Kurt Bauknecht
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7th International Conference, EC-Web 2006
Krakow, Poland, September 2006
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Preface

We welcome you to the 7th International Conference on E-commerce and Web Technologies (EC-Web 2006) held in Krakow, Poland, in conjunction with DEXA 2006. This conference was organized for the first time in Greenwich, UK, in 2000, and it has been able to attract an increasing number of participants and interest, reflecting the progress made in the field. As in the previous years, EC-Web 2006 served as a forum bringing together researchers from academia and practitioners from industry to discuss the current state of the art in e-commerce and Web technologies. Inspiration and new ideas emerged from intensive discussions that took place during the keynote address, the formal sessions and the social events.

The conference attracted 88 paper submissions and each paper was reviewed by three Program Committee members. The Program Committee selected 24 papers for presentation and publication (an acceptance and publication rate of 27%). We have to confess that this task was not that easy due to the high quality of the submitted papers.

We would like to express our thanks to our colleagues who helped put together the technical program: the Program Committee members and external reviewers for their timely and rigorous reviews of the papers, and the Organizing Committee for their help in the administrative work and support. We owe special thanks to Gabriela Wagner for her helping hand concerning the administrative and organizational tasks of this conference.

Finally, we would like to thank all the authors who have submitted papers, authors who presented papers, and the participants who made this conference an intellectually stimulating event.

We hope that all attendees enjoyed the hospitality of Krakow and the conference.

August 2006

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Map-Based Recommendation of Hyperlinked Document Collections

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Abstract. The increasing number of documents returned by search engines for typical requests makes it necessary to look for new methods of representation of the search results.

In this paper, we discuss the possibility to exploit incremental, navigational maps based both on page content, hyperlinks connecting similar pages and ranking algorithms (such as HITS, SALSA, PHITS and PageRank) in order to build visual recommender system. Such system would have an immediate impact on business information management (e.g. CRM and marketing, consulting, education and training) and is a major step on the way to information personalization.

1 Introduction

Recommender systems became indispensable part of modern e-business, especially using the electronic medium of the Internet. It is claimed that even 20% of clients may be encouraged to purchase a good by the most successful recommender systems. Recommenders are applied in advertisement of books (Amazon), CD's (MediaUnbound, MoodLogic, CDNow, SongExplorer), films (Reel.com Movie Matcher, MovieFinder.com Mach Maker), cosmetics (Drugstore.com) and other. But also recommender systems are applied when advice is sought by firms when selecting training courses for employees, job search for unemployed etc.

Recommender systems are not only applied to increase sales, but also to expand cross-selling, attraction of new clients, extending of trust of existent clients, to overcome the barriers of mass advertisement through high personalization of offers. The intense research did not, however, overcome many important limitations, like sparseness of data [21], scalability and real time action, detail level of available data, feedback to the sales firm [22], protection against preference manipulation, visualization of recommendation acceptability reasons [15], client modeling, system evaluation, creation of distributed systems [3], etc.

In our on-going research effort, we target at recommender systems capable of overcoming the limitations of present-day systems with respect to problems of rare data in recommendation, scalability and visualization of recommendation

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for the purpose of proper explanation and justification of recommendation. Results of this research will surely lead to practical guidelines for construction of commercial recommender systems, where above mentioned problems are crucial.

We have created a full-fledged search engine BEATCA for small collections of documents (up to several millions) capable of representing on-line replies to queries in graphical form on a document map. We extended WebSOM's goals by a multilingual approach, new forms of geometrical representation and we experimented also with various modifications to the clustering process itself [17,18] . The crucial issue for understanding the 2D map by the user is the clustering of its contents and appropriate labeling of the clustered map areas.

Several important issues need to be resolved in order to present the user with an understandable map of documents. The first issue is the way of document clustering. In the domains, like e.g. legal documents, where the concepts are not sharply separated, a fuzzy-set theoretic approach to clustering appears to be a promising one. The other one is the issue of initialization of topical maps. Our experiments showed that the random initialization performed in the original WebSOM may not lead to appearance of meaningful structure of the map. Therefore, we proposed several methods for topical map initialization, based on SVD, PHITS, PLSA and Bayesian network techniques.

In this paper, before we report on our current state of research effort starting with Sect. 4, we briefly present an overview of recommender system concepts (Sect. 2) and our concept of an integrated recommender system (Sect. 3).

2 Recommender Systems Overview

Intelligent agent (IA) is a user's assistant or recommender system based on machine learning and data mining techniques. Construction of IA uses the following paradigm taken from the ordinary life: "people uses helpful information without any fixed plans". People do not need and cannot describe their own work in terms of coefficients and classification. People just operate and know what they are interesting in, or what they want when they see it.

Recommender system simulates some social behavior. No one has unlimited knowledge and such knowledge is not necessary on daily basis. However, in some decision problems we have to go into details of specific, narrow knowledge. Sometimes there is a possibility to use advice from experienced person (expert) in a given area. Recommender systems try to help user in such situation by using knowledge collected in specified discipline and watching decisions made by other users decisions in the similar case. These systems have been built as a help in decision process for people, but also for multi-agent systems and generally speaking for systems consisting of objects that have limited knowledge about environment. Recommender system uses knowledge about passive objects to recommend next (somehow similar) item to active objects. For example, recommender system can recommend next web page or article in Internet shop (passive object) that user (active object) is probably looking for.

Recommender systems may be classified along the following criteria: amount and type of data that come from active object, amount and type of required data

about community of active objects, method of recommendation, result type of recommendation, way of delivering recommendation to the active object and the degree of personalization (adaptivity to active object characteristic). More detailed classification and examples of commercial recommender systems can be found in [22].

Methods of recommendation in early systems were based mostly on the following approaches: recommendations based on searching, categories, clustering, association rules or classifiers. Finally, evolution of recommender systems has led to two major approaches in construction of IA:

1. Content-based approach. System creates users profiles by analyzing their operations and recommends documents that are compatible with these profiles.
2. Collaborative approach - collaborative or social filtering [12]. System focuses on a group of users.

The first approach, rooted in the tradition of information processing, is applicable if the system deals with text only. The system seeks information similar to that preferred by the user. If a user is interested in some knowledge areas (represented by documents described by some keywords or phrases) then the recommender looks for documents with similar content to already articulated. The basic problem here is to capture all specific aspects of a document content (e.g. in disciplines such as music, film, computer-related issues etc.). Even restricting recommendations to text documents only, most representations are able to cover only some aspects of document content, which results in weak quality of presented recommendations.

The second approach, called also social learning, relies on exploiting reactions of other users to the same object (e.g. a course, educational path, a film, etc.). The system looks for users with similar interests, capabilities etc. and recommends them information or items they are searching for.

This approach allows for posing questions like "show me information I have never seen but it turned interesting to people like me". Personalized information is provided in an iterative process where information is presented and user is asked to rank it, what allows to determine his/her profile. This profile is next used to locate other users with similar interests, in order to identify groups with similar interests.

Instead of calculating similarity between documents, this method determines degree of membership to a group (for example based on surveys). In contrast to first approach, it does not require analysis of document content, what means that document with arbitrary content could be presented to the user, with the same probability. Each document is assigned with identifier and a degree of membership to a group.

This approach is characterized by two features: first of all the document relevance is determined in the context of the group and not of a single user. Second, evaluation of the document is subjective. Hence one can handle complex and heterogeneous evaluation schemas.

3 Integrated Recommendations

Existing recommender systems, based on a paradigm of content-based filtering as well as those based on collective filtering principle, do not take into consideration possible synergic effects. Such effects emerge when:

- both methodologies are merged,
- system is able to model joint, integrated recommendation of passive and active objects (i.e. clients and products), and not only passive objects pointed by active ones,
- recommendations are based on visual system, which helps to explain and justify a recommendation.

Application of joint methodology is possible if available data contain information on recommended objects as well as relations between recommended and recommending objects. Such information is present, e.g. in WWW documents, where individual html pages have not only textual context, but also hyperlinks between them. From logs saved on a particular host one can obtain so-called click-stream of users surfing from one page to another, and some additional data such as voluntarily filled-in questionnaires. Among other examples are libraries, book stores, or any shop (including e-shops), where products can be described by a set of attributes (e.g. advertisement leaflet) and users can be identified by some ID cards (e.g. loyalty program participation cards). Similarly, for some services (e.g. concerning education or health), both pointed(passive) and pointing(active) objects are described by attributes.

By an *integrated recommendation* we mean recommendation such as "People interested in <characteristics of people> are buying also book <title>" (instead of typical recommendation in form: "People interested in <title> are buying also book <title>"). Thus, integrated recommendation requires that system has an ability to generalize features describing characteristics of active objects (i.e. users or clients).

Recommendation with a visual explanation and justification is a completely new approach, based on creation of two-dimensional, navigational map of objects. Such a map yields a possibility to present an identified area of user's interests together with surrounding context, i.e. main directions of his/her future activities.

4 BEATCA Search Engine

Our first step towards a new model of recommendation system was to create a new-type search engine, based on a document map interface. Our map-based approach to search engine interfacing comprises two important features from the point of view of the target recommendation system: providing an overview over the whole collection of objects, and a very detailed clustering into groups of objects and their immediate (local) contexts.

With a strongly parameterized map creation process, the user of BEATCA can accommodate map generation to his particular needs, or even generate multiple