Collaborative Information Retrieval: Frameworks, Theoretical Models, and Emerging Topics

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ABSTRACT

A great amount of research in the IR domain mostly dealt with both the design of enhanced document ranking models allowing search improvement through user-to-system collaboration. However, in addition to user-to-system form of collaboration, user-to-user collaboration is increasingly acknowledged as an effective mean for gathering the complementary skills and/or knowledge of individual users in order to solve complex search tasks.This tutorial will first give an overview of the ways into collaboration has been implemented in IR models with the attempt of improving the search outcomes with respect to several tasks and related frameworks (ad-hoc search, group-based recommendation, social search, collaborative search). Second, as envisioned in collaborative IR domain (CIR), we will focus on the theoretical models that support and drive user-to-user collaboration in order to perform shared IR tasks. Third, we will develop a road map on emerging and relevant topics addressing issues related to collaboration design. Our goal is to provide participants with concepts and motivation allowing them to investigate this emerging IR domain as well as giving them some clues on how to tackle issues related to the optimization of collaborative tasks. More specifically, the tutorial aims to:

1. Give an overview of the key concept of collaboration in IR and related research topics;
2. Present state-of-the art CIR techniques and models;
3. Discuss about the emerging topics that deal with collaboration;
4. Point out some challenges ahead.

Categories and Subject Descriptors

H.3.3 [**INFORMATION STORAGE AND RETRIEVAL**]: Information Search and Retrieval - *Search process*

Keywords

Collaborative information retrieval; user behavior analysis

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1. TUTORIAL OUTLINE

Part 1: Collaboration in Information Seeking

We will present a large synthesis of the different forms of collaboration, whether user-to-system [24] or user-to-user [14, 11, 4]. Then, considering the particular scenario of collaborative search defined in [3, 4], we will introduce the different underlying paradigms.

1. The different forms of collaboration

- *User-to-system collaboration.*Yang et al. [24] defines dynamic IR as the process of exploiting and modeling users' feedback so as to anticipating future actions. This particular form of collaboration provides interesting insights in terms of users' actions leveraging which is essential in collaborative search. We will give a summary of the collaborative search models based particularly on the dynamic IR approach.

- *User-to-user collaboration.*We will present the fundamental principles of collaborative or group-based filtering, social IR, and collaborative IR. We will also point out the main differences between the underlying design of collaboration within those frameworks with respect to key dimensions of collaboration [4].

2. Collaboration Paradigms

Collaborative search is guided by three main paradigms avoiding redundancy between collaborators' actions and optimize the search effectiveness [2]: the division of labor ,the sharing of knowledge, and the awareness.

Part 2: Models and Techniques for Collaborative Document Seeking and Retrieval

CIR models provide an algorithmic mediation that enables to leverage from collaborators' actions in order to enhance the effectiveness of the search process [19]. We distinguish two categories of models: system-mediated approaches [2, 9, 12, 16] and user-driven system-mediated approaches [18, 20]. To better understand these models, we will start by highlighting the challenges and issues of collaborative IR and presenting empirical studies surrounding collaborative search [15, 23, 21].

1. Challenges and Issues

Collaborative IR is a more complex setting than interactive IR and dynamic IR since it involves groups of users interacting with both the IR system and the other members of the group. We present here the different challenges and issues underlying this complex setting.

2. Empirical understanding of CIR

Several work has studied collaborative search in terms of behavioral process and search performance. We will present here interesting studies and their main results. We will end by a summary of learned lessons and design implications.

3. CIR models and techniques

- *System-mediated Document Ranking models*

The essence of these models is to leverage collaborators actions, namely relevance feedback, through algorithmic techniques by considering that users act according to particular predefined roles [4], whether collaborators act similarly [2, 9]or not [12, 16, 19].

- *User-driven Document Ranking Models*

While roles enable to structure the collaborative search session by setting collaborators' search strategies, an interesting perspective is to overpass the framework of predefined roles constraining users in search skills they might not really fit by rather focusing on latent roles of collaborators [18, 20].

Part 3: Emerging topics around collaboration

This tutorial part aims at motivating participants investigating emerging research topics relying on the key notion of collaboration. More particularly, we will focus on recent advances in social IR, community question-answering and crowd-sourcing.

1. Recommending users

Identifying and recommending experts or users in social-media platforms is a well-known challenge in IR. But, from the collaboration point of view, it leads to interesting perspectives since it would allow favoring interactions between the information provider and the recommended users. The most intuitive frameworks in which collaboration occurs are community question-answering [10] or social networks [7]. In this context, two approaches are emerging: (1) recommending users to mention in order to favor implicit collaboration [5], and (2) recommending users willing to answer based on explicit collaboration [6].

2. Building the right group of collaborators

A further step towards collaboration consists in recommending a cohesive and relevant group of users willing to collaborate to solve a task [17, 22]. One interesting challenge in this field is to build the collaborative group according to users' compatibility, availability, and expertise [1]. Regardless of the task goal, another emerging line of work focuses on collaborative task optimization in crowd-sourcing platforms [8, 13].

Part 4: Questions and Discussion

We will end with an open discussion with participants.

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