

# Chapter 75

## State of the Art

### Recommendation Approaches: Their Issues and Future Research Direction in E-Learning A Survey

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#### ABSTRACT

*Recommender systems have been used successfully in order to deal with information overload problems in a wide variety of domains ranging from e-commerce, e-tourism, to e-learning. They typically predict the ratings of unseen items by a user and recommend the top N items based on user's profile. Moreover, the profile can be enriched further by using additional information such as contextual data, domain knowledge, and tagging information among others for improving the quality of recommendations. Traditional approaches have not been effective in exploiting these additional data sources. Hence, new techniques need to be developed for extracting and integrating them into the recommendation process. In this article, the authors present a survey on state of the art recommendation approaches their algorithms, issues and also provides further research directions for developing smart and intelligent recommender systems.*

#### INTRODUCTION

E-learning is an acronym for electronic learning which makes learning content available online for learners to access from anywhere and at any time. It is broadly inclusive of all the forms of education that make use of technology and multimedia. Online communication with real people may or may not be involved but the focus of E-learning is usually more on the learning content than on the communication between learners and tutors (Fetaji et al., 2011). E-learning systems provide huge benefits in comparison to traditional education systems (Zhang et al., 2004). However, they have several drawbacks

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such as users spending a lot of time in searching the required information and same learning material is provided to all the learners regardless of their interest, skill, and level of knowledge among others. Recommender systems play an important role in this context by suggesting relevant items to learners based on their profile.

Recommender systems have drawn the attention of the research community since the appearance of the first paper on collaborative filtering (Adomavicius et al., 2005). Existing literature (Lu et al., 2015) suggests that among all the recommendation techniques, collaborative filtering, content-based, hybrid and knowledge-based have been used relatively more in the domain of e-government, e-business, e-commerce, e-library, e-learning, and e-resource.

The rest of this article is organized as follows. Firstly, we discuss major recommendation approaches, their critical issues, algorithms and input/output required by them. We also present some popular real systems based on these approaches. Then we provide further research direction which could help in developing more intelligent recommender system. Finally, the paper concludes with the discussion section.

## **BACKGROUND**

The roots of recommender systems lie in cognitive science (Rich, 1979), information retrieval (Salton, 1989) and approximation theory (Powell, 1981). The recommender system appeared as an independent research area in the mid-1990s (Resnick et al., 1994). Recommender systems are software tools suggesting for items to be of use to a user (Resnick et al., 1997). They assist users in selecting the right item from a vast repository on the web, hence overcoming information overload problem. Conventional recommendation approaches such as content filtering, collaborative filtering, and more recently developed web usage mining have been successfully used in several domains. However, they are unable to exploit additional sources of information such as domain knowledge, tag information, and annotation among others which could significantly improve the quality of recommender systems (Pazzani et al., 1997). Non-traditional approaches such as computational intelligence, semantic web usage mining, multi-criteria decision making, and fuzzy linguistic modeling have recently emerged as an extension of the traditional approaches. In conventional systems, recommendations are made based on the profile of user which comprises of either user's ratings or description of item experience by a user (Gemmis et al., 2009). Moreover, users' unwillingness to provide ratings leads to sparse "user item rating matrix" which causes poor quality of recommendations. However, additional information about user and item can enrich a user's profile and hence improve the quality of recommendations.

## **TYPE OF RECOMMENDATION APPROACHES**

We have broadly categorized recommendation techniques into "traditional techniques" and "non-traditional techniques" as shown in Figure 1. Unlike earlier survey papers on recommendation systems, this paper also includes web usage mining (WUM) and semantic web usage mining (SWUM) which play a major role for developing next generation of recommender systems.

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