Chapter XXXIV
Intelligent Fuzzy Database Management Systems

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ABSTRACT

In this chapter, an agent-based fuzzy data mining structure was developed to process and evaluate data with an enlargement in the knowledge dimension, and to build a rule structure for the system. Within the developed system, the focus was on the operation feature of the fuzzy data mining structure, which is the same for each agent composing the system. The suggested association rules are derived from a relational database. Future tasks of the system will be estimated when the system performs fuzzy data mining more quickly thanks to the distributed, autonomous, intelligent, and communicative agent structure of the suggested agent-based fuzzy rule mining system. In fuzzy rule mining, the system will primarily examine and group the relational database in databases of the agents with fuzzy logic and then will shape the rule base of the system by applying the fuzzy data mining method to these data.

INTRODUCTION

A number of real-world systems and applications deal with unclear or vague data. Today’s database systems are expected to handle uncertainties in the data they store. This need occurs because of a variety of factors. For example, the sources that provide information may be unreliable, estimation or judgment may be involved in gathering information, and so on. For such systems, information management components are needed in order to provide support to manage such imprecise data. Intelligent agents will be used to compute operations such as defining attribute peculiarities of data among various data and establishing a rule base by analyzing data and estimating the results. The
agents also have the ability to perform activities such as execution, intercommunication updating, knowledge sharing, and decision making. The agent concept was derived from the denotation of distributed artificial intelligence in the 1970s. Multiagent systems (MASs) may be referred to as a community of agents that is composed of agents with different features and qualifications of similar characteristics. These agents share knowledge on a common platform and operate dependently or independently (Wooldridge & Jennings, 1995). The agents consist of three components that constitute the basic structure of the system: the knowledge base, rule base, and task base. There is a hierarchical structure in the data flow from the knowledge base to the task base within the system. In this hierarchical structure, the information is evaluated in the fuzzy database logic, and data flows from the information to the task. The knowledge base, rule base, and task base components in the agent are the parts that are found in the related database, and they constitute the intelligence feature in the agent.

In this chapter, defined databases are referred to as database selection in the multiagent system, and related databases include the evaluation of databases within the multiagent system through the fuzzy data mining structure. Membership values were determined by taking into consideration the similarity coefficients of knowledge in databases. The decision mechanism of the system is built within the rule structure by the evaluation of the obtained data. First, the knowledge base contributes to the formation of the rule base structure of the system with the help of the knowledge fuzzy database structure. In the second phase, it contributes to the formation of the task base structure of the system through the rule fuzzy database, which exists in the subject-matter system. This intelligent feature of the suggested system also introduces a structure that is called fuzzy agent in this chapter.

The rest of this chapter is organized as follows. The section “Background” explores some necessary background information (literature review) in line with the rules generation process (the multiagent-based knowledge processing model). “Fuzzy Queries and Data Mining” discusses fuzzy data mining process. The next section explains the process from fuzzy data mining to fuzzy mining agents, and the subsections include agents’ mining structures, mining to coordinate and complete data in the agent mechanism, and distributed fuzzy data mining. Then, the integration of fuzzy data mining into multiagent systems for manufacturing activities is discussed. The next section makes suggestions as to the future trends. The last section includes the conclusion.

BACKGROUND

In the studies carried out until now, either the fuzzy relational database or data mining has been examined individually. However, this chapter uses the fuzzy data mining method in evaluating and classifying data, taking into consideration the fuzzy relational database in multiagent systems. The fuzzy data mining approach was preferred in that it ensures a more agile, intelligent, and rapid system. This approach is used in querying, finding, and classifying knowledge as well as in the interrelation among databases within multiagent systems.

Relational databases have been widely used in data processing and in supporting business operations; thus, the dimension has grown rapidly. The relational database system assists the system particularly in making the right decision through evaluations of the fuzzy data mining. The fuzzy set was proposed by Zadeh (1965), and the division of the features into various linguistic values was widely used in pattern recognition and in the fuzzy inference system. Some scientists, making use of this, came up with various results. For example, Ishibuchi, Nozaki, and Tanaka (1992) applied fuzzy logic to pattern classification; Wang and Mendel (1992) generated fuzzy rules; Sun (1994) and Bezdek (1981) examined the method for partitioning feature space; and Kubat, Taşkin, Topal, and Turgay (2004) reviewed the frequency
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