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Intelligent Recommendation System for Course Selection in Smart Education

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Abstract

Being an essential component of smart education, we propose a novel recommendationsystem for course selection in the specialty of information management inChinese Universities.To implement this system, we firstly collect the course enrollment data-set for specific group of students. The sparse linear method (SLIM) is introduced in our framework to generate the top-N recommendations of courses appropriate to the students. Meanwhile, aL_0 regularization term isexploited as the optimization strategywhich is established on the observation of the course items in the current recommendation system. The comparison experiments betweenstate-of-the-art methods and our approachare conducted to evaluate the performance of our method. Experimental results of different topics and number of courses both show that our proposed method outperforms state-of-the-art methods both in accuracy and efficiency.

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Keywords: Course Recommendation System; Sparse Linear Method;Smart Education

1. Introduction

Smart education is the conception to describe the brand new learning process in the information era[1]. It has attracted plenty of attention from experts of various researching fields for recent decades. As learning could be

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undertaken anytime, anywhere in the smart education context by using the intelligent devices and the number of courses in the framework of smart education has greatly increased, the corresponding course selection issue is playing a significant role in the process of modern education and has transferred into the determination of the curriculum that are suitable for the students accurately and efficiently. In the past, a plethora of methods and algorithms[2,3] for course selection have been proposed to deal with course recommendation problem. However, none of them was specifically designed for the requirements of smart education.

A great deal of the methods proposed for the course selection in recommendation systems can be categorized into three different groups, which are collaborative[8], content-based[7], and knowledge-based[5,8]. They all have been applied in different fields such as in [4] a collaborative filtering based artificial immune system was implemented in the course recommendation for college students and the rating results acquired from the teachers were considered as the ground truth of the evaluation outcomes.

According to the requirement of course selection for intelligent recommendation in smart education and inspired by the idea presented in [4, 9], we propose a sparse linear based technique for top-N course recommendation through both adding the expert knowledge and sparseness regularization in the computation. The presented method could extract the inner structure and information of the courses existed in the education management system from the student/course relationship by constraining the newly proposed regularization term optimized calculation. The characteristics of sparseness was introduced to diminish the complexity (or the feature space dimension) of the course recommendation matrix. Sparse linear method (SLIM)[9] was also introduced to our top-N recommendation system, which is hardly exploited in smart education before. According to the characteristics of course recommendation system in Chinese Universities, the technique that we proposed mainly focuses on the accuracy of course recommendation comparing with the ground truth that we collected with experts' discussion. It differs from the original SLIM based methods[6,9], which is mainly used to addresses the applications of top-N course recommendation in real time.

Base on our previous researches on the regular recommendation system computation, most of the entries in course selection matrix are assigned with the same initial value (zero), while the gradients of adjacent entries also have the same assigned values. Therefore, the sparse strategy through the introduction of L_0 regularization term was initially taken as the optimization framework of SLIM. The L_0 terms can globally constrain the non-zero values of entries and the gradients in the recommendation system matrix, which is also treated as the primary contribution of our proposed method. Different from the other commonly used regularization terms (e.g., the L1 and L2 terms), the L_0 regulation term can maintain the interior and subtle relationship between the pair of entries in the course selection matrix while controlling the sparseness.

After the process of data gathering, comparison experiments between state-of-the-art methods and our method are carried out. Both the experimental results of state-of-the-art methods and our method are evaluated with the course recommendations presented by several educational experts

2. Our method

In the following sections, t_j and s_i are used to represent every course and every student in the proposed course recommendation system, respectively. The intact student-course relationship will be calculated with a matrix A (size of $m \times n$), in which the entry is either 1 or 0 (where 1 denotes the student has taken the course, and 0 denotes that the student has not taken the course).

In the proposed framework, a sparse linear method is used to implement the course selection pipeline. In our method, a score of course recommendation on each empty entry with a course t_j and a student s_i is computed with the sparseness aggregation strategy, the general process is shown in Eq.(1).

$$\overline{a_{ij}} = a_i^T w_j \qquad (1)$$

where $\overline{a}$ is the initial course selection of a specific student and w_j is the sparse vector of aggregation coefficients. The model of SLIM in the form of matrix is modified into: