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# Intelligent Decision Aids for Electronic Commerce

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## Introduction

Electronic commerce is a fast growing area of Information Systems research and application. It is difficult to think of a facet of business that has not been significantly affected by this fast growing movement, which is fuelled by the growth in the use of the World Wide Web (WWW). Users of electronic commerce interfaces are engaged in decision-making activity that typically involves evaluating alternatives with respect to a goal and choosing a requisite course of action. Intelligent decision systems are one of the fastest growing areas in decision support systems (DSS) research. Intelligent decision systems use domain specific knowledge to provide intelligent input to the decision-maker.

This paper explores the role of decision aids, especially intelligent decision aids, as a needed component of electronic commerce interfaces to facilitate making decision. A case for the utility of intelligent decision aids in electronic commerce environments as a valuable tool to facilitate the decision making process is made. Some common artificial intelligence (AI) based technologies and their use in supporting decision-making tasks are investigated. Some suggestions on how such aids may be incorporated in these environments are offered. Future research directions in the development of intelligent electronic commerce interfaces are presented.

## AI applications in decision support

AI can enhance DSS research by selectively incorporating machine-based expertise to deliver the potential of DSS in the knowledge era (Goul, Henderson and Tonge 1992). Decision environments that require domain knowledge on the part of the decision-maker are suitable for supporting decision making with intelligent aids. The identification of alternatives, evaluation of alternatives and their associated outcomes or the identification of suitable alternatives to satisfy the goal of the decision-making activity are decision making activities that can be supported with intelligent decision aids. It is a requirement of such systems to explain the relationships that are considered by the system so that decision-makers become more knowledgeable about the problem domain after interacting with the system than they were before.

## Electronic commerce as a decision making task

With the widespread use of the WWW for various business activities, the number of people engaged in electronic commerce is increasing every day. The electronic commerce interface is the point of contact between a seller and a buyer in an electronic marketplace. Human agents are often used as intermediaries in the relationship between buyers and sellers in order to facilitate commerce. Internet-based electronic commerce environments leverage information technology to match buyers and sellers with increased effectiveness and lower transaction costs which lead to more efficient markets (Bakos, 1998). Intelligent environments can enhance this contact and make the experience more rewarding for both parties by informing the buyer about their alternatives and choices and assisting them in understanding the relationship between alternatives and their associated outcomes.

People engaged in electronic commerce activities are involved in the act of decision making. Decision problems may range from simple choices such as making purchasing decisions about consumer goods to the relatively complex decisions such as selecting technology and making supply chain management decisions. A simple case of consumer goods related purchases could serve as an example to illustrate the essential aspects of the activity. A consumer may wish to know the various alternatives that may be available within their financial limitations which satisfy their functional requirements. The utility of the various alternatives with respect to the intended use of the goods would be an important factor in the decision making process. Pre-defined relationships that may exist between the features of these alternatives and the cost function would be an important issue to the consumer. The ability to analyze the sensitivity of the features with respect to the goal is a desirable feature of the decision process. It is clear that such decisions would benefit from support in the evaluation of alternatives and choice of a course of action.

## **Intelligent Decision Support for electronic commerce environments**

The information systems research community has investigated many ways of using artificial intelligence based technology to support business functions. Primary examples are the use of machine learning algorithms and knowledge management techniques in the development of decision support systems. With the widespread growth in the World Wide Web, much research has been done in the investigation of delivering and adapting conventional methods of commerce over this powerful electronic medium of interaction. Intelligent decision making requires that the analysis of data to solve decision problems be driven by accurate models of the business processes. The goal is a decision-making environment that provides accurate models to understand the decision problem and flexible mechanisms to examine the dimensions of the data based on these models.

Some common artificial intelligence based techniques in decision support include expert systems, decision trees, neural networks, and intelligent agents. Expert systems as they are commonly known, are computer systems that can perform the role of a domain expert in the area of a problem that is being investigated by the decision maker. The expertise of the human in terms of either knowledge of the task at hand, or knowledge of the problem area is incorporated into the system (Murray and Tanniru, 1987). Expert systems provide a means of formalizing a lot of mostly experiential and subjective knowledge that may have been heretofore unexpressed and unrecorded (Dhar, 1987). This creates a formal body of knowledge that can be drawn upon in solving decision problems.

Decision trees are a commonly used method for rule based systems. By following each possible path of the decision tree, a set of if-then rules can be generated for possible decision paths for the decision problem. The set of rules represent information about the different states of the system and can be presented as valuable information for a decision making process.

Neural networks have also been successfully applied to many types of business decision problems. They have been extensively used for their ability to capture complex, non-linear relationships in scheduling, computer integrated intelligent manufacturing, and process control (Dagli, 1994). One major drawback of neural network based systems is their inability to explain the answers that they come up with. Hybrid intelligent systems that use a combination of neural networks and rule-based expert systems have been developed to utilize the strengths of each technique for providing explanatory and predictive capabilities to the decision environment (Madey, Weinroth, and Shah, 1994).

Intelligent agents are based on artificial intelligence technology and have proved successful in delivering decision support functionality over web based interfaces. Agents exhibit goal-seeking behaviors that can be used by buyers and sellers in an electronic marketplace. Agents may be used to enhance the virtual communications between the buyer and the “marketplace”, to provide information about specific product features as they relate to the goals of the task, or to come up with a set of alternatives that the user can choose from in making decisions. Intelligent agent technology holds a lot of promise for electronic commerce environments (Nardi, Miller and Wright, 1998).

These tools can be incorporated into electronic commerce environments as the means by which decision problems are solved. These techniques involves requiring input from the user in terms of their goals for the decision task and obtaining some measures of the bounds of the activity, such as resource constraints. Using domain specific knowledge from the seller, the intelligent aids can generate alternatives that may be suitable for the user and allow the user to analyze these alternatives with respect to their goal using a variety of techniques.

For example, evaluation of alternatives of consumer products bounded by available money, with the goal of satisfying the functional requirements of the problem may be facilitated by the use of intelligent aids. Intelligent agents can be used to represent each side, buyers and sellers. The buyer agents can take information about the requirements from the buyer about the constraints and the goal that the decision problem has. It can then enter negotiation sessions with a seller agent to obtain information about alternatives that satisfy the goal and meet the constraints of the buyer. After obtaining this information, the buyer agent can inform the user of the alternatives available and the features of these alternatives. Decision trees and expert systems may be used in collaboration with these systems to develop structured questionnaires to walk users through the set of alternatives available and the implications of each of those alternatives. The benefit of these systems is that they can be used to evaluate the users choices and explain why the system makes the choices that it does. Users are then able to understand their choices, perform knowledge driven analysis of the choices and make intelligently informed decisions regarding alternatives.

## Contributions and Future Work

This research extends work previously done in intelligent decision systems and electronic commerce by making a case for the use of intelligent decision support in electronic commerce environments. We are currently engaged in research to develop intelligent interfaces based on multiple artificial intelligence based techniques, including decision trees, neural networks and intelligent agents as components in electronic commerce interfaces. One result of this research would be the development of a mapping of a set common business decision problem characteristics that are typically faced by electronic commerce users and the appropriate intelligent decision support technologies to support these decision problems. Another result that we hope to achieve is a measure of effectiveness the various techniques as they applied to the decision problems and in terms of the perceptions of the users of the environments. This would advance the current state of the art in terms of intelligent interfaces and their applicability to electronic marketplaces. We anticipate that the results of this research would be of interest to business and information systems academe as well as practitioners in this area.

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