Personalized Recommender System for Digital Libraries

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ABSTRACT

The huge amount of information available online has given rise to personalization and filtering systems. Recommender systems (RS) constitute a specific type of information filtering technique that present items according to user’s interests. In this research, a web-based personalized recommender system capable of providing learners with books that suit their reading abilities was developed. Content-based filtering (CBF) was used to analyze learners’ reading abilities while books that are found suitable to learners are recommended with fuzzy matching techniques. The yokefellow cold-start problem inherent to CBF is assuaged by cold start engine. An experimental study was carried out on a database of 10000 books from different categories of computing studies. The outcome tracked over a period of eight months shows that the proposed system induces greater user satisfaction and this attests users’ desirability of the system.

Keywords: Cold Start Problem, Content-Based Filtering, Digital Library, E-Learning System, Fuzzy Logic, Information Retrieval, Paired Samples Test, Recommender System

INTRODUCTION

The tremendous growth and usage of information has led to the problem of information overload in which users find it difficult to locate right information at the right time (Resnick et al., 1994). Knowledge helps to shape readers’ perspectives about the content of a text, attention given to it, their interests about the content, and their judgments of importance regarding the content (Alexander et al., 1994). Hence, the complexity of knowledge is dependent on the forms and dimensions of available learning styles.

Learning is being conducted with new forms of technologies, yet the potential outcomes of students’ interactions with available technologies are uncertain (Alexander et al., 1994). The incessant availability of books makes it difficult to proffer suitable Text-Based Learning models for assessing the relationships between books and learners. However in recent time, researches have been conducted with the goal of providing learners with more precise and personalized services (Pazzani & Billsus, 2007).

Linguistic quality of text is a critical factor used to quantify users’ reading ability, different approaches, such as Lexile Measures (Schnick & Knickelbine, 2004) were proposed to measure

DOI: 10.4018/ijwltt.2014010102
the Lexile rates of readers. (Pazzani & Billsus, 2007) presented several factors that contribute to the considerateness and quality of texts.

As information and e-commerce burgeons, RS becomes inevitable incessant tool. A RS applies data analysis techniques to support users in identifying interesting items among large numbers (Ghauth & Abdullah, 2010). Among the popular RS techniques, CBF and CF are commonly used to recommend products, meticulously, to users. Various RS techniques had been explained in (Melville et al., 2002; Ojokoh et al., 2012; Resnick & Varian, 1997; Sarwar et al., 2001). Hybrid RSs combine two or more recommendation techniques to gain better performance with fewer drawbacks, such systems were emphasized in (Leyla & Olfa, 2010; Resnick & Varian, 1997).

Personalization is a special form of differentiation which allows a RS to respond to users' unique needs. Personalized recommender systems using profiles, content data, and feedbacks have been proposed (Mei-Hua Hsu 2008; Ojokoh et al., 2012).

The objective of this study is to propose a web-based personalized recommender system based using CBF and Fuzzy Matching Techniques. The system examines the readability of a user and recommends books that are relative to the user's level. The web based system was implemented on a database with 10000 books from different categories of computing studies. An experimental study was carried out within eight months and the result obtained was used to evaluate the performance of the system. The outcome of the experiment shows that the proposed system induces a greater user satisfaction and in turn, demonstrates users’ desirability of personalized recommender systems.

The remaining part of this paper is organized with the background study and literature review presented in the next section, methodology of the proposed system in the section after, and an experimental study in the section following that. Also, the section after presents an evaluation of the proposed system while conclusion and area of future research are presented in the conclusion.

Background Study and Related Works

The Lexile framework is a scientific approach for measuring the difficulty levels and reading abilities of books and learners respectively (Schnick & Knickelbine, 2004). As the most widely adopted reading measure in use today, Lexile offers a scientific approach that facilitates learning and instruction by improving interpretation ability and informing educational decisions and instructional strategies (Collen & Hal, 2004). Using Lexile, it is possible to match students with appropriate texts and track their reading ability with common scale. The framework includes a Lexile Measure which represents the difficulty of textual materials and users’ reading ability (MetaMetrics, 2004).

The term “reading ability” is used to describe a user’s capability of reading texts. This is measured and analyzed with the aid of certain quantitative factors which include: the number of unfamiliar words in a text; the complexity of sentences in the text; and the overall length of the text. MetaMetrics developed scientific measures of academic achievement and complementary technologies that link assessment results with instruction. It helps learners achieve their goals by providing unique insight of their ability and potential for growth.

Lexile Text Measure is a measure of how difficult a book or an article is to comprehend and it is based on two strong predictors which are: word frequency and sentence length. The Lexile text measure is a good starting point in book-selection process however many other factors that affect the relationship between learners and books, such as content, age, and interests of the learners are yet to be fully elucidated (Kerkiri et al., 2007).

RS is an Internet tool that helps users to navigate through huge amount of information available over the network and receive information relevant to users’ preferences (Pazzani & Billsus, 2007). RSs are widely accepted as critical tool in sustaining the Internet economy (Shapiro & Varian, 1999). Recent surveys (Gediminas & Alexander, 2010; Robin, 2006)
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