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The Role of Semantic Expansion Network in E-advising

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Abstract. Different tools were used to enhance educational services, one of theses services is advising. The manual academic advising suffers from many deficiencies in match making process. This is applied for student guidance and transfer cases. These deficiencies are referred to: knowledge of advisors, awareness of course contents and how to capture the student preference. Different automated techniques can be used for converting the manual process of academic advising into automated one. One of the major techniques used in educational data analysis is data mining. This paper proposes a mechanism of a system that uses data mining techniques which calculates student achievement level regarding the available majors. The mechanism converts the individual course into a group of concepts and enables matching of similarities between concepts of different courses. The proposed mechanism will be beneficial in for transfer cases between major. Based on the system recommendation, the student can take a decision of perfect major based on the achieving level.

Keywords: Academic advising; Semantic Network, Concept, Major Transfer

1. Introduction

Academic advising helps the students to achieve their educational goal, it recommends to the student which course he/she should register based on student's profile and offered courses in each semester. The advisor is considered to be a facilitator in the learning process ([9], [11]).

Since that the advising process affects the educational process directly, it includes many steps as: supporting students, explaining policies, procedures, and academic requirements, exploring skill levels, such as writing, mathematics, study skills, and assisting with study plan as well as career path [9].

The aim of this research is to produce a mechanism that executes the advising problems automatically instead of the manual academic process. The proposed framework can overcome some of manual limitations related to limited number of advisors (labor intensive) that are not able to serve the huge number of students, advising double curricula (double major), and lack of advising knowledge. This may lead to serious consequences of mistaken choice ([6],[9],[12]).

The paper is organized as follows. First, the author identifies the problem. Then, previous work related to academic advising is stated. Third, the proposed method is defined and justified. Finally, conclusion includes the advantages of the proposed approach and the directions for future work.

2. Related Work

Different researchers discuss automated techniques for handling the processes of the educational field. Main researches related to educational services, academic advising and different techniques for automated advising, these points will be explored in the following subsection;

2.1. Educational Services

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The need for information sharing in the educational services is important, since different employees, instructors and even students have experience and knowledge in specific fields that should be shared with others. Nobody can deny the importance of knowledge sharing and knowledge management in academic institutions [1].

In e-learning systems, student can search for courses using the recommender of e-learning system [8].The recommendation system collects information from the log of student history and course ontology that shows detailed information of each course and its pre-requisites courses.

The process of mining e-learning materials is described using the proposed model of [13]. The researcher's uses different applications of data mining in web-based educational systems as Moodle.

As one of e-learning techniques, Data mining is defined as the extraction of hidden information from large databases [1]. Data mining can be used in different applications as stated in [1]. Also different researchers used data mining in academic advising as ([1],[2], [3], [8], [9], [13]). Data mining can be used in major selection according to ([5], [6]).

2.2. Academic Advising

Academic advising step is defined as the process of supporting, motivating student's thought-out university's study plan and along the achievement of their educational goals. There are number of researches proposed solutions in the educational field especially, the academic advising [11].

A decision system that helps the student to choose the best major is proposed by [8]. The system calculates the supporting degree (passing mark) for each course, and count it to reach the whole major supporting degree, the system suggests the major of highest supporting degree to the student [8].

MyMajors depends on collecting data by interviewing many advisors in colleges who have expertise in academic advising and receiving frequent feedback and reactions from student, faculty and advisors. The experiment shows the following system's benefits: the use of the advising system reduces the time consumed in advising process, it improve the enrollment of marketing potential by having a full-time recruiter/advisor in high schools 24 hours a day, everyday [6].

To enhance the educational service and the academic advising as shown previously, different automated techniques such as ontology (a known tool for knowledge representation) are used for the automation of this process.([3],[15]).

2.3. Techniques used in Academic Advising

Previous researches identified the most of academic advising problem and obstacles. This section will explore such techniques in-depth. These techniques include: Decision Support System, Decision Tree, Data Mining techniques, Decision Matrix, and Rule-based Reasoning.

Knowledge management definition depends on the nature and needs of the business or organization; however knowledge is the management of the cognitive production factors accommodated in a business or government organization [1]. Knowledge provides number of the benefits in education: student's information will be increased through capturing, storing and sharing of knowledge. The proper and efficient knowledge sharing cannot be done using the human interaction only, however a systematic approach should be used [1].

Examples of techniques used for knowledge management are knowledge base, knowledge map, data mining and online skills [1]. Knowledge became an important source for sharing information and for enhancing the performance of any business [16]. There are others techniques of knowledge management in academic environments ([1], [3], [9], and [14], [17]). Student Advisor Expert System (SAES) is an expert system which aims to provide an intelligent advice to the student of which major he/she should register. SAES uses combination of case-based and rule-bases analysis in order to provide a decision support [5].

Sharing the knowledge of different academic advisor is important for the purpose of automating this step, , artificial neural network [9], rule based reasoning ([6], [5], [8]), domain ontological model [4] and classification [13] used for this purpose.

For the learning propose, authors in [10] help learners to explore the related concepts in the chosen educational contents. This recommendation system uses term frequency and association rules that affect the

learner's exploratory learning. The tool used for supporting the recommendation system is mind map tool which uses semantic network representation.

The academic advising process can be used to plan the automated program scheduling service. Authors in [7] provide a framework for academic advising while handling the plan of the scheduling process. Decision tree is used as a technique to reach a stuffiest level for automatic academic advising.

3. Proposed Approach

The proposed method encompasses three main phases: course training, major training and course classification. The proposed method compares individual courses in student transcript by course in different major curriculum. The matching process results in rate/level of achievement for each major. According to that, the system can support students in decision making process for major selection, the major of highest achievement level is most probably being chosen by the student unless the students indicates other preferences. The following figures show different phases of proposed approach.

3.1. Proposed Approach Phases

The first phase is the course training one. The course name is given as an input for this phase; the first module represents transferring course into group of concepts. So proposed mechanism checks the syllabus of course from the database and converts the syllabus into concepts. The list of concepts forms an input to the second module.

This module constructs the semantic network for course by the assistance of the concept semantic database and the lexical database. The spreading activation model is executed over the semantic network. The output of such phase is the spreaded course semantic expansion network (SEN). "Figure 1"represents this phase.

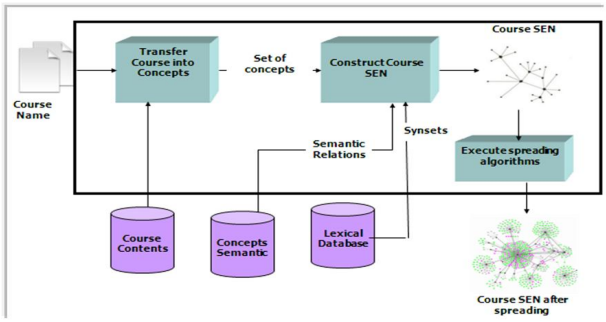

Fig. 1. The course training phase

The second phase is the major training phase, first module represents constructing the courses list based on the major-courses database. After checking the courses list, the major semantic network is constructed using the course SEN (imported from the previous phase) and major study plan database, the output at this phase represents a semantic expansion network for the major (SEN) as shown in "Figure 2".

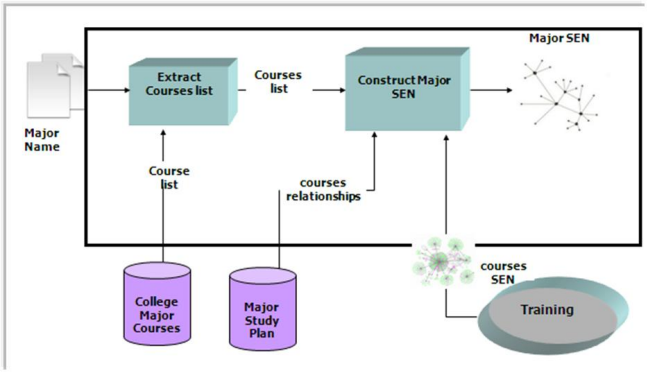

Fig. 2. The major training phase

The third phase is the classification of the individual course; this step focuses on matching process between the course given by the student and courses included in each major SEN. First, the content of the course is the main entry in order to transform a course into concepts module, a new SEN is constructed for the tested course and this SEN is spreaded based on the spreading activation model.

Finally the tested course SEN is matched to the Major training phase SEN created, extracted from the previous phase. The result of matching (achievement level) is the output of the phase as shown in "Figure 3".

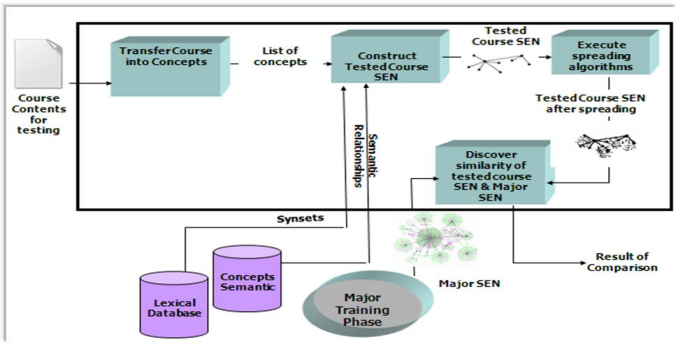

Fig. 3. The final phase in the proposed approach

The result of the comparison/matching process is the achieved level that supports decision making for the major choice. The major with the highest achievements level is the most suitable one for the student based on the proposed mechanism.

4. Evaluation and Test Results

The following subsections will discuss the experiment design, evaluation of the proposed mechanism and the testing results.

4.1. Experiment Design

The proposed mechanism provides an automated advisor that assists students in major transfer and provides accurate "match making" process using majors curriculum and course syllabus. The proposed mechanism referred back to previous studies in order to overcome their deficiencies and propose applicable mechanism. Traditional manual system of academic advising were criticized and assessed from advisors and students perspectives, issues resulted from such assessment were considered in the proposed mechanism.

4.2. Experiment Results

The use of automated mechanism is compared with the manual advising procedure, similar cases were feed into the two system and assessment of results were indicated by students and academic advisors. The results of the survey indicated its usefulness and speeding up the process of academic advising especially in transfer cases. The main objective of experiment is to validate the proposed approach; the mechanism was evaluated by a group of students and academic advisors.

5. Conclusion

The paper provides an automated mechanism for academic advising in university system. The mechanism provides solution for transfer cases between university majors. The match making process indicates the similarly of course contents and such course similarities was used in major matching and calculating the achievements level. The mechanism referred to different groups of students, advisor to evaluate its results and compares it with the traditional manual system.

The proposed mechanism could be extended to include different majors of different colleges and differentiated course syllabus. Transfer cases between different colleges of different majors could be handled using this paper contribution. The proposed model could include student preference as well prior to recommendation phase in order to filter the results and propose the most convenient major to his/her preferences.

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