

to understand the user behaviors in recommender systems so as to provide recommendation explanation. We will also introduce research efforts on the explainability of recommendation models, beginning from early-stage user/item-based collaborative filtering methods and content-based methods, to matrix factorization based methods, and to the recent deep learning-based approaches.

In terms of explainable search, we will introduce from both user perspective and system designer perspective. In user perspective, search system can be seen as a tool to access a huge information repository, and users should have a correct mental model of the system to know its capabilities and limitations. Based on research efforts on user behavior analysis, we will introduce how to help users understand why the search engine ranks particular documents at top positions. From system designer perspective, we will introduce how and why ranking models such as learning to rank and deep matching models output user-perceived relevances in the way that they are supposed to, based on recent advances on feature sensitive analysis and attention mechanisms.

2 BRIEF BIO OF PRESENTER

Yongfeng Zhang is an Assistant Professor in the Department of Computer Science at Rutgers University (The State University of New Jersey). His research interest is in Information Retrieval, Recommender Systems, Machine Learning, and Internet Economics. In the previous he was a postdoc research associate in the Center for Intelligent Information Retrieval (CIIR) at UMass Amherst, and did his PhD and BE in Computer Science at Tsinghua University, with a BS in Economics at Peking University. He is a Siebel Scholar of the class 2015, and a Baidu Scholar of the class 2014. He has been consistently working on explainable recommendation and search systems. His recent work on the explainability of search and recommendation models include visually explainable recommendation, knowledge base embedding for explainable recommendation, neural-symbolic reasoning, natural language generation for explainable recommendation, as well as explainable product search in e-commerce [1–5, 9–11, 13]. He co-organized and served as the co-chair of the 1st and 2nd International Workshop on Explainable Recommendation and Search (EARS 2018¹ and EARS 2019²), co-located with SIGIR 2018 and 2019. He has been teaching graduate classes ever since the spring semester of 2017, and was awarded a Best Professor Award for Teaching and Mentoring by the Rutgers Computer Science Graduate Student Society in the year of 2018.

3 AUDIENCE AND MATERIALS

The tutorial will be mainly targeting on information retrieval and recommendation system researchers and practitioners. Since we will introduce how recent NLP and Knowledge base techniques will help explainable recommendation and search, it may also attract NLP, Semantic, and Knowledge researchers. Since we will also introduce how explainable recommendation and search are applied in commercial real-world systems such as e-commerce, search engine, and social networks, it may also attract industry researchers and practitioners from different areas. For prerequisite, basic understandings of information retrieval and recommendation

system knowledge will be preferred, but we will introduce the basic concepts in the tutorial for better audience engagement. The tutorial slides and relevant papers in explainable recommendation and search for the audiences are provided at the tutorial website³.

4 PREVIOUS EDITIONS

This is the third edition of the Tutorial on Explainable Recommendation and Search. Before this we presented the tutorial on WWW 2019 [15] and SIGIR 2019 [14]. We have also organized the first and second International Workshop on Explainable Recommendation and Search (EARS 2018 and EARS 2019) co-located with SIGIR 2018 [16, 17] and SIGIR 2019 [18], which helps to prepare a clear, well-organized and inspiring tutorial on this topic.

REFERENCES

- [1] Qingyao Ai, Vahid Azizi, et al. 2018. Learning heterogeneous knowledge base embeddings for explainable recommendation. *Algorithms* 11, 9 (2018), 137.
- [2] Xu Chen, Hanxiang Chen, Hongteng Xu, Yongfeng Zhang, Yixin Cao, Zheng Qin, and Hongyuan Zha. 2019. Personalized Fashion Recommendation with Visual Explanations based on Multimodal Attention Network: Towards Visually Explainable Recommendation. In *Proceedings of the 42nd International ACM SIGIR Conference on Research and Development in Information Retrieval*. ACM, 765–774.
- [3] Xu Chen, Zheng Qin, Yongfeng Zhang, and Tao Xu. 2016. Learning to rank features for recommendation over multiple categories. In *Proceedings of the 39th International ACM SIGIR conference on Research and Development in Information Retrieval*. ACM, 305–314.
- [4] Xu Chen, Hongteng Xu, Yongfeng Zhang, Jiayi Tang, Yixin Cao, Hongyuan Zha, and Zheng Qin. 2018. Sequential Recommendation with User Memory Networks. In *Proceedings of the eleventh ACM international conference on web search and data mining*. ACM.
- [5] Xu Chen, Yongfeng Zhang, and Zheng Qin. 2019. Dynamic Explainable Recommendation based on Neural Attentive Models. *AAAI* (2019).
- [6] David Gunning. 2017. Explainable artificial intelligence (xai). *Defense Advanced Research Projects Agency (DARPA), nd Web* (2017).
- [7] Jaspreet Singh and Avishek Anand. 2019. EXS: Explainable Search Using Local Model Agnostic Interpretability. In *WSDM*. 770–773.
- [8] Xiting Wang, Yiru Chen, Jie Yang, Le Wu, Zhengtao Wu, and Xing Xie. 2018. A Reinforcement Learning Framework for Explainable Recommendation. In *2018 IEEE International Conference on Data Mining (ICDM)*. IEEE, 587–596.
- [9] Yikun Xian, Zuohui Fu, S Muthukrishnan, Gerard de Melo, and Yongfeng Zhang. 2019. Reinforcement Knowledge Graph Reasoning for Explainable Recommendation. *SIGIR* (2019).
- [10] Yongfeng Zhang. 2015. Incorporating phrase-level sentiment analysis on textual reviews for personalized recommendation. In *Proceedings of the eighth ACM international conference on web search and data mining*. ACM, 435–440.
- [11] Yongfeng Zhang. 2017. Explainable Recommendation: Theory and Applications. *arXiv preprint arXiv:1708.06409* (2017).
- [12] Yongfeng Zhang and Xu Chen. 2018. Explainable recommendation: A survey and new perspectives. *arXiv preprint arXiv:1804.11192* (2018).
- [13] Yongfeng Zhang, Guokun Lai, Min Zhang, Yi Zhang, Yiqun Liu, and Shaoping Ma. 2014. Explicit factor models for explainable recommendation based on phrase-level sentiment analysis. In *SIGIR*. 83–92.
- [14] Yongfeng Zhang, Jiayin Mao, and Qingyao Ai. 2019. SIGIR 2019 Tutorial on Explainable Recommendation and Search. In *Proceedings of the 42nd International ACM SIGIR Conference on Research and Development in Information Retrieval*. ACM, 1417–1418.
- [15] Yongfeng Zhang, Jiayin Mao, and Qingyao Ai. 2019. WWW'19 Tutorial on Explainable Recommendation and Search. In *Companion Proceedings of The 2019 World Wide Web Conference*. ACM, 1330–1331.
- [16] Yongfeng Zhang, Yi Zhang, and Min Zhang. 2018. SIGIR 2018 Workshop on Explainable Recommendation and Search (EARS 2018). In *SIGIR*.
- [17] Yongfeng Zhang, Yi Zhang, and Min Zhang. 2019. Report on EARS'18: 1st International Workshop on Explainable Recommendation and Search. In *ACM SIGIR Forum*, Vol. 52. ACM, 125–131.
- [18] Yongfeng Zhang, Yi Zhang, Min Zhang, and Chirag Shah. 2019. EARS 2019: The 2nd International Workshop on Explainable Recommendation and Search. In *Proceedings of the 42nd International ACM SIGIR Conference on Research and Development in Information Retrieval*. ACM, 1438–1440.

¹<http://ears2018.github.io>

²<http://ears2019.github.io>

³<https://sites.google.com/view/ears-tutorial/>