WWW'19 Tutorial on Explainable Recommendation and Search

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ABSTRACT

Explainable recommendation and search attempt to develop models or methods that not only generate high-quality recommendation or search results, but also intuitive explanations of the results for users or system designers, where the explanations can be either post-hoc or directly come from an explainable model. Explainable recommendation and search can help to improve the system transparency, persuasiveness, trustworthiness, and effectiveness. This is even more important in personalized search and recommendation scenarios, where users would like to know why a particular product, web page, news report, or friend suggestion exists in his or her own search and recommendation lists. The tutorial focuses on the research and application of explainable recommendation and search algorithms, as well as their application in real-world systems such as search engine, e-commerce and social networks. The tutorial aims at introducing and communicating explainable recommendation and search methods to the community, as well as gathering researchers and practitioners interested in this research direction for discussions, idea communications, and research promotions.

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1 TOPIC AND RELEVANCE

The tutorial will introduce the research and application of Explainable Recommendation and Search Systems, under the background of Explainable AI in a more general sense. Early recommendation and search systems adopted intuitive yet easily explainable models to generate recommendation and search lists, such as user-based and item-based collaborative filtering for recommendation, which provide recommendations based on similar users or items, or TF-IDF based retrieval models for search, which provide document ranking lists according to word similarity between different documents.

However, state-of-the-art recommendation and search models extensively rely on complex machine learning and latent representation models such as matrix factorization or even deep neural networks, and they work with various types of information sources such as ratings, text, images, audio or video signals. The complexity of state-of-the-art models makes search and recommendation systems blank-boxes for end users, and the lack of explainability weakens the persuasiveness and trustworthiness of the system, making explainable recommendation and search important research issues to IR, RecSys, KDD, and the Web research communities.

In a broader sense, researchers in the whole artificial intelligence community have also realized the importance of Explainable AI [3], which aims to address a wide range of AI explainability problems in deep learning, computer vision, automatic driving systems, and natural language processing tasks. As an important branch of AI research, this further highlights the importance and urgency for our IR/RecSys/KDD/Web communities to address the explainability issues of various recommendation and search systems.

Recently, a series of AI regulations have entered into force, such as the EU General Data Protection Regulation (GDPR) and The California Consumer Privacy Act of 2018, which emphasize the "principle of transparency" of intelligent algorithms, and imply the "right to explanation" of algorithmic decisions. As an important branch of AI research, this further highlights the importance and urgency for our research community to discuss and address the explainability issues of various recommendation and search systems.

Breadth. The tutorial covers two main topics, explainable recommendation and explainable search [1, 2, 4–9]. Both topics will start from very early research efforts on recommendation and search systems, such as user/item-based collaborative filtering methods, TF-IDF, and BM25 models, so that we can prepare the audiences will proper background and problem settings. The tutorial will then introduce a sequence of efforts from the community on the explainability issues of recommendation and search systems in a chronological order, so that we can help the audience to understand how the research area developed from 1980/1990s research pioneers to the most recent research advances. We will also provide a taxonomy to classify different methods for better understanding. The tutorial will cover the topics about how explainable and search techniques are applied in real-world systems such as e-commerce (Amazon, Alibaba), search engines (Google, Bing), and social networks (Facebook, Twitter).

Depth. State-of-the-art search and recommendation systems are powered by different kinds of machine learning models to estimate the relevance between queries and documents or users and items. As these models become more sophisticated, it also becomes difficult to understand how they actually work. Consequently, the lack of explainability makes it difficult for system designers to debug and improve the ranking models, or for end users to better access the search/recommendation results so as to build trust in the system. Therefore, some research efforts, albeit not necessarily under the term explainable recommendation and search, have been put to improve the explainability of recommendation and search systems.

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In terms of explainable recommendation, we will introduce research efforts on Computer Human Interaction (CHI) that attempts 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.

The team. All of the presenters are active researchers in the explainable recommendation and search area. Dr. Zhang has been consistently working on Explainable Recommendation. He co-organized the first International Workshop on ExplainAble Recommendation and Search (EARS) co-located with SIGIR 2018 [10, 11]. Dr. Mao and Dr. Ai have been working on Explainable Search systems, where Dr. Mao specializes in user behavior analysis for explainable search and Dr. Ai specializes in explainable machine learning models for explainable search. The team assemble ensures that we cover both research topics, as well as research efforts from both information science and computer science communities.

2 BRIEF BIO OF ORGANIZERS

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, Data Mining, and Internet Economics. In the previous he was a postdoc 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 Univeristy. 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 systems ever since 2014. His recent work on the explainability of search and recommendation models include visually explainable recommendation, knowledge graph-based explainable recommendation, natural language generation for explainable recommendation, as well as explainable product search in e-commerce.

Jiaxin Mao is a postdoc from the Department of Computer Science and Technology of Tsinghua University, advised by Prof. Shaoping Ma and Prof. Yiqun Liu. He focuses on user behavior analysis of search engines and has expertise in utilizing user behavior signals to estimate their preference and satisfaction in Web Search and building click models to extract unbiased relevance feedback in different search contexts. He also served as a SIGIR student liaison for Asia region from 2017 to 2018.

Qingyao Ai is a fifth year Ph.D student advised by Prof. W. Bruce Croft in the Center for Intelligent Information Retrieval (CIIR), College of Information and Computer Sciences, University of Massachusetts Amherst. His research mainly focuses on developing intelligent retrieval systems with machine learning techniques. He actively works on applying deep learning techniques on information retrieval problems including ad-hoc retrieval, explainable product search/recommendation and learning to rank. Before his study in CIIR, he obtained his bachelor degree from Dept. Computer Science and Technology, Tsinghua University, and finished his undergraduate thesis project on click models in THUIR lab, advised by Prof. Yiqun Liu.

3 AUDIENCE

The tutorial mainly targets on IR, RecSys, Machine Learning, and Data Mining researchers and practitioners. Since we will introduce how recent NLP and Knowledge graph techniques will help explainable recommendation and search, it is also relevant to NLP, Semantic, and Knowledge Base researchers. We also introduce how explainable recommendation and search are applied in commercial real-world systems such as e-commerce, search engine, and social networks, which is relevant to 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.

4 PREVIOUS EDITIONS

This is the first edition of the Tutorial on Explainable Recommendation and Search. Before this we organized the first International Workshop on Explainable Recommendation and Search (EARS 2018) co-located with SIGIR 2018[1]. The experience and communications from the workshop helped to prepare a clear, well-organized and inspiring tutorial on this topic.

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