THE VOICE OF REASON SINCE THE BEGINNING

CSYE 7200 - COURSE PROJECT Team - 5

FAKE NEWS

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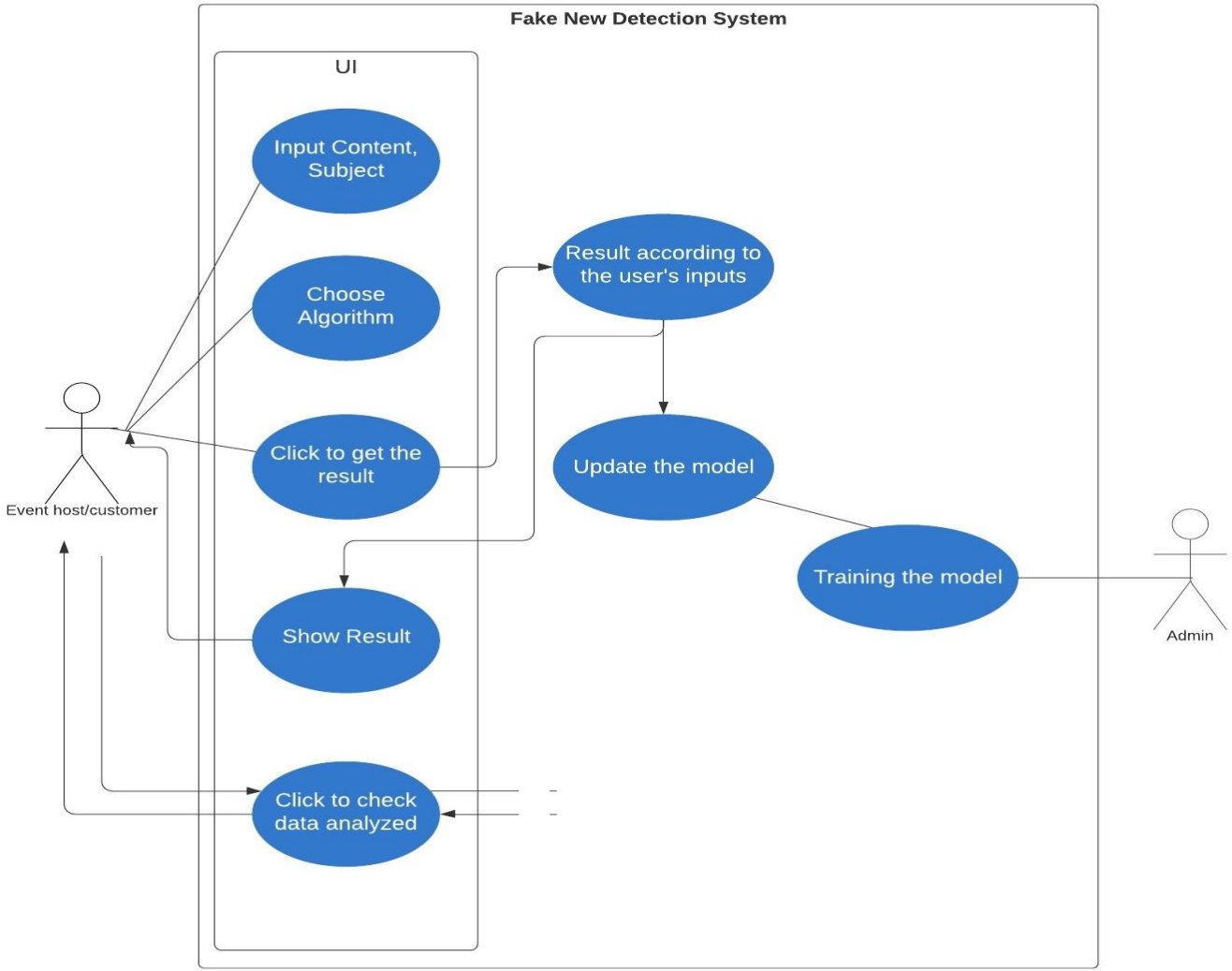
Use Case


Fake New Detection System
UI
Input Content, Subject
Choose Algorithm
Click to get the result
Show Result
Click to check data analyzed
Result according to the user's inputs
Update the model
Training the model
Event host/customer
Admin

Project Goals

- A Interactive page to accept the user input
- A well trained model to analyze the characteristics
- A higher probability output of the data provided

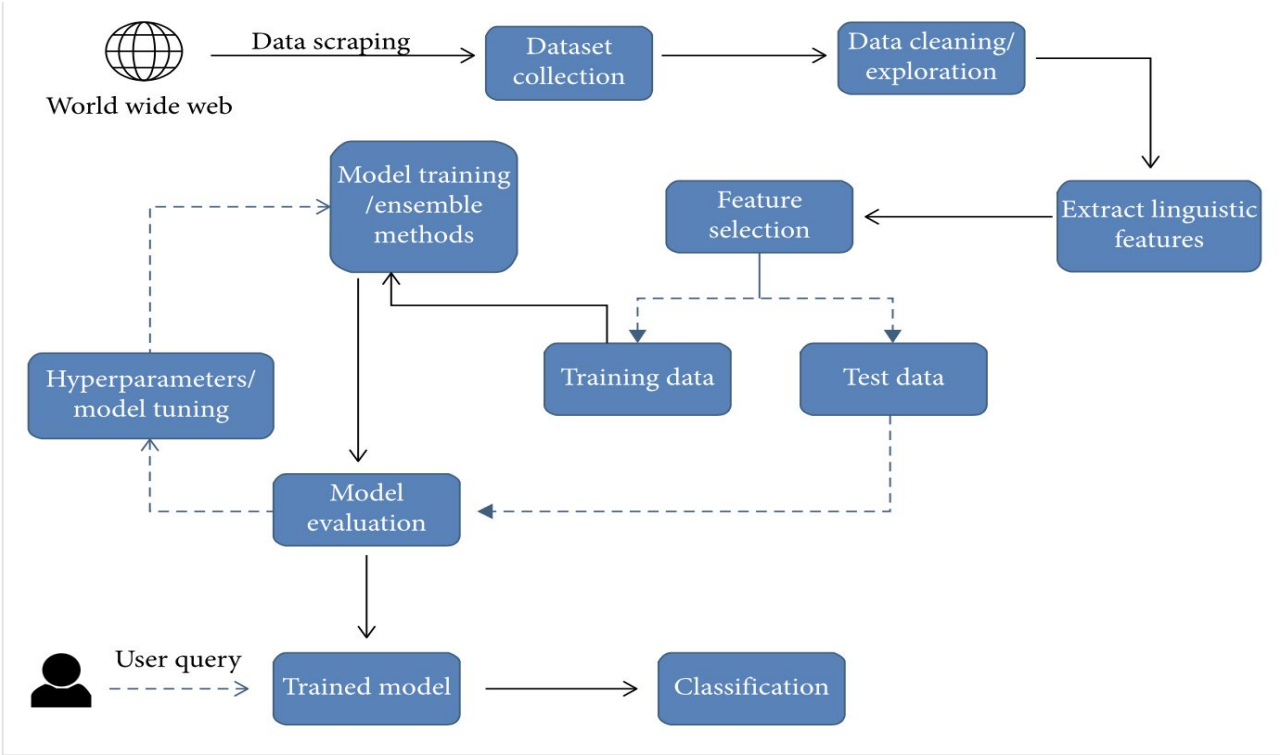
UI Design


Fake News Detector
News
None
Random Forest
Scan


Random Forest
Random Forest
Naive Bayes


None
US News
World News
Politics
Government News
Middle East
None

Methodology



Data Source

- Data ~ 44898 rows

```
+--------------------+--------------------+------------+------------------+------+
|               title|                text|     subject|              date|target|
+--------------------+--------------------+------------+------------------+------+
|As U.S. budget fi...|WASHINGTON (Reute...|politicsNews|December 31, 2017 |     0|
|U.S. military to ...|WASHINGTON (Reute...|politicsNews|December 29, 2017 |     0|
|Senior U.S. Repub...|WASHINGTON (Reute...|politicsNews|December 31, 2017 |     0|
|FBI Russia probe ...|WASHINGTON (Reute...|politicsNews|December 30, 2017 |     0|
|Trump wants Posta...|SEATTLE/WASHINGTO...|politicsNews|December 29, 2017 |     0|
|White House, Cong...|WEST PALM BEACH, ...|politicsNews|December 29, 2017 |     0|
|Trump says Russia...|WEST PALM BEACH, ...|politicsNews|December 29, 2017 |     0|
|Factbox: Trump on...|The following sta...|politicsNews|December 29, 2017 |     0|
|Trump on Twitter ...|The following sta...|politicsNews|December 29, 2017 |     0|
|Alabama official ...|WASHINGTON (Reute...|politicsNews|December 28, 2017 |     0|
+--------------------+--------------------+------------+------------------+------+
only showing top 10 rows
```

TF IDF

-extract features and find keywords

- TF(t,d) - number of times a term t appears in document d
- DF(t,D) - number of documents d that contains term t
- |D| is the total number of documents in the corpus

$$idf(t) = \log(N/(df + 1))$$

$$tf\text{-}idf(t, d) = tf(t, d) * \log(N/(df + 1))$$

Natural Language Processing

- Extract tokens from title
- Remove stop words from title
- Compute Term frequency from title
- Compute Term frequency-inverse document frequency from title
- Extract tokens from text
- Remove stop words from text
- Compute Term frequency from text
- Compute Term frequency-inverse document frequency text
- StringIndexer subject

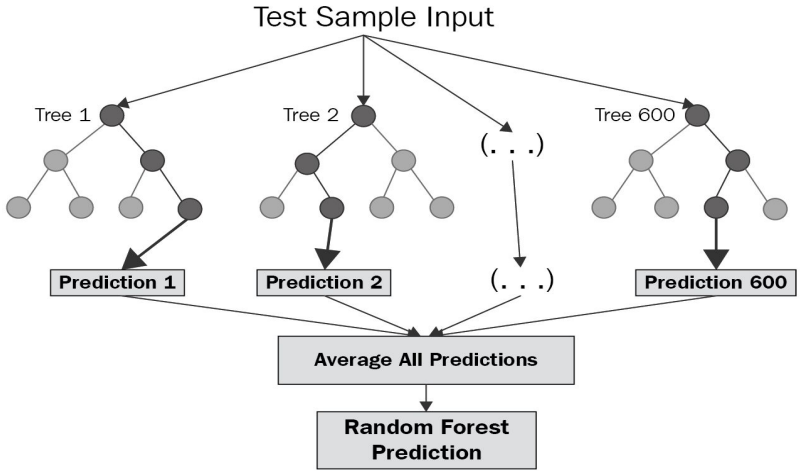
Natural Language Processing

text_words	text_sw_removed	tokens	text_ct_vectorized	text_tfidf	title_words	title_sw_removed	title_ct_vectorized	title_tfidf
[cleveland, reute...	[cleveland, reute...	9	(3,[0,1,2],[23.0,...	(3,[0,1,2],[16.27...	[make, republican...	[make, republican...	(3,[0],[1.0])	(3,[0],[1.1398993...
[berlin, reuters,...	[berlin, reuters,...	9	(3,[1],[4.0])	(3,[1],[1.2510729...	[a, long, way, to...	[long, way, go, g...	(3,[],[])	(3,[],[])
[yangon, reuters,...	[yangon, reuters,...	6	(3,[1,2],[18.0,1.0])	(3,[1,2],[5.62982...	[and, then, they,...	[exploded, rohing...	(3,[],[])	(3,[],[])
[reuters, u, s, s...	[reuters, u, sena...	8	(3,[1],[9.0])	(3,[1],[2.8149141...	[ashamed, franken...	[ashamed, franken...	(3,[],[])	(3,[],[])
[washington, reut...	[washington, reut...	8	(3,[0,1,2],[9.0,5...	(3,[0,1,2],[6.368...	[bobby, three, st...	[bobby, three, st...	(3,[0],[1.0])	(3,[0],[1.1398993...
[new, york, reute...	[new, york, reute...	7	(3,[1],[2.0])	(3,[1],[0.6255364...	[bridgegate, name...	[bridgegate, name...	(3,[2],[1.0])	(3,[2],[2.1787106...
[newark, n, j, re...	[newark, n, j, re...	8	(3,[0,1],[1.0,6.0])	(3,[0,1],[0.70766...	[bridgegate, witn...	[bridgegate, witn...	(3,[],[])	(3,[],[])
[manila, reuters,...	[manila, reuters,...	9	(3,[1],[7.0])	(3,[1],[2.1893776...	[can, i, get, it,...	[get, go, canada,...	(3,[],[])	(3,[],[])
[geneva, reuters,...	[geneva, reuters,...	9	(3,[1],[9.0])	(3,[1],[2.8149141...	[consistent, patt...	[consistent, patt...	(3,[2],[1.0])	(3,[2],[2.1787106...
[near, ramallah, ...	[near, ramallah, ...	7	(3,[0,1,2],[1.0,2...	(3,[0,1,2],[0.707...	[day, of, rage, a...	[day, rage, knife...	(3,[],[])	(3,[],[])
[brussels, reuter...	[brussels, reuter...	6	(3,[1],[7.0])	(3,[1],[2.1893776...	[deadline, of, de...	[deadline, deadli...	(3,[],[])	(3,[],[])
[brussels, reuter...	[brussels, reuter...	8	(3,[1,2],[8.0,1.0])	(3,[1,2],[2.50214...	[despondent, may,...	[despondent, may,...	(3,[],[])	(3,[],[])
[new, york, reute...	[new, york, reute...	5	(3,[0,1],[3.0,7.0])	(3,[0,1],[2.12298...	[economikes, the,...	[economikes, gate...	(3,[],[])	(3,[],[])
[boston, new, yor...	[boston, new, yor...	7	(3,[0,1,2],[6.0,6...	(3,[0,1,2],[4.245...	[fist, bumps, at,...	[fist, bumps, hed...	(3,[0],[1.0])	(3,[0],[1.1398993...
[united, nations,...	[united, nations,...	7	(3,[1],[3.0])	(3,[1],[0.9383047...	[fix, it, or, nix...	[fix, nix, netany...	(3,[],[])	(3,[],[])
[bordeaux, france...	[bordeaux, france...	7	(3,[0,1,2],[4.0,5...	(3,[0,1,2],[2.830...	[france, is, not,...	[france, u, presi...	(3,[2],[1.0])	(3,[2],[2.1787106...
[brussels, reuter...	[brussels, reuter...	8	(3,[0,1,2],[6.0,9...	(3,[0,1,2],[4.245...	[fully, committed...	[fully, committed...	(3,[2],[1.0])	(3,[2],[2.1787106...
[geneva, reuters,...	[geneva, reuters,...	8	(3,[1],[3.0])	(3,[1],[0.9383047...	[glimmer, of, hop...	[glimmer, hope, f...	(3,[],[])	(3,[],[])
[jerusalem, guate...	[jerusalem, guate...	9	(3,[0,1,2],[3.0,5...	(3,[0,1,2],[2.122...	[god, bless, you,...	[god, bless, neta...	(3,[],[])	(3,[],[])
[washington, reut...	[washington, reut...	12	(3,[0,1,2],[7.0,4...	(3,[0,1,2],[4.953...	[good, to, go, to...	[good, go, top, t...	(3,[0],[1.0])	(3,[0],[1.1398993...

Random Forest Classifier

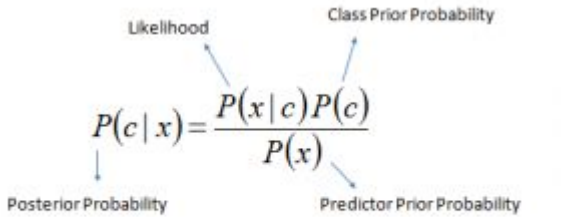
- builds multiple decision trees and merges them together to get a more accurate and stable prediction

- Given a input training dataset X = x1... xn with response Y = y1...yn, we select a random sample with replacement from the training dataset and fit the tree



Naive Bayes Classifier

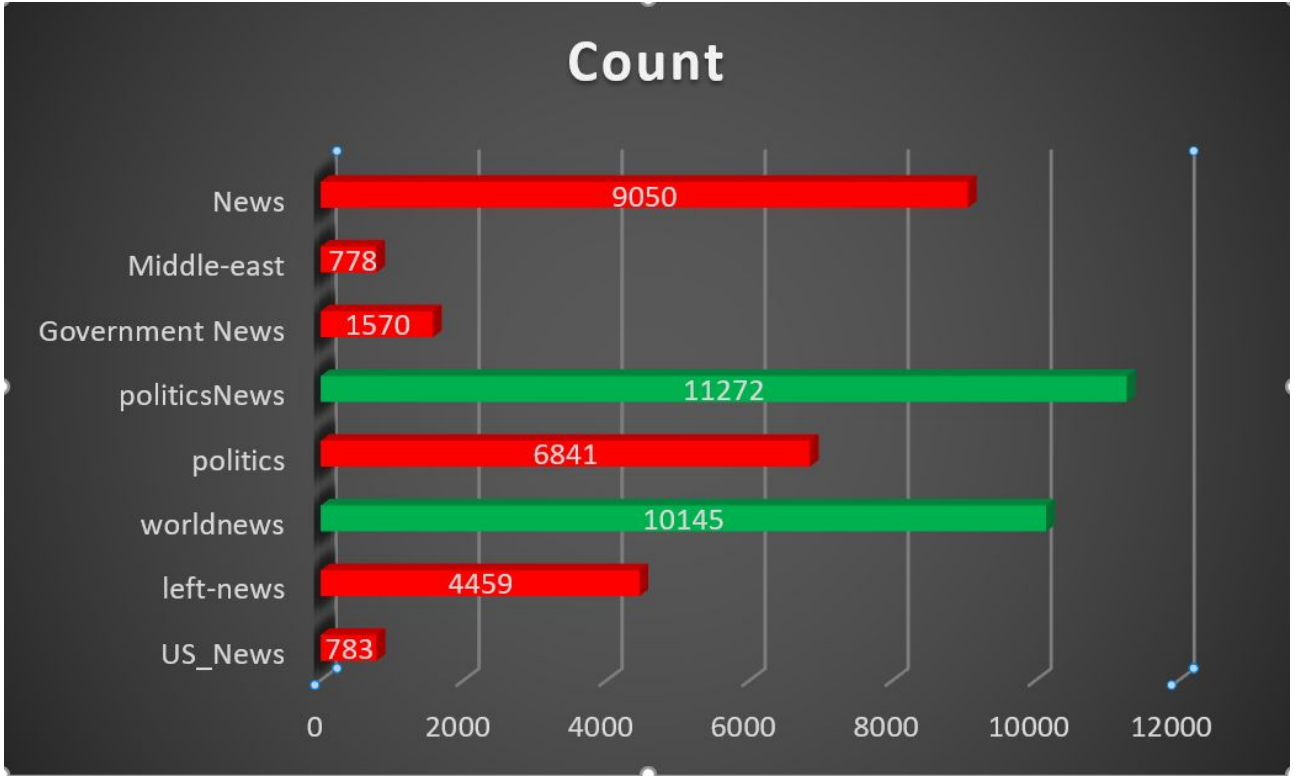
- We convert the input data into frequency table as from the TFIDF class
- Generate the Likelihood table by finding the probabilities.
- use Naive Bayesian equation to calculate the posterior probability for each class. The class with the highest posterior probability is the outcome of prediction.



$$P(c \mid \mathrm{X}) = P(x_1 \mid c) \times P(x_2 \mid c) \times \cdots \times P(x_n \mid c) \times P(c)$$

Visualization

subject	count
US_News	783
left-news	4459
worldnews	10145
politics	6841
politicsNews	11272
Government News	1570
Middle-east	778
News	9050



Model Performance

```
Random Forest test set with title and subject accuracy = 1.0
```

```
Naive Bayes test set with title and subject accuracy = 0.8906587272050615
```

```
Random Forest test set with title  accuracy = 0.8356959734580003
```

```
Naive Bayes test set with title accuracy = 0.7930031329255557
```

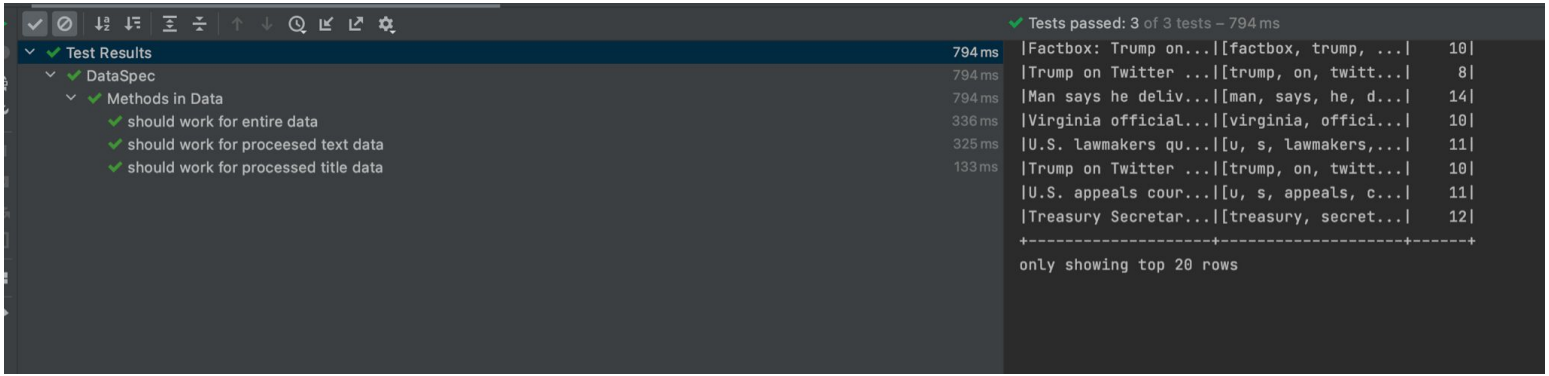
```
Random Forest test set Accuracy = 0.7827976324267626
```

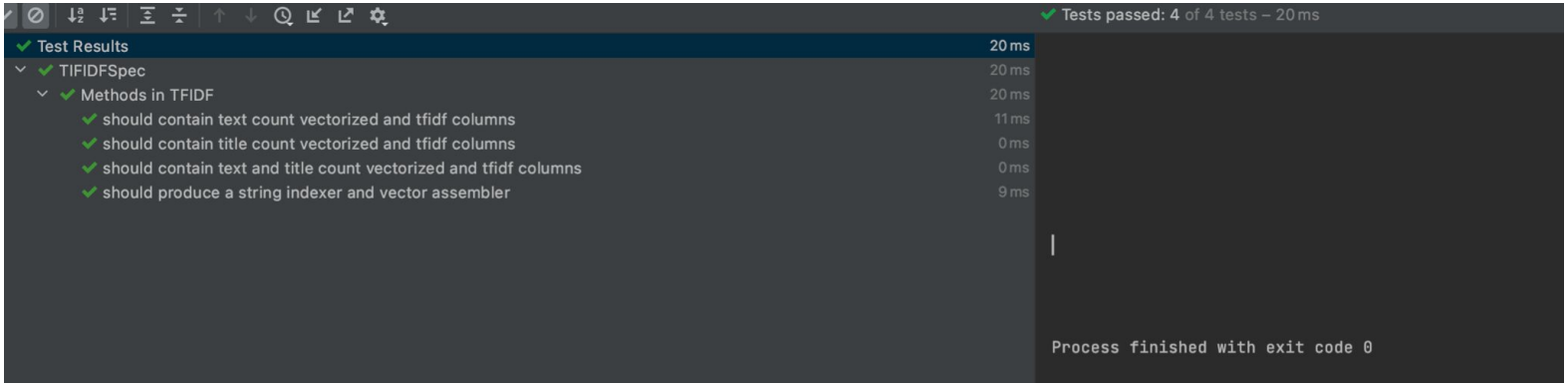
```
Naive Bayes test set accuracy = 0.7273339821816276
```

```
Model Prediction Time - 113ms
+--------------------+--------------------+-------+----+------+--------------------+--------------------+------+--------------------+--------------------+--------------------+--------------------+------------
|               title|                text|subject|date|target|          text_words|     text_sw_removed|tokens|  text_ct_vectorized|          text_tfidf|         title_words|    title_sw_removed|title_ct_vec
+--------------------+--------------------+-------+----+------+--------------------+--------------------+------+--------------------+--------------------+--------------------+--------------------+------------
|fight looms, Repu...|On Christmas day,...|       |user|  null|[on, christmas, d...|[christmas, day, ...|     4|(3,[0,2],[10.0,1.0])|(3,[0,2],[0.0,0.1...|[fight, looms, re...|[fight, looms, re...|(3,[1,2],[1.(
+--------------------+--------------------+-------+----+------+--------------------+--------------------+------+--------------------+--------------------+--------------------+--------------------+------------


+--------------------------------------------------------------------------------------------+
|value                                                                                       |
+--------------------------------------------------------------------------------------------+
|{"prediction":1.0,"probability":{"type":1,"values":[0.47724739200392907,0.5227526079960709]}}|
+--------------------------------------------------------------------------------------------+


Process finished with exit code 0
```

Externally added files can be added to Git

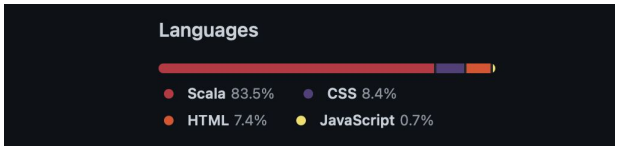
Unit Testing





Acceptance Criteria

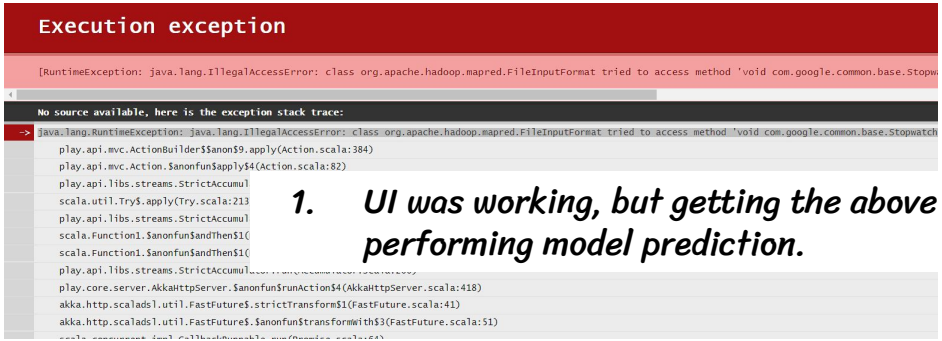
- UI to accept Users input and visualize the data
- Model Response < 5s
  - Response time achieved < 1s
- Model Accuracy  65%
  - Accuracy achieved through models



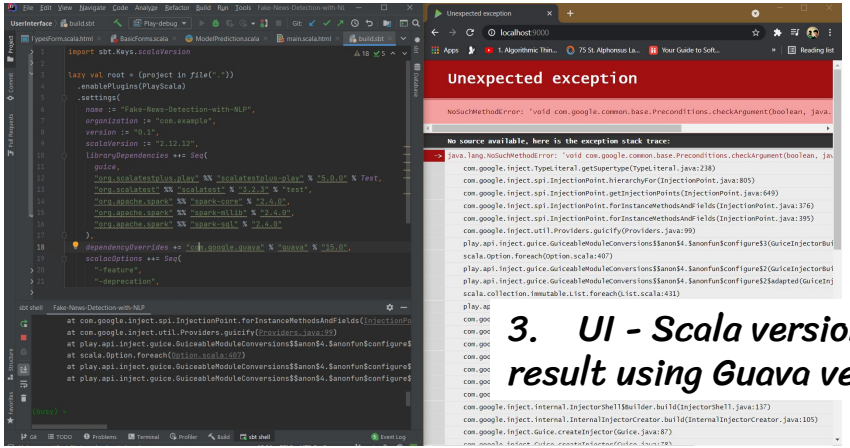
References

- https://spark.apache.org/docs/latest/ml-features.html
- https://www.tutorialspoint.com/apache_kafka/apache_kafka_real_time_application.htm

Shortcomings - Model prediction using Play Framework.



1. UI was working, but getting the above error while performing model prediction.



2. Stackoverflow suggested to add Guava 15(library)

```
dependencyOverrides += "com.google.guava" % "guava" % "15.0"
```

3. UI - Scala version compatibility, unable to display user input result using Guava version 15

Thank You