Sentiment Analysis of Product Reviews

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Table of Content

Background

Amazon company released various products like the Kindle, Fire TV, etc. This dataset consists of over 20,000 reviews of Amazon products. This dataset includes basic product information, rating, review text, and more for each product.

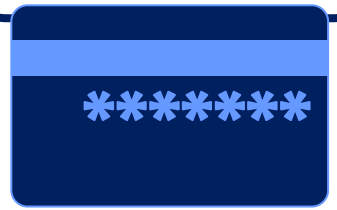
Project Overview

Goal

Identify and analyze consumer sentiments on Amazon products reviews

Dataset

Subset of the Amazon Product Reviews dataset from Kaggle.



Data Understanding & Preprocessing

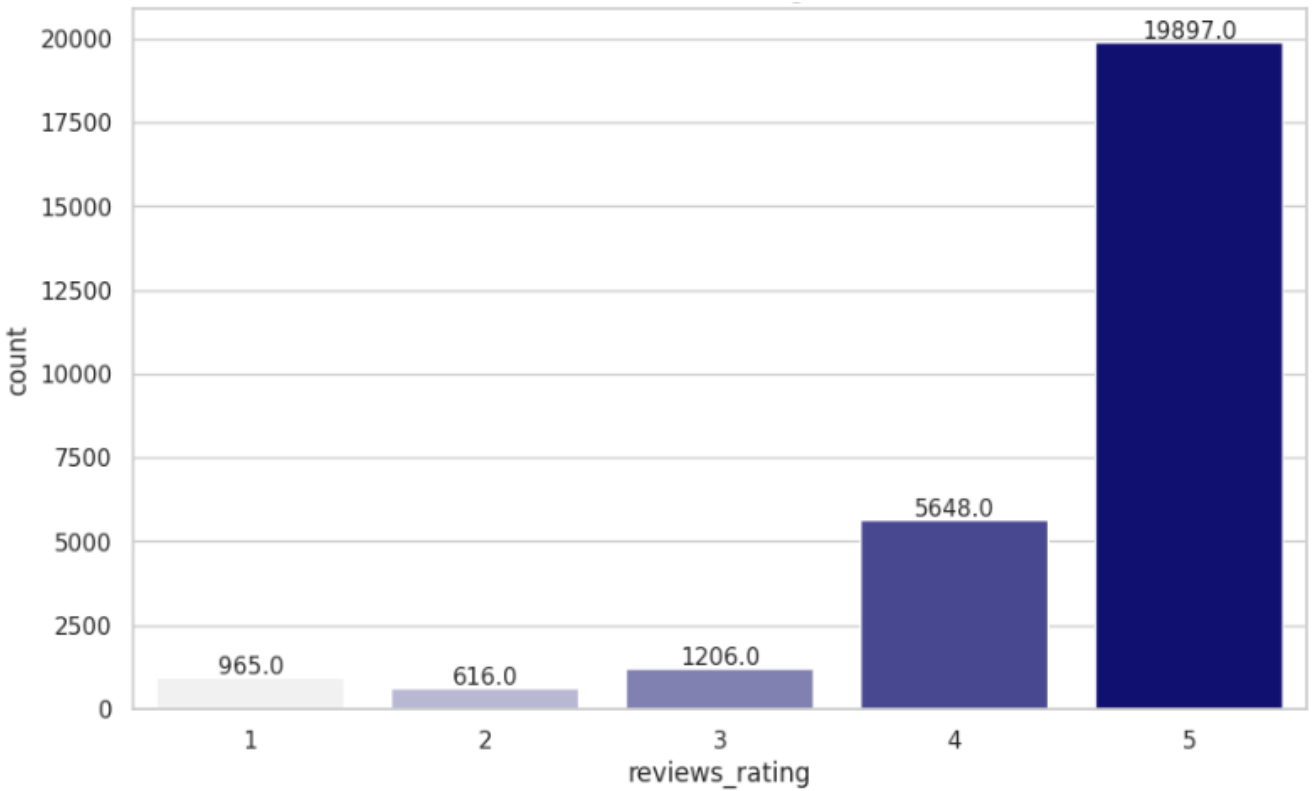
- Name of products
- Rating of Products
- Text review of products
- Tittle review of products (more concise than reviews.text)

Column Name	Non-Null Count	Dtype
id	28332	object
dateAdded	28332	object
dateUpdated	28332	object
name	28332	object
asins	28332	object
brand	28332	object
categories	28332	object
primaryCategories	28332	object
imageURLs	28332	object
keys	28332	object
manufacturer	28332	object
manufacturerNumber	28332	object
reviews.date	28332	object
reviews.dateSeen	28332	object
reviews.didPurchase	9	object
reviews.doRecommend	16086	object
reviews.id	41	float64
reviews.numHelpful	16115	float64
reviews.rating	28332	int64
reviews.sourceURLs	28332	object
reviews.text	28332	object
reviews.title	28332	object
reviews.username	28332	object
sourceURLs	28332	object

EDA : Product Ratings

01

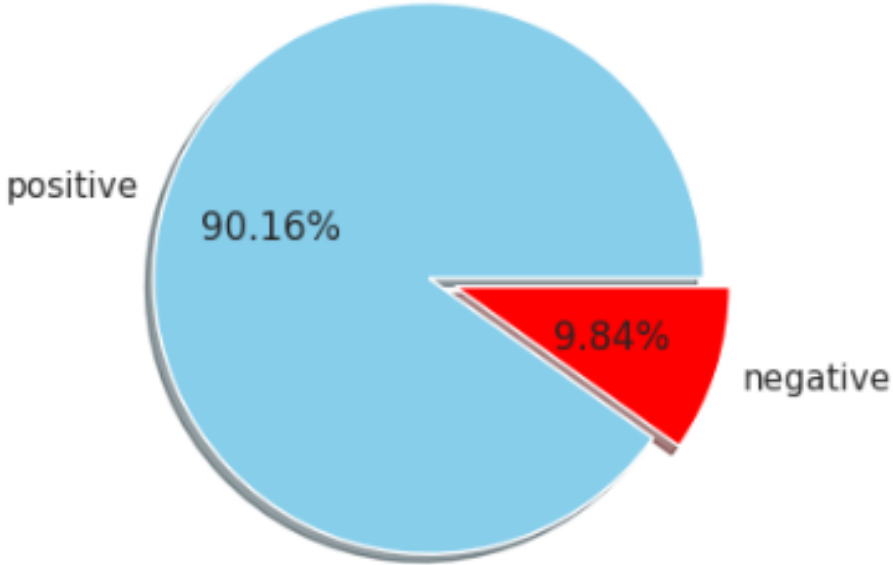
Most of the customer rating is 5.



EDA : Pie Chart of Product Ratings

02

We classify positive (rating 4 & 5) and negative (rating 3 & 2 & 1) reviews : 90.16% positive and 9.84% negative.

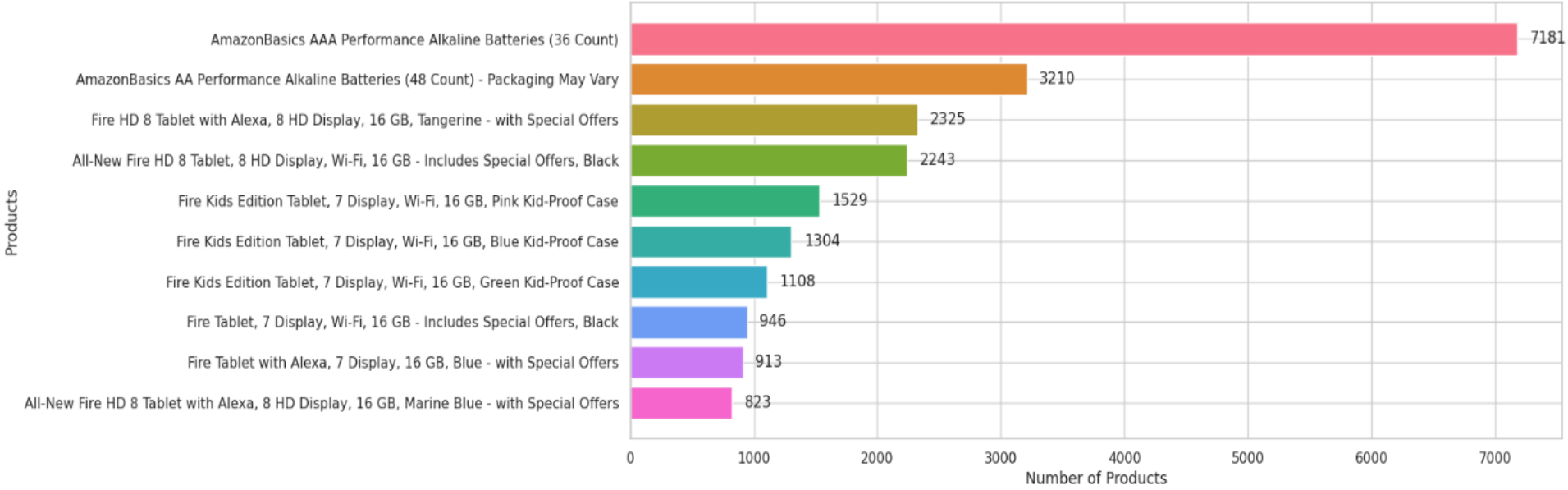


EDA : Top 10 Products with Positive Sentiment

03

Favorite product with positive sentiment :

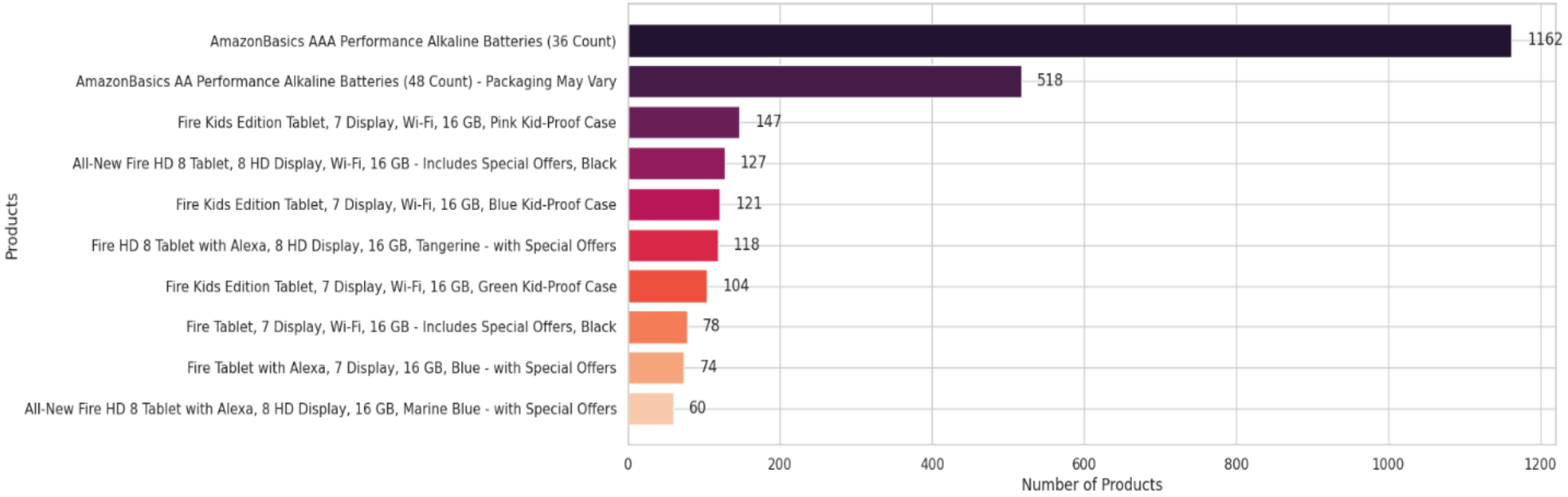
AmazonBasics AAA Performance Alkaline Batteries (36 Count).



EDA : Top 10 Products with Negative Sentiment

04

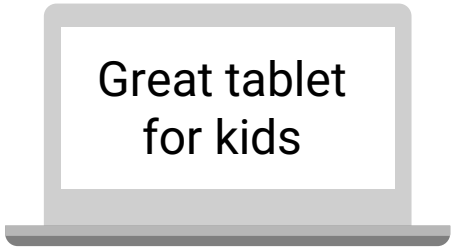
Favorite product with negative sentiment is same with the positive sentiment : AmazonBasics AAA Performance Alkaline Batteries (36 Count).



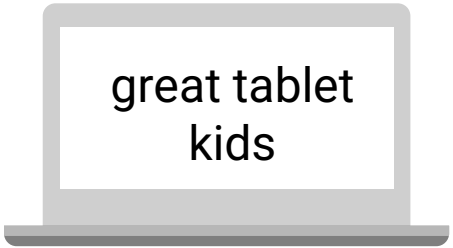
EDA : WorldCloud

05

Before



After



Text Processing

1. Remove links
2. Remove hyperlinks and markups
3. Unify whitespaces
5. Remove non-alphabetic characters using regular expression
6. Remove punctuation, convert to lowercase
7. Join the characters again to form the string
8. Remove stop words using ntlk library
9. Remove non-sensical words (troll messages) defined as having more
10. Check if text is empty after cleaning

WorldCloud (After Text Processing)

Positive Reviews

love, great, easy, price

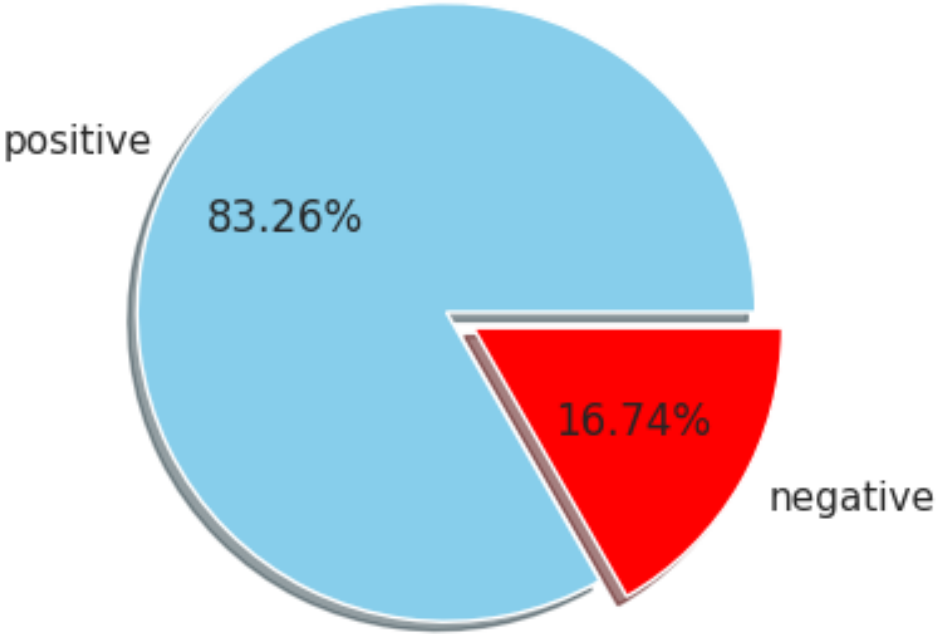
Negative Reviews

last, one, work, long

EDA : Sentiment of Text Review

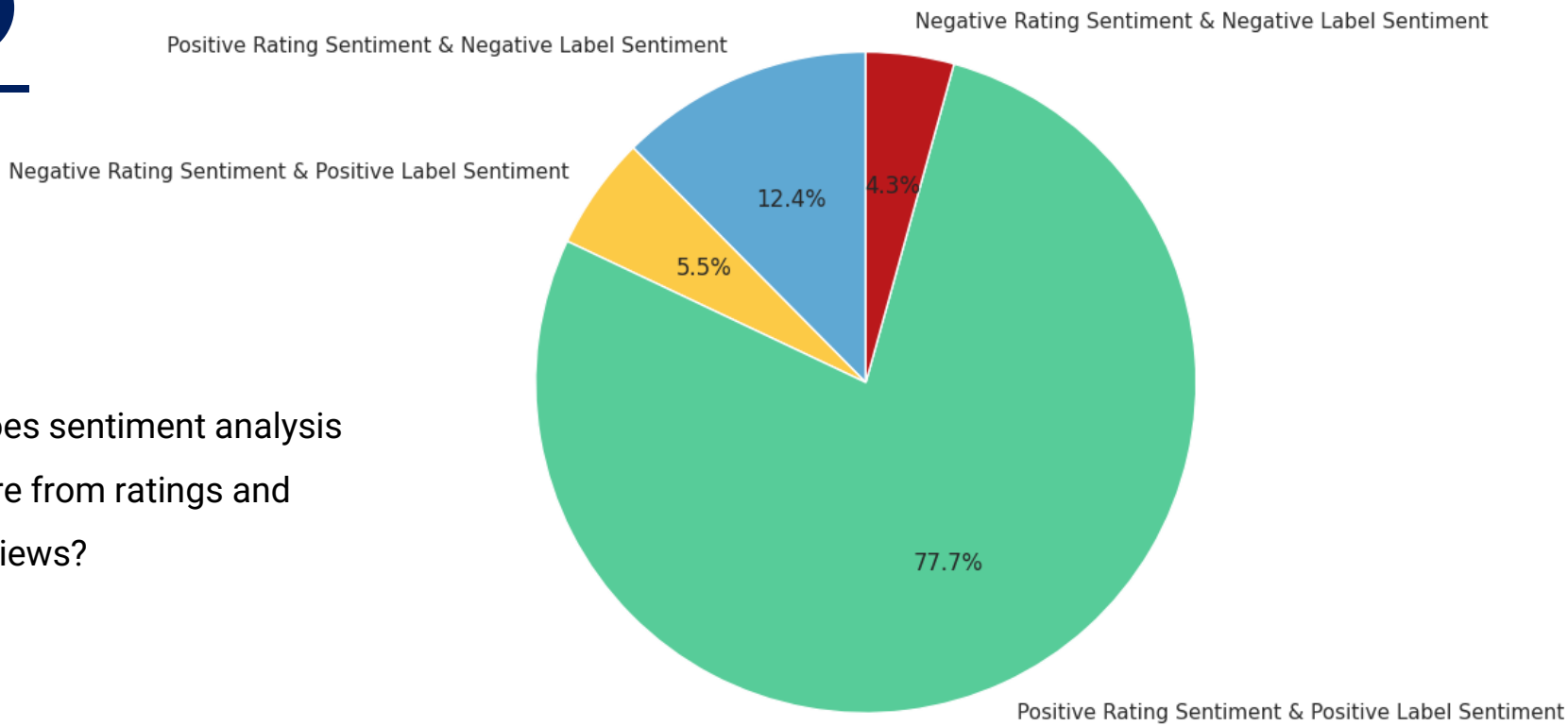
06

We classify sentiment from text review (after text processing) using TextBlob: 83.26% positive and 16.74% negative.



EDA : Sentiment from Rating and Text Review

07



How does sentiment analysis compare from ratings and text reviews?

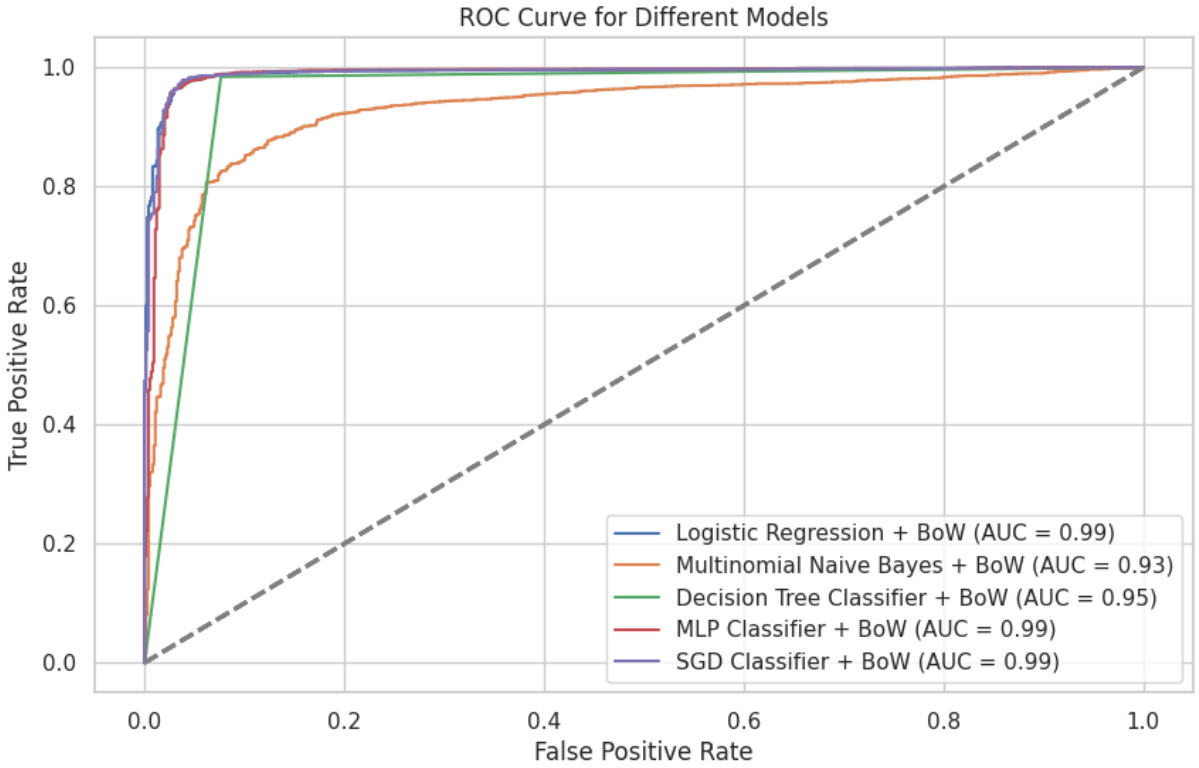
Modeling : with Bag of Words

We create model using text review (after processing) and sentiment of text review.

	F1-Score -1 (%)	F1-Score 1 (%)	ROC AUC Score (%)
Logistic Regression + BoW	93	99	99.14
Multinomial Naive Bayes + BoW	47	93	93.07
Decision Tree Classifier + BoW	92	98	95.40
MLP Classifier + BoW	93	99	98.83
SGD Classifier + BoW	94	99	N/A

Logistic Regression+ BoW performs the best

ROC Curve for Different Models



Logistic Regression+ BoW performs the best

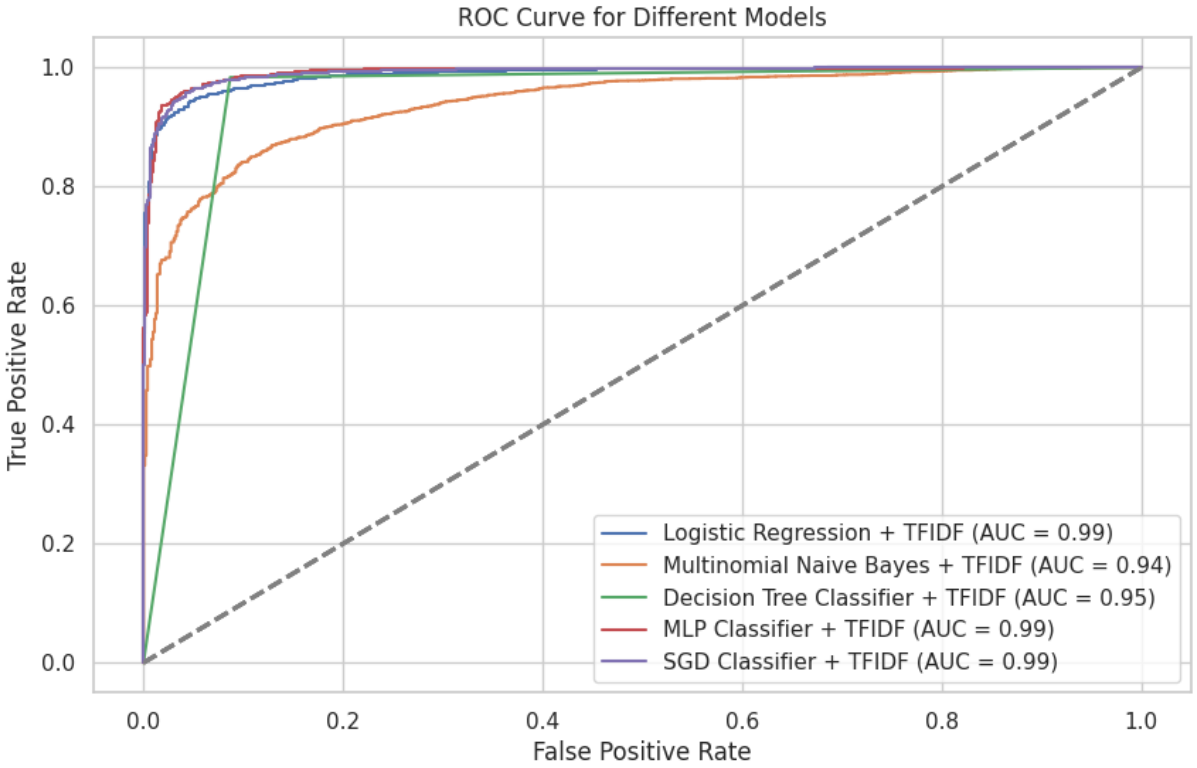
Modeling : with TFIDF Vectorizer

We create model using text review (after processing) and sentiment of text review.

	F1-Score -1 (%)	F1-Score 1 (%)	ROC AUC Score (%)
Logistic Regression + TFIDF	84	97	98.88
Multinomial Naive Bayes + TFIDF	09	91	94.09
Decision Tree Classifier + TFIDF	92	98	95.17
MLP Classifier + TFIDF	91	98	88.63
SGD Classifier + TFIDF	90	98	N/A

Logistic Regression + TFIDF performs the best

ROC Curve for Different Models



Logistic Regression+ BoW performs the best

Conclusions

- The models show good performance in predicting sentiment on Amazon product reviews. In general, the models achieved high accuracy, with most accuracies above 94%.
- The Logistic Regression obtained quite high F1-Score and ROC AUC Score values, indicating the model's ability to classify sentiment in a balanced manner between precision and recall, as well as the ability to separate positive and negative classes.
- Using Bag of Words or Count Vectorizer and TFIDF Vectorizer show high results.

  Priority : higher accuracy -> BoW model

  Priorities : dealing with word frequency, and/or prioritize computing time -> TFIDF model
- Most product reviews have positive sentiment, characterized by high accuracy values and F1-Scores for the positive class. This shows that the majority of Amazon customers have a good experience with the products they have reviewed.

Recommendations

- Logistic Regression as the main model for Amazon product sentiment analysis.
- Company can use the best models that have been developed to monitor consumer sentiment towards their products in real-time.
- Company is advised to further analyze the differences between customer's rating and text review of product.
  Rating 4 / 5 with negative sentiment of text review or
  Rating 1 / 2 / 3 with positive sentiment of text review.

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