Chapter 10
CRS:
A Course Recommender System

Kamal Taha
Khalifa University of Science, Technology, and Research, UAE

ABSTRACT

Most problems facing Distance Education (DE) academic advising can be overcome using a course recommender system. Such a system can overcome the problem of students who do not know their interest in courses from merely their titles or descriptions provided in course catalogues. The authors introduce in this chapter an XML user-based Collaborative Filtering (CF) system called CRS. The system aims at predicting a DE student's academic performance and interest on a course based on a collection of profiles of students who have similar interests and academic performance in prior courses. The system advises a student to take courses that were taken successfully by students who have the same interests and academic performance as the active student. The framework of CRS identifies a set of course features for every academic major. The authors experimentally evaluate CRS. Results show marked improvement.

INTRODUCTION

Currently, Recommender Systems (RS) are widely used in different domains such as E-commerce and digital libraries. In general, recommendation systems suggest items or products, by analyzing what users with similar tastes have chosen in the past. Recently, recommender systems are applied in the e-learning domain in order to personalize learning content. In this process, students are matched with the appropriate learning objects. Students are connected with each other according to their individual interests, skills, needs, and learning goals. A number of research works advocate the use of recommender system in e-learning systems and learning management systems. Calvo (2003) uses recommender system in intelligent learning system. Andronico (2003) suggests educational resources to students through mobile phones. Liu & Gree (2005) provides a framework that selects a list of learning objects that suit students.

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There are a number of approaches for recommending learning objects. One of these approaches is Content-Based System (CBS) recommend courses to students based on the content of courses and the student's preferences. The approach detects the similarities between courses attributes (such as name, abstract, keywords) and other courses. The student enters a course's attributes and the system recommends courses that have similarities with the active course's attributes. Another approach is Rule Based Filtering. The approach filters courses based on a set of rules to be applied to the student's profile and the system's profile.

There have been a number of works that have addressed on-line automatic advising and predicting student performance in e-learning (Vance, 2004; Khribi, 2007; Thai-Nghe, 2010). Mohamed (2007) provides techniques for on-line automatic recommendations in e-learning systems using the access history of learners. The work of (Vance, 2004) provides a guide to developing e-advising standards for advisees, advisors, and administrators. The work of (Thai-Nghe, 2010) uses recommender system techniques for educational data mining and for predicting student performance.

A DE student may not be able to know his interest in a course from merely its title or from the description of the course provided in the course catalogue. Also, the advisor needs to advise the student to take a course that suits the student's academic performance and skills. Towards this, the advisor needs to consider the performance of students in all his prior courses, which is time consuming. These problems can be overcome using a course recommender system. We introduce in this chapter a type of Collaborative Filtering (CF) system called Course Recommender System (CRS). The system aims at predicting a student's academic performance and interest on a course based on a collection of profiles of students who have similar interests and academic performance on prior courses.

The framework of CRS identifies a set of course features for every academic major. A course feature is a characteristic skill or attribute that a student needs to possess in order to succeed in the course. For example, some of the course features for Computer Science major can be comprehension skills, memorization skills, programming skills, math skills, inferential thinking skills, problem solving skills, application of strategies skills, etc. Students are categorized based on their similarity on course features. Each category (bicluster) includes students who have close academic skills and interests (i.e., course features) in a number of courses. CRS would return to the active student a ranked list of courses that have been rated high by the majority of the members of the cluster, to which the active student belongs. That is, CRS outputs ranked lists of courses, taking into account not only the initial preferences of the active student, but also the ratings of the bicluster, to which the student belongs. The basic idea is that if the students who have the same academic profile as the active student took a course successfully in the past, it is likely this active student will succeed in this course. That is, the underlying assumption is that those who have similar academic performance and interest on prior courses tend to have the same academic performance and interest on future courses. CRS assigns a bicluster to each student user dynamically on the fly. In the framework of CRS, students' characteristics (e.g., biclusters) are inferred *implicitly* by the system without involving the user. That is, the student is not required to reveal the biclusters to which the student belongs. The student is determined whether or not he/she belongs to a bicluster G by matching his/her ratings on course features with the ratings of G. CRS constructs biclusters and also identifies their interests and academic skills *dynamically* on the fly. We developed formal concepts and algorithms that identify the interests and academic skills of various biclusters dynamically on the fly. These interests and academic skills are determined from the interests and academic skills of the biclusters' member users using a group modeling strategy.