Chapter 5.3
Value of Information in Distributed Decision Support Systems

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ABSTRACT

This chapter deals with the analysis of the value of information in a distributed decision support systems. It characterises the basic measures of the value of information, with the stress put to the utility function, the effect of the knowledge discovery techniques in databases on the value of information and multicriteria methods of decisions support. In the chapter, a multi-agent system is presented, which is an example of a distributed decision support system. In the last part of the chapter, the choice methods and consensus methods for increasing the value of information through the eliminate contradiction of information within the system are presented.

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INTRODUCTION

Nowadays information is a crucial element of an economic development of a society. Only base information that have a given value persons, who management different kind of organisations have to make correct decision. Information gains the particular meaning in the distributed decision support systems. These systems function as a set of computers joined in local and global networks (e.g. Internet) and assigned to the decision support. The value of information in these systems is measured through the application of the utility functions. An important problem is that the genuine utility of information is known only in the moment when the results of the decision made with its use are known.. The important attributes of information are its urgency and actuality because a correct decision

may be only made when the system is able to get the up-to-date information, which is needed to make this decision, quickly. Other attributes of information are undeniability, intelligibility and credibility. Often the information is credible if it can be crosschecked. A correct determination of the value of information is very important in the process of decision making, because the correctness of the decision depends on that value. Thus, the problem with decision support systems is getting such information, which value is the greatest for solving the problem. If decision support system is distributed then the expectations for the value of information are even greater because the system can obtain the information from different sources. The sources of information of a distributed system can be placed in many different parts of the world and the value of information can differ. The information of the as greatest value is crucial for making proper decisions. This chapter make a suggestion to solve mentioned problems. Thus the fundamental measures of the value of information considering the distributed decision support system are presented. In distributed system situations that lower the value of information can occur. For example, if data replication occurs, it can happen, that the out-of-date data on one of the servers is the cause of the outdating of the information or can also be such, that one of the system nodes generate incorrect information (e.g. "byzantine" failure), which is entirely useless in the decision support process. An "information chaos' which often happens on the Internet is also a frequent problem. There is so much information in the network, that proper selection becomes a serious challenge for the system. There can also be situations, in which several different sources give contradictory information; determining which information is correct is a task for the distributed decision support system.

An essential problem are also different versions of information generated by different nodes of system (e.g. servers), which cause the intrasystem information contradiction. In this situation the system can present the user with several variants of decisions (which may also be contradictory) or it can analyze information and define one, the most satisfactory for the user (based on the criteria given by the user). This second solution is certainly better, because the user does not have to think about which decision to choose.

The chapter will also present solutions influencing the increase of the value of information in distributed decision support systems, such as data mining and their projecting on the utility of information. It also describes the multicriteria distributed decision support systems with the use of different sources of information.

In next part multi-agent distributed decision support systems are characterized. Agent, as an intelligent and mobile program, can not only execute commands, but also read signals from its environment and react accordingly. Thus multi-agent system can get and process information of the greatest value automatically.

To eliminate contradiction of information within the system, choice methods which allow to choose one of the examined decisions, and the consensus methods are presented. The difference between these two methods is, that in the latter the chosen decision does not have to be one of the existing decisions (generated by the system nodes); it can be a new decision, which will be the most approximate to those existing ones. In other words all of existing decision will be taken into consideration to certain extent. It certainly decreases the risk of the decision making.

The main purpose of the chapter is to determine the methods for the measurement of the value of information in the distributed decision support systems and to find the methods of increasing the value of information in this systems.

BACKGROUND

Decision making is a difficult and complex process. It must be noted that in current socioeconomic