Course research of personalized recommendation algorithm

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Abstract. The paper introduces the concept of a layered recommendation system (LRS) based on multi-dimensional feature vectors to implement personalized course generation model and algorithms. In this work, we present a personalized course generation algorithm based on the multi-dimensional feature vectors (PCG-LRS) and hybrid applications by content-based recommendations and collaborative filtering recommendation algorithm to generate personalized curriculums.

Keywords: layered recommendation system; Personalized learning; Recommendation algorithms

1 Introduction

The existing course generation method is to proceed from the student's interest, hobby, browsing behavior for the students in personalized recommendation of learning resources [1-2], or to find suitable learning resources for students learning goals for the students, and the application of sequencing technologies to generate course. However, in the actual teaching, before the network learner is learning a course, in the course of learning plan, learning goal is required by the field of professional teacher according to the teaching characteristics of the course itself, the degree of difficulty, teaching objects (students) of the initial level and learning objectives and other features to design and develop. In the learning process, because the difference between learners, such as different initial levels, learning ability, learning time difference different arrangements, different learning stages have different local learning plan, learning objectives [3-4], need in the whole learning process for different students set up the course content different [5-6].

Combined with the analysis of learner initial personality characteristics, puts forward a personalized program recommendation algorithm based on hierarchical implementation algorithm (PCG-LRS), to achieve Learners personalized learning course content is generated in the preparation stages of learning.
2 Conceptual Model of Personalized Course Generation

2.1 User model

User model is to reflect the real information and computing ability, while limiting the user modeling method is selecting in a certain extent. Common user model representation are: theme representation, keyword list notation, representation method based on neural network, representation method based on of Ontology and the representation method based on vector space model.

In this system, first, the user model is to collect related knowledge level learning ability and of assessment learners before a course. In this paper, experts design a set of pretest questions, the test project that contains the preparation knowledge required courses. Learners participate in pre-school testing, system achieves data collection, analysis and to calculate assess knowledge level and learning capabilities. To generate knowledge matrix Q and ability matrix B. In this paper, the user model is using representation method based on the vector space. At the same time, as the personalized recommendation algorithm in course development process is personalized learning object recommendation, it is based on the learn characteristics of the learner, so in the user model is not interested in a node. But learning characteristic of node, the different characteristics of the study, such as the concept of master degree, learning ability, goal, described in detail below:

Set a course knowledge structure diagram concept set to \( C = (c_1, c_2, \ldots, c_n) \)

Corresponding to each concept \( c_i \), respectively, to define the corresponding feature vector \((s_i, b_i, o_i)\), where \( s_i \) indicates the concept of \( c_i \) learners learning score in the learning process. \( b_i \) represents the concept \( c_i \) of learner's learning capability assessment. \( o_i \) represents the concept of \( k_i \) learners learning objectives.

It is based on this, we get the student personality characteristics vectors as follows:

Knowledge Vector: \( C = (c_1, c_2, \ldots, c_n) \)
Knowledge score vector: \( S = (s_1, s_2, \ldots, s_n) \)
Ability vector: \( B = (b_1, b_2, \ldots, b_n) \)
Target vector: \( O = (o_1, o_2, \ldots, o_n) \)

Therefore, this paper represents the learners to learn the concept \( c \) characteristics \((c_1, s_1, b_1, o_1) \) by four-tuple form. Personalized Learning Profile (PLP) used n-dimensional feature vector was expressed as:

\[
PLP = (C, W, B, O) = ((c_1, s_1, b_1, o_1), (c_2, s_2, b_2, o_2), \ldots, (c_n, s_n, b_n, o_n))
\]

2.2 The learning object model

In implementation process of the personalized recommendation algorithm, learning object model and the characteristics of the user knowledge are mutual restraint.
This paper created an index of resource and concept, to show a learning object in collection of resource. Let course knowledge structure diagram concept set was \( C = (c_1, c_2, \ldots, c_n) \), Collection of all learning objects in resources repository were \( R = (r_1, r_2, \ldots, r_m) \). Then The correlation coefficient between \( i \)-th learning object \( r_i \) and \( k \)-th concept \( c_k \) were calculated as follows:

\[
V_{ik} = tf_{ik} \times \log \left( \frac{M}{df_k} \right) = tf_{ik} \times IDF
\]

Which, \( V_{ik} \) denotes \( k \)-th concept right at \( i \)-th value of learning objects. \( tf_{ik} \) represents concept \( k \) frequency of appearance in learning objects \( i \). \( M \) represents the total number of Learning Object in the courses. \( df_k \) represents concept \( k \) frequency of appearance in the courses.

3 Experimental Analysis and Results

The experimental methods are as follows:

First, for all the concept of the knowledge base for teaching document \( D \) weights to define an average weight \( \text{Avg}_d \).

\[
\text{Avg}_d = \sum_{i=1}^{M} \sum_{j=1}^{M} w_{ij}
\]

Then taken \( d = \text{Avg}_d \); \( d = 1.5 \text{Avg}_d \); \( d = 2 \text{Avg}_d \); \( d = 3 \text{Avg}_d \), for teachers proposed Teaching programs \( D \), Application algorithm3-1 to generate different course knowledge domain \( KD_1, KD_2, KD_3, KD_4 \). The application of this method for 16 teachers put forward to teaching plan for their teaching subjects, respectively used different threshold to generate knowledge domain of different course. The results are feedback to the 16 teachers, please they were evaluated with knowledge domain of different course.

The experimental results are shown in Figure 1, when the threshold is taken as the average weight, teachers for their overall satisfaction are only 43%. And when the threshold increases as the average weight of 1.5 times, 2 times, 2.5 times, course knowledge domain of teacher to generate satisfaction increased. And when the threshold to continue to increase, average weight 3 times, 3.5 times, satisfaction course knowledge generated is decline. Thus, according to the results of this experiment. Threshold in this paper is \( d = 2.5 \text{Avg}_d \).
4 Conclusion

This paper mainly studies courses automatic generation and personalized learning in large-scale formal learning the network education environment. Separate the course domain knowledge and learning objects, the personalized needs of layered learning process will achieve teaching objectives Proposed a formal learning program for teaching teachers to develop programs to automatically generate efficient algorithm to solve large-scale network quickly to build professional teachers teaching online courses in network teaching learn. Proposed personalized knowledge generation algorithm based on user knowledge structure characteristics. On the basis of the teaching programs generated knowledge domain, and further to generate personalized knowledge domain for the user. The experimental data proved that the accuracy of automatic generation algorithm for teacher courses and accuracy hierarchical recommendation algorithm personalized course generated for the students had higher and scalability.

References
