



Deep Learning-based Sentiment Classification for Amazon Products Reviews

Data Driven Approach to Understand Sentiments of Product Reviews

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Project Title & Description

Deep Learning-based Sentiment Classification for Amazon Product

This project aims to develop an advanced sentiment analysis model using Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM) networks to classify product reviews from Amazon into positive and negative sentiment categories. By leveraging deep learning techniques, we will try to create a robust model capable of understanding the contextual details in product reviews, providing valuable insights into customer sentiment.

Problem Statement

In the digital age of e-commerce, product reviews have become a critical source of information for both consumers and businesses. The exponential growth of online shopping platforms has led to an unprecedented volume of user-generated content that holds immense strategic value. Consider these compelling insights:

1. Consumer Decision-Making:

According to [CapitalOne Shopping](#)

- 99% of consumers read online reviews before making a purchase and reviews influence 93% of consumers' purchasing decisions.
- Reviews influence purchasing decisions across all product categories
- Potential buyers rely heavily on sentiment expressed in previous customers' experiences

2. Business Intelligence:

- Companies lose approximately \$62 billion annually due to poor customer service(<https://www.forbes.com/sites/shephyken/2017/04/01/are-you-part-of-the-62-billion-loss-due-to-poor-customer-service/>)
- Sentiment analysis provides real-time insights into product performance and customer satisfaction
- Helps identify product strengths, weaknesses, and areas for improvement

3. Economic Impact:

- A single negative review can drive away potential customers
- Positive reviews can increase conversion rates by up to 3 times

- Reviews act as a crucial trust-building mechanism in online marketplaces

Challenges in Manual Review Analysis:

- Massive volume of reviews (millions generated daily)
- Time-consuming manual sentiment assessment
- Subjective human interpretation
- Inability to process reviews at scale

Relevance to NLP:

Recurrent Neural Networks (RNNs) are highly relevant for sentiment analysis in Natural Language Processing (NLP) due to their ability to effectively process sequential data, like text, where the meaning of a word can be influenced by the words that precede or follow it. Sentiment analysis involves determining the emotional tone behind a piece of text, such as whether a sentence expresses positive, negative, or neutral sentiment. RNNs are capable of capturing the temporal dependencies in text, allowing them to consider the context provided by earlier words when predicting sentiment.

- Modeling language's intrinsic sequentially
- Capturing complex contextual nuances
- Providing adaptive, learned representations
- Handling linguistic complexity dynamically

The approach transforms sentiment analysis from a static classification task to a sophisticated, context-aware computational linguistic challenge.

Data Sources

Dataset: Amazon Reviews Dataset from Kaggle

- Source: Kaggle (<https://www.kaggle.com/datasets/bittlingmayer/amazonreviews>)
- Structure:
 - Binary classification:
 - __label__1: 1-2 star reviews (negative sentiment)
 - __label__2: 4-5 star reviews (positive sentiment)
 - Excludes neutral 3-star reviews
 - Includes review titles and text
 - Primarily English language reviews, with some multilingual content

Volume:

- Training: 468 MB (3.6 million)
- Test: 52 MB (400K)

Data Structure:

Column	Description	Datatype
Label	Sentiment	Text
Reviews	Actual Product Reviews	Text

Expected Outcomes

Anticipated outcomes/learning

- Comparative performance analysis of RNN and LSTM models
- Understanding deep learning model's sentiment classification capabilities

Evaluation Process

We are planning to use Accuracy as an evaluation Metrics. Percentage of correctly classified sentiment labels (positive, negative, neutral) compared to the total number of samples.

But also, if we find the data to be imbalanced, we may also use Precision, Recall and F1-score. We also will produce a Confusion Matrix.