Chapter 22
A Framework for "Just–in– Time Learning" Decision Support in Organizations

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ABSTRACT

This article describes an integrated "Just-in-Time Learning" framework for providing decision support in organizations. The framework emerges from years of work with the national laboratories and facilities that are under the direction of the United States Department of Energy. The article begins by describing expert systems technology and how it has been used to provide decision support in organizations. This is followed by a discussion of the strengths and weaknesses of expert systems technology for this purpose. Next, a "Just-in-Time Learning" framework is introduced where the theoretical foundation for the framework is described. Afterwards, the other aspects of the framework including the types of knowledge, learners it serves, and how the framework can be utilized for decision support are detailed. Finally, a discussion section summarizes how a Just-in-Time Learning Framework can achieve some of the strengths -- while overcoming some of the weaknesses -- of expert system technology for providing decision support in organizations.

INTRODUCTION

Decision support has taken many forms in organizations. The term typically conjures up a computer system that provides access to information that will aid decision-makers for making better business decisions. Recognizing the value of better decision-making, information system designers and developers sought to utilize the most "promising technologies" to develop decision support systems. One of these promising technologies was labeled an "expert system" -- derived from the term knowledge-based expert system that emerged from the field of Artificial Intelligence (AI). George Luger gives a good explanation of an expert system in his textbook on Artificial Intelligence (Luger, 2004):

"One major insight gained from early work in problem solving was the importance of domain-specific knowledge. A doctor, for example, is not effective at diagnosing illness solely because she possesses some innate general problem-solving skill; she is effective because she knows a lot about medicine. Similarly, a geologist is effective at discovering mineral deposits because he is able to apply a good deal of theoretical and empirical knowledge about geology to the problem at hand. Expert knowledge is a combination of a theoretical understanding of the problem and a collection of heuristic problem-solving rules that experience has shown to be effective in the domain. Expert systems are constructed by obtaining this knowledge from a human expert and coding it into a form that a computer may apply to similar problems. This reliance on the knowledge of a human domain expert for the system's problem solving strategies is a major feature of expert systems."

To summarize Luger's definition, an expert system is a technology that utilizes human knowledge captured in a computer program to solve a problem that ordinarily requires human expertise. The idea behind them is to imitate the reasoning process that human experts use to solve specific problems. Also, non-experts can improve their problem-solving capabilities with the use of these systems. And human experts can use expert systems as knowledgeable assistants. Hence, it was an easy and natural conclusion that expert systems technology would be well suited for developing decision support systems; as a result, information system designers and developers began to develop decision support systems based on expert systems technology (Turban, 1992, Giarratano & Riley, 2004, Chang, 1994).

Before the advent of expert systems, previous efforts in the field of Artificial Intelligence (AI) research focused on a general-purpose approach to modeling human expertise. This general-purpose approach is exemplified by the General-purpose Problem Solver (GPS) developed by Newell and Simon (Newell & Simon, 1972). GPS was an attempt to create a sophisticated, but general process, for solving problems that could be used in many domains. Work on general-purpose approaches continued for several years without any major accomplishments. A shift from these general-purpose reasoning approaches to domain specific and knowledge intensive approaches occurred in the late 1960s with the development of the first expert system, DENDRAL, at Stanford University (Buchanan & Shortliffe, 1985). The focus for DENDRAL was on creating a complete model of the knowledge used to make decisions in a narrow and specific domain. DENDRAL used data found in mass spectrometry to identify unknown chemical compounds. A key insight that was learned at the time was that the power of an expert system is derived from the specific knowledge it possesses, not from the particular formalisms and inference schemes it employs. The development of DENDRAL was followed by the development of MYCIN, also at Stanford. MYCIN's task domain was antimicrobial selection, i.e., the problem of choosing an antibiotic medicine (or combination of medicines) for treating a patient with a bacterial infection. It was the widely reported success of DENDRAL, MYCIN, and the other expert systems that followed which encouraged information system designers and developers to build decision support systems based on expert systems technology (Turban, 1992).

METHOD

To illustrate how a traditional expert system approach could be utilized for decision support within the framework presented in this article, we will step through the following example scenario shown in Figure 1.

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