Chapter 7

Educational Data Mining Review:
Teaching Enhancement

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ABSTRACT

In today’s era, educational data mining is a discipline of high importance for teaching enhancement. EDM techniques can reveal useful information to educators to help them design or modify the structure of courses. EDM techniques majorly include machine learning and data mining techniques. In this chapter of the book, we will deliberate upon various data mining techniques that will help in identifying at-risk students, identifying priority learning needs for different groups of students, increasing graduation rates, effectively assessing institutional performance, maximizing campus resources, optimizing subject curriculum renewal. Various applications of data mining are also discussed by quoting example of various case studies. Analysis of social networks in educational field to understand student network formation in classrooms and the types of impact these networks have on student is also discussed.

INTRODUCTION TO EDUCATIONAL DATA MINING

Educational data mining or “EDM” is an emerging multidisciplinary area of scientific research which centers on the development of methods and techniques for exploring the data that originates from various educational information systems. These methods and techniques will help to better understand students and the environment which they learn in.

The availability and use of big data has created a subtle difference in the information we use in our daily lives. Education has always been high on all agendas. With advent increase of data science in the education sector, the transformative developments have been done to understand the learning patterns of students. This can dramatically expand the process of teaching and learning procedures.

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Educational Data Mining focuses on designing new algorithms and tools for discovering and analyzing educational data patterns. The various algorithms are decision tree, Naïve Bayes, k-nearest neighbour (using classification technique), Apriori algorithm (using association rule mining), K-means, K-mode (using clustering techniques). The various methods and techniques used by Educational Data Mining are from statistics, machine learning and from data mining (DM). These methods help in analyzing the data collected during teaching and learning processes.

EDM helps in identification of students learning patterns and the environment in which they learn. It enables data driven decisions that helps in improving the current educational practices. Educational data mining (EDM) covers DM methods with respect to the structure of educational data. EDM deals with the analysis of study-related data as to understand student behavior. These techniques are usually applied to provide more effective learning environment.

EDM techniques can reveal useful information to educators to help them design or modify the structure of courses. Students can also facilitate their studies using the discovered knowledge.

EDM is rooted in general data mining, however the EDM methods are different from data mining methods due to multidisciplinary hierarchy of educational data and the inter dependence of different variables of educational data. Because of multidisciplinary hierarchy and the inter dependence of data variables, various psychometric techniques along with machine learning methods are integrated for analysis of data.

Computer-supported interactive learning methods and tools—intelligent tutoring systems, simulations, games—have opened up the doors to collect and analyze student data to discover patterns and trends in these data, and to make new discoveries and test hypotheses about how students learn. Data collected from online learning systems can be aggregated over large numbers of students and may contain many variables that data mining algorithms can explore for model building.

**CYCLIC APPLICATION OF DATA MINING IN EDUCATIONAL SYSTEMS**

Data mining techniques are useful in discovering useful information that can assist educators in formative evaluation of educational systems when designing or modifying an environment or teaching approach. Below is the cyclic graph showing the application of data mining in any educational system.

In Figure 1, educators are responsible for designing, planning, building and maintaining of educational systems. The educational systems may belong to traditional classrooms, web based systems, adaptive systems or e-learning systems. These educational systems provide academic and interactive data about students, their usage patterns, course information etc. Various data mining techniques like clustering, classification, text mining and pattern recognition are applied on these systems to mine the useful information that helps in improving the teaching-learning process. This discovered knowledge is useful for both educators and students. The mined knowledge helps educators in better designing and maintenance of educational systems and helps the educators to evaluate the instructional design in a formative manner.

This mined knowledge helps the educators, students and the educational systems to guide facilitate and enhance learning as a whole.