**Abstract**

This study delves into the enhancement of sentiment analysis within Amazon product reviews, focusing on the integration of diverse data modalities including textual content, emojis, star ratings, and total votes to enrich the interpretation of consumer sentiment. Leveraging the Bidirectional Encoder Representations from Transformers (BERT) model across three experimental configurations, this research assesses the individual and combined impact of these features on sentiment classification accuracy in selected e-commerce product categories.

The first experiment evaluates the baseline sentiment classification using only review text, setting a foundational understanding of sentiment analysis with BERT. The subsequent experiment introduces emojis, exploring their synergistic effect with textual content on emotion detection accuracy. The final and most comprehensive experiment integrates all data modalities, assessing the multi-feature model's performance in providing a nuanced understanding of consumer feedback.

Results reveal significant enhancements in sentiment classification accuracy with the integration of multimodal data, highlighting the critical role of non-textual features like emojis, star ratings, and total votes in capturing the full spectrum of consumer sentiment. The multi-feature model, incorporating all data modalities, demonstrates superior performance, markedly improving sentiment classification accuracy across various product categories.

This study presents the potential of multi-modal characteristics in improving the precision and contextual depth of sentiment interpretation, hence advancing the approach in natural language processing for sentiment analysis. The results highlight the useful applications of sophisticated sentiment analysis techniques in comprehending customer comments and raising customer happiness, providing e-commerce stakeholders with actionable insights. The study adds to the body of knowledge on sentiment analysis in academia and offers a methodological foundation for future studies that will use a variety of data modalities to use enriched sentiment analysis for e-commerce and other applications.

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