Social Media Data Analysis within Deep Learning Models to Support education Brand Management Decisions

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Abstract: In order to explore the application of deep learning models in supporting education Brand Management decisions, this paper takes Xiaomi smartphones as a case study, selecting specific social media platforms. Data related to this brand was collected from a certain social media platform over a specific period. Subsequently, by constructing and training deep learning models, the paper analyzes user sentiment, hot topics, and brand influence of Xiaomi smartphones on social media. The research results indicate that deep learning models can effectively identify and interpret key information in social media data, providing valuable insights for education Brand Management.

Keywords: Deep learning models; Social media data; Education brand decision

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1. Introduction

With the prevalence of social media in daily life, businesses increasingly rely on these platforms to understand consumer attitudes and behaviors, optimizing education Brand Management. Deep learning, as an advanced data analysis technology, offers the potential to extract profound insights from large-scale social media data [1]. This study focuses on Xiaomi smartphones, a brand with widespread social media influence, exploring the application of deep learning models in analyzing social media data and examining their supportive role in education Brand Management decisions. The research aims to bridge the application gap between deep learning technology and practical education Brand Management practices, providing a new perspective for brands to gain insights into consumer behavior through social media.

2. Research Methodology

(1) Case selection rationale

The main reason for selecting Xiaomi smartphones as the case study in this research is that the brand exhibits significant activity and has a wide user base on social media. As a leading technology company, Xiaomi and its products generate extensive discussions and interactions on social media platforms, providing rich data sources for deep learning models. Additionally, Xiaomi heavily relies on social media platforms for its marketing strategy, making it an ideal case for studying the application of social media data in education Brand Management [2]. Analyzing social media data related to Xiaomi smartphones allows for a better understanding of consumer behavior and brand interaction patterns, providing practical insights for education Brand Management.

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(2) Data collection

1) Social media platform selection and data types

During the data collection phase, this research focuses on the activities of Xiaomi smartphones on major social media platforms. Considering the diverse user characteristics and interaction methods on different platforms, the study selects several major social media platforms, including Weibo, WeChat, and Douban. These platforms cover different user demographics and have distinct characteristics in content sharing and interaction forms. The collected data types include user-generated text, user comments, likes, and shares, reflecting user attitudes and perceptions toward Xiaomi smartphones.

2) Data collection time frame and magnitude

The data collection period for this study spans the past year, covering several important product releases and market activities related to Xiaomi smartphones. This ensures the timeliness and relevance of the data. Within this timeframe, the research team collected a large amount of social media posts and interaction data, totaling hundreds of thousands of records. This data magnitude is sufficient to support the training and analysis of deep learning models, providing reliable support for education Brand Management decisions. Through this data, the study can reveal the performance of Xiaomi smartphones' brand across different user groups and the impact of various marketing activities.

(3) Construction and training of deep learning models

1) Model selection and rationale

To analyze user sentiments and trends related to Xiaomi smartphones on social media, this research selects a deep learning model combining Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM). The choice of this model is due to its powerful capabilities in handling textual data and efficient feature extraction. CNN excels in text classification tasks, particularly in capturing local correlations, such as identifying keywords or phrases, which is crucial for analyzing short texts on social media [3]. LSTM, as a variant of Recurrent Neural Networks (RNN), is well-suited for handling data with time-series characteristics, effectively capturing long-distance dependency information in text, which is useful for understanding the context of user comments. Combining these two models allows for a more comprehensive analysis of social media data, delving into user sentiment and hot topics of brand discussions.

2) Training data and parameter settings

Training data mainly comes from the collected social media posts and interaction data. To enhance the model's accuracy and generalization ability, data preprocessing was performed, including text cleaning (removing irrelevant characters and punctuation), tokenization, and word vectorization using Word2Vec to convert the text into numerical inputs recognizable by the model. Regarding model parameter settings, for the CNN part, multiple convolutional layers were configured, each containing different-sized convolutional kernels to capture features of different lengths. For the LSTM part, appropriate hidden layer dimensions and a multi-layer structure were set to enhance the model's learning ability for time-series data. In the training process, cross-entropy loss function was used to optimize the classification task, employing the Adam optimizer for parameter optimization due to its adaptive learning rate advantages. Additionally, to prevent overfitting, dropout technique was introduced, and the model underwent multiple iterations during training until its performance on the validation set no longer significantly improved. Through these detailed training steps and parameter adjustments, the model effectively learns valuable information from complex social media data.

Table 1: Breakdown of Steps for Constructing and Training the Deep Learning Model

Step	Specific Operation	Detailed Description
Data Preprocessing	Text Cleaning	Remove irrelevant characters and punctuation, clean noise in social media data
	Tokenization	Linguistic tokenization of social media text
	Word Vectorization	Use Word2Vec model to convert text data into numerical vectors
CNN Parameter Settings	Convolutional Layer Setup	Configure multiple convolutional layers to learn hierarchical features of text data
	Convolutional Kernel Size	Each convolutional layer uses different sizes of kernels to capture text patterns of different lengths
LSTM Parameter Settings	Hidden Layer Dimension	Set appropriate hidden layer dimensions to handle complex text data
	Multi-Layer Structure	Build a multi-layer LSTM structure to enhance learning capability for time-series data
Training Process	Loss Function	Use cross-entropy loss function to optimize the model's performance in the classification task
	Optimizer	Utilize the Adam optimizer for parameter optimization, taking advantage of its adaptive learning rate
	Dropout Technique	Apply Dropout technique during training to prevent model overfitting

3. Case Analysis

(1) Overview of Xiaomi smartphone brand

Xiaomi, as a major Chinese smartphone manufacturer and technology company, has been dedicated to providing users with high-value products since its establishment. Xiaomi has not only achieved significant success in the Chinese market but has also successfully expanded internationally, gaining widespread attention in regions such as India, Southeast Asia, and Europe. The brand philosophy of Xiaomi smartphones emphasizes being "born for enthusiasts," meaning a commitment to providing high-quality and high-performance smartphone products for technology enthusiasts. Xiaomi's marketing strategy relies heavily on online marketing and social media activities, establishing close interactive relationships with user groups. Their social media strategy focuses on interacting with consumers by sharing the latest product information, technological innovations, and various promotional activities, thereby building a strong brand loyalty among fans.

(2) Analysis of social media data characteristics

For the performance of Xiaomi smartphones on social media, this study collected a substantial amount of relevant data, including posts and user interaction data on platforms such as Weibo, WeChat, and Douban. Analysis of this data revealed several significant features of Xiaomi smartphones on social media. Firstly, posts about Xiaomi smartphones mainly concentrate on new product releases, technological updates, and promotional activities, reflecting the brand's focus on products and technology. Secondly, discussions among users about Xiaomi smartphones primarily focus on product value for money, technological innovation, and user experience, indicating a high consistency between user perception of the Xiaomi brand and the company's brand positioning. Additionally, the data also showed variations in the activity levels of Xiaomi on different social media platforms, such as higher interaction frequency on Weibo compared to WeChat and Douban. This difference may be attributed to variations in user characteristics and usage habits across different platforms. Through in-depth analysis of this data, a more comprehensive understanding of the performance of Xiaomi smartphones on social media can be achieved.

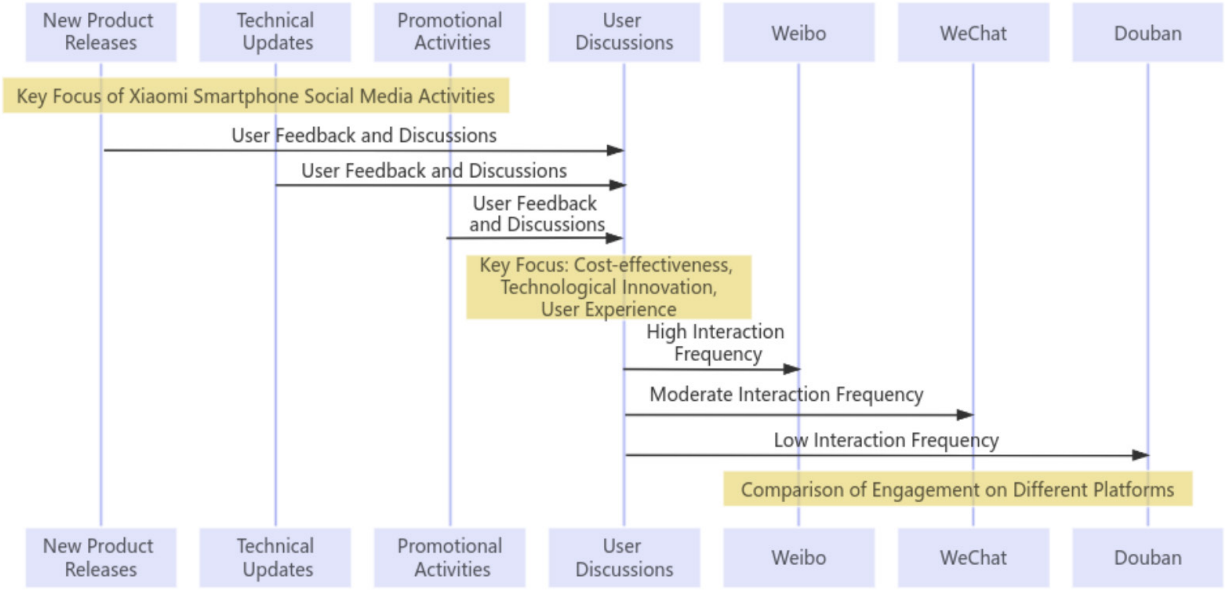

Figure 1 Xiaomi Smartphone Performance on Social Media and Timeline of User Interaction

(3) Analysis results of deep learning models

1) User sentiment analysis

We initially conducted detailed preprocessing of the collected social media data, including data cleaning (removing invalid and duplicate content), text segmentation, and standardizing text using natural language processing techniques. Subsequently, a deep learning model was utilized for sentiment classification, using a pre-trained sentiment analysis model capable of identifying positive, negative, or neutral sentiment tendencies in the text. When dealing with thousands of user comments and feedback, the model could judge the sentiment of each comment by analyzing keywords, phrases, and context. To gain a more accurate understanding of consumer sentiment towards Xiaomi smartphones, the analysis results were quantified, specifically by counting the number of positive and negative comments and comparing these numbers to the total comment count. The data analysis revealed a clear trend: the majority of users exhibited positive sentiments towards Xiaomi smartphones, especially when discussing the brand's value for money and technological innovation. For instance, common terms in positive comments included “cost-effective,” “high-performance,” and “innovative,” emphasizing user recognition of Xiaomi products. On the other hand, negative sentiment comments focused on areas such as inadequate after-sales service and specific product features like “battery issues” and “screen malfunctions.” These negative feedback points provided valuable directions for improvement for Xiaomi. Finally, we compared and analyzed sentiment fluctuations during different time periods, such as new product releases or significant updates. Tracking sentiment changes during these key events revealed a significant increase in both positive and negative sentiment quantity and intensity. This identification of sentiment fluctuations not only reflected the significant impact of these events on brand image and user satisfaction but also provided valuable information for Xiaomi's future market activities and product releases.

2) Identification of hot topics and trends

Identifying hot topics and trends requires utilizing deep learning models to analyze text from a large collection of social media posts, extracting valuable information from massive data, and identifying the topics and discussion trends that are most interesting to current users. Firstly, preprocessing of social media data is necessary, including text cleaning and standardization to ensure accuracy in the analysis. Subsequently, natural language processing techniques were used to analyze the content of the posts. In this process, deep learning models could identify

frequently occurring vocabulary and expressions by learning from extensive text data, revealing the hot topics of user discussions. Additionally, word frequency analysis and co-occurrence word analysis were employed to determine which keywords and topics were widely discussed among users. For example, through word frequency statistics, we found that terms such as "high performance low price," "camera upgrade," and "battery life" frequently appeared in user discussions. This indicated that these aspects were of particular concern to users regarding Xiaomi smartphones. The identification of these keywords not only reflected user needs and interests but also provided important references for the product positioning and market strategy of Xiaomi smartphones. Furthermore, time series analysis was indispensable to identify the temporal trends of user-discussed topics. By tracking the mention frequency of different keywords during different time periods, insights into how the popularity of specific topics changed over time were obtained. For instance, we observed a significant increase in the discussion of relevant topics after new product releases or important updates. This temporal trend analysis helped understand the dynamic changes in user interests, providing chronological insights for Xiaomi in formulating marketing and product development plans.

3) Brand Influence assessment

In brand influence assessment, a data-driven approach is needed to comprehensively analyze the impact of Xiaomi smartphones on social media. This approach heavily relies on deep learning models that combine user interaction data and sentiment analysis results, providing a comprehensive evaluation of brand influence. Firstly, a significant amount of user interaction data related to Xiaomi smartphones on social media platforms, including likes, shares, and comment

4. Insights for education Brand Management Decisions Based on Analysis Results

The analysis results of deep learning models provide Xiaomi smartphone education Brand Management with multiple important insights, guiding future brand strategies and decisions.

Firstly, user sentiment analysis reveals widespread positive evaluations of Xiaomi smartphones by consumers, especially in terms of value for money and technological innovation. This suggests that the brand should continue to emphasize these strengths and highlight them more prominently in marketing communications. On the other hand, the existence of negative sentiment indicates that Xiaomi needs to address and improve shortcomings in after-sales service and product features. By optimizing these aspects, Xiaomi can enhance consumer satisfaction and brand loyalty, thereby strengthening its competitiveness in the market.

Secondly, the identification of hot topics and trends provides Xiaomi with insights into current user focal points, which is crucial for planning future product development and marketing activities. For example, considering user concerns about camera upgrades and battery life, Xiaomi can prioritize these features in future product designs and emphasize these improvements in market promotions. This user-demand-oriented product and marketing strategy is more likely to attract and retain customers.

Lastly, brand influence assessment shows the importance of various social media activities in enhancing brand visibility and user engagement. This implies that Xiaomi should continue leveraging social media platforms to enhance interaction with users, such as by organizing online events and publishing interactive content. Additionally, the analysis reveals differences in brand influence on different social media platforms, necessitating Xiaomi to adopt differentiated strategies on various platforms to maximize their impact.

5. Conclusion

Through in-depth analysis of the performance of Xiaomi smartphone brand on social media, this study

has uncovered the powerful potential of deep learning models in understanding consumer behavior and emotions, identifying trends, and evaluating brand influence. Although there are certain limitations, such as data representativeness and model generalizability issues, the findings of this study offer new perspectives and strategies for education Brand Management. Future research can further optimize models and expand the scope of data to comprehensively understand the impact of social media data on education Brand Management decisions. Looking ahead, with advancements in technology and the development of data analysis tools, the application of deep learning in the field of education Brand Management holds increasingly promising prospects.

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