Airline Sentiment Analysis

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Problem

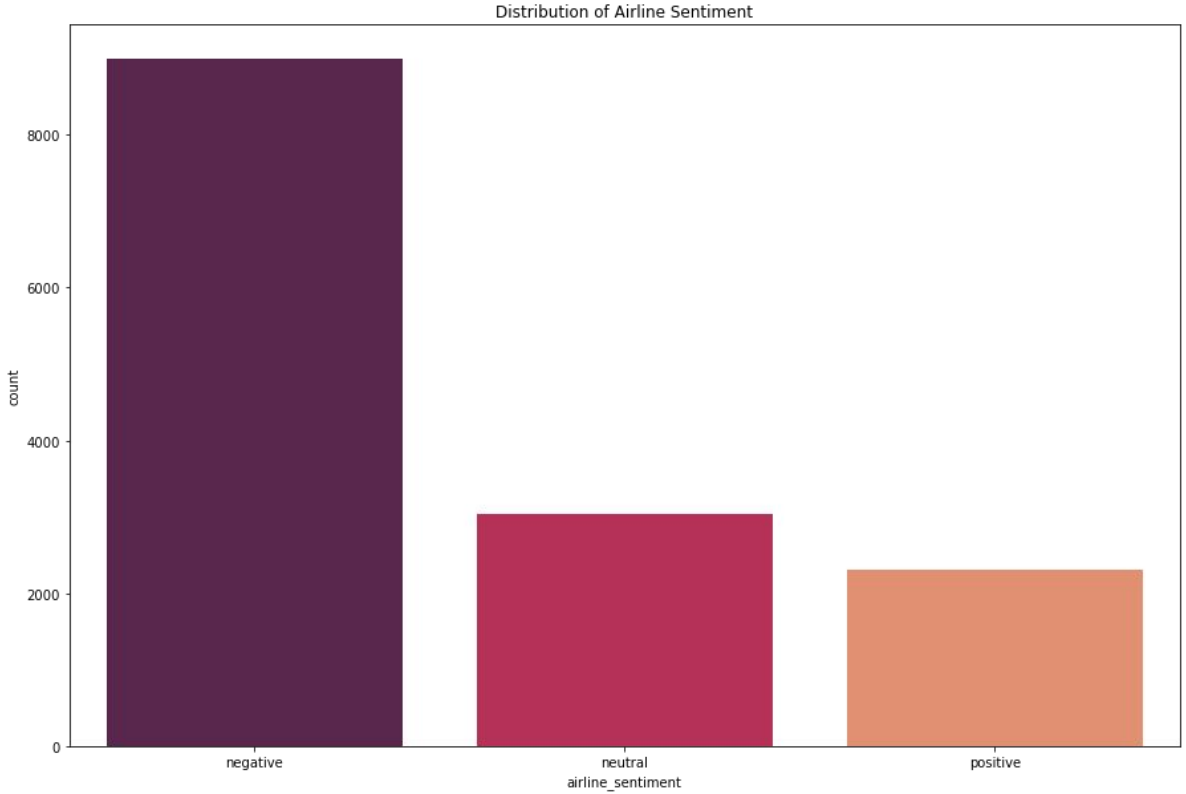
- As businesses change, so do their customers sentiments.
- Companies need to track their customer sentiment.
- Create a sentiment analysis for airline companies.
- Identify business solutions for airline companies

Data Overview and Cleaning

- The dataset is from kaggle.
- The data was scraped from Twitter between Feb 23, 2015 and Feb 22, 2015 and classified as negative, positive, or neutral.
- Mainly focusing on the following columns: “airline”, “airline_sentiment”, “negativereason”, “text”

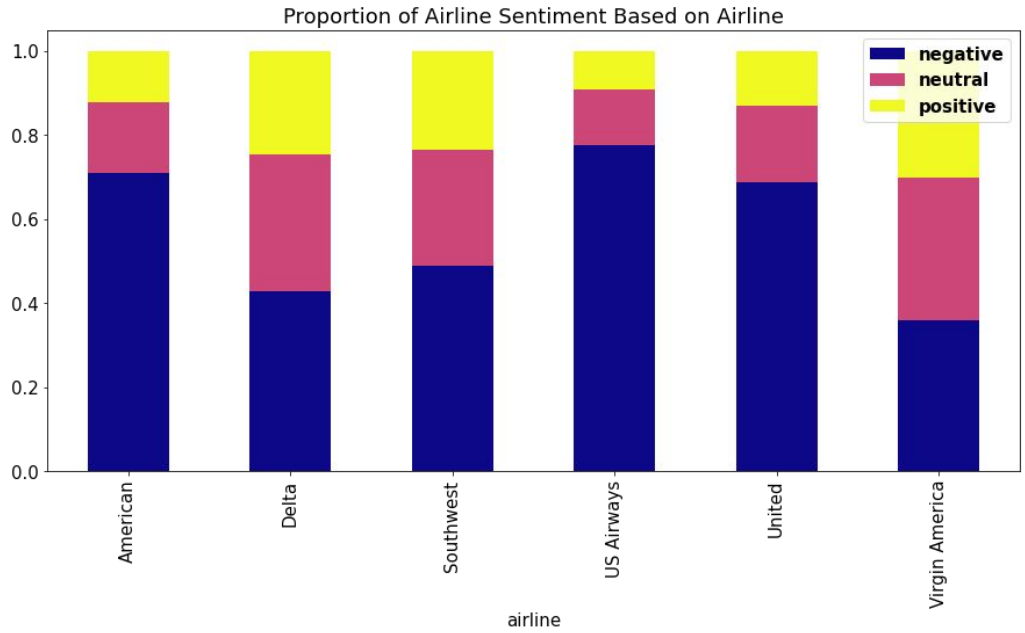
Analysis: Distribution of Airline Sentiment

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



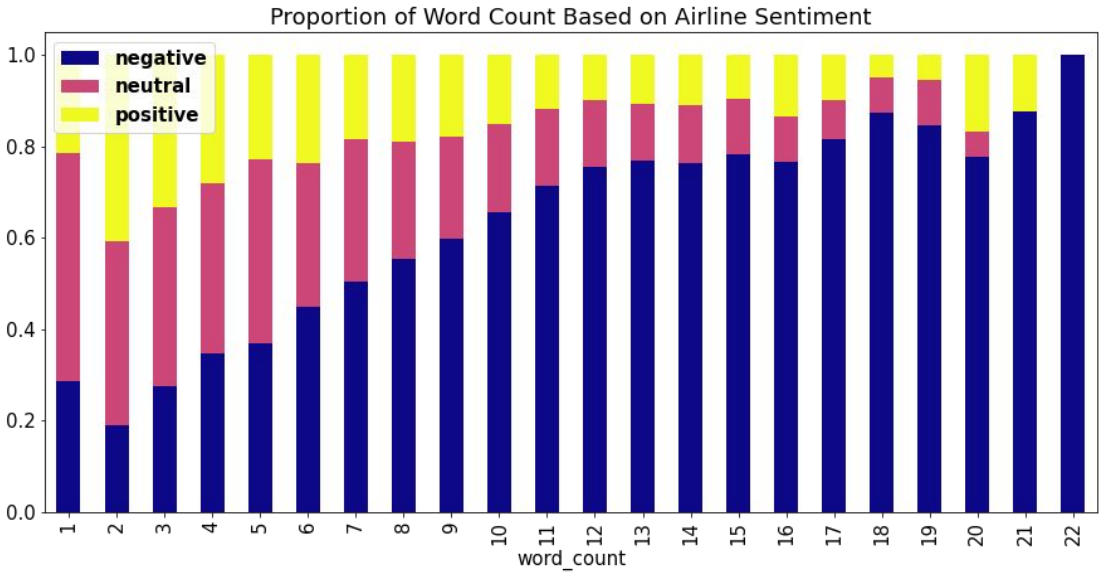
Analysis: Proportion of Airline Sentiment

- 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



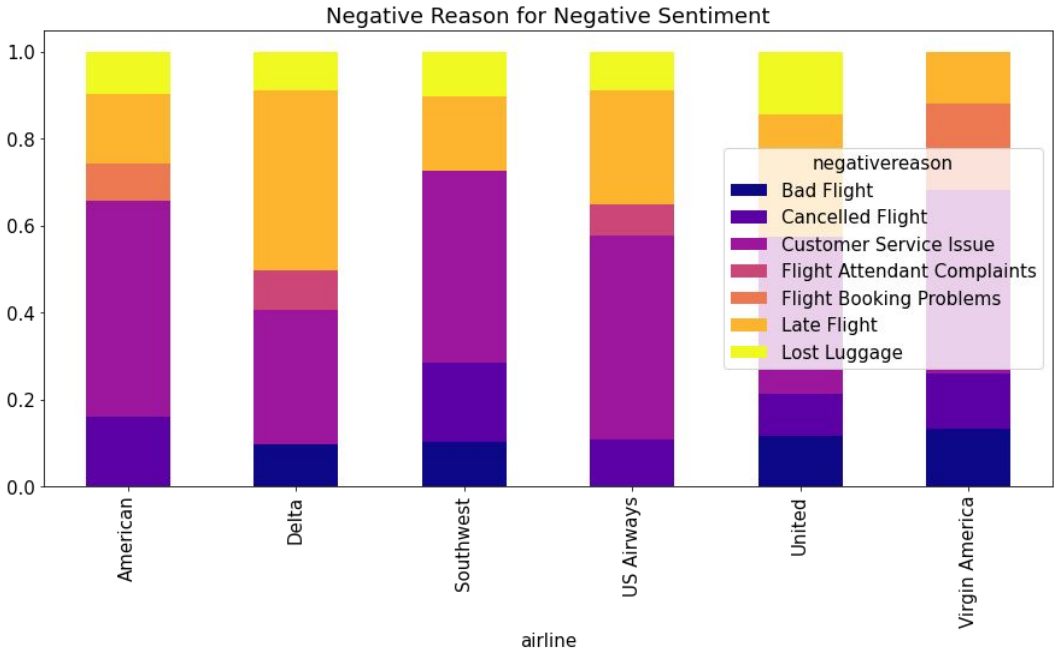
Proportion of Word Count

- 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.



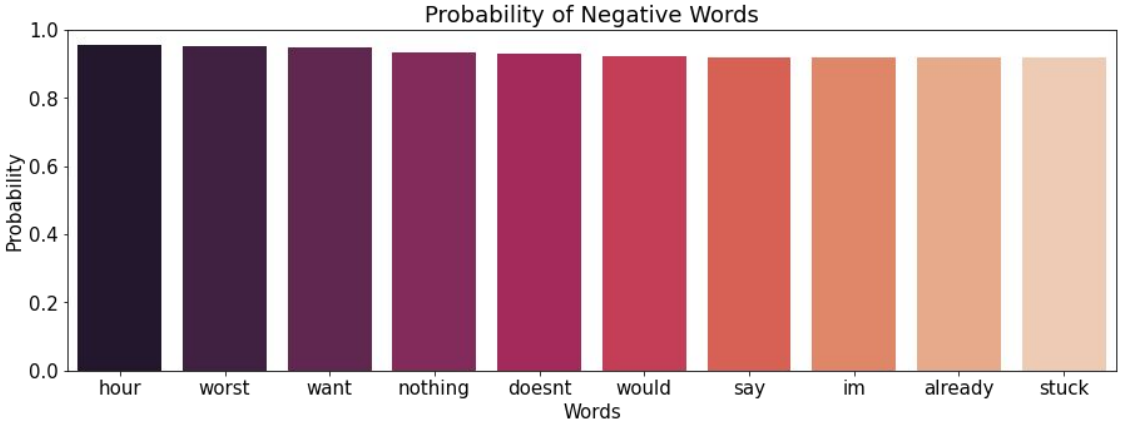
Negative Reason for Negative Sentiment

- This is top 5 reasons for negative sentiment
- Customer service issues and late flights are the top issues across airlines.



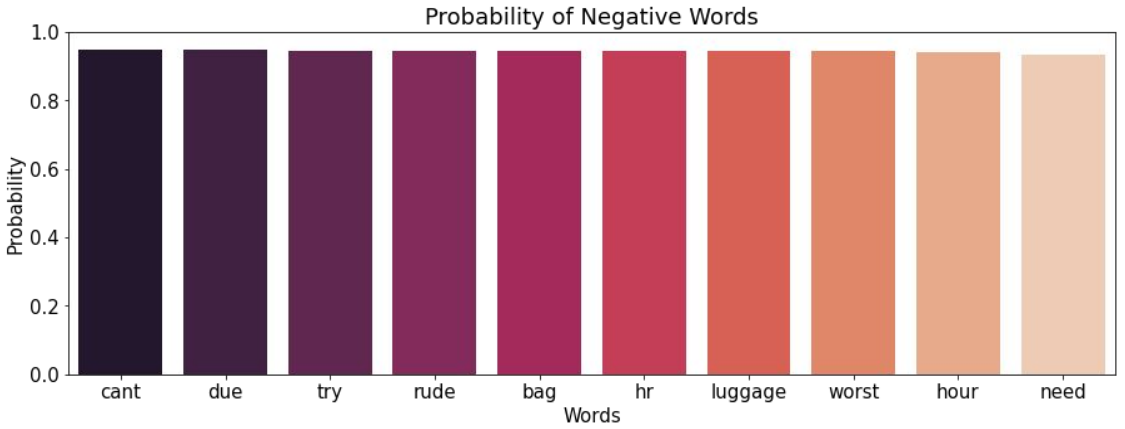
Predictive Words: United

- Late and delayed flights
- Stuck for several hours
- Couldn’t reach customer service
- Lost luggage and had a hard time recovering them
- “@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.”



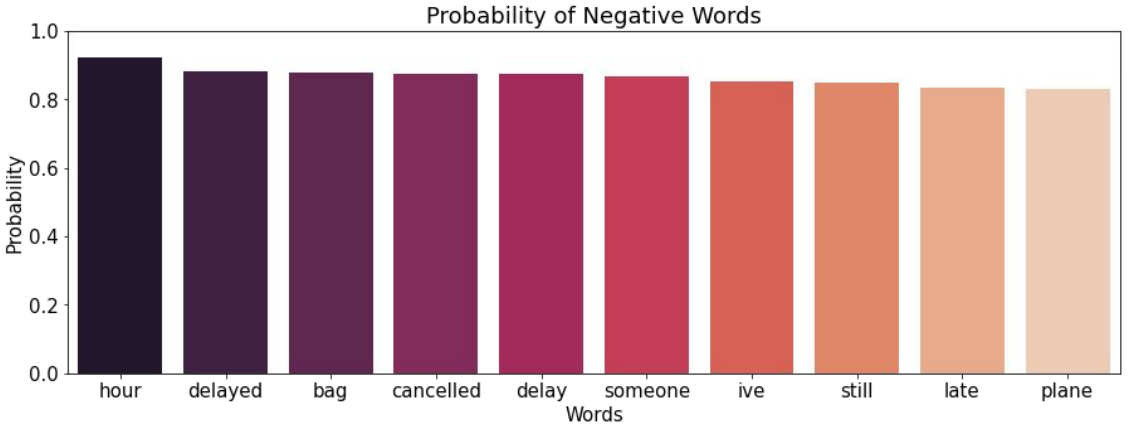
Predictive Words: American

- Late flights & customer service issues
- Booking and re-scheduling issues
- Rude flight attendants, and lost luggage
- “@AmericanAir im tryin to book a flight but cant get ahold of anyone!”
- “@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”



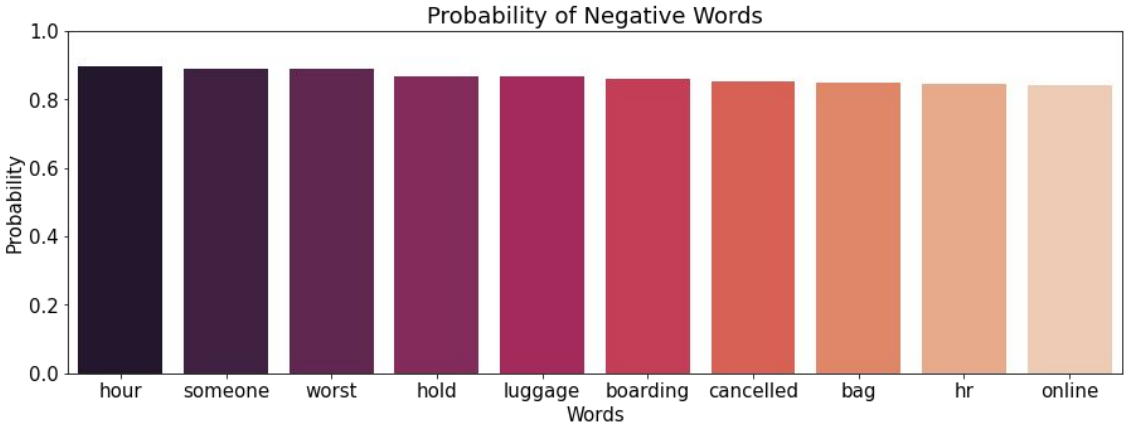
Predictive Words: Delta

- Delayed and canceled flights and customer service issues
- Trouble contacting customer service and had to call several times
- “@JetBlue I had to call back five times to get someone on the phone who knew what they were doing. By that time my getaway went up by $200.”
- “@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.”



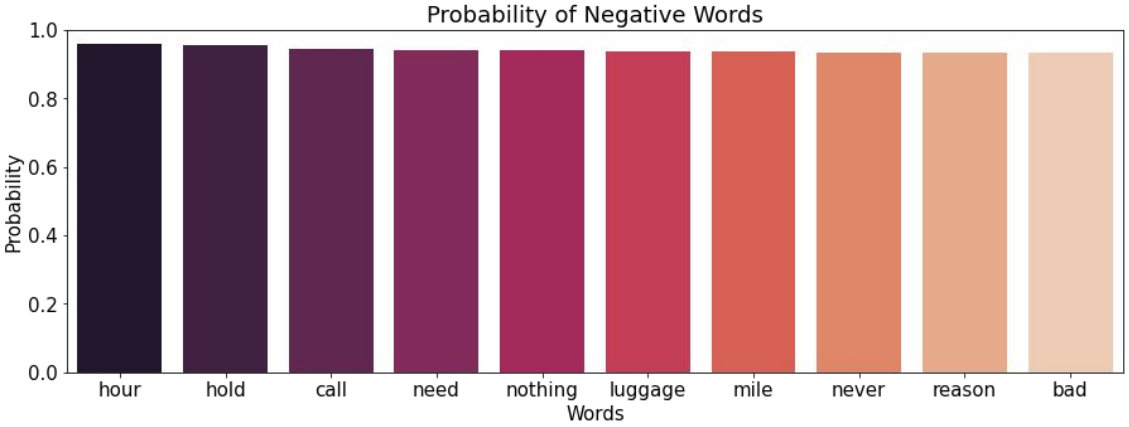
Predictive Words: Southwest

- Customer service issues
- If customers have to change their reservations, get boarding passes, etc, they have to call customer service instead of doing it online
- Customers are also experiencing delayed and late flights and lost and damaged luggage
- “@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”



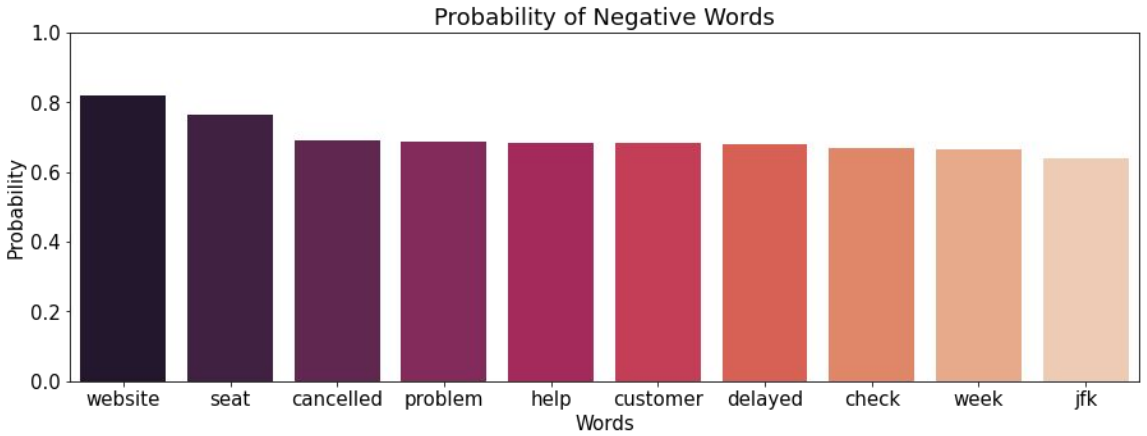
Predictive Words: US Airways

- Customer service issues
- Not being able to connect with customer service and being on hold
- Being hung up on
- also experiencing lost luggage
- “@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.”
- “@USAirways @Beamske how about a real live person talk to the person whose luggage was lost for 4 days and vacation wrecked . @yorkshire2002”



Predictive Words: Virgin America

- Flight booking problems and cancelled flights
- Customers weren't able to reschedule a flight online.
- Website was down
- With customers' flights being canceled, it is hard for them to reschedule their flight
- "@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 text.
- Make text lowercase and remove punctuations and special characters.
- Lemmatize text - returns a root word
- Remove stopwords (“this”, “is”, etc.)
- Tokenize text - puts words in a list

Modeling: Data Vectorizing

- Vectorizing text to 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%

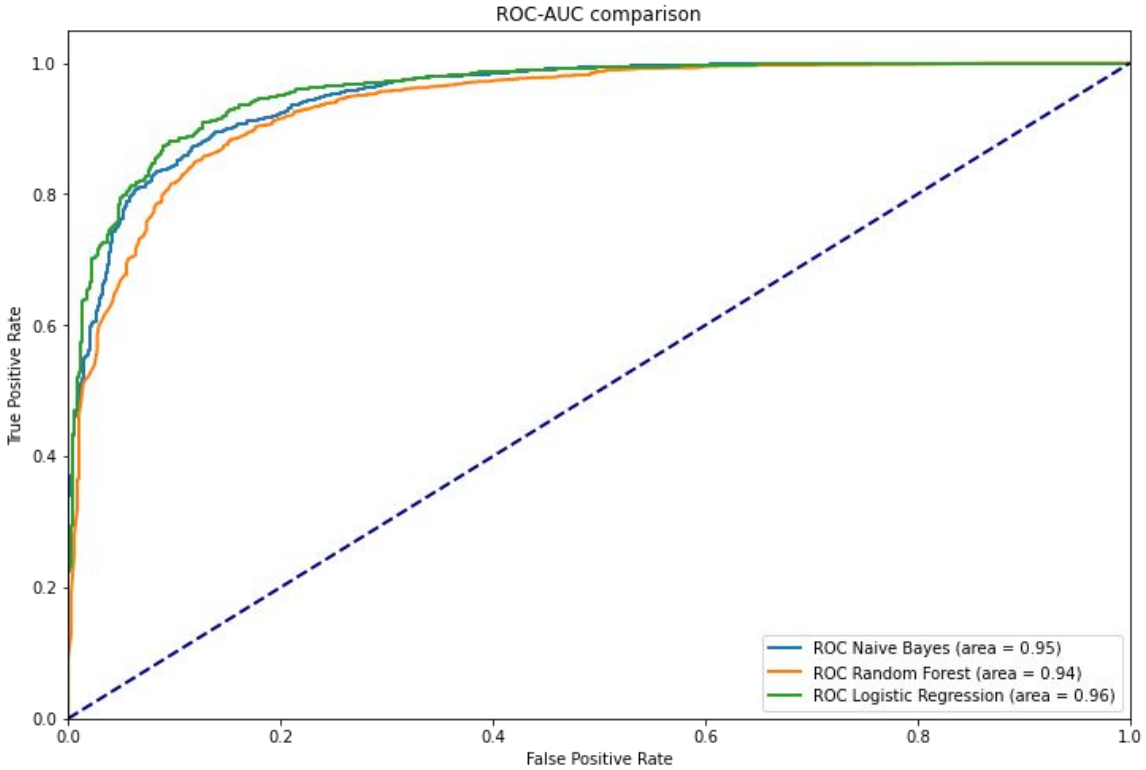
Model Selection: Selecting Model

Model	Best Parameters	ROC-AUC Score	Accuracy
Naive Bayes	n/a	0.9512	89.17%
Random Forest	**max_depth**: None, **max_features**: auto, **n_estimators**: 400	0.9373	89.91%
Logistic Regression 1	**C**: 1, **max_iter**: 1000	0.9583	90.94%

Model Selection: Selecting Model Cont.

Model	Best Parameters	ROC-AUC Score	Accuracy
Logistic Regression 2 - CountVect with n-grams	**C**: 1, **max_iter**: 1000	0.9570	91.44%
Logistic Regression 3 - Tf-idf with n-grams	**C**: 1, **max_iter**: 1000	0.9517	87.72%

ROC-AUC Comparisons



Best Threshold

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

Threshold	Recall	Precision	Accuracy	F1-Score	Ba
Default (0.5)	0.99	0.91	0.91	0.95	0.8

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 alert customers with appropriate message based on sentiment.
- A false negative would predict a tweet to be a positive sentiment tweet, but it was actually a negative sentiment tweet.
- A false negative will result a customer not receiving the proper customer service help.

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

Business Case 2: Customer Service Cont.

- A false positive would predict a negative sentiment tweet, but it was actually a positive sentiment tweet.
- A false positive will result in a bot responding to a customer that had a positive experience and offer a discount or refund
- 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.

End