Understanding the Political Landscape in US

Data mining in Reddit posts

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Overview

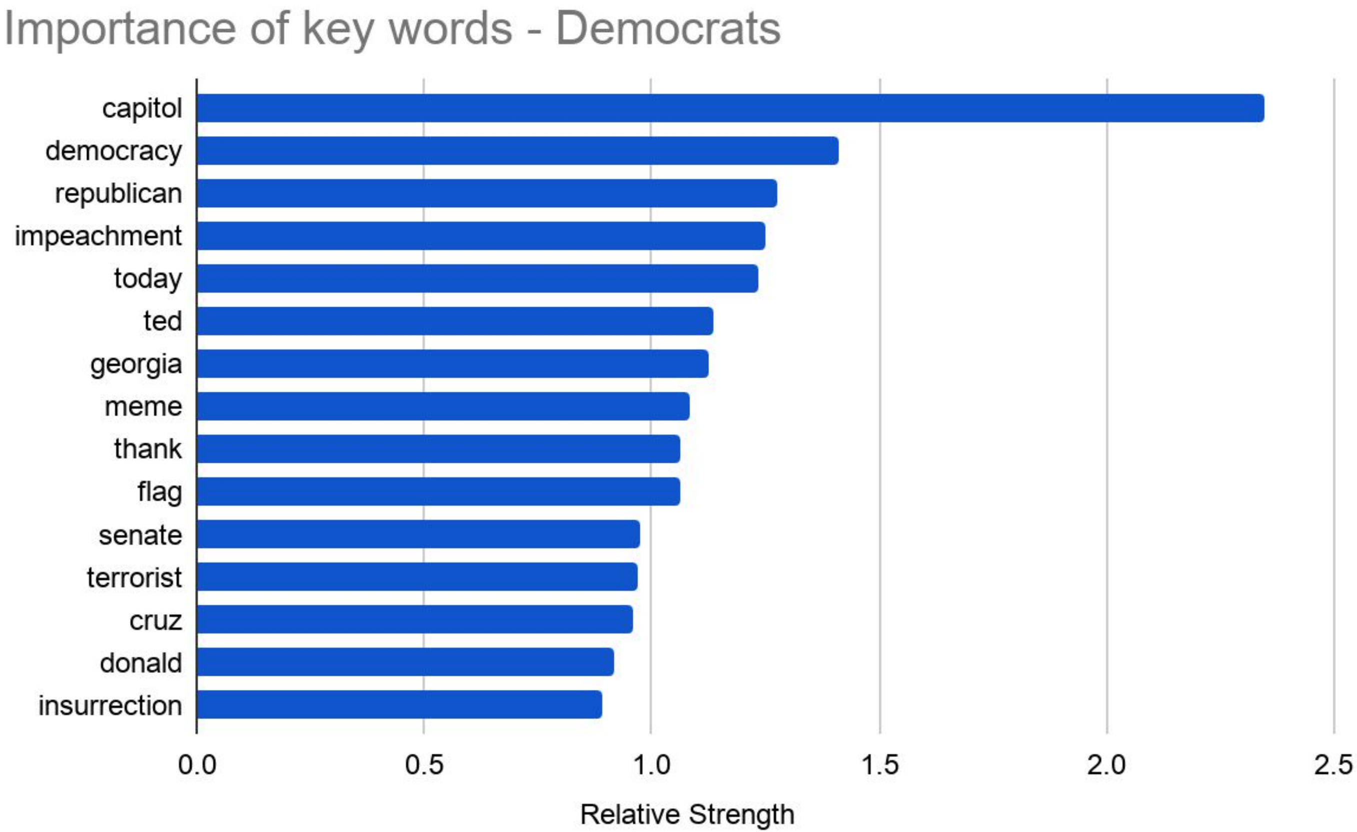
Given the popularity of social media, it is becoming a standard operating procedure for major political and business groups to extract insights of the public information.

In this project, we have performed a test to classify whether the posts are from the Conservatives or Democrats subreddits, using the Natural Language Processing (NPL) algorithms.

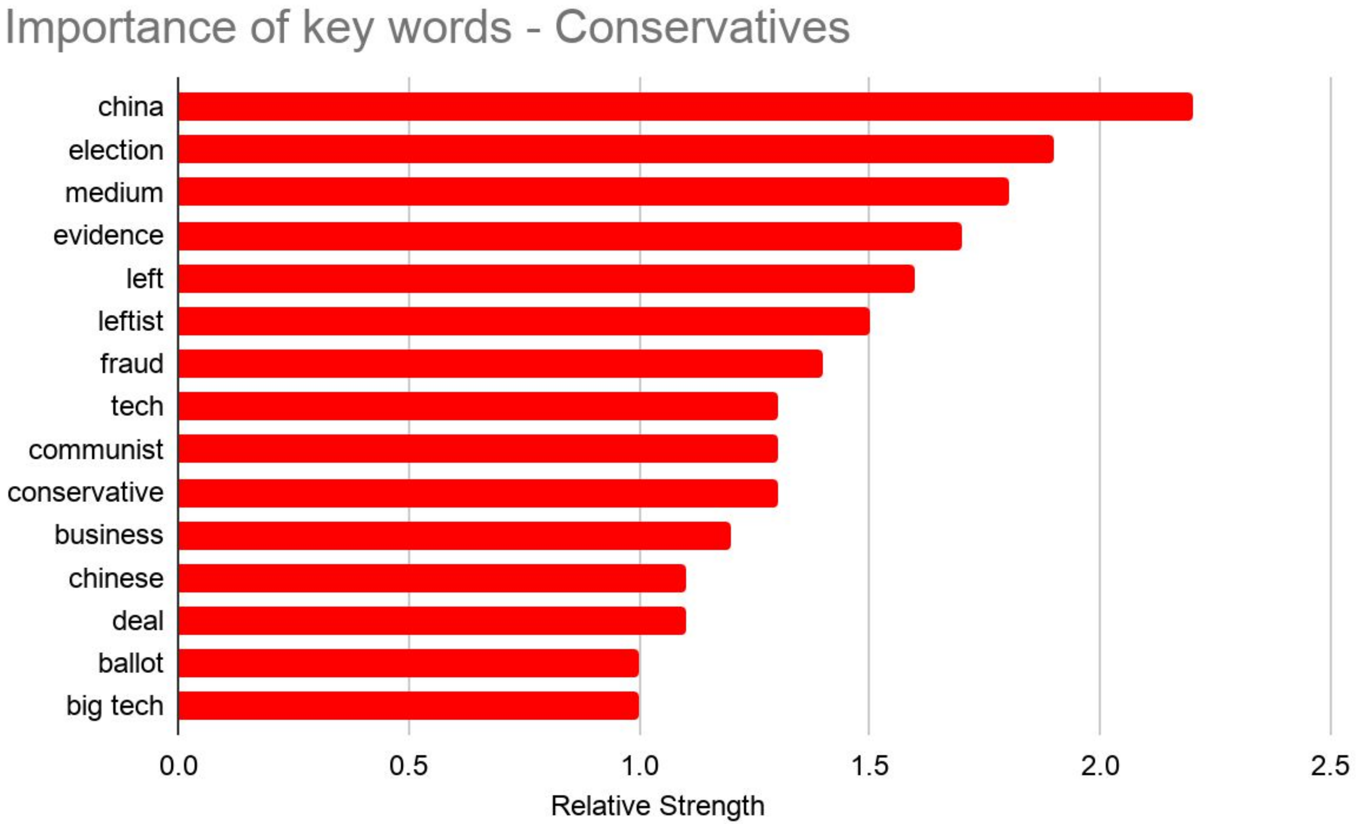
Out of a sample of ~2000 posts, we have built a classifier at an accuracy of 98%, versus a baseline accuracy of 66%.

Based on the weightings of key words in a model, some insights are derived as to what could be viewed as important issues. This will be useful in driving the marketing strategy of political and business groups.

Exploratory Data Analysis - Feature Importance

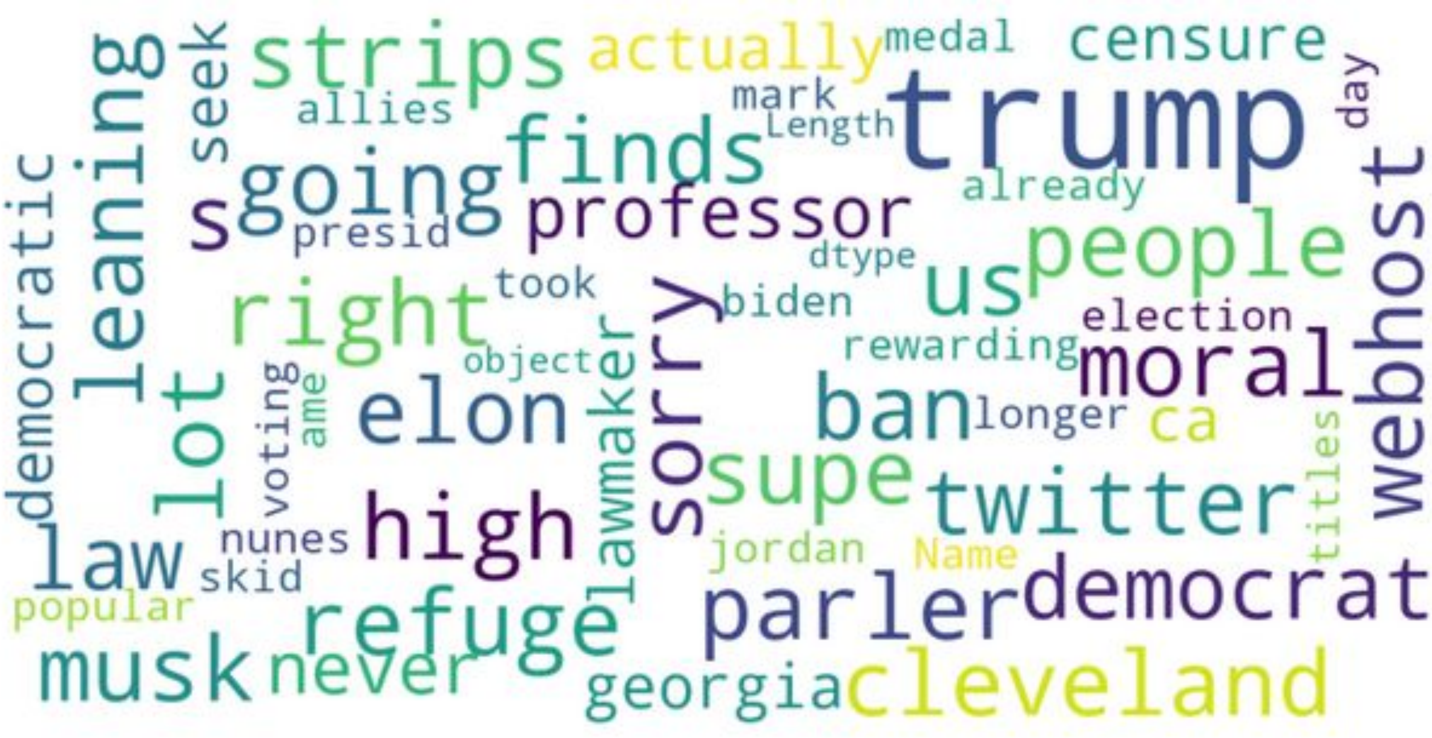


Exploratory Data Analysis - Feature Importance



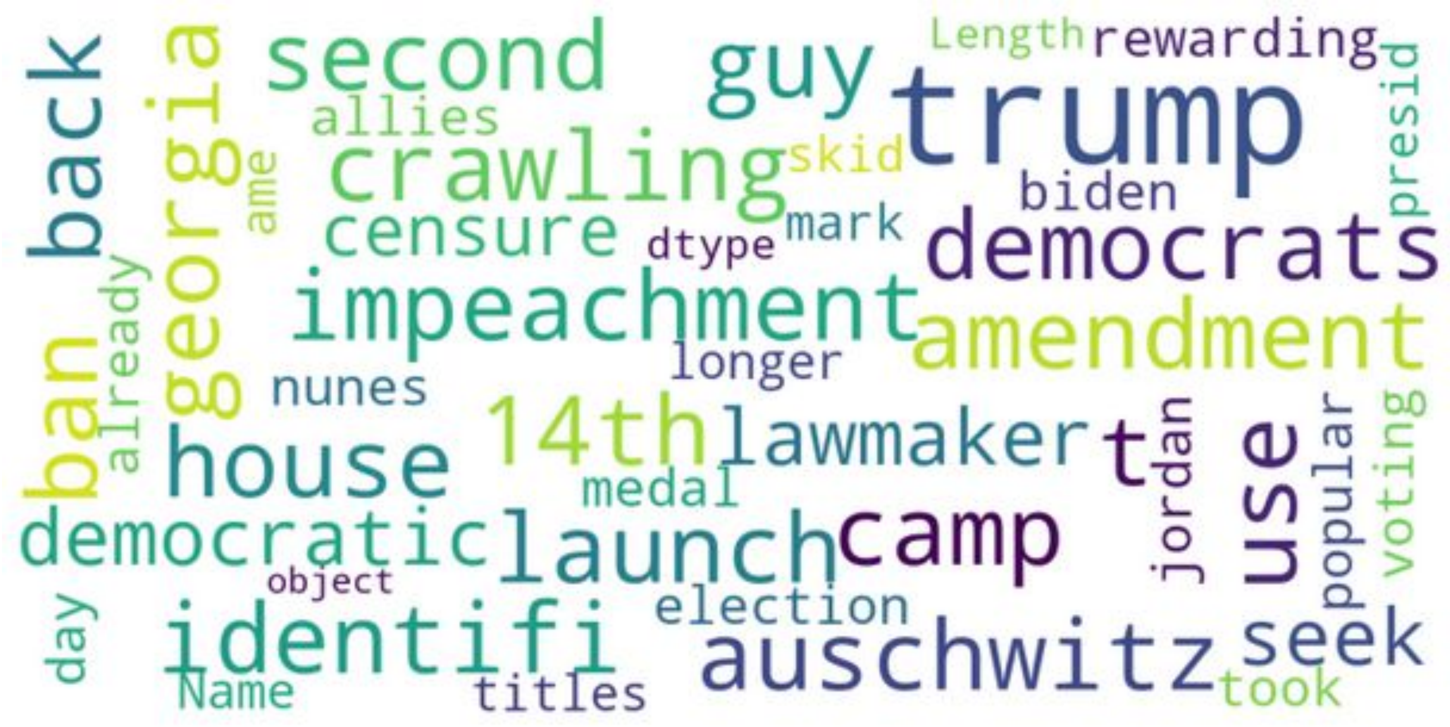
Exploratory Data Analysis - Word Cloud

Frequency of words used in titles of both ***r/Conservative*** and ***r/democrats***



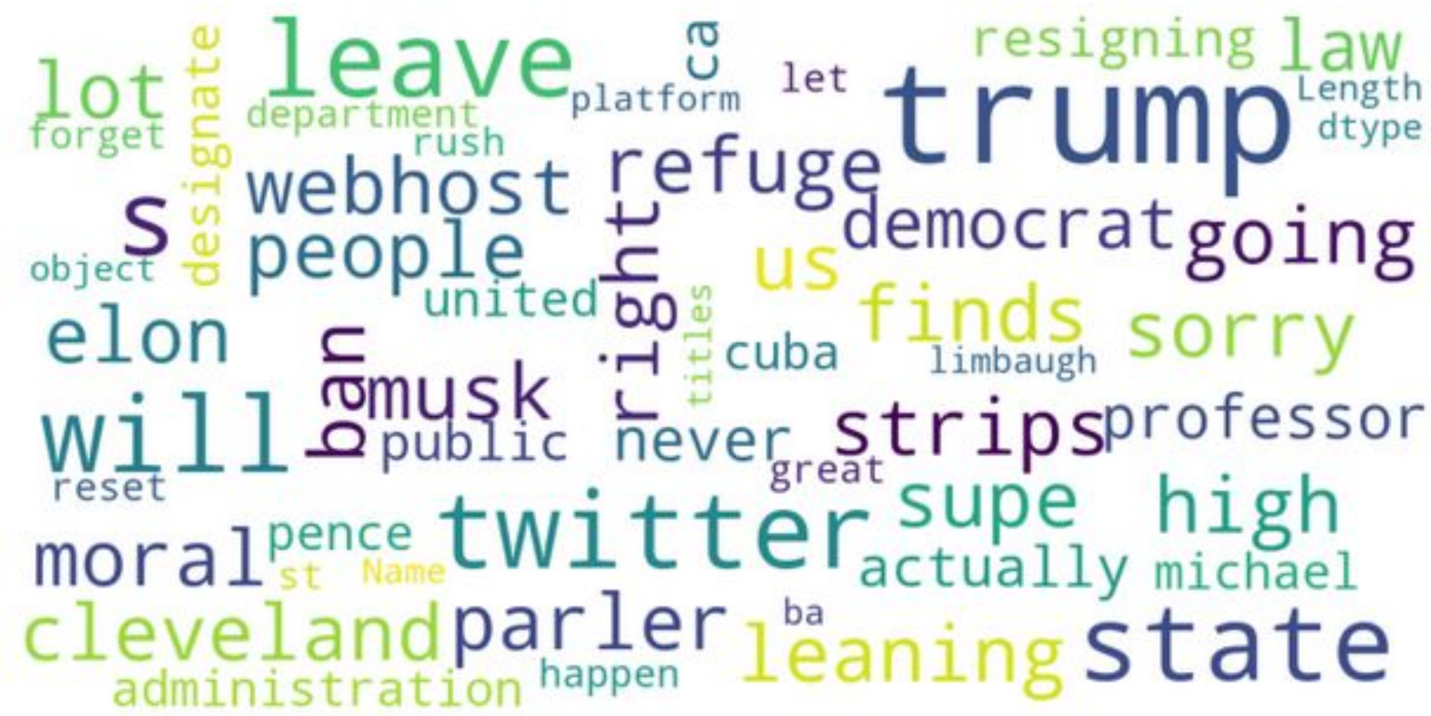
Democrats Camp

Frequency of words used in titles of ***r/democrats***

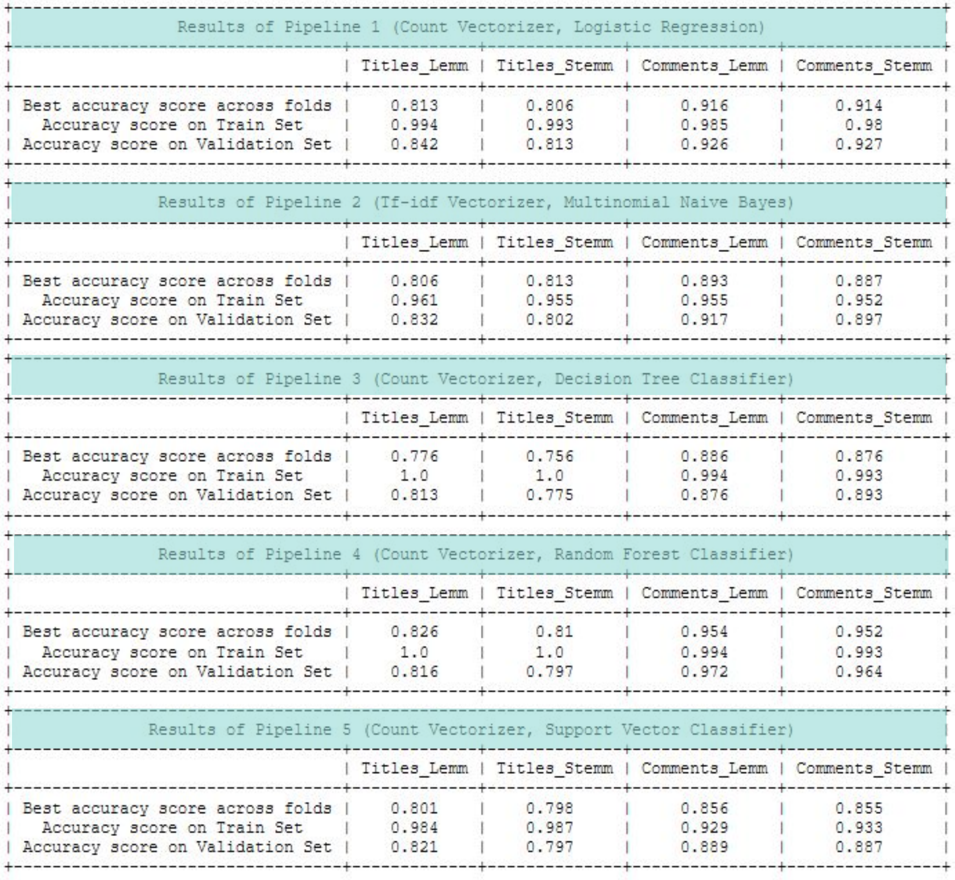


Conservatives Camp

Frequency of words used in titles of ***r/Conservative***



Model Analysis and Selection



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+-----------------------------------------------------------------------------------------------------+
|                  Results of Pipeline 1 (Count Vectorizer, Logistic Regression)                      |
+-----------------------------------+-------------+--------------+----------------+----------------+
|                                   | Titles_Lemm | Titles_Stemm | Comments_Lemm  | Comments_Stemm |
+-----------------------------------+-------------+--------------+----------------+----------------+
| Best accuracy score across folds  |    0.813    |    0.806     |     0.916      |     0.914      |
|   Accuracy score on Train Set     |    0.994    |    0.993     |     0.985      |      0.98      |
| Accuracy score on Validation Set  |    0.842    |    0.813     |     0.926      |     0.927      |
+-----------------------------------+-------------+--------------+----------------+----------------+
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|               Results of Pipeline 2 (Tf-idf Vectorizer, Multinomial Naive Bayes)                    |
+-----------------------------------+-------------+--------------+----------------+----------------+
|                                   | Titles_Lemm | Titles_Stemm | Comments_Lemm  | Comments_Stemm |
+-----------------------------------+-------------+--------------+----------------+----------------+
| Best accuracy score across folds  |    0.806    |    0.813     |     0.893      |     0.887      |
|   Accuracy score on Train Set     |    0.961    |    0.955     |     0.955      |     0.952      |
| Accuracy score on Validation Set  |    0.832    |    0.802     |     0.917      |     0.897      |
+-----------------------------------+-------------+--------------+----------------+----------------+
+-----------------------------------------------------------------------------------------------------+
|               Results of Pipeline 3 (Count Vectorizer, Decision Tree Classifier)                    |
+-----------------------------------+-------------+--------------+----------------+----------------+
|                                   | Titles_Lemm | Titles_Stemm | Comments_Lemm  | Comments_Stemm |
+-----------------------------------+-------------+--------------+----------------+----------------+
| Best accuracy score across folds  |    0.776    |    0.756     |     0.886      |     0.876      |
|   Accuracy score on Train Set     |     1.0     |     1.0      |     0.994      |     0.993      |
| Accuracy score on Validation Set  |    0.813    |    0.775     |     0.876      |     0.893      |
+-----------------------------------+-------------+--------------+----------------+----------------+
+-----------------------------------------------------------------------------------------------------+
|               Results of Pipeline 4 (Count Vectorizer, Random Forest Classifier)                    |
+-----------------------------------+-------------+--------------+----------------+----------------+
|                                   | Titles_Lemm | Titles_Stemm | Comments_Lemm  | Comments_Stemm |
+-----------------------------------+-------------+--------------+----------------+----------------+
| Best accuracy score across folds  |    0.826    |     0.81     |     0.954      |     0.952      |
|   Accuracy score on Train Set     |     1.0     |     1.0      |     0.994      |     0.993      |
| Accuracy score on Validation Set  |    0.816    |    0.797     |     0.972      |     0.964      |
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|             Results of Pipeline 5 (Count Vectorizer, Support Vector Classifier)                     |
+-----------------------------------+-------------+--------------+----------------+----------------+
|                                   | Titles_Lemm | Titles_Stemm | Comments_Lemm  | Comments_Stemm |
+-----------------------------------+-------------+--------------+----------------+----------------+
| Best accuracy score across folds  |    0.801    |    0.798     |     0.856      |     0.855      |
|   Accuracy score on Train Set     |    0.984    |    0.987     |     0.929      |     0.933      |
| Accuracy score on Validation Set  |    0.821    |    0.797     |     0.889      |     0.887      |
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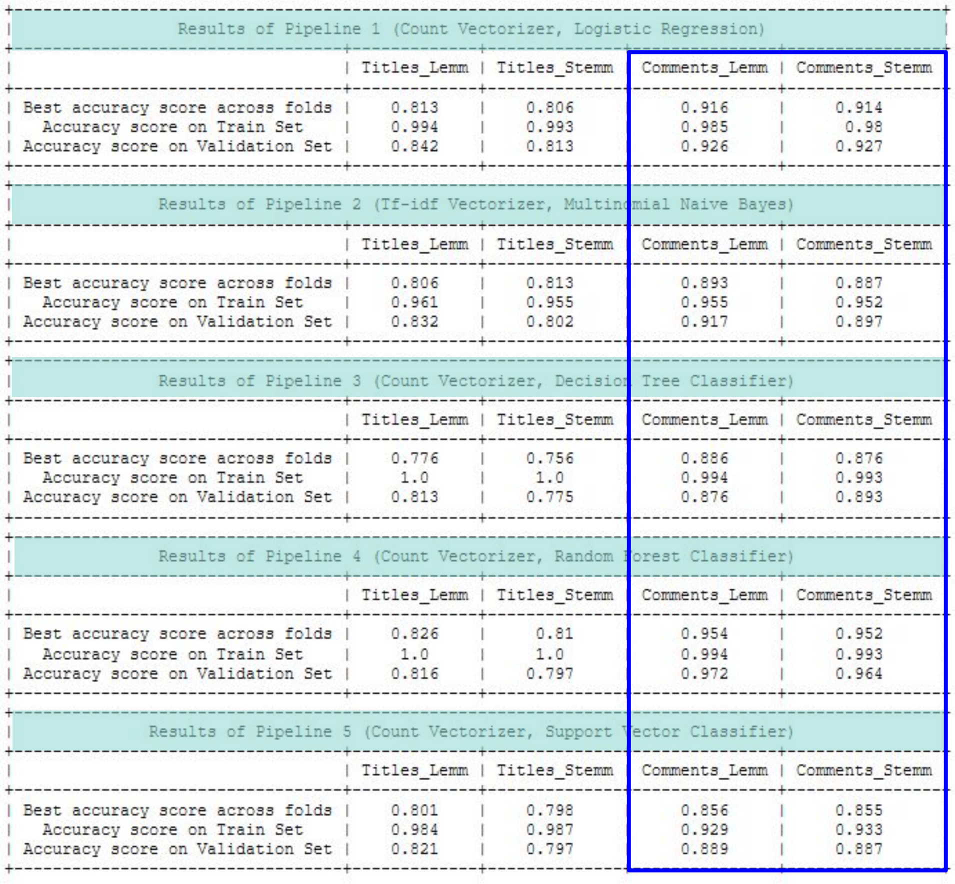
- 5 different classification algorithms considered :
  - Logistic Regression,
  - Multinomial Naive Bayes,
  - Decision Tree Classifier,
  - Random Forest Classifier, and
  - Support Vector Classifier

- Evaluation metric:
  - Accuracy score
  - No imbalanced classes
  - Objective of the project makes us impartial towards either class

- Baseline Model
  - Default parameters

Model Analysis and Selection



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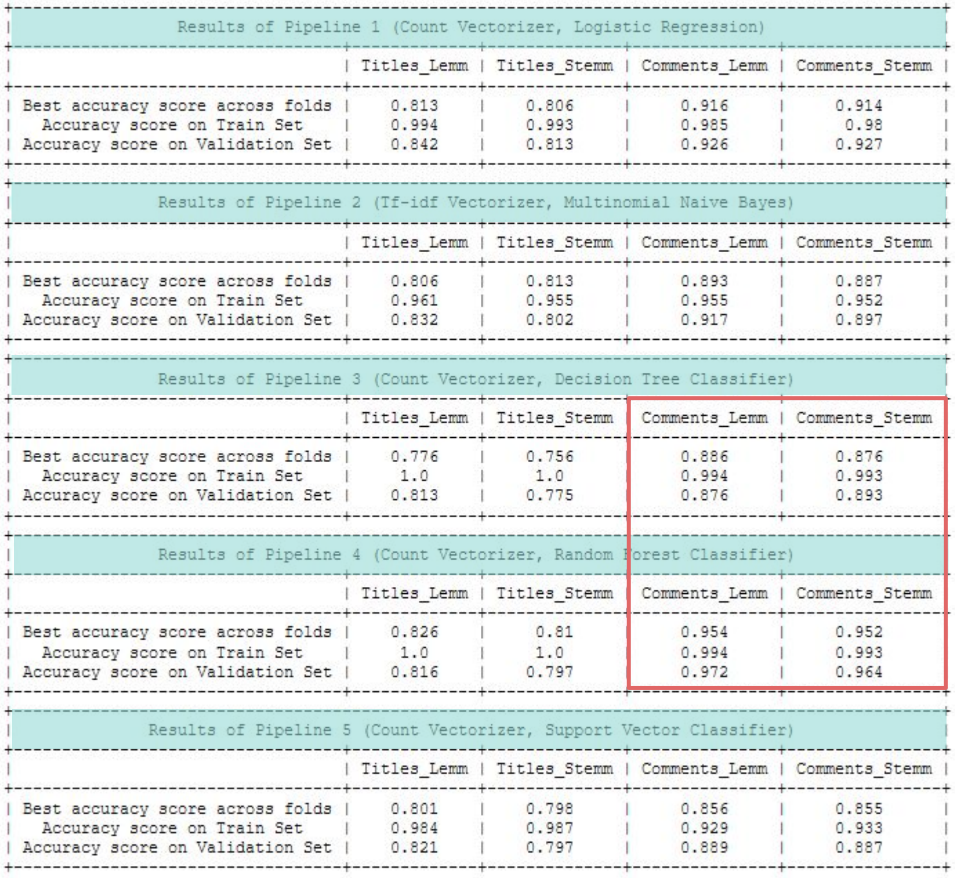
- Generally across all models, training the model on comments did better than titles
  - Much more words in comments than in titles
  - For a post, there is a title but there could be >1,000 comments in the comment thread

- Between stemming and lemmatizing the words, the models are mixed in their results
  - Impartial toward either
  - Move forward with stemmed comments

Model Analysis and Selection



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- Based on accuracy score on train set, Decision Tree Classifier and Random Forest Classifier did the best

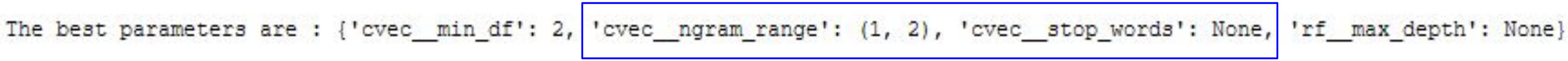
- Compared with score on validation set, the Random Forest Classifier generalized better on unseen data.

Selected Model:

Random Forest Classifier

Model Evaluation

- Performed a grid search to find best parameters



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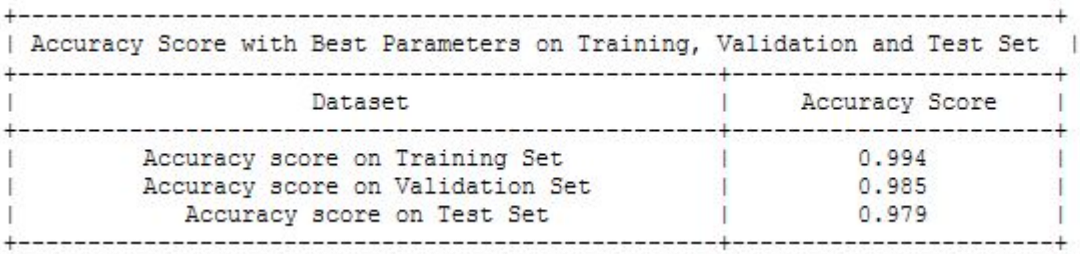
The best parameters are : {'cvec__min_df': 2, 'cvec__ngram_range': (1, 2), 'cvec__stop_words': None, 'rf__max_depth': None}
```

- Removing stop words did not improve the model, likely because stop words help with the context of content in each subreddit
- Unigrams and bigrams perform better than using just unigrams for a similar reason



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+--------------------------------------------------------------------------+
| Accuracy Score with Best Parameters on Training, Validation and Test Set |
+--------------------------------------------------+-----------------------+
|                     Dataset                      |    Accuracy Score     |
+--------------------------------------------------+-----------------------+
|          Accuracy score on Training Set          |         0.994         |
|         Accuracy score on Validation Set         |         0.985         |
|            Accuracy score on Test Set            |         0.979         |
+--------------------------------------------------+-----------------------+
```
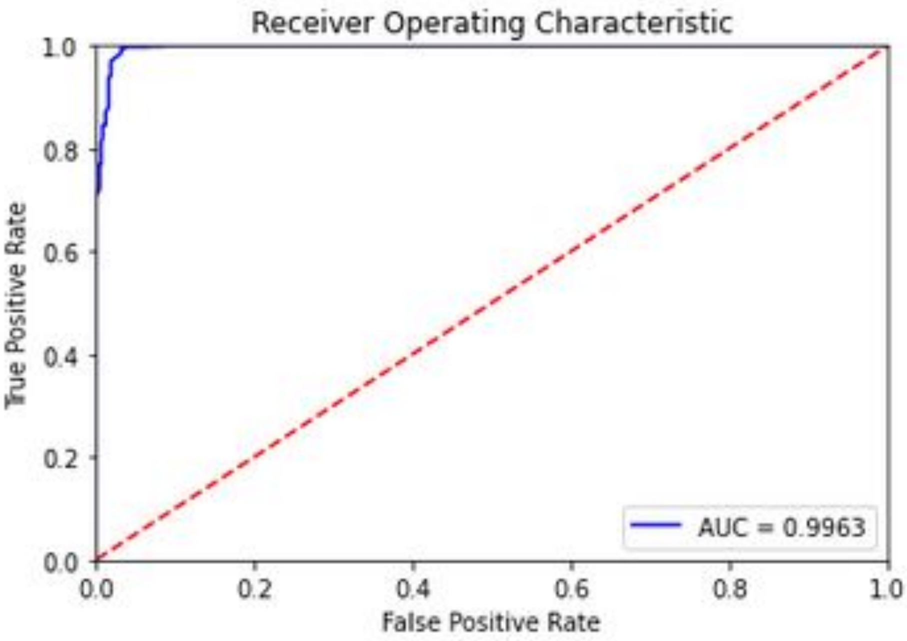

- Performed better than the baseline model
- Model is able to account for **97.9%** of variability of data

Model Evaluation

ROC-AUC curve



- Represents degree or measure of separability
- With a relatively high performing model, an AUC close to 1 is expected

Conclusion

- Production model did very well to classify a post into ***r/Conservative*** and ***r/democrats***.
- For the same topic, content that is discussed in each subreddit goes in very different directions (ie. redditors use very distinct words for each subreddit)
- From wordcloud and feature importance, it is clear that there are no common repeats (except “trump”) between both subreddits.
- The weightings of model coefficients were ranked and the more "influential" key words were examined. Comparing this list with the most common key words in the corpus, it was confirmed that the most popular words in the corpus may not be the most effectively in classification, ie the model was able to extract important key words from each class.

Thank You

Questions