Chapter 3.25
An Integrated Data Mining and Simulation Solution

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ABSTRACT

Simulation and data mining can provide managers with decision support tools. However, the heart of data mining is knowledge discovery; as it enables skilled practitioners with the power to discover relevant objects and the relationships that exist between these objects, while simulation provides a vehicle to represent those objects and their relationships. In this chapter, the authors will propose an intelligent DSS framework based on data mining and simulation integration. The main output of this framework is the increase of knowledge. Two case studies will be presented, the first one on car market demand simulation. The simulation model was built using neural networks to get the first set of prediction results. Data mining methodology used named ANFIS (Adaptive Neuro-Fuzzy Inference System). The second case study will demonstrate how applying data mining and simulation in assuring quality in higher education.

INTRODUCTION

Data mining techniques provide people with new power to research and manipulate the existing large volume of data. A data mining process discovers interesting information from the hidden data that can either be used for future prediction and/or intelligently summarizing the details of the data (Mei, and Thole, 2008).

On the other hand, Simulation is a powerful technique for systems representations; because it provides a concise way for knowledge encapsulation. Simulation can be used effectively supporting managers in decision making, especially in situations characterized by uncertainty. Simulation can

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provide realistic models for testing real-world decision making scenarios (what-if scenarios), and comparing alternative decisions in order to choose the best solution affecting company's success, by enhancing profitability, market share, and customer satisfaction.

Simulation methodologies, such as what-if analysis, can provide the engine to analyze company's policy changes. For example, adding new tellers to a bank, or adding new airline route, or changing the number of machines in a job shop (Better, Glover, and Laguna, 2007).

Using data mining can help recalibrating system simulation models in many real world applications, as it provides the insights gleaned from the hidden and interesting data patterns.

This chapter will be divided as the following: the next section will present the data mining and business intelligence techniques used in conjunction with simulation, different experiences on the integration of simulation and data mining will be presented, then we will propose an intelligent DSS framework based on data mining and simulation integration, finally the proposed framework will be validated using a two case studies on car market demand simulation, and applying data mining in assuring quality in higher education.

Introduction to Data Mining and Business Intelligence

It is noted that the number of databases keeps growing rapidly because of the availability of powerful and affordable database systems. Millions of databases have been used in business management, government administration, scientific and engineering data management, and many other applications. This explosive growth in data and databases has generated an urgent need for new techniques and tools that can intelligently and automatically transform the processed data into useful information and knowledge, which provide enterprises with a competitive advantage, working asset that delivers new revenue, and to enable them to better service and retain their customers (Stolba, and Tjoa, 2006).

In 1996, the Organization for Economic Co-operation and Development (OECD) redefined "knowledge-based economies" as "economies which are directly based on the production, distribution and use of knowledge and information" (Weiss, Buckley, Kapoor, and Damgaard, 2003). According to the definition, Data Mining and Knowledge Management, and more generally Business Intelligence, should be foundations for building the knowledge economy. Business Intelligence is an umbrella term that combines architectures, tools, data bases, applications, practices, and methodologies (Turban, Aronson, Liang, and Sharda, 2007; Cody, Kreulen, Krishna, and Spangler, 2002). Weiss et al. 2003 defined Business Intelligence as the "combination of data mining, data warehousing, knowledge management, and traditional decision support systems".

Business Intelligence is becoming vital for many organizations, especially those which have extremely large amount of data (Shariat, and Hightower, 2007; Kerdprasop, and Kerdpraso, 2007). Organizations such as Continental Airlines have seen investment in Business Intelligence generate increases in revenue and cost saving equivalent to 1000% return on investment (ROI) (Zack, Rainer, and Marshall, 2007). The measure of any business intelligence solution is its ability to derive knowledge from data. The challenge is met with the ability to identify patterns, trends, rules, and relationships from volumes of information which is too large to be processed by human analysis alone.

Decision makers depend on detailed and accurate information when they have to make decisions. Business Intelligence can provide decision makers with such accurate information, and with the appropriate tools for data analysis (Jermol, Lavrac, and Urbanci, 2003; Negash 2004; Lau, Lee, Ho, and Lam, 2004]. It is the process of transforming various types of business data into meaningful information that can help, decision