

# Sentiment Analysis on Customer Reviews: Model Comparison

## Summary

This documentation provides an overview of the sentiment analysis performed on customer reviews for a product on Amazon. This analysis aimed to classify customer sentiments as positive, negative, or neutral based on their reviews. Different models were evaluated and compared to determine their accuracy in sentiment classification.

## 1. Introduction

This analysis aimed to gain insights from customer reviews by performing sentiment analysis. The dataset consisted of customer reviews preprocessed by removing special characters, stemming, and tokenization. The analysis aimed to identify the sentiment polarity of the reviews and assess the performance of various machine learning models.

## 2. Data Preprocessing

The customer review dataset was subjected to preprocessing steps to ensure data quality and consistency. The text data was cleaned by removing special characters and then subjected to stemming to reduce words to their root forms. Tokenization was applied to split the text into individual words for further analysis.

## 3. Model Evaluation

Three models were selected for sentiment analysis: Naive Bayes, Logistic Regression, and Support Vector Machines (SVM). These models were chosen based on their suitability for text classification tasks. The dataset was split into training and validation sets to train the models and assess their performance.

## 4. Model Performance

The models were evaluated based on various metrics, including accuracy, precision, recall, and F1 score. Accuracy measures the overall correctness of the predictions, while precision focuses on the accuracy of positive predictions. Recall assesses the model's ability to identify positive instances correctly, and the F1 score provides a balanced measure of precision and recall.

## 5. Results and Comparison

The results of the model evaluation are summarized in a table. The Multinomial Naive Bayes model achieved an average accuracy of 91%, while Logistic Regression and SVM models achieved average accuracies of 96% and 96%, respectively. Precision, recall, and F1 scores were also calculated for each model. The Support Vector Machine model demonstrated the highest average precision and F1 score, indicating its effectiveness in positive sentiment classification.

## 6. Visualization

A visual representation of the results was created using a styled DataFrame. The maximum values for validation accuracy, precision, test accuracy, recall, and F1 score were highlighted in green. This visualization provides a quick overview of the best-performing models in each category.

## **7. Conclusion**

In conclusion, sentiment analysis on customer reviews using machine learning models proved to be effective in classifying customer sentiments. The Logistic Regression model demonstrated the highest performance among the models evaluated, with the highest precision and F1 score. These findings can assist businesses in understanding customer sentiments and making informed decisions based on customer feedback.

## **8. Recommendations**

Based on the results, it is recommended to further explore the Logistic Regression model for sentiment analysis on customer reviews. Additionally, additional features or techniques such as word embeddings or deep learning models like Recurrent Neural Networks (RNNs) can be explored to enhance the accuracy and performance of sentiment classification.

## **9. Limitations**

It is important to note that the accuracy and performance of the models may vary depending on the dataset and domain. The results obtained in this analysis are specific to the provided dataset and may not generalize to other contexts. Further experimentation and evaluation on diverse datasets are recommended to validate the findings.

## **10. Future Work**

Future work can involve expanding the analysis by incorporating more advanced techniques, such as deep learning models like Transformers or ensemble methods like Random Forest and Gradient Boosting. Additionally, sentiment analysis can be extended to other data sources, such as social media platforms, to gain a comprehensive understanding of customer sentiments.