

Comparative Sentiment Analysis Using VADER and BERT

Amazon Reviews Sentiment Analysis

TextBlob · VADER · BERT (Transformers)

Project Overview

Sentiment analysis through Amazon product reviews is what this project is all about, be it through three different NLP approaches — TextBlob, VADER, and BERT (Transformers).

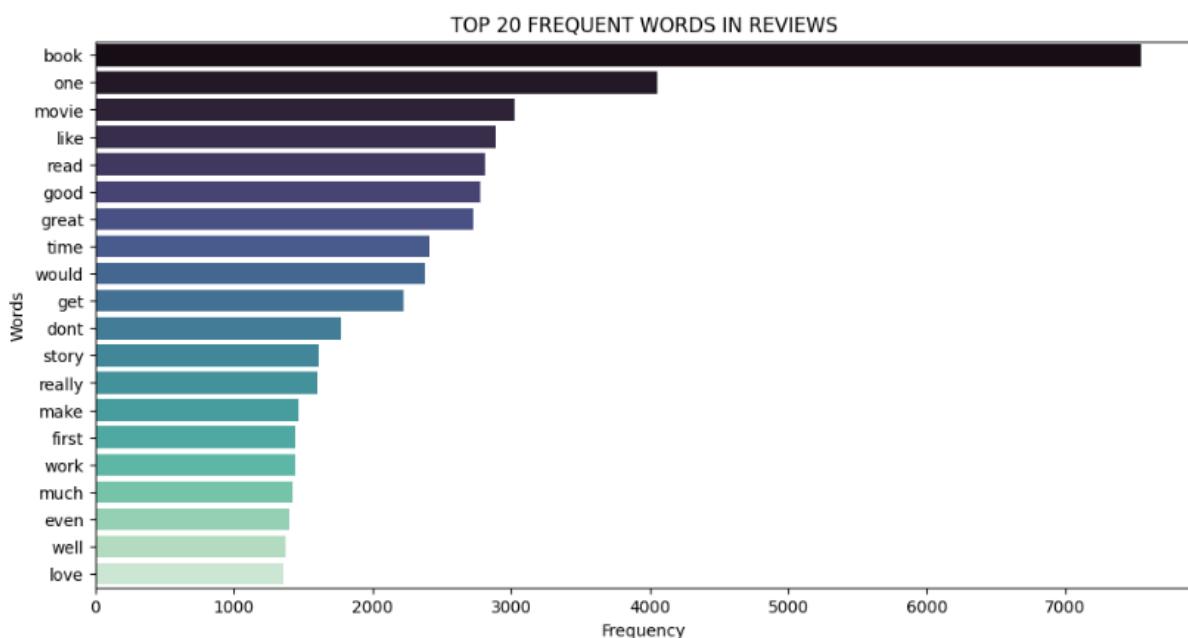
The main goal is to determine customer sentiment through different models, evaluate the differences, and display the emotional patterns in a picture using massive review data. The method consists of text cleaning, feature extraction, sentiment scoring, and visualizing the results using current Python libraries.

Dataset Summary

The text reviews dataset is composed of thousands of reviews with a corresponding column for the scores denoting the sentiment (0 for negative and 1 for positive). The major part of the reviews pertains to the books and movies, where words like book, one, movie, read, story, and good are repeatedly used.

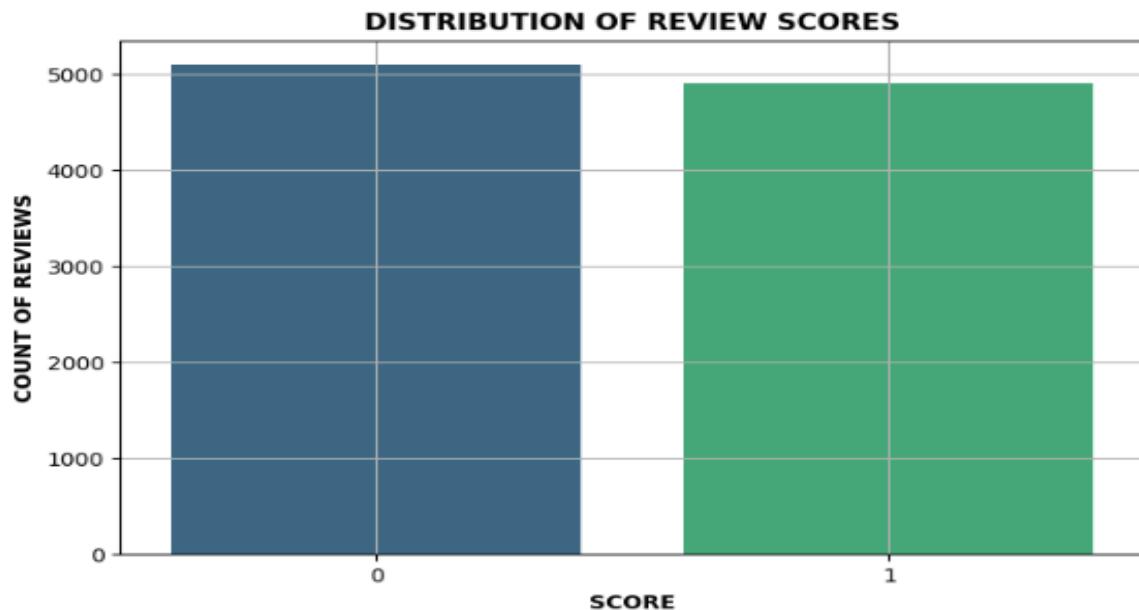
Visual Insights

1. Top 20 Frequent Words



The words appearing in the reviews most often are book, one, movie, like, and read. This signifies that the dataset is mostly composed of book reviews, interspersed with little mentions of movies. Additionally, the very frequent use of rather neutral terms such as “book” and “one” indicates a variety of tones present in the reviews.

2. Review Score Distribution



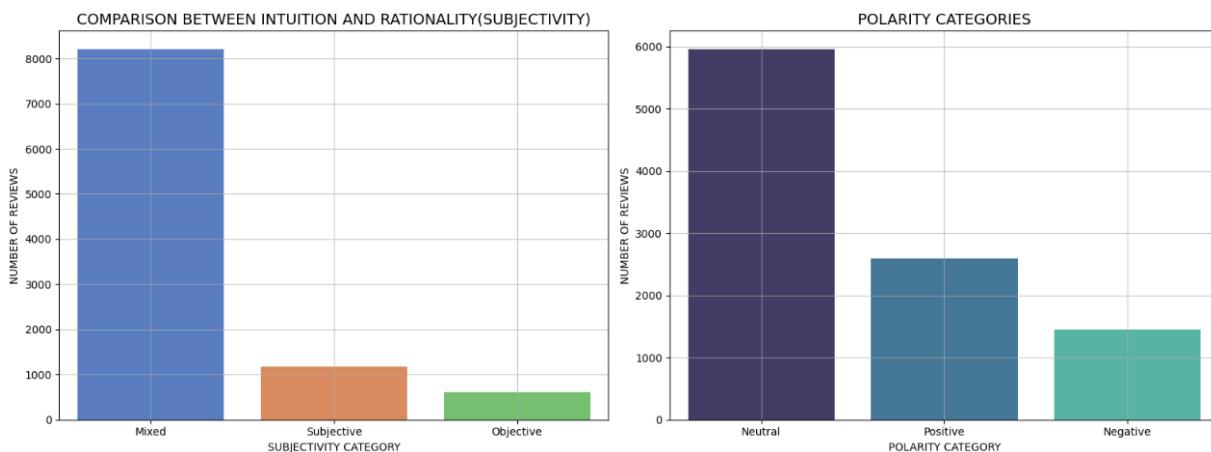
The scores given in the reviews are quite evenly distributed since they include around 5,000 positive reviews and about 4,900 negative ones. This evenness of the reviews is a benefit for the training and evaluation of the models, as it is completely unbiased. The full range of sentiments is represented quite well.

3. Word Cloud



The word cloud visualizes the most prevalent terms found in all the reviews. The frequently mentioned words are book, movie, one, good, story, and love. This points out the reviewer's context, which basically consisted of entertainment items like books, films, and music, and it also shows that a rather neutral emotionality was expressed in general.

4. Subjectivity and Polarity Distribution



Subjectivity Category:

- | |
|---|
| • Mixed: approximately 8,200 reviews (around 82%) |
| • Subjective: around 1,100 to 1,200 reviews (around 11–12%) |
| • Objective: around 600 reviews (about 6–7%) |

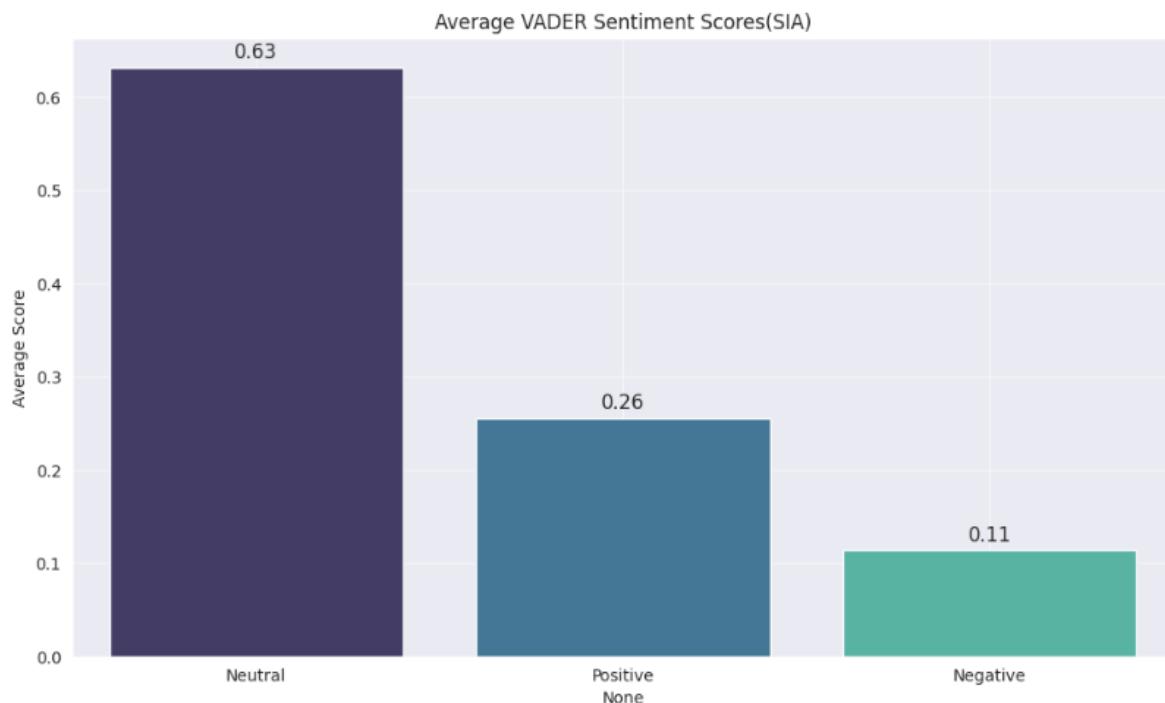
On the basis of data, most of the reviews are classified as Mixed; they contain both factual and opinion-based elements.

Polarity Category:

- | |
|--|
| • Neutral: approximately 5,900 to 6,000 reviews (around 60%) |
| • Positive: around 2,600 reviews (about 25%) |
| • Negative: around 1,400 to 1,500 reviews (about 15%) |

This shows that most reviews have a neutral tone, followed by positive, then negative sentiments.

5. Average VADER Sentiment Scores

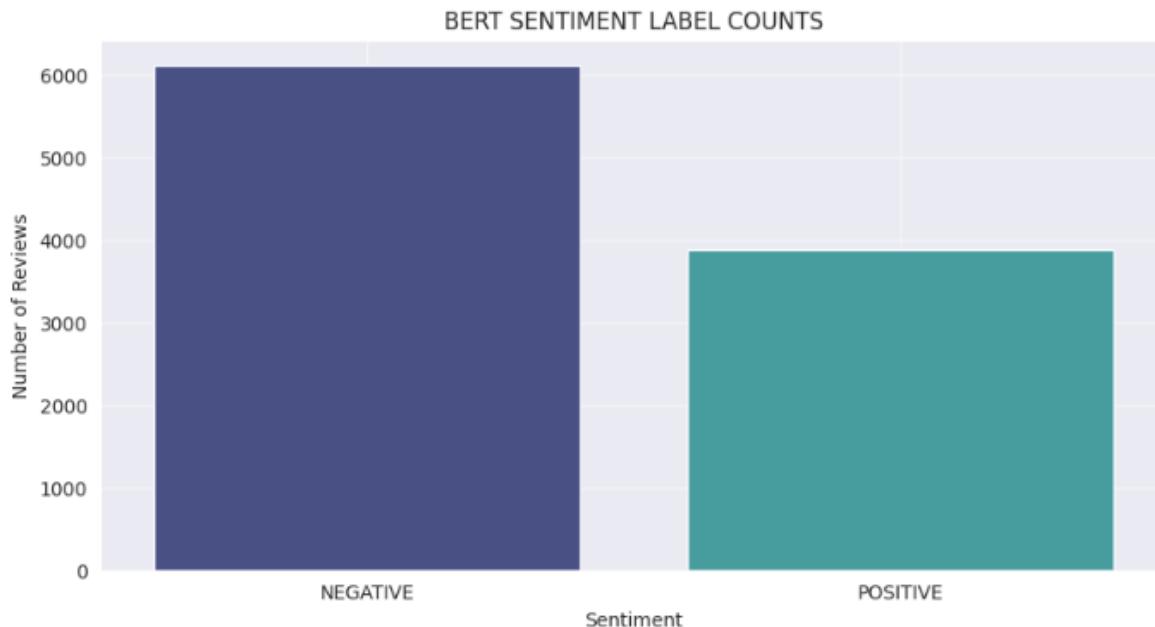


The VADER sentiment analyzer measures average scores across three categories:

- Neutral: 0.63
- Positive: 0.26
- Negative: 0.11

The findings indicate that the predominant interpretation of the text is neutral, which might imply that the customers voice their opinions in a quite restrained way rather than being overly emotional or divided.

6. BERT Sentiment Label Counts



According to BERT transformer-based sentiment analysis:

- Negative reviews: approximately 6,100 (around 61%)
- Positive reviews: approximately 3,900 (around 39%)

The BERT model detected majority of sentiments as negative than positive ones. This suggests that BERT captures subtle dissatisfaction or contextual negativity that simpler models like VADER or TextBlob might overlook.

Key Pointers

- **Text Preprocessing:**
Noise such as spaces, punctuation, numbers, and hyperlinks is removed in order to be processed by applying regular expressions and tokenizers.
- **Lexicon-Based Analysis:**
The implementation utilizing TextBlob to determine polarity (positivity/negativity) and subjectivity (fact vs opinion) has been accomplished.
- **Rule-Based Sentiment (VADER):**
The scores for positive, negative, and neutral sentiments, which quantify the emotional intensity of texts, have been extracted.
- **Transformer-Based Sentiment (BERT):**
A pre-trained transformer model from the Hugging Face library was employed for deep contextual sentiment analysis.
- **Feature Extraction:**
CountVectorizer was used to change the cleaned text into a numerical format which is suitable for machine learning algorithms.
- **Data Visualization:**
Textual patterns and sentiment distributions were represented through graphs made by Seaborn, Matplotlib, and WordCloud.

Model Comparison Summary

Model	Strength	Limitation	Key Observation
TextBlob	Quick and simple sentiment extraction.	Struggles with sarcasm and context.	Classifies most reviews as neutral or slightly positive.
VADER	Detects tone, punctuation, and emphasis.	Less effective on long complex reviews.	Majority of reviews classified as neutral (average score 0.63).
BERT	Context-aware and captures complex emotions.	Slower and GPU-dependent.	Finds higher negativity (61%) indicating deeper contextual sensitivity.

Insights and Conclusions

1. A large proportion of reviews are mixed and neutral, which demonstrates that customers have different perspectives and writing styles.
2. According to TextBlob and VADER, the greater part of the text is neutral or a little positive.
3. BERT, due to its high contextual awareness, detects more subtle negativity in language than others and proves its capability to understand tone and nuance at deeper levels.
4. The dataset's equal distribution of positive and negative labels renders it perfect for training or assessing new sentiment models in the future.