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Supporting Collaborative Information Activities in Networked Communities

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Over the years, computer scientists have primarily studied the information discovery process as a single user activity. For example, the research field of information retrieval has provided us with sophisticated techniques for supporting the search process, but mostly in the context of a single, isolated user's interaction with an information base. The recent surge of interest in Knowledge Management, however, has contributed to enlarging the view on processes involving information discovery, sharing and reuse. Recent research now focuses as well on their cooperative aspects and methods for supporting these.

In particular, a number of case studies have studied the cooperative nature of information search activities. Notably, the case study reported in [7, 8] provides insight into the forms of cooperation that can take place during a search process.

Four basic modes of cooperation were identified:

- Sharing of results among members of a team or community.
- Self-initiated broadcast by one individual of interesting information encountered in search results.
- Member(s) of the team or community act as consultants.
- Archival of information judged potentially useful by group members into a group repository.

More evidence of cooperative aspects comes from the work of Twidale at al. [3,8] who have studied in depth the kinds of collaboration that can occur in either the physical or digital library. They have proposed a typology of the cooperative search activities that could benefit from computer support,

constructed upon a foundation of the three main objects they identify as central to search activities: people, the search process and the search results.

Specifically, they identify three main categories of computer support:

- Services for identifying persons that could advise upon the search, possibly in a synchronous mode (as proposed in [5]); for example, experts or users who have previously conducted a search on a similar topic.
- Services for recommending, rating, annotating and creating bibliographies.
- Services for supporting collaboration by appropriate enhancements of the representation of the search process, as is done, for example, in the Ariadne project [9].

The first of the above studies refers to a work setting, the second to a library environment. Both show strong evidence of collaboration.

Questions that remain are: how can the collaborative needs in different settings be further characterized in terms of the characteristics of the particular community of people? What further insights concerning information-related collaborative activities will result from a more in-depth study of the nature of the community? And, finally, how can various kinds of computer support be best adapted to suit the needs of different communities of people engaged in collaborative information activities?

To address these questions, we have focused our research across two different communities: communities of practice in the workplace; and a community of users accessing common library facilities. These communities have different characteristics. Communities of practice in a workplace are stable. They consist of a closed group of people who know each other execute well defined tasks, and usually collaborate for their work. Users accessing common library facilities have much less in common. They build somehow a community just because they use the same facilities, just because they are at the same place at the same time. Collaboration among them emerges only because they meet each other. This collaboration consists essentially of sharing personal experience within the library.

The kinds of computer support for collaborative activities that we have studied across the different communities can be divided into two main categories:

(1) intelligent engines that use machine learning and information retrieval (IR) techniques to improve the search and sharing processes; and

(2) customized user interfaces whose aim is to foster and support human-to-human cooperation.

Our approach to collaborative information retrieval begins with standard IR: the representation of user interests and document content with term-weight vectors. We then can borrow from the well-established IR toolkit to guide the search process; for example, by using similarity measures to determine how well a document matches a user's interests. If we then treat people not as solitary individuals but as members of a community, we then become interested in also measuring:

- The amount of correlation among people in a certain community in terms of their interests;
- The profile of the community as a whole, in terms of relevant documents and areas of discovery (what is searched for);
- The distribution of interests across a community.

Information search and information sharing engines enacted within the context of a community can provide improved support for these processes. For example, in some cases, a search may match well with one or more previous ones and the compiled results can be retrieved from the community memory. In other cases, some of the results of the new search may themselves match items in the community memory that have already been evaluated by members. In this case, collaborative filtering techniques can be used to predict the relative usefulness of the particular result for the person(s) conducting the search. Alternatively, the results returned by a search can be ranked against the community profile, which can itself be incrementally constructed on the basis of relevance feedback provided by members over time.

In addition, searches that occur commonly within a community can be identified and automatically clustered to form FAQs. Finally, some search processes can be enacted as long-lived processes, with potentially different members of the community participating in refining the search and culling the results over time. Members can also be notified of ongoing searches that match their interests and expertise in a way that takes into account their history of participation in long-lived searches in the past.

These additional capabilities of information search and information sharing engines entail new forms of user interfaces to support such community activities. Ackerman et al. advocate the treatment of people as first class objects in information systems, and the explicit consideration of the structure and the process of searches. One way of doing this is to use explicit social activity indicators, as in the Zephyr system [1].

In our work on user interfaces we have explored two approaches, the explicit representation of the user in the search process and the use of large screen displays in social spaces to provide peripheral awareness of ongoing activity in

a community. In the first case we make use of 3D shared virtual environments to represent both the information being browsed and the users browsing that information. An example of this is the VR-VIBE system [2] which provides a multi-user 3D interface for searching collections of documents. In VR-VIBE the users can iteratively construct a search on the document collection and browse the documents retrieved by the search. In addition to the display of representations of the documents and the search users are visible to one another and can communicate either via networked real-time audio channels or text chat.

Our second approach focuses on more loosely coupled collaboration and has the aim of promoting awareness of the topics currently of interest to a community. In this work we use large screen displays positioned at social focal points. The software driving the displays responds to the use of the knowledge base by community members and displays information on the items that are currently of greatest interest to community members. In addition comments on information items and users ratings of those items are also displayed. This technology was originally developed for use in a leisure setting [4] but we are now exploring how it can be used in the work environment.

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