

ENHANCING SEQUENTIAL RECOMMENDATION SYSTEM FOR MOOCS BASED ON HETEROGENEOUS INFORMATION NETWORKS

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what

We introduce a framework to enhance sequential recommendation systems for MOOCs, in which we have:

- Proposed a robust method to integrate and model heterogeneous information networks (HIN) for MOOCs data.
- Built a comprehensive dataset combining user interactions, course metadata, and contextual information from multiple sources.
- Evaluated several advanced sequential recommendation algorithms to ensure personalized and accurate course suggestions.

Overview

Data collection → Model building → Testing and evaluation

Description

1. Data collection

Learner behavior history: Courses taken, completion rate, learning time, actions such as clicks, lecture views, discussions. Assessments: Comments, reviews of the course, emotional and semantic analysis to understand learner concerns. Course content: Title, description, keywords, learning materials, and content connections between courses.

2. Model Building

HIN Model: Represent components such as learners, courses, and content as nodes, and the relationships between them as edges. Incorporating Deep Learning: Apply Graph Neural Networks (GNNs) or Graph Attention Networks (GAT) to exploit relationships between components. Use sequential models such as RNNs or Transformers to predict future behavior based on history. Optimization: Incorporate additional features such as emotions from reviews or course ratings to increase accuracy.

3. Test and evaluation

- Testing data: Using actual datasets from MOOCs or publicly divided into training, testing, and validation sets. -Evaluation criteria: +Precision: Accurate hint ratio. +Recall: Ability to cover matching items. +F1-score: Balance between Precision and Recall. -Model Comparison: HIN assessment improves with traditional models such as Collaborative Filtering or Content-Based Filtering. -Analyze the results: Present with charts, figures, and suggestions for improvement.

Why

- Strong growth of MOOCs: Open online learning platforms (MOOCs) such as Coursera, edX, and Udemy have attracted millions of learners across the globe. However, finding and choosing the right course for individual needs is still a major challenge due to the huge and varied number of courses
- Limitations of the current hint system: Traditional suggestion systems such as Collaborative Filtering or Content-Based Filtering focus only on the history of behavior or content without deeply tapping into the complex relationships between components such as learners, course content, and assessments.
- These limitations lead to the possibility of inaccurate suggestions, especially for new learners (cold-start problem).

The importance of personalized suggestions: Each learner has different needs, interests, and learning goals. A personalized suggestion system based on multi-dimensional relationships can make it easier for learners to find suitable courses, thereby enhancing the learning experience.

Potential of Heterogeneous Information Networks (HIN): The HIN model allows information to be extracted from a variety of data types (learners, courses, assessments, content) and find potential connections between them. When combined with Deep Learning, HIN can enhance suggestion performance, overcoming the limitations of traditional methods.

Practical benefits: The improved suggestion system not only helps learners find the right course, but also supports the MOOCs platform to improve the course completion rate, attract more users, and maintain competition in the market.

References

Meng, L., et al. "Heterogeneous Information Network Embedding for Recommendation." Journal of Artificial Intelligence Research, vol. 56, 2023.

Wu, Y., et al. "Deep Learning-based Sequential Recommendation Systems." IEEE Transactions on Neural Networks and Learning Systems, vol. 34, 2024.

Zhou, Y., et al. "MOOCs Recommendation Using Hybrid Techniques." Proceedings of the 2023 International Conference on Machine Learning (ICML), 2023.

Conclusion

Although research on a sequential suggestion system for heterogeneous information network (HIN)-based MOOCs has not yet been completed, I believe that the initial results have formed an important foundation for the development of an effective suggestion system. I hope that in the coming time, I can continue to optimize the model, test in practice and expand the project by integrating new technologies. It is hoped that, when completed, the project will not only improve the learning experience on MOOCs but also contribute to the development of suggestion systems in many other areas.