Real or Not?

NLP with Disaster Tweets

Team 8

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Overview

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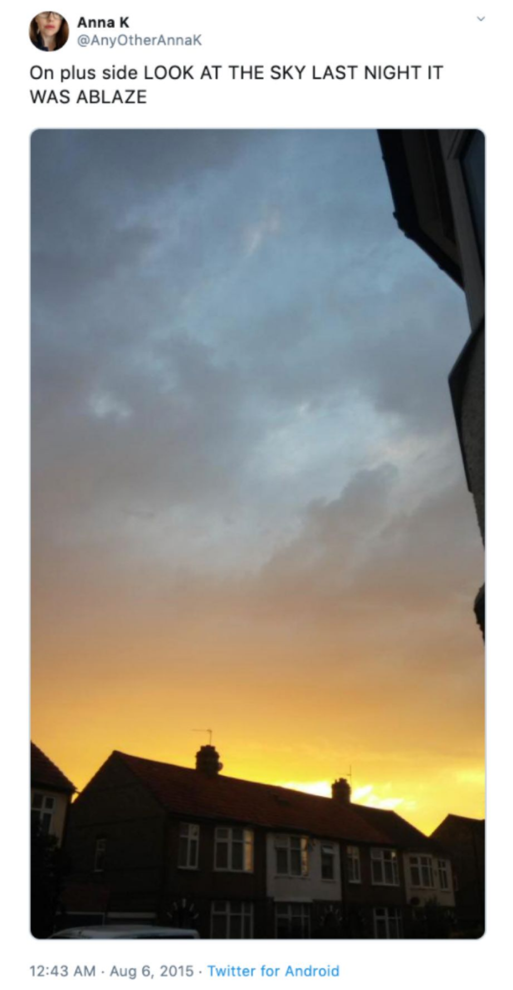
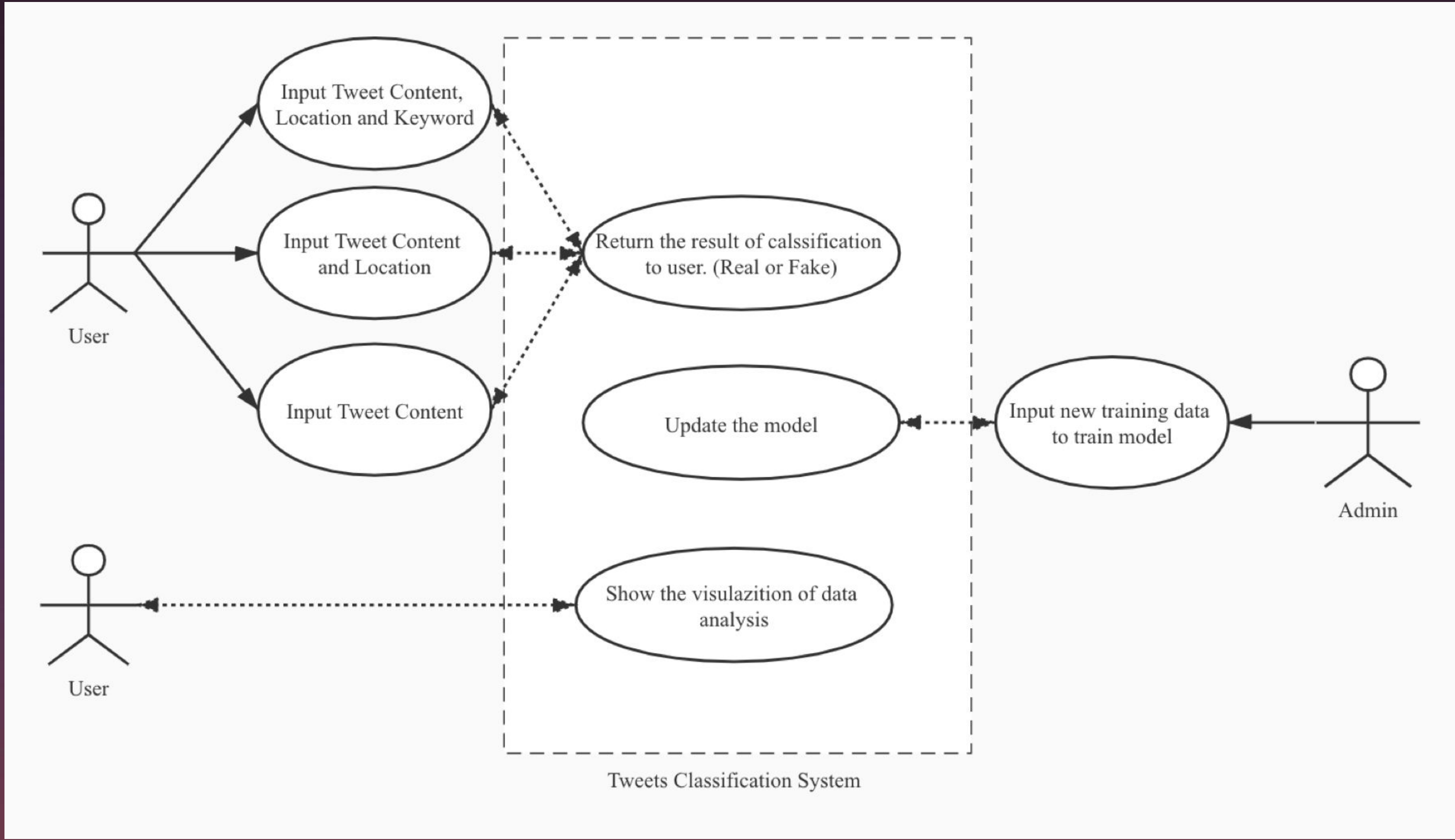
01 Background

Twitter has become an important communication channel in times of emergency.
The ubiquitousness of smartphones enables people to announce an emergency they're observing in real-time. Because of this, more agencies are interested in programatically monitoring Twitter (i.e. disaster relief organizations and news agencies).
But, it's not always clear whether a person's words are actually announcing a disaster.



01 Uses Cases Review



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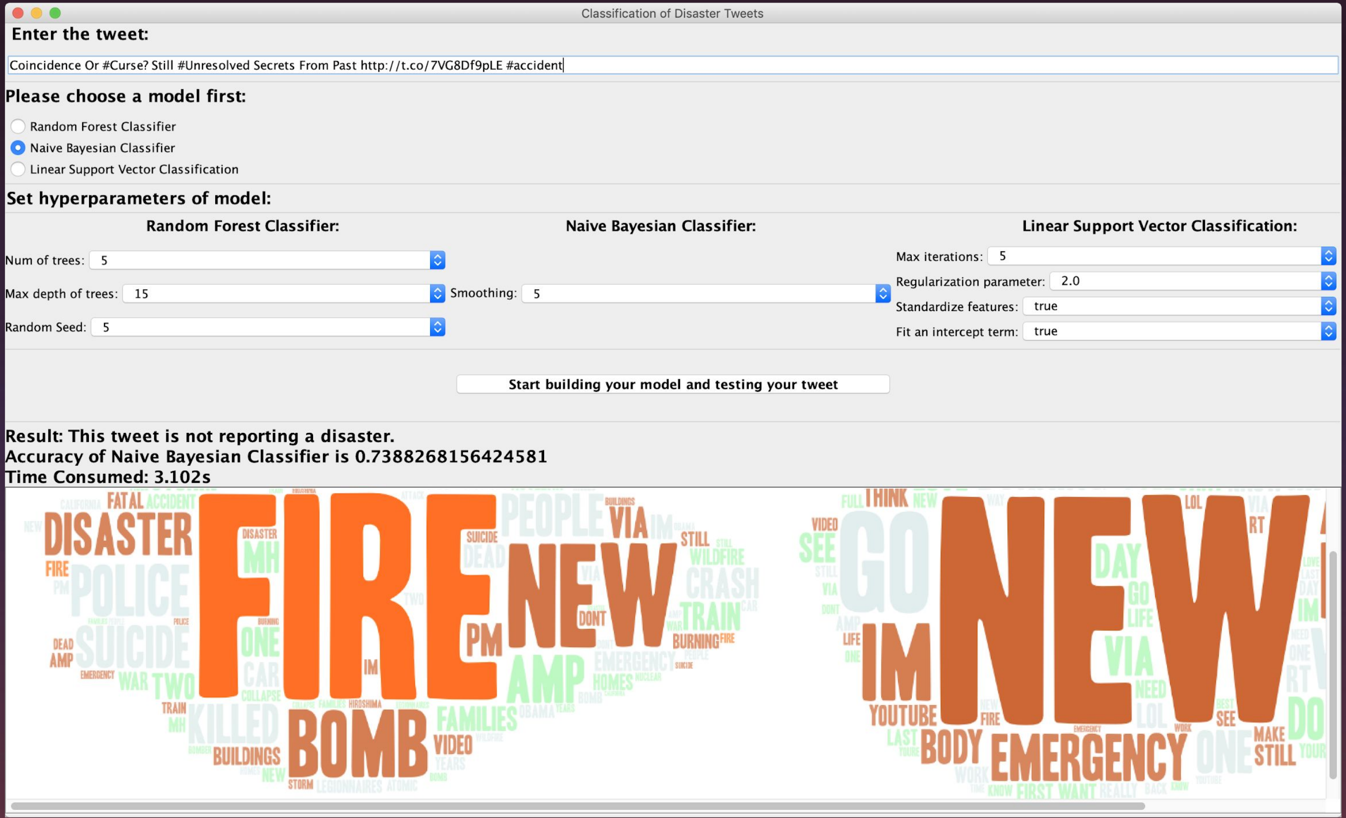
UI Design


Classification of Disaster Tweets
Enter the tweet:
Coincidence Or #Curse? Still #Unresolved Secrets From Past http://t.co/7VG8Df9pLE #accident
Please choose a model first:
Random Forest Classifier
Naive Bayesian Classifier
Linear Support Vector Classification
Set hyperparameters of model:
Random Forest Classifier:
Num of trees: 5
Max depth of trees: 15
Random Seed: 5
Naive Bayesian Classifier:
Smoothing: 5
Linear Support Vector Classification:
Max iterations: 5
Regularization parameter: 2.0
Standardize features: true
Fit an intercept term: true
Start building your model and testing your tweet
Result: This tweet is not reporting a disaster.
Accuracy of Naive Bayesian Classifier is 0.7388268156424581
Time Consumed: 3.102s

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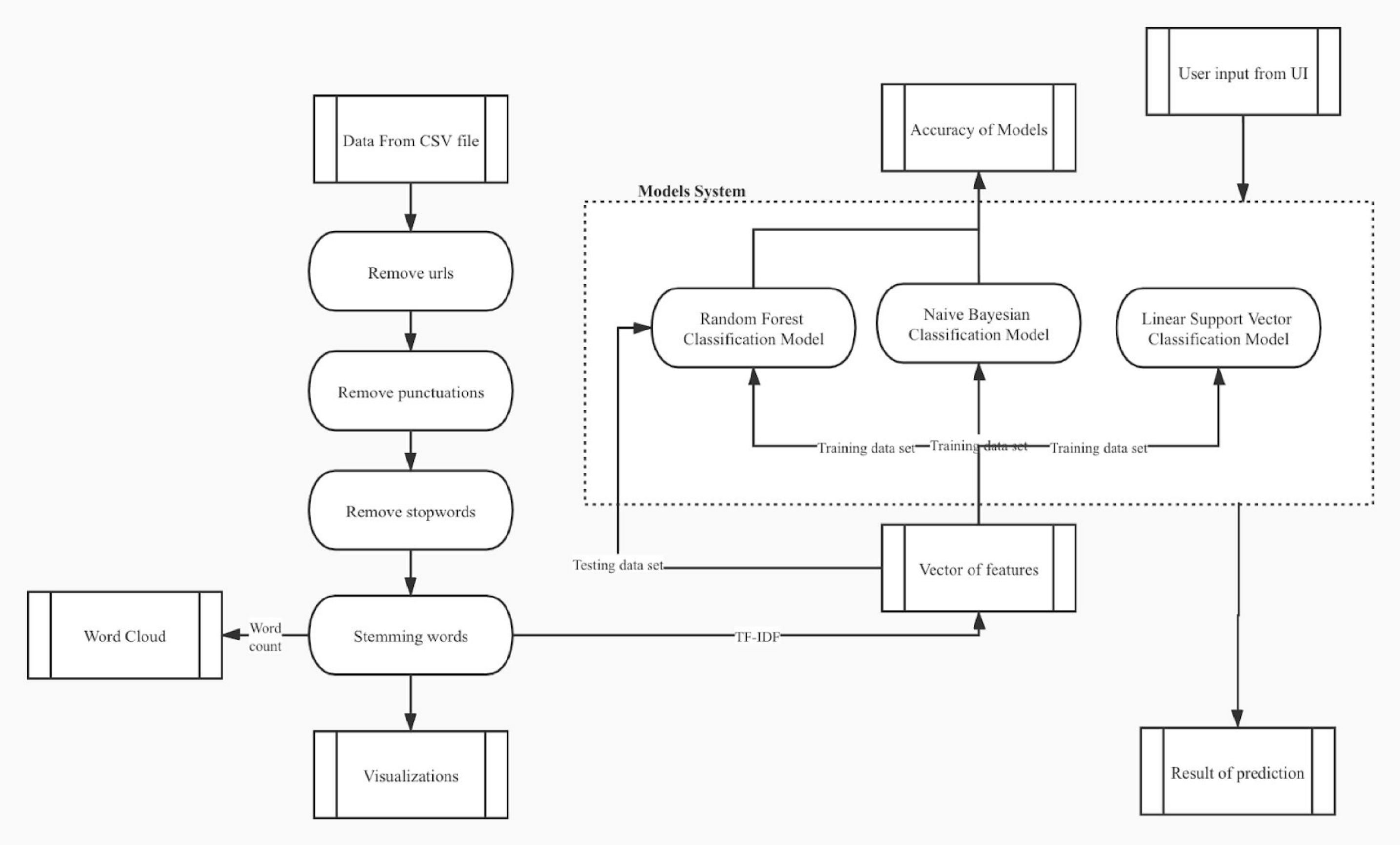
Goals

1. Create a reactive page to detect fake news on twitter.
2. Create a reactive page to analyze the characteristics of fake tweets.
3. Get a well trained model for fake tweets prediction.

02 Methodology



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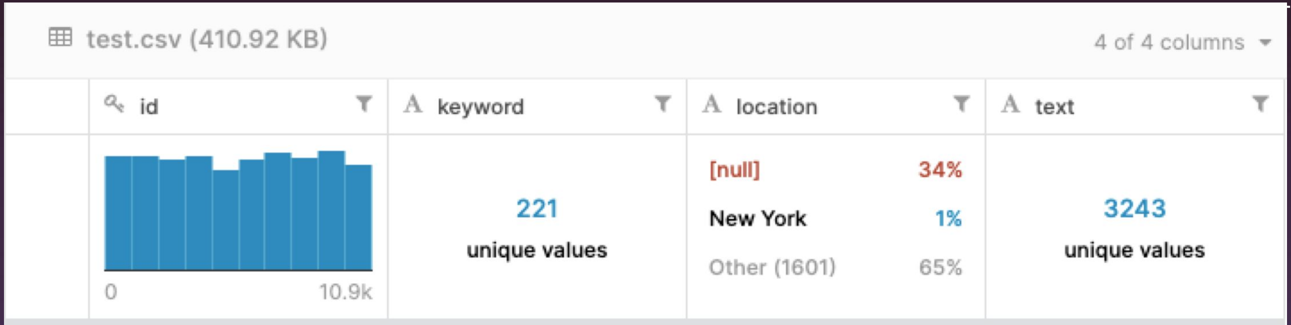
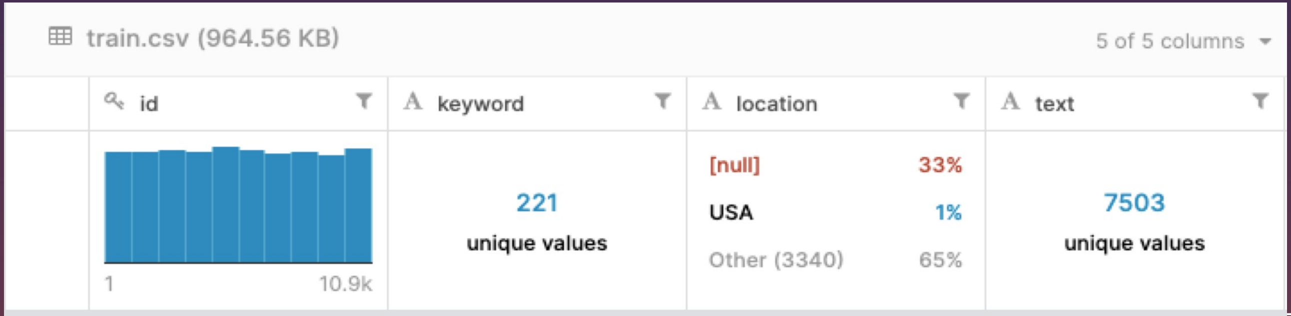
Methodology

- Used Zeppelin for running code line by line
- Extracted features of tweets (nature language) by TF-IDF
- Implemented 3 classification algorithms:
    - Random Forest Classifier
    - Naive Bayesian Classifier
    - Linear Support Vector Classifier
- Applied functions from Spark MLlib, Spark SQL, Spark RDD
- Designed and implemented UI by Scala Swing
- Visualized data by Vegas

01 Data Sources





Data come form Kaggle competition

Data magnitude is more than 10,000 rows

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TF-IDF

Used to extract features and find keywords

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

$$IDF(t, D) = \log \frac{|D| + 1}{DF(t, D) + 1},$$

$$TFIDF(t, d, D) = TF(t, d) \cdot IDF(t, D).$$

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NLP

- Use Tokenizer to tokenize the tweets
- Use StopWordsRemover to remove the stop words

  Such as “ I, am, what, have, is, are….. ”
- Use HashingTF and IDF to vectorize the words
- Then we got featured data from nature language

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Classification Algorithm

In order to classify the tweets according to if it is a real disaster tweets, we implemented three different classification algorithms:

- Random Forest Classifier
- Naive Bayesian Classifier
- Linear Support Vector Classifier

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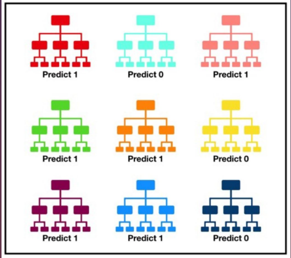
Random Forest Classifier

- A large number of relatively uncorrelated models (trees) operating as a committee will outperform any of the individual constituent models.
- Given a training set X = x1, ..., xn with responses Y = y1, ..., yn, bagging repeatedly (B times) selects a random sample with replacement of the training set and fits trees to these samples
- For b = 1, ..., B:
  - Sample, with replacement, n training examples from X, Y; call these Xb, Yb.
  - Train a classification or regression tree fb on Xb, Yb.

$$\hat{f} = \frac{1}{B} \sum_{b=1}^{B} f_b(x')$$

$$\sigma = \sqrt{\frac{\sum_{b=1}^{B} (f_b(x') - \hat{f})^2}{B-1}}.$$



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Naive Bayesian Classifier

- Another assumption made here is that all the predictors have an equal effect on the outcome.
- X represents the features , y represents the label

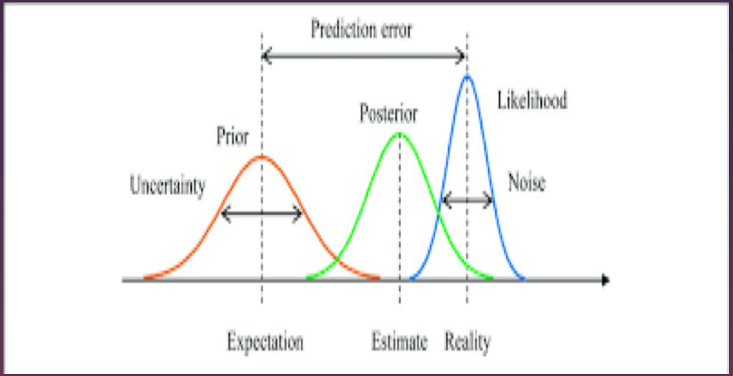
$$X = (x_1, x_2, x_3, ..., x_n)$$

- According to Bayesian Theory

$$P(y|x_1, ..., x_n) = \frac{P(x_1|y)P(x_2|y)...P(x_n|y)P(y)}{P(x_1)P(x_2)...P(x_n)}$$

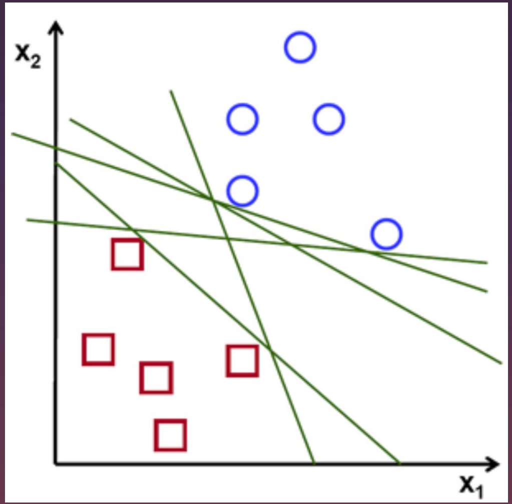
$$P(y|x_1, ..., x_n) \propto P(y) \prod_{i=1}^{n} P(x_i|y)$$

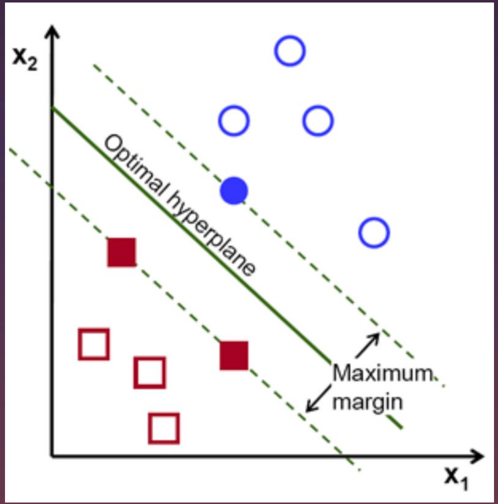
$$y = argmax_y P(y) \prod_{i=1}^{n} P(x_i|y)$$

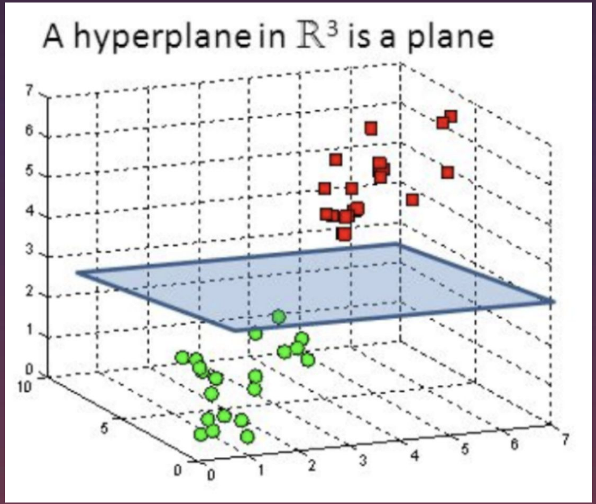


03 Linear Support Vector Classifier

- The objective of the support vector machine algorithm is to find a hyperplane in an N-dimensional space(N — the number of features) that distinctly classifies the data points.







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Linear Support Vector Classifier

- In the SVM algorithm, we are looking to maximize the margin between the data points and the hyperplane. The loss function that helps maximize the margin is hinge loss.

$$c(x, y, f(x)) = \begin{cases} 0, & \text{if } y * f(x) \geq 1 \\ 1 - y * f(x), & \text{else} \end{cases}$$

$$min_w \lambda \parallel w \parallel^2 + \sum_{i=1}^{n} (1 - y_i \langle x_i, w \rangle)_+$$

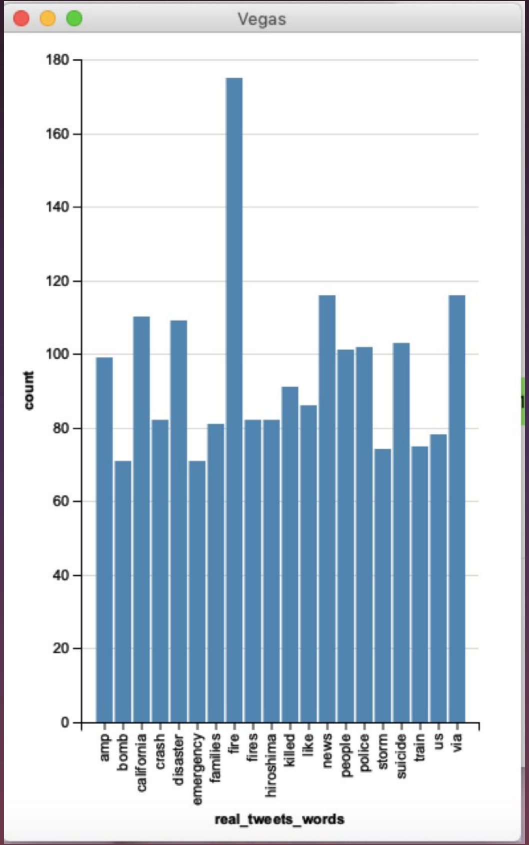
- Take partial derivatives with respect to the weights to find the gradients
- Update gradient (no misclassification)
- Update gradient (with misclassification)

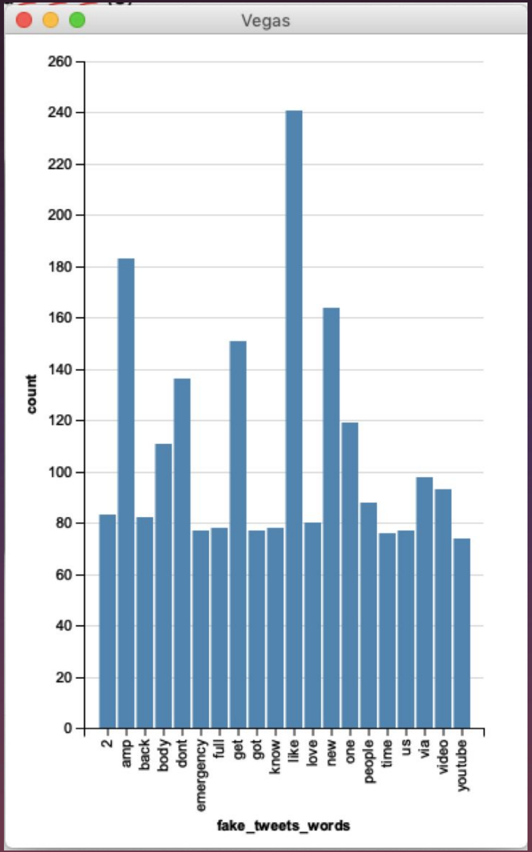
$$\frac{\delta}{\delta w_k} \big(1 - y_i \langle x_i, w \rangle\big)_+ = \begin{cases} 0, & \text{if } y_i \langle x_i, w \rangle \geq 1 \\ -y_i x_{ik}, & \text{else} \end{cases}$$

$$w = w - \alpha \cdot (2\lambda w)$$

$$w = w + \alpha \cdot (y_i \cdot x_i - 2\lambda w)$$

03 Visualization of Keyword Extraction





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Real Disaster Tweets

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Fake Disaster Tweets

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Evaluation of models

Model	Accuracy
Random Forest Classifier	0.7456170505328291
Naive Bayesian Classifier	0.8380480905233381
Linear Support Vector Classifier	0.8553220806062694

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Acceptance Criteria Review

As a user, I am able to input Disaster Tweet content, location and keyword to get the prediction if the tweet is fake:

- The prediction accuracy for complete input data should be over 70%
- The time to respond should be under 5 seconds

As a user, I am able to show the visualization of data analysis:

- The time to respond should be under 5 seconds

Thank You