

摘要

在互联网时代，由于在线新闻服务平台的便捷，用户习惯于依靠各种数字化新闻媒介获取感兴趣的内容。然而，在线新闻服务平台每天都产生大量的新闻文章。对用户来说，从大量信息中筛选符合自己兴趣的内容具有挑战性。因此，新闻推荐系统应运而生。新闻推荐系统的关键在于获得新闻和用户兴趣的准确表示。为了更好地向用户推荐新闻，平台需要了解用户的偏好和需求，并对新闻进行有效的表示。现有平台的新闻推荐方法主要采用新闻标题、类别或者特定的信息进行用户兴趣的匹配，难以准确建模新闻和用户表示。在线新闻平台常常包括了新闻摘要、标题、类别、子类别等信息，通过对新闻内容进行细粒度语义表示可以有效建模新闻和用户的兴趣表示。本文考虑了摘要、标题、类别、子类别等之间的语义关系，提出了多特征注意力融合表示用户兴趣的新闻推荐方法，以及多特征层次化感知用户兴趣的新闻推荐方法，通过实验验证了方法的有效性。主要研究内容如下：

(1) 提出了多特征注意力融合表示用户兴趣的新闻推荐方法。首先，对新闻标题、文本摘要、类别、子类别等特征信息，分别学习了语义表示，通过注意力机制得到统一的新闻表示，用来建模候选新闻表示；然后，利用 CNN 对用户点击新闻及其上下文进行建模，同时利用多头自注意力学习新闻内容间的相关性，最终得到用户兴趣表示；最后，根据用户兴趣表示与候选新闻表示计算用户的兴趣得分，基于兴趣得分对用户进行推荐。实验结果表明，考虑了新闻的多种特征信息可以增强新闻的表示质量，进而提高新闻推荐的性能。

(2) 提出了多特征层次化感知用户兴趣的新闻推荐方法。首先，对候选新闻的多种特征信息进行建模，学习候选新闻的表示；然后，通过用户浏览的新闻文本内容建立用户的初始化兴趣表示，计算粗粒度类别特征对文本内容的注意力，构建粗粒度类别特征增强的用户兴趣表示，进一步计算细粒度类别特征对文档内容的注意力，构建细粒度类别特征增强的用户兴趣表示，融合得到特征增强的用户兴趣表示；最后，计算特征增强用户兴趣表示与候选新闻表示的内积，为用户进行兴趣得分较高的新闻推荐。实验结果表明，通过多特征层次化感知用户兴趣的方法可以有效建模用户兴趣和候选新闻之间的相似性，提高新闻推荐的性能。

(3) 设计实现了基于用户兴趣建模的新闻推荐系统。该系统通过利用新闻的多种特征信息，对候选新闻进行建模；同时分析用户点击新闻的多特征信息建模用

户的兴趣表示，实现了对用户的个性化新闻推荐。

关键词：新闻推荐；多特征；注意力机制；用户兴趣建模

ABSTRACT

In the Internet era, due to the convenience of online news service platforms, users are accustomed to relying on various digital news media to obtain content of interest. However, online news service platforms generate a large number of news articles every day, and it can be challenging for users to sift through the vast amount of information to find content that suits their interests. Therefore, news recommendation system came into being. The key to a news recommendation system is to obtain an accurate representation of news and user interests. In order to better recommend news to users, platforms need to understand users' preferences and needs and effectively represent news. The existing news recommendation methods mainly use news headlines, categories or other special information to match users' interests, which is difficult to accurately model news and user representation. Online news platforms often include news summaries, headlines, categories, sub-categories and other information. Fine-grained semantic representation of news content can effectively model news and user interest representation. Considering the semantic relationships among abstract, title, category and subcategory, this paper proposes a news recommendation method based on multi-feature attention fusion to represent user interests and a news recommendation method based on multi-feature hierarchical perception of user interests. The main research contents are as follows:

(1) A news recommendation method based on multi-feature attention fusion to represent user interests is proposed. Firstly, the semantic representation of news headlines, text abstracts, categories, subcategories and other feature information is learned respectively, and the unified news representation is obtained through the attention mechanism to model the candidate news representation. Then, using CNN to model the user's click on news and its context, and using multi-head self-attention to learn the correlation between news content, ultimately get the user's interest expression. Finally, the user's interest score is calculated according to the user's interest expression and candidate news expression, and the user is recommended based on the interest score. The experimental results show that considering various characteristic information of news can enhance the presentation quality of news and improve the performance of news

recommendation.

(2) A multi-feature hierarchical news recommendation method for perceiving user interests is proposed. Firstly, multiple characteristic information of candidate news is modeled to learn the representation of candidate news. Then, the initial interest representation of users is established through the news text content that users browse, the attention of coarse-grained category features to text content is calculated, and the user interest representation enhanced by coarse-grained category features is constructed, and the attention of fine-grained category features to document content is further calculated, and the user interest representation enhanced by fine-grained category features is constructed. And feature enhanced user interest representations are obtained through fusion. Finally, the features are calculated to enhance the inner product of user interest representation and candidate news representation, and the news with high interest score is recommended for users. The experimental results show that the multi-feature hierarchical perception of user interest can effectively model the similarity between user interest and candidate news, and improve the performance of news recommendation.

(3) A news recommendation system based on user interest modeling is designed and implemented. The system uses various characteristic information of news to model candidate news. At the same time, the multi-feature information of user click news is analyzed to model user interest representation, and personalized news recommendation for users is realized.

Key words: News recommendation; Multi-feature; Attention mechanism; User interest modeling

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