

E-Commerce Review Sentiment Analysis and Purchase Intention Prediction Based on Deep Learning Technology

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ABSTRACT

This study proposes a deep learning-based analytical model to conduct an in-depth study of the relationship between consumer trust, perceived benefits, and purchase intention. This model combines natural language processing and sentiment analysis, using the BERT-LSTNet-Softmax model to extract textual features in reviews and perform temporal predictions of consumer sentiment and purchase intention. Experimental results show that this model achieves excellent performance in the e-commerce field and provides a powerful tool for in-depth understanding of consumer purchasing decisions. This research promotes the application of deep learning technology in the field of e-commerce, helps to improve the accuracy of consumer purchase intentions, and provides more support for the development of the e-commerce market and consumer decision-making.

KEYWORDS

BERT model, Consumer Behavior, Data Analysis, Deep Learning, E-commerce, Emotion Analysis

1. INTRODUCTION

E-commerce plays a vital role in today's global business landscape, constantly evolving and expanding. With the advent of the digital age, consumers increasingly tend to satisfy their needs through online shopping, making e-commerce an integral part of modern life. However, despite the rapid growth of e-commerce, the field also faces one of a series of important challenges, namely the complex relationship between consumer trust and purchase intention (Yang et al., 2020). In the era of information explosion, consumers are constantly exposed to various product reviews, and the emotions and perceived benefits in these reviews often have a profound impact on purchasing decisions (Zhou, 2020). Therefore, it becomes crucial to gain a deep understanding of consumers' purchase decision-making process in e-commerce environments. The core goal of this study is to use deep learning

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technology to deeply explore the complex relationship between the emotion of e-commerce product reviews and purchase intention to reveal the intrinsic mechanism of consumer behavior.

Deep learning methods have made significant research progress in the field of e-commerce, especially in solving consumer behavior, sentiment analysis, and purchase intention prediction (Alzahrani et al., 2022). These methods take full advantage of the powerful features of deep neural networks, such as automatic feature extraction, context modeling, and large-scale data processing, to better understand and predict consumer purchasing decisions (Chou & Tsai, 2022). However, these advances are accompanied by a series of challenges and problems, such as the huge data scale, diversity, and complexity in the e-commerce field, which require deep learning models to have more powerful computing resources and computing capabilities (Lu & Wu, 2022). In addition, there are multiple levels of emotional and semantic information in e-commerce product reviews, which require deep learning models to better capture and understand. Finally, research in the field of e-commerce requires more interdisciplinary collaboration to integrate expertise from different fields, such as marketing, psychology, computer science, and data science. These challenges will be the motivation and direction for our in-depth research in this field.

In deep learning research in the field of e-commerce, a variety of models are widely used to solve problems such as sentiment analysis and purchase intention prediction. The following are several representative deep learning models, including CNN, LSTM, GRU and TCN, which have important application potential in the field of e-commerce.

Convolutional neural network is a deep learning model originally used for image processing. The core idea is to effectively capture local features through convolutional layers and pooling layers, and gradually build global information to achieve advanced feature learning (Q. Li et al., 2021). In the field of natural language processing, CNN was introduced for text classification and sentiment analysis. The core component of CNN is the convolution layer, which includes multiple convolution kernels, each convolution kernel is used to capture different features. These convolution kernels perform convolution operations on the text through sliding windows to generate feature maps (X. Li et al., 2023). Subsequently, the feature map is dimensionally reduced and the most significant features are extracted through a pooling layer. Finally, the fully connected layer classifies the extracted features. CNN is widely used in sentiment analysis and text classification tasks in the field of e-commerce. It performs well when processing large-scale text data, especially when local information and semantic features need to be considered (H. Li et al., 2023). CNN is widely used in the field of e-commerce for product review sentiment analysis to help companies understand customer satisfaction and purchase intentions. It is also used for detecting fake reviews and sentiment polarity analysis of reviews. One of the main challenges of CNN is to handle long-distance dependencies of text, since convolution operations mainly focus on local information. Solutions to this problem include introducing deeper models or combining other models such as LSTM or GRU to better capture contextual information.

Long short-term memory network is a variant of Recurrent Neural Network (RNN), designed to solve the problem of traditional RNN's difficulty in capturing long-distance dependencies. LSTM was first proposed by Hochreiter and Schmidhuber in 1997. Its design concept is to use a gating mechanism to selectively update and forget information to better process sequence data. The core of LSTM is a recurrent unit containing input gate, forget gate, output gate and cell state (Issaoui et al., 2021). These gates control the flow of information, allowing the network to learn and remember important information while ignoring unnecessary information. This enables LSTM to handle long sequences and capture long-term dependencies in the sequence (Yadav et al., 2023). LSTM is widely used in sequence modeling tasks, including text generation, machine translation, sentiment analysis, and time series data prediction. In the field of e-commerce, it can be used for time series prediction of purchase intentions and consumer behavior modeling. In e-commerce, LSTM is often used to analyze the temporal trend of purchase intentions. It can help companies better understand the evolution of consumer purchasing decisions and predict future behavior more accurately (Luo et al., 2020). Although LSTM performs well in capturing long-term dependencies, it still suffers from

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