Chapter X

An Intelligent Support System Integrating Data Mining and Online Analytical Processing

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ABSTRACT

Intelligent decision support requires flexible, knowledge-driven analysis of data to solve complex decision problems faced by contemporary decision makers. Recently, online analytical processing (OLAP) and data mining have received much attention from researchers and practitioner alike, as components of an intelligent decision support environment. Little that has been done in developing models to integrate the capabilities of data mining and online analytical processing to provide a systematic model for intelligent decision making that allows users to examine multiple views of the data that are generated using knowledge about the environment and the decision problem domain. This paper presents an integrated model in which data mining and online analytical processing complement each other to support intelligent decision making for data rich environments. The integrated approach models system behaviors

that are of interest to decision makers; predicts the occurrence of such behaviors; provides support to explain the occurrence of such behaviors and supports decision making to identify a course of action to manage these behaviors.

INTRODUCTION

Increasing complexities in decision problems and an exponential growth in the volume of data available for analysis are characteristic of contemporary decision problems. Systems support for managerial decision-making in today's environments requires precision and accuracy in the problem representation, intelligence in the selection of data relevant to the specific decision problem and flexible analytical support to alleviate the cognitive burden on the decision maker. Intelligent decision support systems (IDSS) that provide accurate models to understand the decision problem and flexible mechanisms to examine the multiple dimensions of the problem can enhance the analysis and support the decision-making process. A goal of IDSS design is a decision-making environment with flexible mechanisms to analyze the relevant data using the models of the problem domain as a reference.

This research presents a model to integrate the unique benefits of two very promising technologies — data mining and OLAP — to develop a model for an IDSS. Data mining techniques are used to provide accurate and sophisticated models of the process based on historical data from the business processes. Actively mining the data enables dynamic models that capture emerging relationships in the data. Analysis, based on such models, is accurate and current in its depiction of the problem environment. OLAP is used in decision support systems (DSS) to provide the decision maker with fast and flexible analytic capabilities for large amounts of data. As an improvement on existing approaches, the model supports explanatory and predictive capabilities that are based on mined models of the process.

The following section presents background information in the use of artificial intelligence (AI)-based techniques for decision support. After presenting the theoretical basis and some approaches to incorporate AI-based techniques in DSS, we review the concepts of data mining and OLAP and present some arguments for their integration to support decision-making. The next section presents the architecture of the IDSS, based on the integration of data mining and OLAP. Components of the model are discussed in detail and directions for implementation are offered. We conclude with a synopsis of our prototype and discuss some future directions for research to further the state of the art in intelligent decision systems.

BACKGROUND RESEARCH
Systems Support for Decision-Making

Administration of an organization involves making decisions to determine appropriate courses of action that help the organization achieve its objectives (Simon, 1976). Such decision-making is the primary function of administrators and managers in an organization. DSS have been developed to aid managers in the critical decision-making process. Keen and Scott Morton (1978) define a DSS as "a coherent system of computer

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