



Airline Sentiment Analysis

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Problem

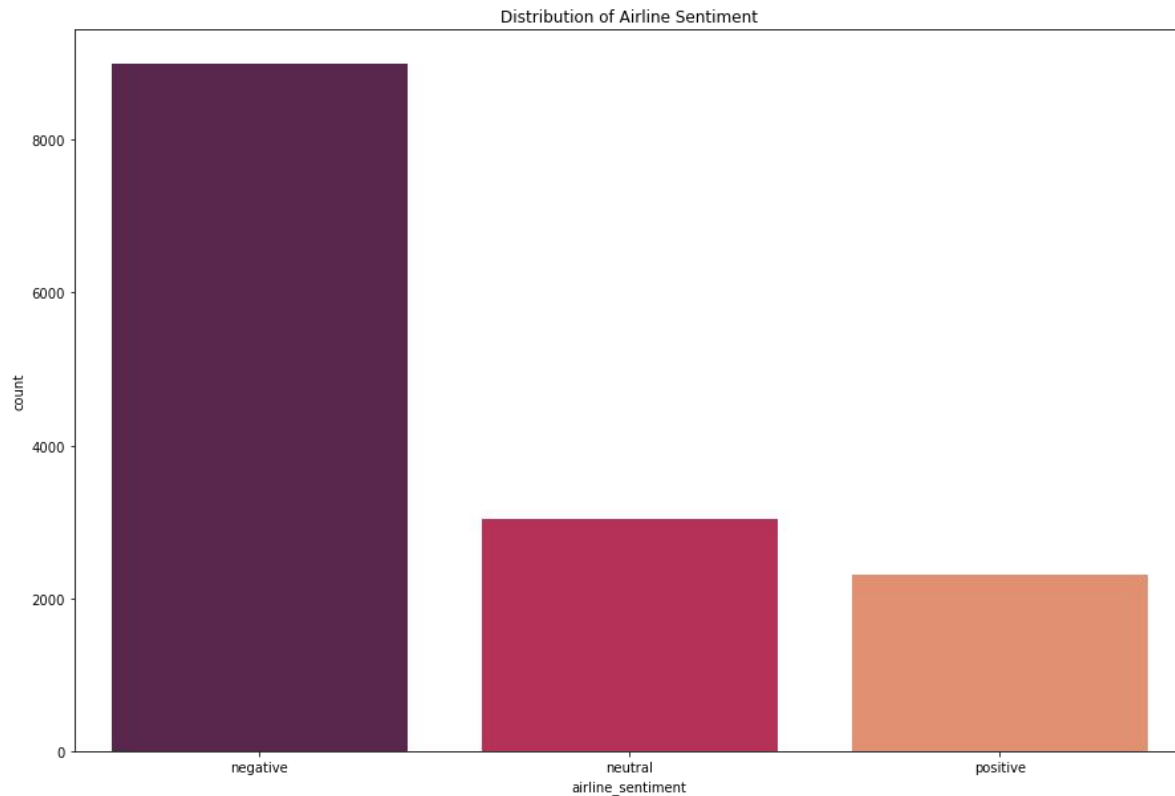
- ❖ As businesses change, so do their customers sentiments.
- ❖ Companies need to track their customer sentiment.
- ❖ Create a sentiment analysis for airline companies.
- ❖ Identify business solutions for airline companies

Data Overview and Cleaning

- ❖ The dataset is from Kaggle.
- ❖ The data were scraped from Twitter between Feb 16, 2015 and Feb 24, 2015 and classified as negative, positive, or neutral.
- ❖ Mainly focusing on the following columns: “airline”, “airline_sentiment”, “negativereason”, “text”

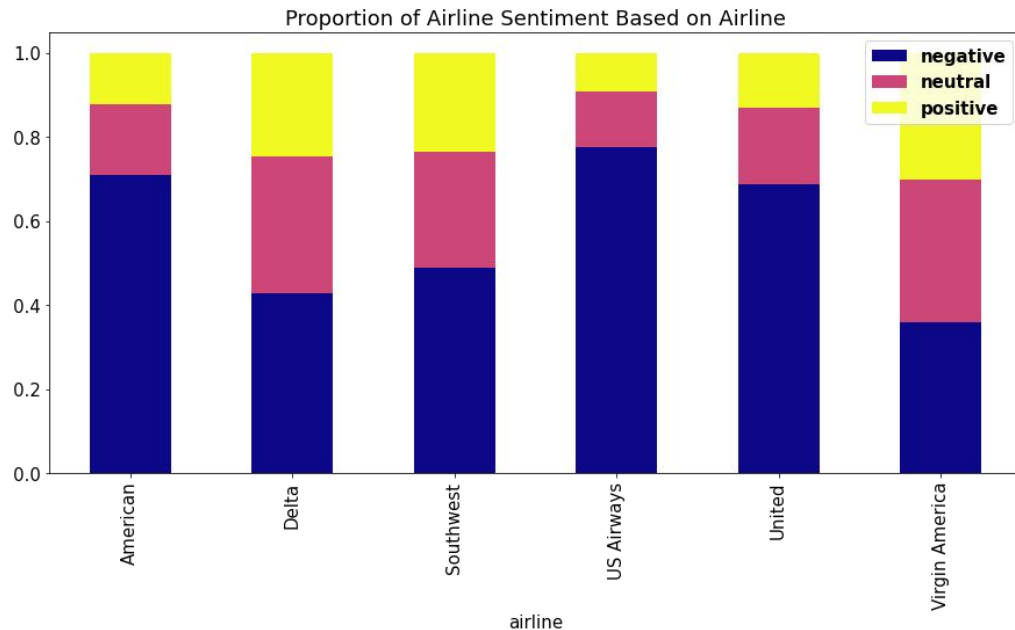
Analysis: Distribution of Airline Sentiment

- ❖ Most of the sentiments are negative.
- ❖ This is an imbalanced dataset.



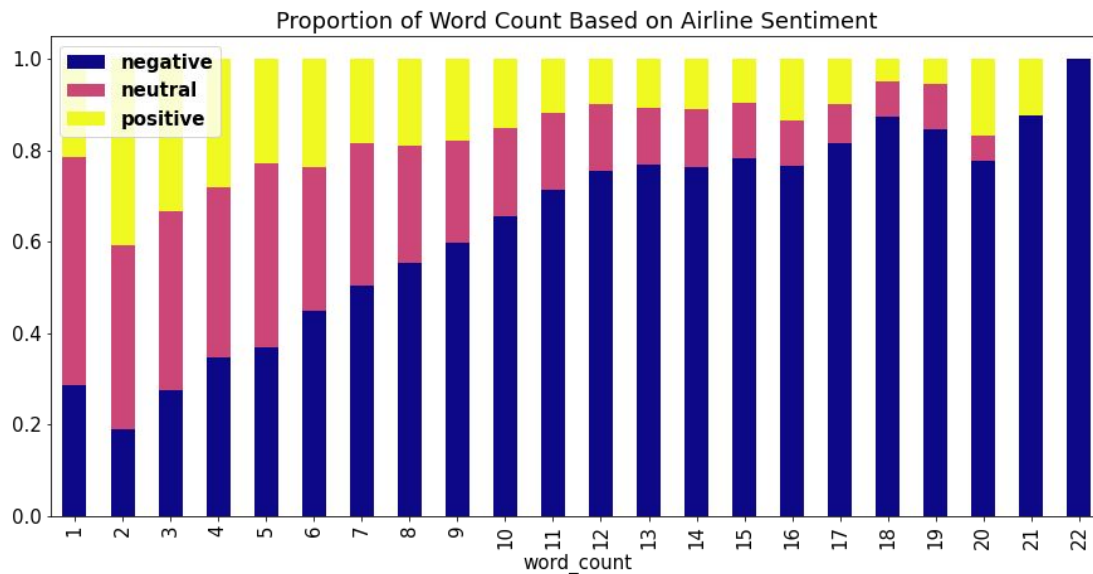
Analysis: Proportion of Airline Sentiment

- ❖ US Airways has the most proportion of negative sentiment
- ❖ Virgin America has the least amount of positive sentiment, but it only accounts for 3.4% of the data



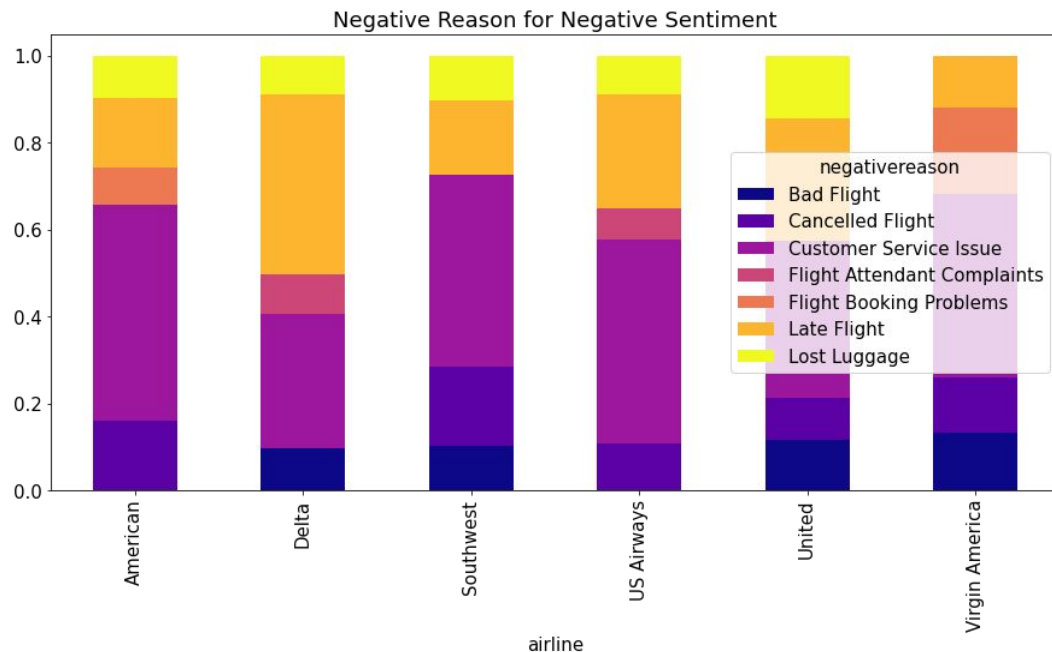
Proportion of Word Count

- ❖ The negative sentiment tweets have more words in their text.
- ❖ The tweets with a positive or neutral sentiment have the least amount of words per tweet.



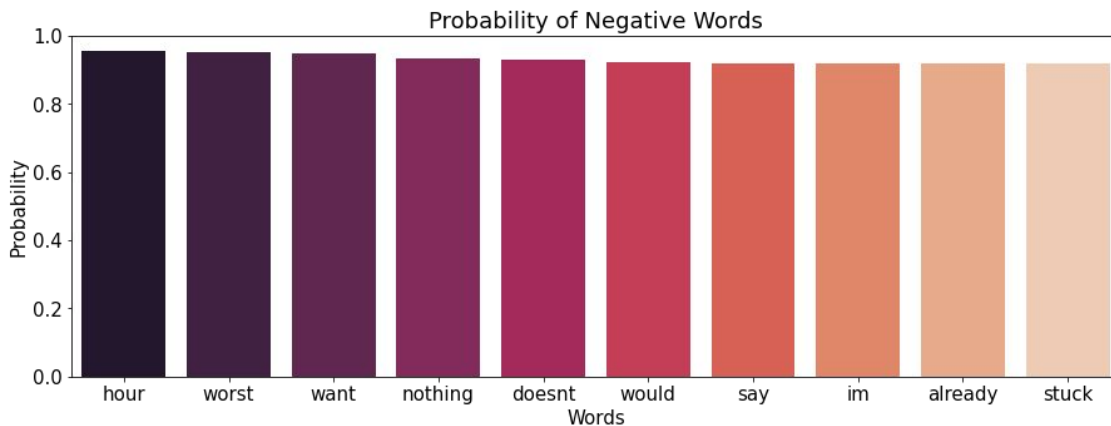
Negative Reason for Negative Sentiment

- ❖ Top 5 reasons for negative sentiment for each airline are shown
- ❖ Customer service issues and late flights are the top issues across airlines.
- ❖ Delta top negative reason is late flights.
- ❖ The other airlines were customer service issues.



Predictive Words: United

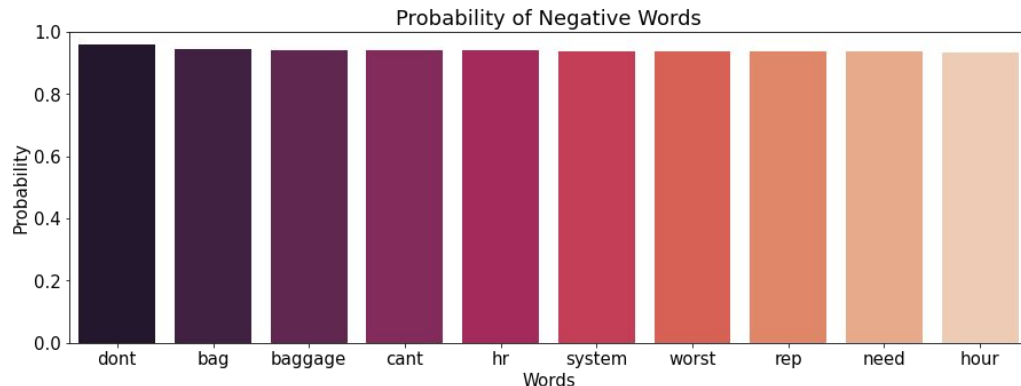
- ❖ One unique issue United had was that several customers complained that they were stuck and were not able to reach their proper destination in a timely manner.
- ❖ This was because of the late and delayed flights.
- ❖ It caused several customers to miss their connecting flight as well.



- “@united I tried but no one was available in bogota and everyone was rude in Houston. I was stuck for 35 hours because of you guys”
- “@united I sure did. I had to drive a total of 3 hours to get my own bag. I'd like to explain that debacle but no one wants to talk to me.”

Predictive Words: American

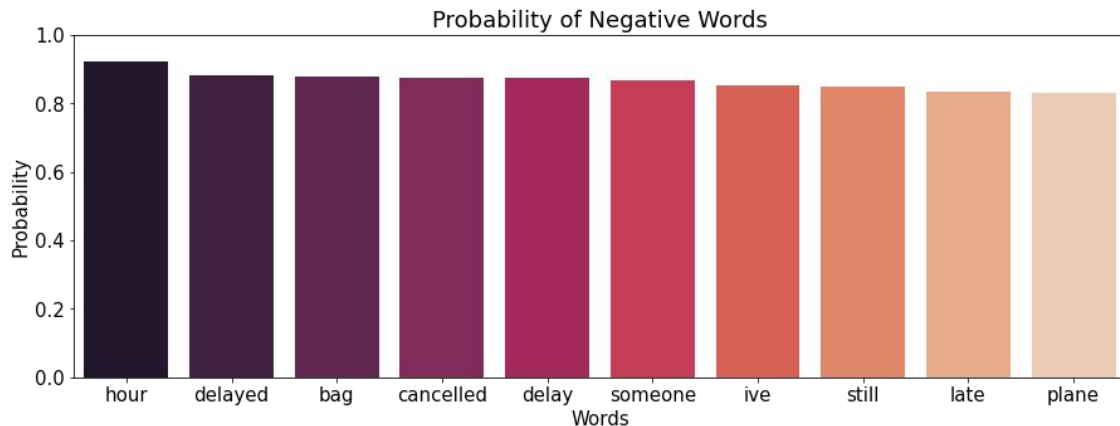
- ❖ A common problem for the airline is that customers are losing their luggage and having a hard time recovering them.
- ❖ One customer even complained about items being stolen from their luggage.
- ❖ They are also experiencing late flights.



- “@AmericanAir Right. But more than two **hours** Late Flight, and it seems due to poor communication, which sounded like it was annoying on-plane staff”
- “@AmericanAir extremely upset that your **baggage** handlers decide to go in my luggage and take my belongings”

Predictive Words: Delta

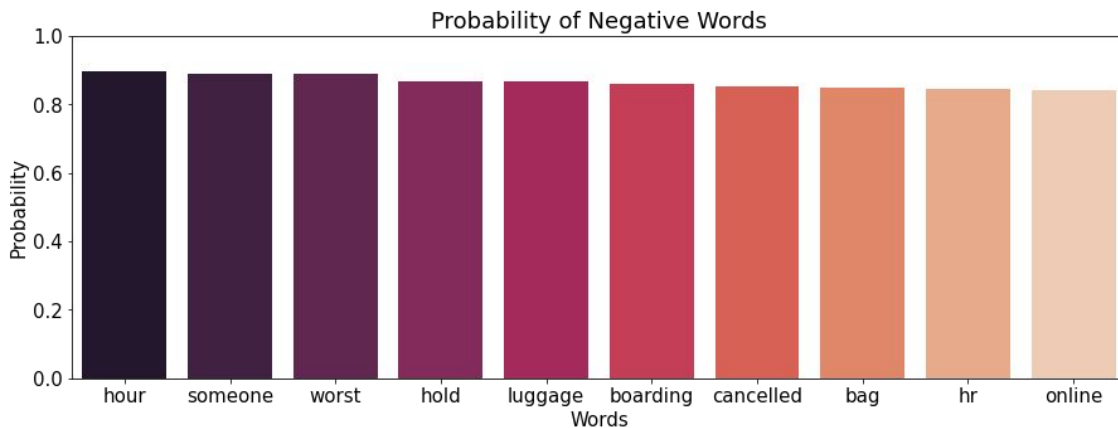
- ❖ All of the other airlines had customer service issues as their top negative reason for a negative sentiment.
- ❖ Delta's top negative reason is late flights.
- ❖ They are also experiencing delayed and cancelled flights.



- “@JetBlue what is the deal with flt 460 today? Departure keeps changing. When is it going why is it so **Late** Flight?”
- “@JetBlue great job getting flight 28 in 10 minutes early. Too bad we're at 50 minutes and counting waiting for our **bags**.”

Predictive Words: Southwest

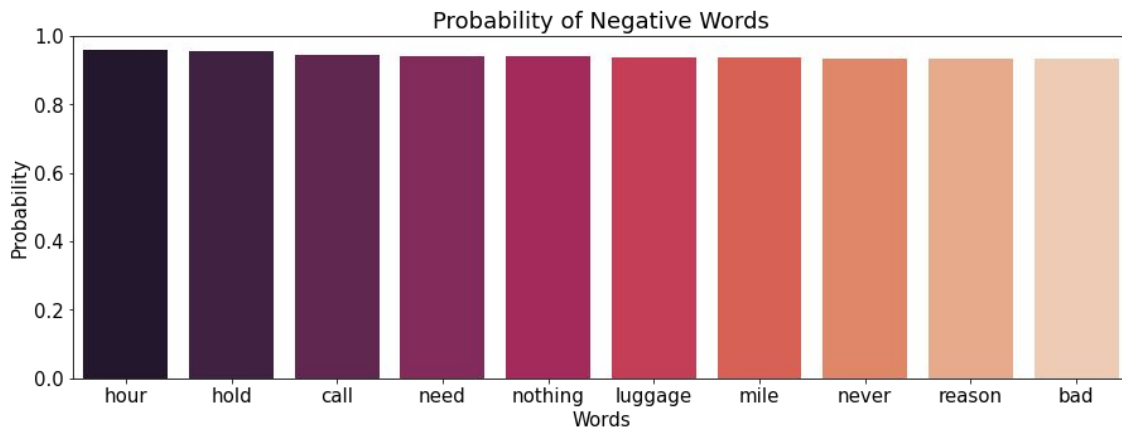
- ❖ Customers have to change their reservations, get boarding passes, etc, by calling customer service instead of doing it online
- ❖ It makes it difficult for customers to receive the help they need.
- ❖ Southwest can explore implementing efficient customer service systems.



- “@SouthwestAir Why can we no longer change trips with a companion **online**? Been doing it for years, now get message can't be done **online**?”
- “@SouthwestAir can you have someone call me back? I have been on **hold** two times today for over 20 min and still haven't gotten through”

Predictive Words: US Airways

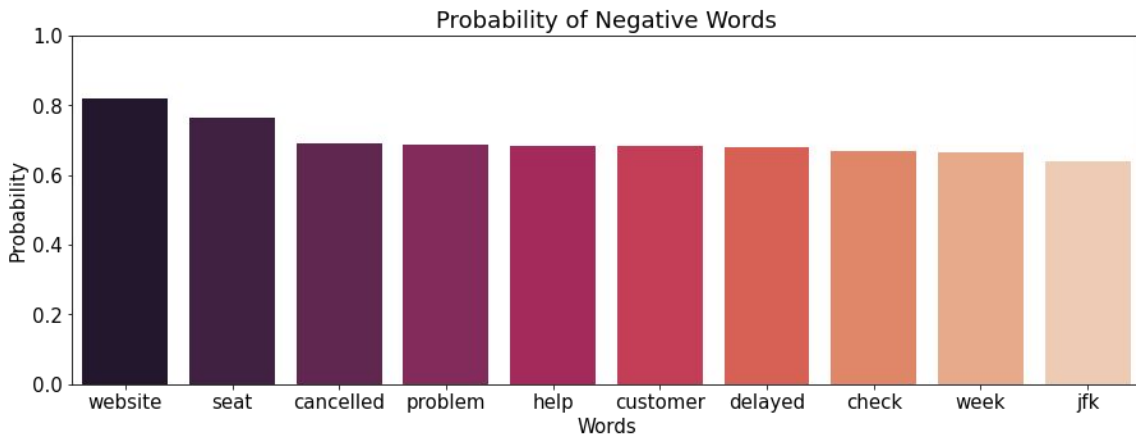
- ❖ US Airways customers are having trouble connecting with a customer service representative and being on hold like Southwest.
- ❖ However their customers are experiencing being disconnected from the customer service line.



- “@USAirways but I've been trying to **call** them since yesterday and I keep getting hung up on? Can you get me through to them??”
- “@USAirways I've been on **hold** to change a date on a ticket for over 3 **hours**. Can someone please assist me? Unacceptable.”

Predictive Words: Virgin America

- ❖ Only airline that customers complained about the website being down.
- ❖ Customers weren't able to reschedule a flight online.
- ❖ can fix either by increasing their bandwidth, making frequent updates to their website, add new features or a better user experience, etc.



- “@VirginAmerica Is it me, or is your **website** down? BTW, your new **website** isn't a great user experience. Time for another redesign.”
- “@VirginAmerica How do I reschedule my **Cancelled** Flightled flights online? The change button is greyed out!”

Modeling: Data Text Preprocessing

- ❖ The following needs to be done to preprocess the text.
 - Made text lowercase and remove punctuations and special characters.
 - Lemmatized text
 - Removed stopwords (“this”, “is”, etc.)
 - Tokenized text

Modeling: Data Vectorizing

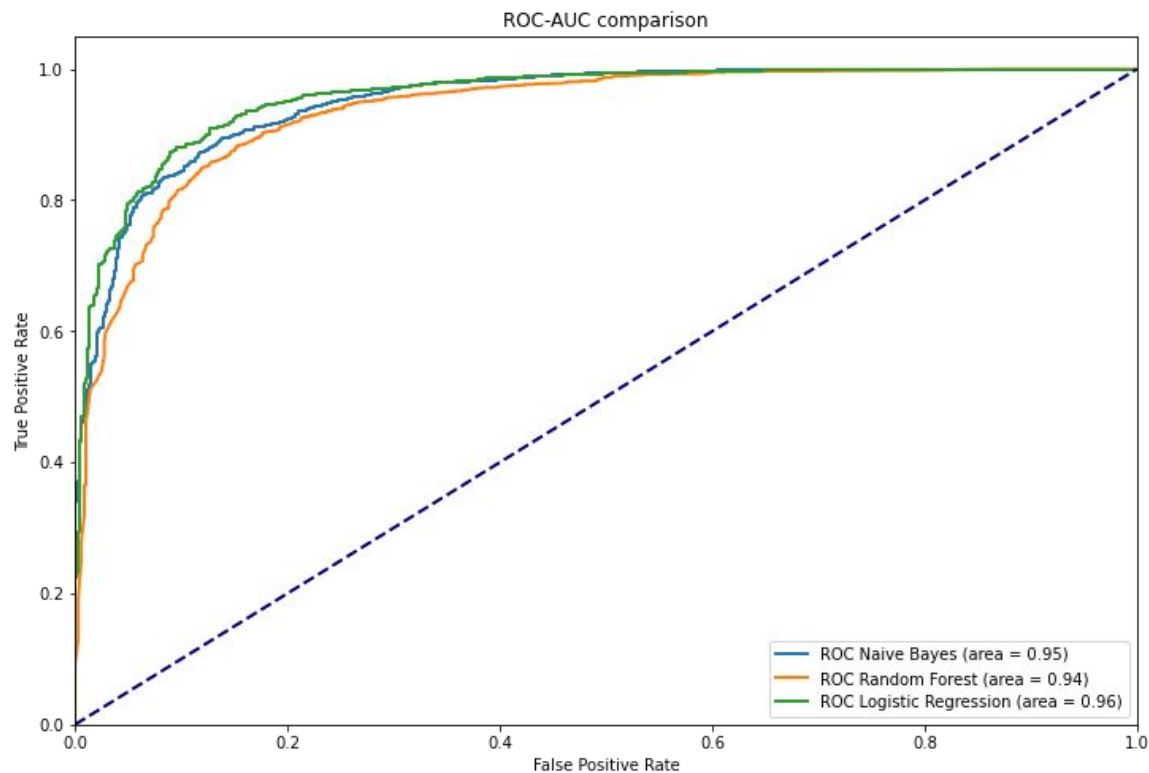
- ❖ Vectorizing text from raw data
- ❖ Tested CountVectorizer and TfidfVectorizer
- ❖ Based on ROC-AUC Score TfidfVectorizer performed the best.

Vectorizer	ROC-AUC Score	Accuracy
CountVectorizer	0.9577	92.18%
TfidfVectorizer	0.9583	90.94%

Model Selection: Selecting Model

Model	Best Parameters	ROC-AUC Score
Logistic Regression 1	C: 1, max_iter: 1000	0.9583
Logistic Regression 2 - CountVect with n-grams	C: 1, max_iter: 1000	0.9570
Logistic Regression 3 - Tf-idf with n-grams	C: 1, max_iter: 1000	0.9517
Naive Bayes	n/a	0.9512
Random Forest	max_depth: None, max_features: auto, n_estimators: 400	0.9373

ROC-AUC Comparisons



Threshold-moving

- ❖ Change the threshold for classification problems to improve performance.
- ❖ Threshold will change based on specific business needs

Threshold	Recall	Precision	Accuracy	F1-Score	Balanced Accuracy
Default (0.5)	0.99	0.91	0.91	0.95	0.80

Business Case 1: Track Sentiment Analysis

- ❖ Track overall customer sentiment on Twitter
- ❖ Managers can make assessments for improvements.
- ❖ Focus on balanced accuracy which is good for imbalance dataset and when we care about the positive and negative classes.
- ❖ Having a threshold of 0.70 allows the model to have a better balanced accuracy.

Threshold	Default (0.50)	Optimal Balanced Accuracy (0.70)
Recall	0.99	0.95
Precision	0.91	0.95
Accuracy	0.91	0.92
F1-Score	0.95	0.95
Balanced Accuracy	0.80	0.88

Business Case 2: Customer Service

- ❖ Use model to alert bot to respond to customers with appropriate message based on sentiment.
- ❖ False Negative
- ❖ False Positive
- ❖ We could use F1-Score since it uses precision and recall.
- ❖ The metric might change based on a cost analysis of the false positives and compare to the false negatives.

Threshold	Default (0.50)	Optimal F1-Measure(0.664)
Recall	0.99	0.96
Precision	0.91	0.95
Accuracy	0.91	0.92
F1-Score	0.95	0.95
Balanced Accuracy	0.80	0.87

Conclusion

- ❖ Tracking customer sentiment can help businesses improve products and services.
- ❖ This model can be used for airlines based on specific business needs.
- ❖ The next steps would include looking deeper at the causes of misclassification to improve the model because some tweets can have sarcasm.
- ❖ I would also gather tweets from a longer timeframe because all of the tweets collected are from Feb 16, 2015 and Feb 24, 2015.

Questions?
