

A Hotspot-Aware Personalized News Recommendation Mechanism Based on DistilBERT-TC-MA

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ABSTRACT

Aiming at the problems of existing news recommendation methods, such as inadequate exploration of the semantic information of news, neglecting potential hotspot features of news, and challenging the balance between user preferences and hotspot features, a hotspot-aware personalized news recommendation model (DistilBERT-TC-MA) is suggested, which integrates the distilled version of BERT (DistilBERT), text convolutional neural network (TextCNN), and multilayer attention (MA). First, it takes full advantage of DistilBERT, TextCNN, and self-attention mechanism to achieve news encoding. Following this, representations of trending news are dynamically aggregated using the attention mechanism, while user preferences are mined utilizing user click history. Finally, in order to successfully accomplish the click prediction of candidate news, the hotspot features, user preferences, and candidate news are ultimately combined using a click predictor. The experimental results of the suggested DistilBERT-TC-MA model on MIND dataset are better than several other advanced methods.

KEYWORDS

Distilbert, Hot Feature Extraction, Multilayer Attentional Interaction, News Recommendation, Textcnn, User Preference Mining

The current trend shows that users prefer browsing news through connected devices. However, as the quantity of news continues to grow, users often feel overwhelmed in the ocean of information, making it challenging to swiftly and accurately discover news content that aligns with their preferences and needs. Consequently, achieving personalized news recommendations is a crucial solution to enhance the user's news reading experience. (Qin, J., & Lu, P., 2020; Tian, X., et al., 2021; Jiang, S., Zhao, H., & Guo, J., 2021).

The task of news recommendation is to deliver news resources to users that they might find interesting from a plethora of news information, effectively filtering out irrelevant news, and meeting diverse user demands for news information to enhance the quality of their reading experience. Many current research efforts (Talha et al., 2023) analyze user historical behavior, click records, and other personalized information to establish user interest models, uncover user interests, and more precisely

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predict user interests in different topics and keywords. Initially, many works adopt machine learning-based methods, such as (Liu et al., 2010), who design a model based on user click behavior. It utilizes a Bayesian method to learn user's interest representation based on the distribution of user clicks on articles of different news topics. However, such methods often require manual annotation of features and struggle to deeply explore the semantic information. Therefore, CNN, LSTM, and attention networks gradually become employed. For instance, Zhu et al. (2019) utilize two parallel max-pooling CNN to explore implicit feature representations. However, traditional CNNs face challenges in handling long-distance text interactions in news modeling. (Wu et al., 2019) propose a method based on a multi-head self-attention mechanism, enhancing the representation capability of news features. However, large pre-trained language models demonstrate stronger modeling capabilities in capturing complex contextual information in news text, and they are widely applied in personalized news recommendation. For example, (Zhang et al., 2021) incorporate title into the BERT, simultaneously capturing word-level and news-level representation to enhance text representation. It can be observed that the introduction of pre-trained models makes news recommendation more accurate and effective.

However, this entirely user-interest-based recommendation approach may lead to recommendations that are overly similar or even repetitive to the content users have clicked on, resulting in the creation of information bubbles. In fact, trending news significantly influences users. For instance, users interested in sports and military topics might also find daily trending news appealing. Therefore, user click intentions are not only related to individual interests but may also be associated with certain trending news. The current strategy for recommending trending news is to recommend the same trending news to all users, but this approach struggles to address the differentiation in user interests. Hence, some studies propose effective solutions. For example, (Jonnalagedda & Gauch et al., 2013) propose a hybrid method that combines news popularity and user profiles to recommend personalized popular news. They use cosine similarity (Harbouche et al., 2023) to calculate the match between a piece of news and popularity or individual interest. However, these studies often employ traditional machine learning methods, making it challenging to deeply explore potential hot point features and flexibly balance user interests and hot point features. In recent years, some research uses deep learning techniques to explore deep semantic features and learns user's interest representations through user's click history, effectively enhancing the expressive capabilities of news representation and user interest representation. However, there is currently limited work considering the use of deep learning to extract trending features and balance user interests and trending features.

Based on this, this paper designs a Hotspot-Aware News Recommendation Model using DistilBERT-TC-MA. To alleviate the model's size and parameter count for improved efficiency, and considering the challenges of effectively mining deep semantic information in news modeling with current deep learning methods, the model utilizes DistilBERT, TextCNN, and SelfAttention neural network models to effectively process news headline features and deeply explore the rich semantic information in news. In order to effectively balance personalized recommendations and trending news, enhancing both the personalization and diversity of recommendations, the paper proposes the use of attention networks in the Hotspot Information Mining and User Preference Mining modules. These modules interactively incorporate candidate news, hotspots, and user information. In summary, the paper makes the following contributions:

- 1) We design a Hotspot-Aware News Recommendation Model based on DistilBERT-TC-MA, aiming to explore the rich semantic features. The model effectively balances personalized recommendations and trending news, thereby enhancing the personalization and diversity of recommendations.
- 2) By adopting DistilBERT, TextCNN, and SelfAttention neural network models, we maintain model efficiency while deeply mining rich semantic information.
- 3) This paper introduces the Hotspot Information Mining and User Preference Mining modules. Through the incorporation of attention networks, these modules effectively facilitate interaction

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