Artificial Intelligence in Text-Based Information Systems

When you have a lot of information to sort through, you don't want to find what you need. This special series examines techniques being applied to information retrieval problems.

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Information retrieval has been investigated for several decades by researchers in information science, library science, and computer science. The field is becoming more and more important because of the increasing amount of electronic information available and the advances in technologies such as multimedia systems, storage media, and computer networks.

In the past, text databases were mainly used in centralized environments: Information centers such as CompuServe and the On-line Computer Library Center maintained the databases, and users accessed them by connecting (mostly by dialing) to the center. Recently we have seen a trend toward replacing paper with electronic media, such as CD-ROM. For example, many computer vendors are sending their technical manuals to customers on CD-ROM instead of paper. Consequently, people are increasingly using textual databases directly without the help of intermediaries such as librarians.

Text-based applications need effective retrieval methods that can handle ad hoc and ill-defined queries, but the retrieval facilities available to users have been rather primitive. Commercial systems are almost exclusively based on the Boolean retrieval model: The user specifies a Boolean combination of keywords, and documents are retrieved based on their satisfying the condition. More recently, commercial systems based on statistical models have appeared, in which documents are ranked according to some similarity function defined by the system.

The functionality required of a text-based information system is also increasing. Users are no longer concerned only with retrieval but also with other aspects of text management, including document imaging, routing, dissemination, extraction, and categorization. Traditional information retrieval techniques cannot satisfy all these new needs. AI techniques, on the other hand, are considered by many as having promise for text-based applications. Unfortunately, the results reported thus far on the application of AI to information retrieval have been inconclusive, and many claims remain unsupported by large experiments or real application experience.

IEEE Expert's special series will examine recent projects applying AI techniques to traditional information retrieval problems. We hope it will bring researchers in AI and information retrieval closer together, raise their awareness of work done in both fields, and increase their synergy, which will benefit both fields.

First, Bruce Croft's introduction to the major research issues in information retrieval describes recent developments in knowledge-based approaches. Croft argues that although a fair amount of work has been done, the effectiveness of this approach has yet to be demonstrated. He suggests that statistical techniques and knowledge-based approaches should be viewed as complementary rather than competitive.

The second article, by Paul Jacobs, describes a system that categorizes news stories by integrating statistical and knowledge-based techniques. Categorization of news articles facilitates dissemination, retrieval, and browsing. Jacobs' system uses a statistical technique to obtain simple lexicosemantic patterns from a large set of training data, while complex patterns are developed manually.

The third article, by Hsinchun Chen, Kevin Lynch, Koushik Basu, and Tobun Dorbin Ng, reports on the cooperative use of several thesauri for concept-based retrieval. Like Jacobs' system, this approach uses statistical techniques, in this case to generate concept relations for one of the thesauri. The thesauri are tied together with a blackboard architecture and controlled by a neural-net-based activation module that identifies concepts in the thesauri related to the user's search criteria.

To some extent, these articles show the need for statistical techniques in knowledge-based environments and for multiple domain knowledge sources to overcome information retrieval problems. Articles reporting on other techniques will be featured in subsequent issues.

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