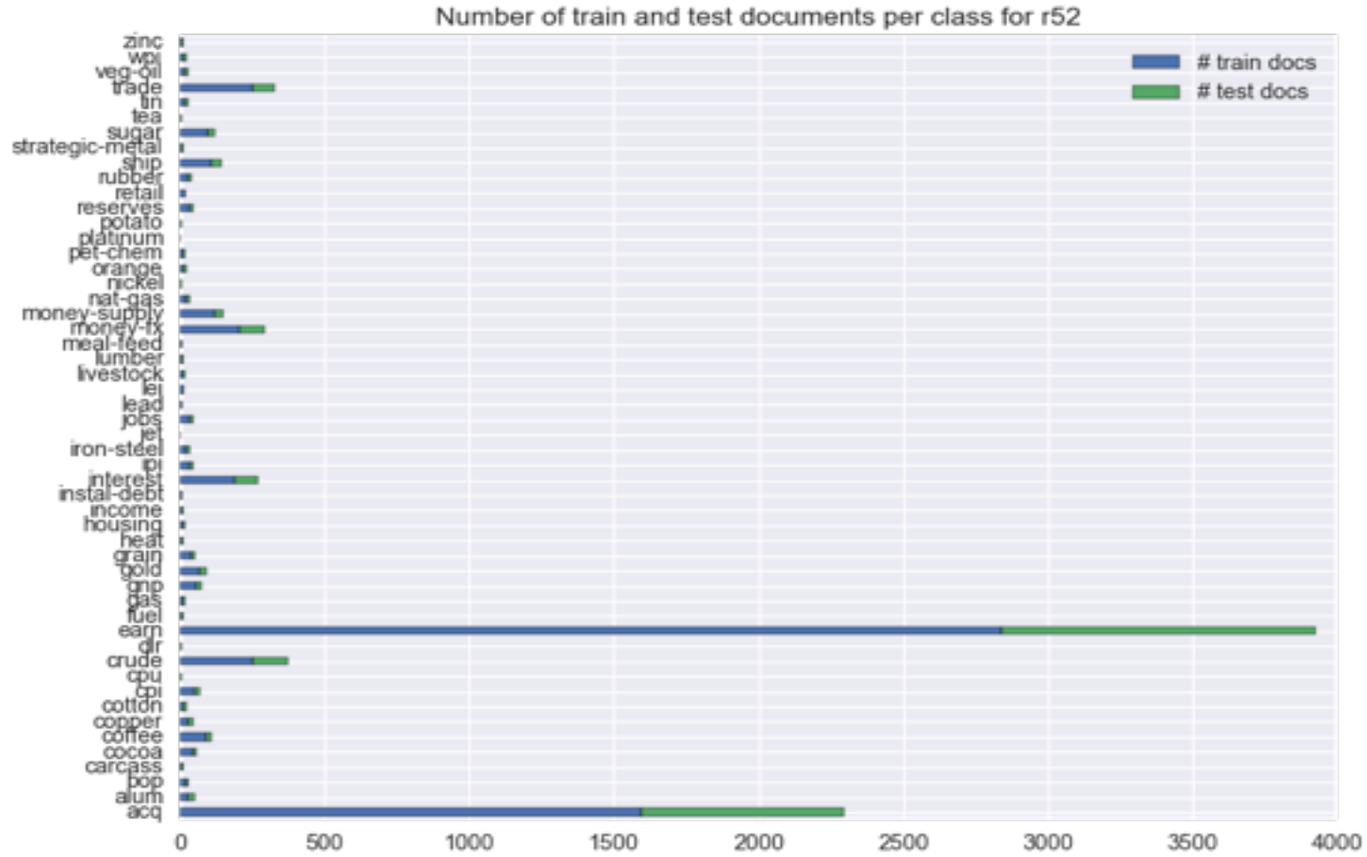
- Successful if: reproduce the initial "related work" from my thesis.

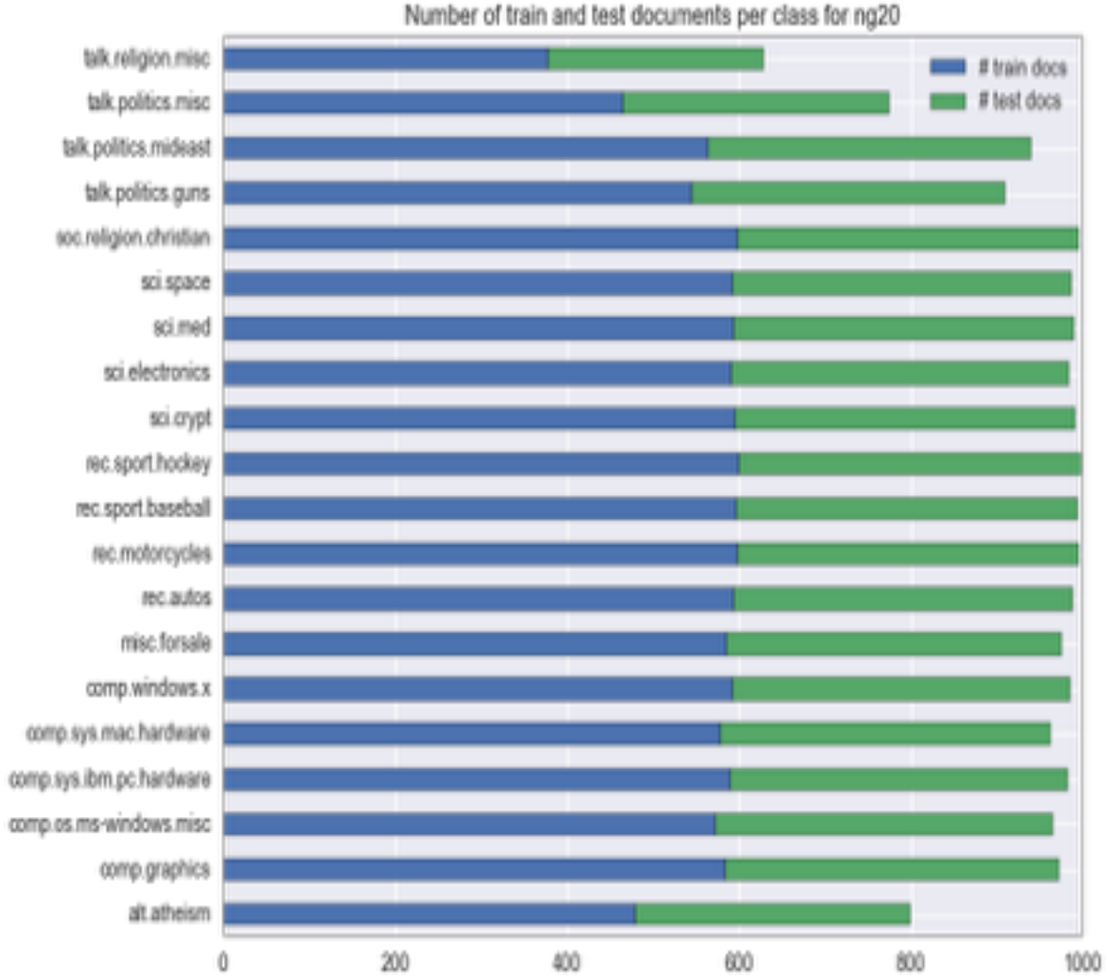
# Explain data and run statistical analysis

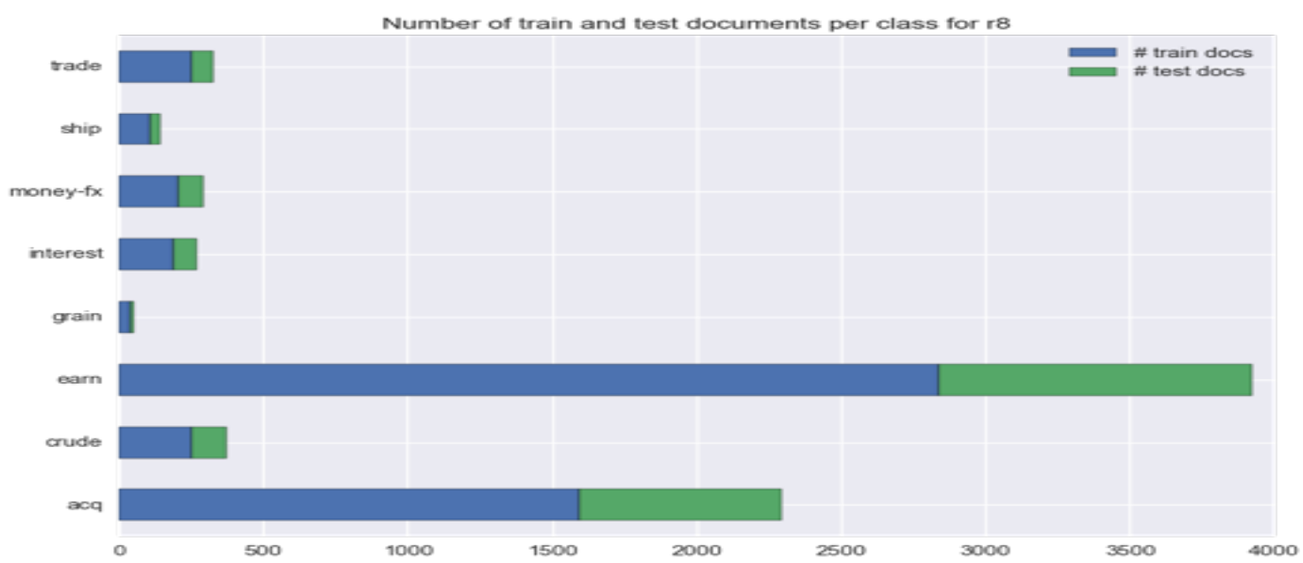
- Datasets: 20 Newsgroups, Reuters-21578
- Numbers of documents
- Numbers of features
- Word clouds

# Numbers of documents

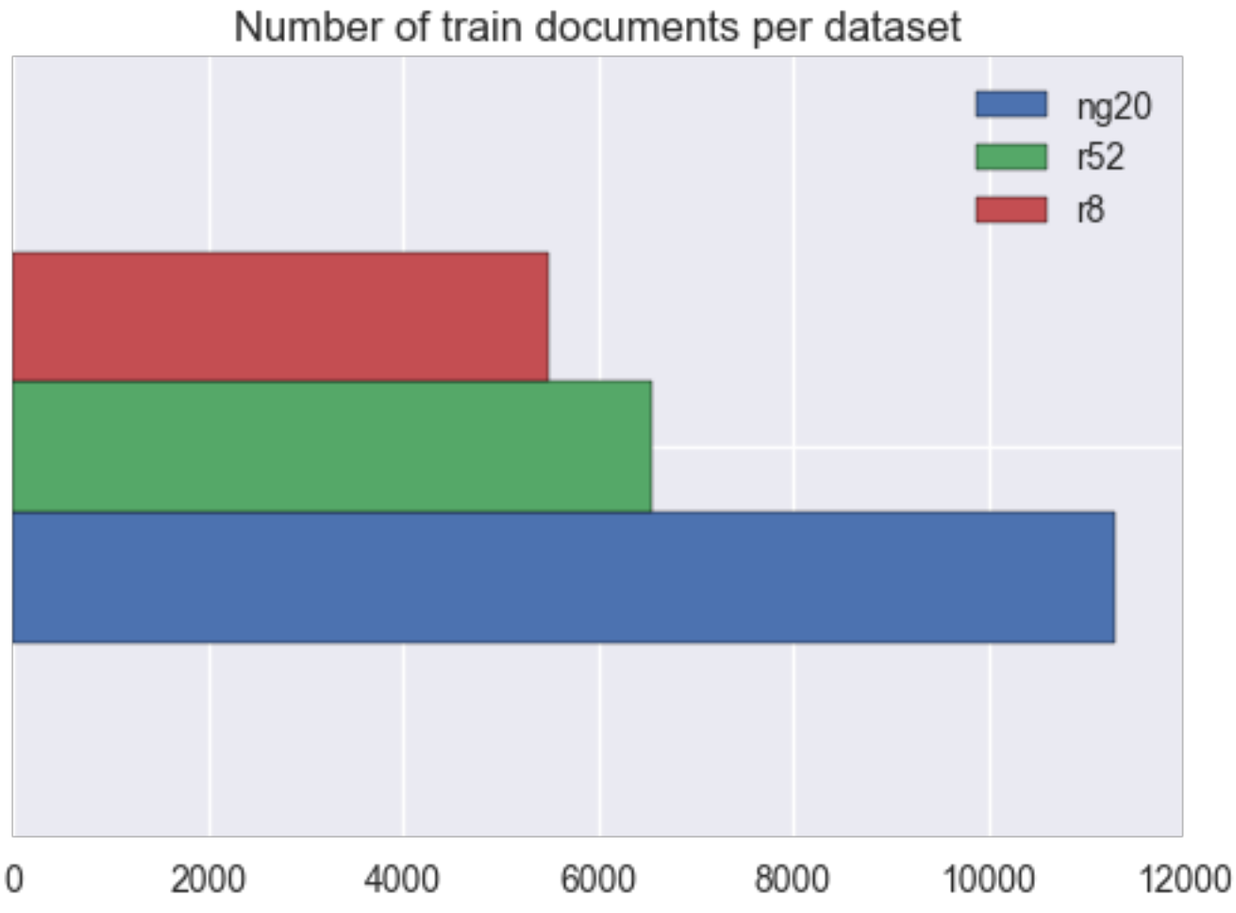
| | # train docs | # test docs | total # docs |
|---|---|---|---|
| **r8** | 5485 | 2189 | 7674 |
| **r52** | 6532 | 2568 | 9100 |
| **ng20** | 11293 | 7528 | 18821 |

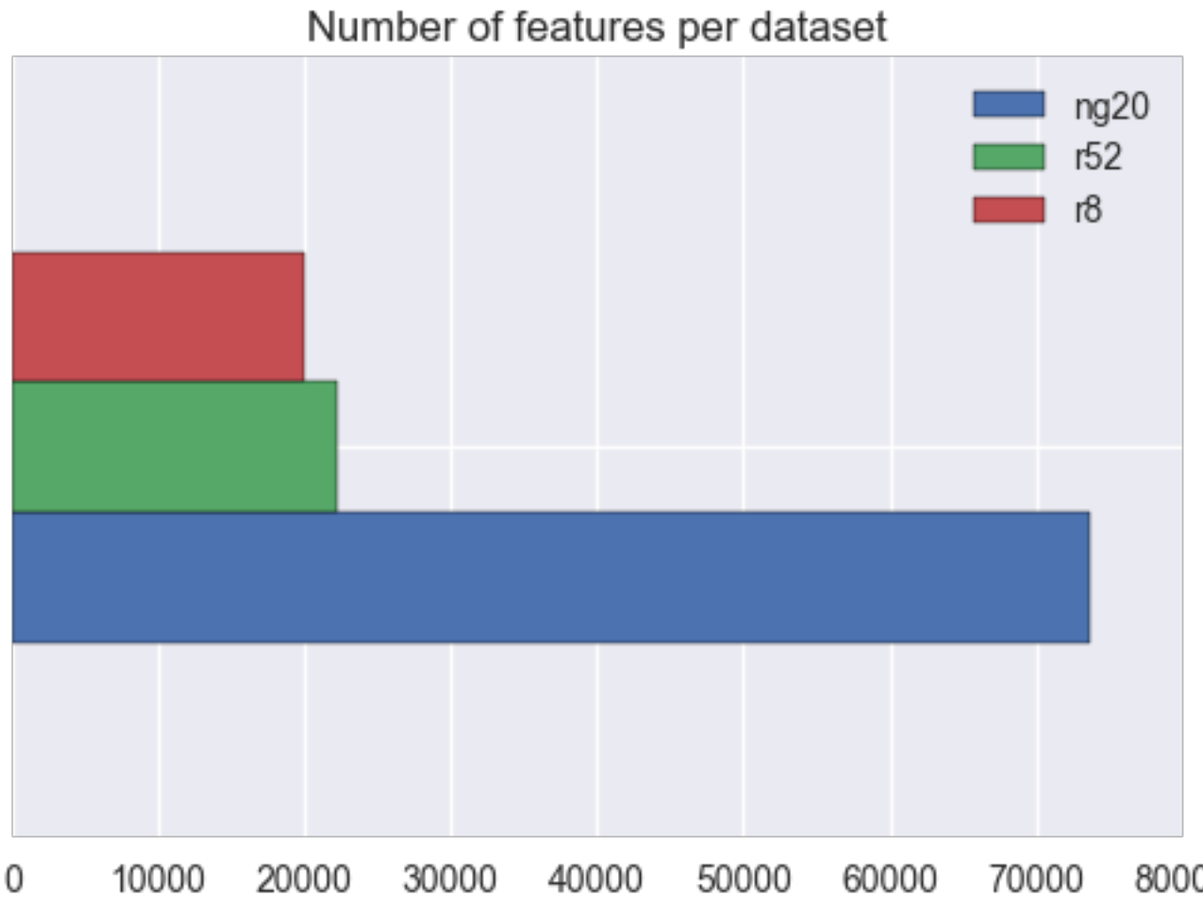


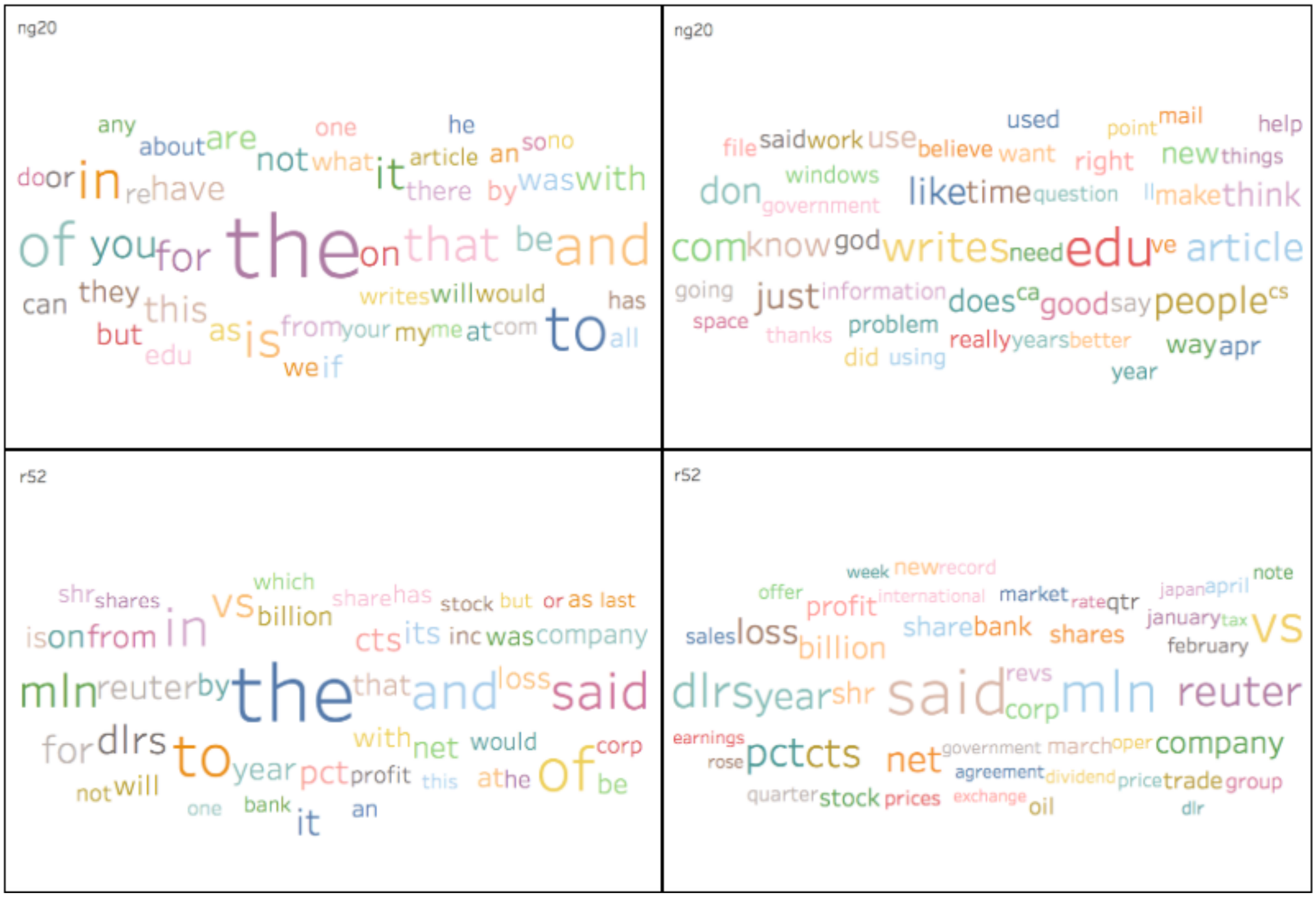



# Numbers of features



# Word clouds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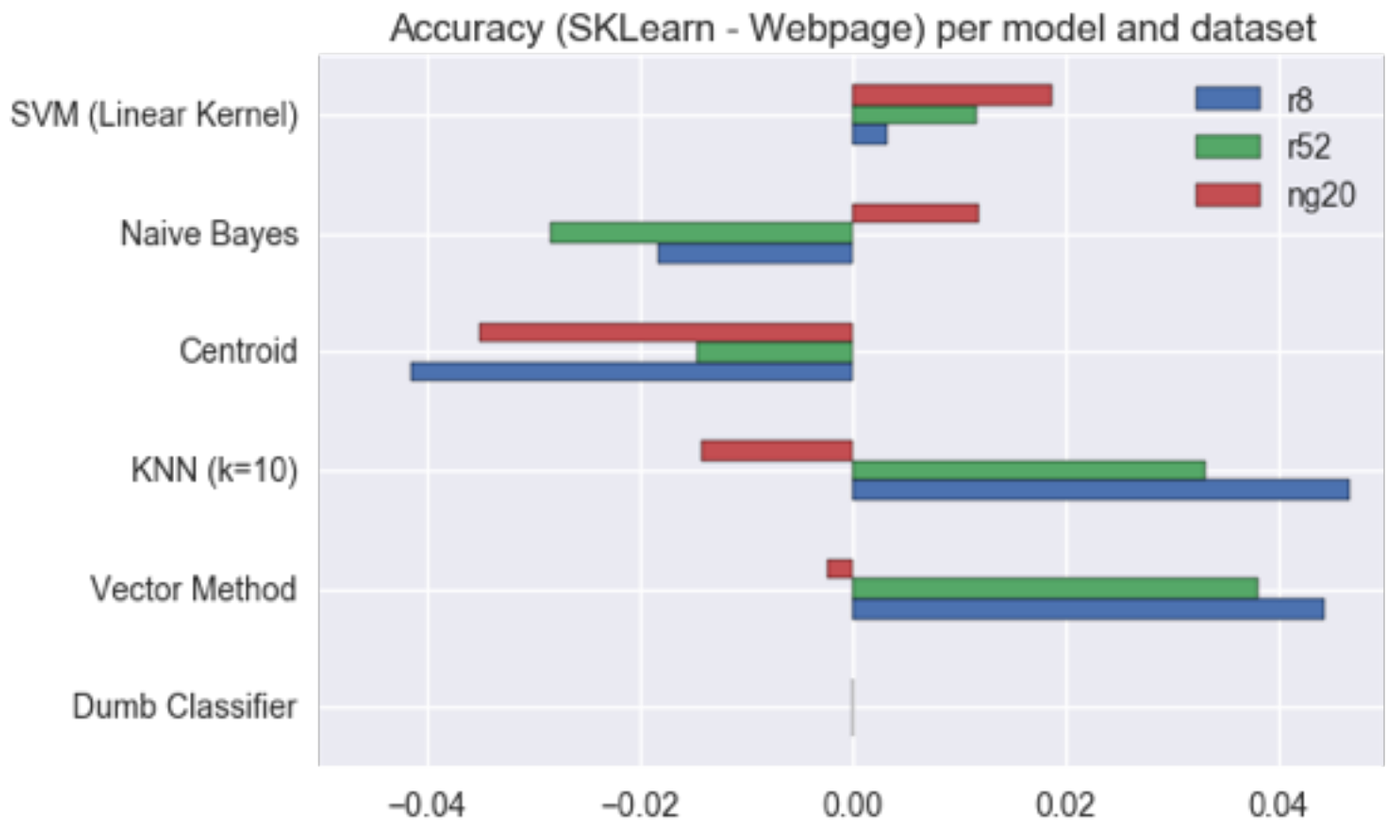
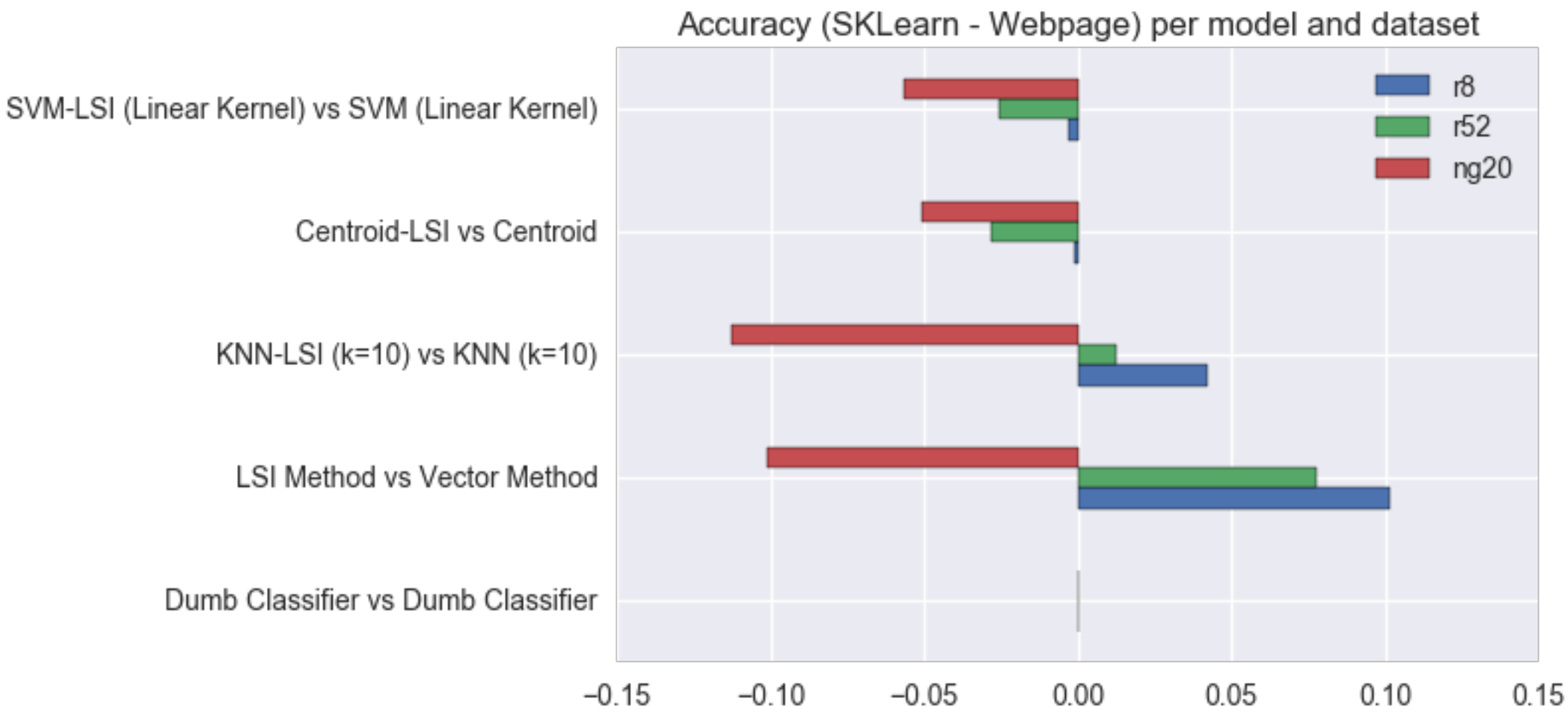
# Word clouds (cont.)

# Apply ML models
## (reproduce previous results)

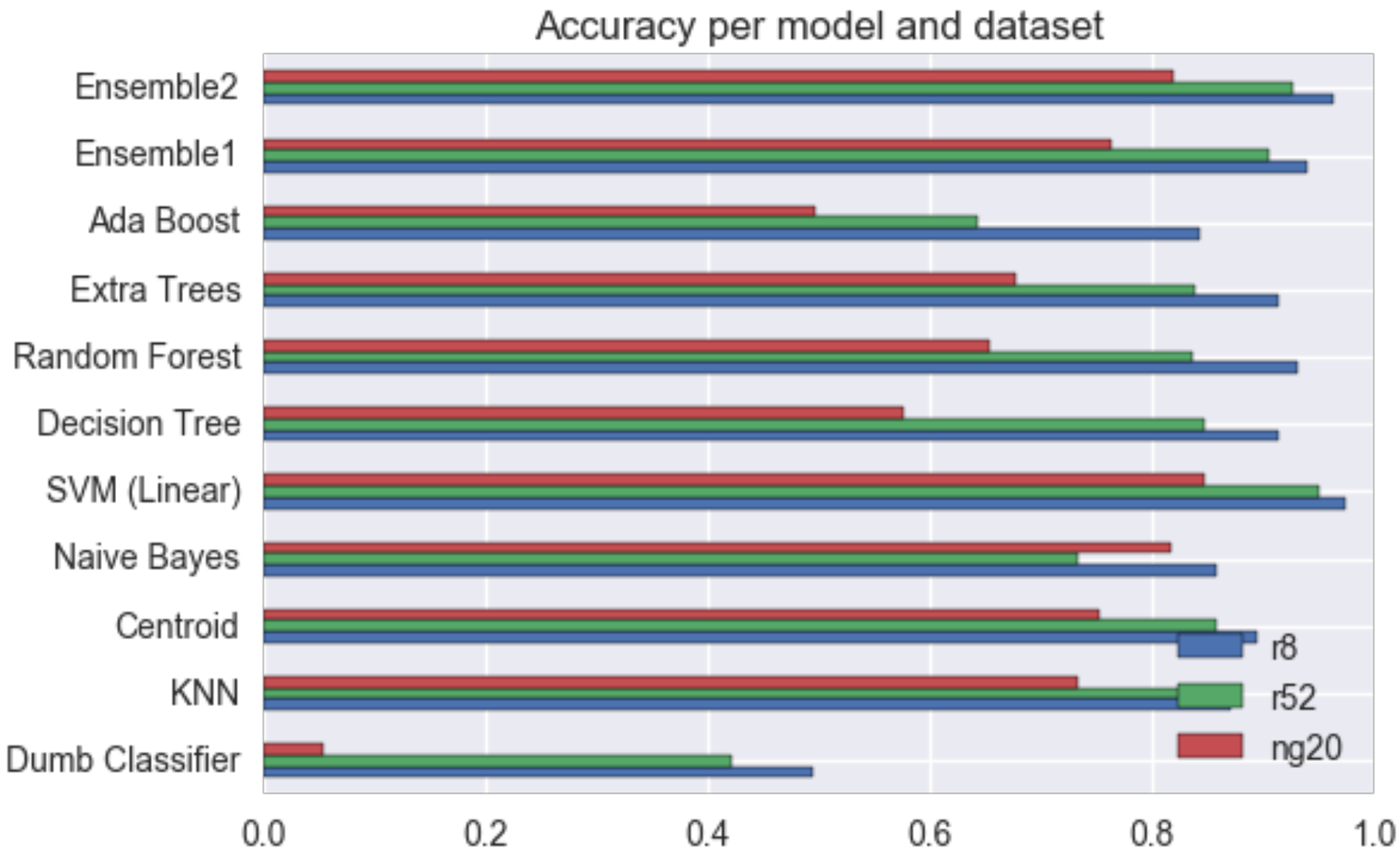
| Accuracy Values | | | | | |
|---|---|---|---|---|---|
| **Classification Method** | **R8** | **R52** | **20Ng** | **Cade12** | **WebKb** |
| Dumb classifier | 0.4947 | 0.4217 | 0.0530 | 0.2083 | 0.3897 |
| Vector Method | 0.7889 | 0.7687 | 0.7240 | 0.4142 | 0.6447 |
| kNN (k = 10) | 0.8524 | 0.8322 | 0.7593 | 0.5120 | 0.7256 |
| Centroid (Normalized Sum) | 0.9356 | 0.8717 | 0.7885 | 0.5148 | 0.8266 |
| Naive Bayes | 0.9607 | 0.8692 | 0.8103 | 0.5727 | 0.8352 |
| SVM (Linear Kernel) | 0.9698 | 0.9377 | 0.8284 | 0.5284 | 0.8582 |



# Apply ML models
## (use LSI/LSA/SVD to improve results)



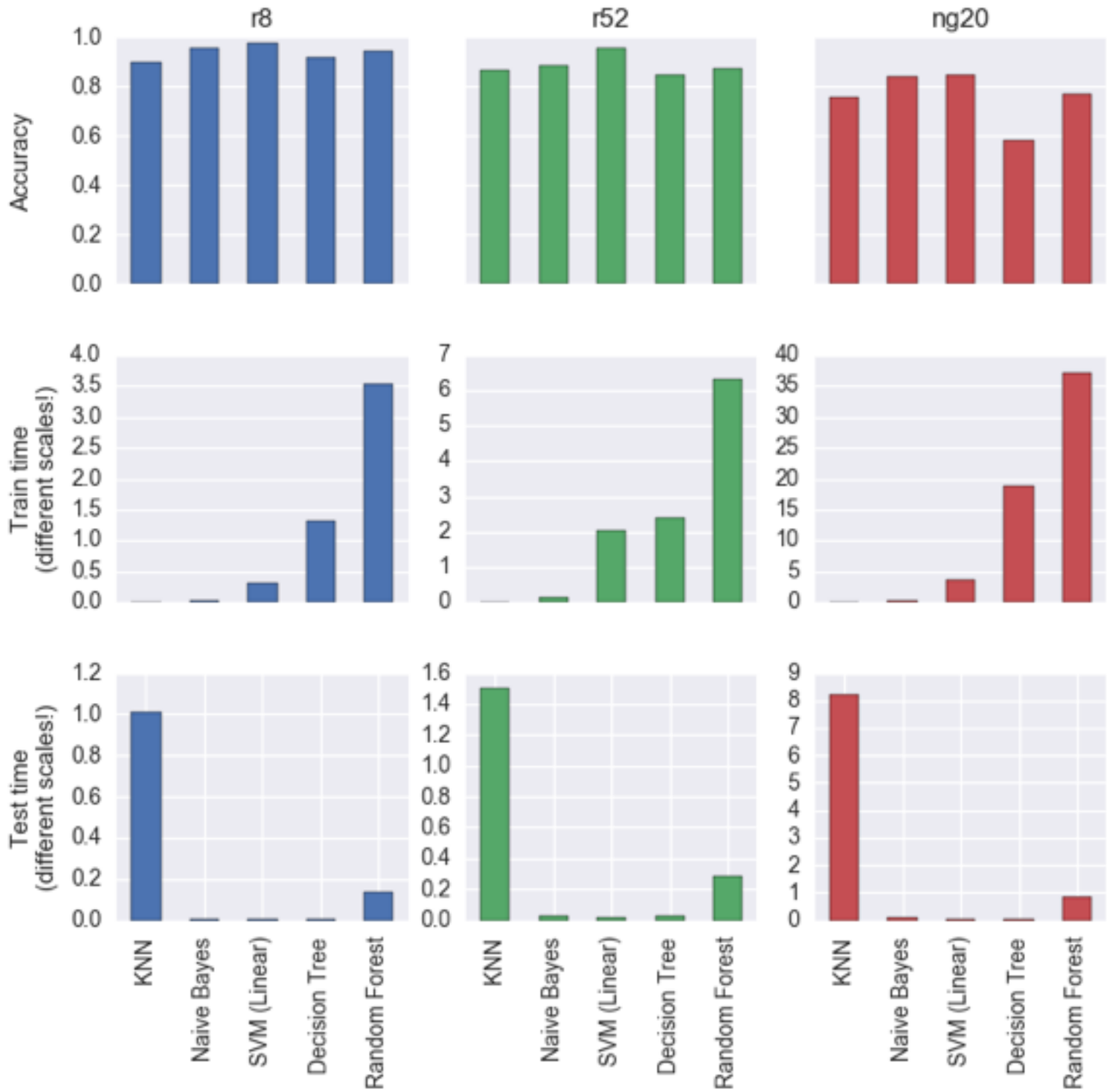
# Apply ML models
## (use more RT/Boost/Ensemble)



# Apply ML models
## (optimise parameters — GridSearchCV)

# Apply ML models

## (compare results and time)



# Summary

- **SVMs (still) rock!**
- Future work:
  - More ML models
  - More (and bigger) datasets
  - Different feature selection
  - Other success measures
  - AWS to parallelise tasks

# Thank you!

- Questions?