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# Implicit feedback techniques on recommender systems applied to electronic books

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ABSTRACT

The goal of this research is to define and capture a series of parameters that allowed us to perform a comparative analysis and find correlations between explicit and implicit feedback on recommender systems. Most of these systems require explicit actions from the users, such as rating, and commenting. In the context of electronic books this interaction may alter the patterns of reading and understanding of the users, as they are asked to stop reading and rate the content. By simulating the behavior of an electronic book reader we have improved the feedback process, by implicitly capturing, measuring, and classifying the information needed to discover user interests. In these times of information overload, we can now develop recommender systems that are mostly based on the user's behavior, by relying on the obtained results.

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## 1. Introduction

Due to the large amount of information available on the Internet, sometimes it is difficult for users to find the content that they really need in a quick and easy way. The user tends to: seek for recommendations from others who have previously had the same needs; or select those items that are closest to what they were looking for (Sanjuan Martínez, Pelayo G-Bustelo, González Crespo, & Torres Franco, 2009).

The use of recommender system as an information retrieval technique attempts to solve the problem of data overload. They filter the information available on the web and help users to find more interesting and valuable information (Noor & Martinez, 2009; O'Donovan & Smyth, 2005; Taghipour & Kardan, 2008).

In order for recommender systems to be more effective we believe that is necessary to enhance the feedback process. We need to implicitly gather as much information related to the user profile as possible, so to be able to measure the user's interest about an item or group of items. As illustrated in Claypool et al. (2001), the most common solutions and the more prevalent are the ones based on explicit ratings. These techniques can alter the user's regular navigation and reading patterns, because they have to stop and rate the items.

By defining a collection of implicit parameters, comparatively analyzing their values, and measuring their correlations, we infer the grade of interest that users may have for certain items while interacting with an electronic book. This process allows us to convert implicit values into explicit ratings that help the recommender system make more precise recommendations. The remainder of this paper is structured as follows: in Section 2 we describe the main problems with existing recommender system in electronic books; in Section 3 we present the state of art of recommender systems; Section 4 shows our case study; and finally, in Section 5 we explain our conclusions and possible future work.

## 2. Problems

To efficiently capture and measure the interaction parameters between a user and an electronic book, and implement a recommender system suitable for these types of devices, we must take into consideration a number of problems. In general, we can say that there are three major problems associated with this subject (Núñez Valdéz et al., 2010).

### 2.1. Information overload

The access to tremendous amount of data available on the Internet requires mechanisms and classification algorithms to optimize the search of information and access these contents efficiently. The amount of information available on the Web increases every day, and this becomes an optimization problem for recommender systems (González Crespo et al., 2011; O'Donovan & Smyth, 2005; Resnick, 1994).

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### 2.2. Implementation of an efficient feedback mechanism

In most cases, feedback mechanisms are based on explicit feedback, and this may cause inconvenience to the users, as they typically do not like rating contents.

Explicit ratings are the most common and obvious indicators of the user's interest, because it allow them to tell the system what they really think of the rateable objects. On the other hand, they alter the user's regular navigation and reading patterns, because they have to stop and rate the items. In addition, the users may not rate the objects if they do not perceive any benefit (Claypool et al., 2001).

Therefore, we believe it is necessary to capture as much information as possible without the direct intervention of the users, in order to (Sanjuan Martínez et al., 2009) determine their interests and needs and try to implement a more effective feedback mechanism.

### 2.3. Limited computing capability in electronic book devices

The memory and CPU consumption of any recommender system is very high as they have to deal with lots of data. The algorithms optimization to improve its performance is one of the main fields of research in this area.

A constant characteristic of these systems is the processing of constantly altered data (real time), which requires efficient algorithms with a low cost of execution.

A recommender system requires a continuous learning about the user's profiles and a constant update of the system's information. And so, it is necessary to minimize memory and CPU usage during the feedback retrieval.

As eBooks have certain limitations of computation and storage, it is necessary to evaluate and design a methodology that enables these devices to update and store the object's ratings.

This would allow recommender systems to operate effectively and without relying on external technologies on an ongoing basis. We need a synchronization mechanism of the data available on external servers. This can be implemented either through Web services or through a synchronization process against a desktop computer application. This synchronization must end up with all the user profile's information being stored in the electronic device using a standard format.

## 3. State of art of recommender systems

Today recommender systems are very useful on the Web and are widely used, these help users find content that is interesting to them easily, quickly and without much effort. These contents are selected by recommender systems of a large amount of content that are available on the web.

In general, a recommender system is defined by Wang (1998) as "*A system that has as its main task, choosing certain objects that meet the requirements of users, where each of these objects are stored in a computer system and characterized by a set of attributes.*"

These consist of a series of mechanisms and techniques applied to the retrieval of information to try to resolve the problem of data overload on the Internet. These help users to choose the objects that can be useful and interesting, these objects can be any type, such as books, movies, songs, websites, blogs (González Crespo et al., 2011).

Recommender systems are based on personalized information filtering, used to predict whether a particular user likes a particular item (prediction problem), or identify a set of *N* items that may be of interest to certain users (top-*N* recommendation problem) (Resnick & Varian, 1997).

### 3.1. Recommender system classification

Recommender systems can be classified into different types according to the type of information that used to make recommendations (Adomavicius & Tuzhilin, 2005; Adomavicius et al., 2005).

Traditionally there are several paradigms of filtering information used to generate recommendations, these are classified as:

- *Content-based*: these try recommend similar contents to another that liked to a particular user in the past.
- *Collaborative filtering*: identifies users whose tastes are similar to a given user and recommends to this user the contents that likes to the other users.
- *Hybrid approach*: is a combination between content-based and collaborative filtering.

Other variety of techniques have been proposed for performing recommendation by other authors as Adomavicius and Tuzhilin (2005), although one way or another, these are related with the classifications of recommender systems mentioned above, these include: Demographic recommendation, Knowledge based recommendation, Utility based recommendation.

Currently there are a wide range of recommendation systems that are used in different areas, whether for commercial or scientific or experimental purposes. For example: PHOAKS (Terveen et al., 1997), Referral Web (Kautz et al., 1997), Fab: content-based collaborative recommendation (Balabanovi et al., 1997), Amazon.com recommendations: item-to-item collaborative filtering (Linden et al., 2003).

### 3.2. Feedback techniques

The recommender systems collect user information through the feedback techniques, and stored in users profile in order later to reflect your interests and make recommendations. The feedback techniques are classified into two types: Explicit and Implicit feedback (Adomavicius et al., 2005; Resnick & Varian, 1997; Ziegler, 2005).

The combination between explicit and implicit feedback techniques provides another paradigm for recommender systems, despite that these exhibit different characteristics about users' preferences (Jawaheer, 2010).

#### 3.2.1. Explicit feedback

Through a survey process, the user evaluates the system by assigning a score to an individual object or a set of objects. Explicit feedback provides users with a mechanism to unequivocally express their interests in objects (Jawaheer et al., 2010).

Fig. 1 shows the most common explicit feedback system used by users on the web to express their interest by objects.

For example, Amazon online store, Film affinity, Movilens and other, use the *star ratings system* that allows users to indicate which products are of their interest.

On the other hand, social networks as Facebook, YouTube and other use the *Like rating system* to allow the users to rate the contents.

Finally, *Google+1* is a new feature that Google added to its search engine so users can evaluate explicitly the websites that like them. So, they recommends website to their contacts.

#### 3.2.2. Implicit feedback

This process consist in evaluate the objects without interventions of users. Namely, this evaluation is performed without the user being aware, through capture of information obtained from the actions made by the users in the application. For example, when the user accesses to a news or read an article online, according to

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