

Multilabel Classification Model for Customer Review Analysis

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1 Introduction

This report outlines the development and performance of a multilabel classification model designed to categorize customer reviews into various predefined classes. The objective was to accurately identify the sentiment and categories that each review falls into, facilitating targeted responses and improvements in customer service.

2 Methodology

2.1 Data Preprocessing

The model development process began with the transformation of customer review data into a binary format suitable for multilabel classification. This transformation involved converting the text data into a format that machine learning models can process, using techniques such as tokenization and encoding.

The dataset was then split into training and testing subsets, ensuring a balance between the classes to prevent model bias. Data cleaning steps were undertaken to handle missing values and remove any anomalies that could adversely affect model performance.

2.2 Model Building and Training

The model was built using the BERT (Bidirectional Encoder Representations from Transformers) architecture, renowned for its effectiveness in understanding the context of words in text by considering the words that come before and after. This choice was driven by BERT's success in various natural language processing tasks, including sentiment analysis and text classification.

PyTorch Lightning was employed to streamline the training process, with a custom dataset class and data module designed to handle the tokenization and batching of the review texts. The training process was augmented with an early stopping mechanism to prevent overfitting, ensuring the model generalizes well to unseen data.

2.3 Testing and Evaluation

The model was evaluated using a held-out test set, demonstrating its ability to classify reviews accurately across multiple classes. An example review was also processed through the model to illustrate its practical application, showcasing the model's predictive capabilities in a real-world scenario.

3 Advantages

- Contextual Understanding: Leveraging BERT allows the model to understand the context of words in customer reviews, leading to more accurate classification.
- Multilabel Capability: The model can classify reviews into multiple categories simultaneously, providing a comprehensive analysis of customer feedback.
- The use of PyTorch Lightning and the modular design of the model facilitate easy scaling and adaptation to larger datasets or different classification tasks.

4 Disadvantages

- Resource Intensive: The complexity of the BERT model requires significant computational resources for training and inference, potentially limiting its use in resource-constrained environments.
- Preprocessing Overhead: The need for extensive data preprocessing and transformation can add to the time and complexity of deploying the model in a production setting.

5 Potential Problems

- **Class Imbalance:** The model may struggle with imbalanced datasets where some classes are underrepresented, leading to biased predictions.
- **Contextual Nuances:** While BERT is effective at understanding context, subtle nuances in customer sentiment might still be missed, especially in cases of sarcasm or irony.
- **Adaptation to New Categories:** The model may require retraining or fine-tuning to accurately classify reviews into new categories not represented in the training data.

6 Conclusion

The developed multilabel classification model represents a robust tool for analyzing customer reviews, offering detailed insights into customer sentiment and concerns across multiple categories. While there are challenges in terms of resource requirements and potential biases, the advantages in terms of accuracy and contextual understanding make it a valuable asset for customer service and feedback analysis.