

Expert Systems in Government Administration

Joseph Weintraub

Artificial Intelligence is solving more and more real world problems, but penetration into the complexities of government administration has been minimal. The author suggests that combining expert system technology with conventional procedural computer systems can lead to substantial efficiencies. Business rules can be removed from business-oriented computer systems and stored in a separate but integrated knowledge base, where maintenance will be centralized. Fourteen specific practical applications are suggested.

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Conventional procedural computer systems are widely used by federal, state, and city government agencies to support daily operations. Traditionally, these systems have been used to automate the accounting function, automate labor-intensive activities, manage and control vast financial and physical assets, process payrolls for hundreds of thousands of employees, and merge and summarize information about a wide set of activities in support of management decision making.

These traditional computer systems are distinguished by the following characteristics. First, the business rules and activities that are automated are discrete, structured, well defined, and well founded. Universally, they can be defined in a two- or three-dimensional truth table, and conventionally, they are often if-then rules imbedded in Cobol or Ada source code.

Second, 20 percent of the processing in application systems is business rules oriented; the remaining 80 percent focuses on selecting, sorting, merging, manipulating, and reporting data.

Although these systems have been enormously successful in supporting these daily activities, they are not useful for solving difficult business problems that (1) require expertise about a large number of complex facts, rules, or decision factors; (2) must account for the probability of outcomes as opposed to procedural certainty based on changing conditions, government regulations, and work-force agreements; and (3) are solved heuristically based on expert experience and knowledge gained over long periods of time in an often highly unstructured manner.

Expert systems technology has recently evolved as an effective way to focus the power of the computer to solve these types of problems. Expert systems differ from traditional systems in that they use an approach to problem solving based on reasoning, inference, goal search, control search, and metaknowledge and can deal with missing and conflicting data.

Not only does this technology promise to advance the types of decision making that can be enhanced through automation, but evidence suggests traditional applications might be easier and less costly to build and maintain using this form of problem solving.

It is ironic that government administration has thus far made little practical use of AI. Much of the AI research that has been completed at universities and corporations and most of the training of AI researchers has been funded by the federal government, primarily the National Science Foundation and the Department of Defense. Despite a lack of immediate practical results, the Defense Advanced Research Projects Agency (DARPA) has provided support for AI and expert systems research for over 10 years. Both the Strategic Defense Initiative and the Strategic Computing Program have involved major investments in AI research. In the last two years, interest in the use of AI in government administration has substantially increased. Almost every major government agency has attempted to apply this technology to some of its operational problems, with mixed and inconclusive results.

The objective of this article is to briefly assess expert systems technology available today and suggest several likely areas within government

administration where it would be valuable. I then consider the development of pilot applications to determine to what extent expert systems can be used to leverage critical activities and solve specific business problems.

Instituting a Pilot Expert System

One major government agency has over 90,000 employees, of which approximately one-third are members of 1 of 19 different unions. These unions have separate, distinct, and complex contractual agreements that are periodically modified, which necessitates changes to the rules imbedded within existing computer systems.

Although at first appearance the needed rule changes appeared to be routine, it took significant management information systems (MIS) effort over an eight-month period to modify, test, and implement them. Preliminary analysis of expert system technology indicates that if the union rules had not been imbedded in hundreds of pages of Cobol code but instead had resided in a maintainable and separate rule base, then these same contract changes could have been implemented in a fraction of the time.

This area is likely the first for a pilot system integrating expert system technology with conventional procedural processing. The benefits to be derived from this project are fivefold: (1) gaining knowledge and experience in expert systems and AI technology and disbursing this valuable knowledge and experience to other applications used by the government and its agencies, (2) ensuring that compatible expert system software is used by the government and its subsidiary agencies, (3) identifying improved methodologies to handle computer rule-based systems, (4) reducing development and maintenance efforts associated with complex rule-based systems, and (5), providing the government with the tools to achieve greater efficiency in tracking the job assignments of union workers while maintaining adherence to contractual agreements.

The Information Systems Plan

The applicability of expert systems and AI to government administration can be seen in a careful "between the lines" reading of the Information Systems Plan (ISP). Although not explicitly stated, many of the systems and projects defined in ISP are driven by extensive and complex logic processes and would benefit from AI technology. The projects are identified as part of this class:

Forecasting—financial planning and cash management. Expert systems technology would provide the required flexibility in structuring and analyzing financial data for modeling and simulation purposes.

Labor relations. Expert systems technology would allow the entire recasting of payroll and labor distribution data to reflect contemplated changes during contract negotiations, allowing a thorough analysis of the contract's impact.

Document and archive retrieval. AI search algorithms would speed the storage and search for critical and often classified information.

Regulatory compliance adviser. A number of expert systems could be built to direct administrators through the often intricate structure of regulations that guide each step of their work.

Office automation techniques. Electronic filing and mail and local area network techniques for building modern work groups could aid cooperation on large projects.

Capital assets analysis. An expert system integrated with the capital inventory database could assist in turning this vast amount of data into useful information.

Personnel employment assessment. AI-based personnel assessment is available to assist in screening, hiring, and periodically reviewing government employees.

Legal advice expert. Where proposed contractual agreements with outside vendors are sensitive to questions of law, an expert system could quickly locate the applicable precedent or statute.

Computer-aided instruction. AI techniques have matured in this area to the extent that seemingly customized interactive learning sessions are available to the individual employee on virtually any subject.

Bid and proposal preparation assistance. The procurement management process could be supported with an interactive decision support system with access to prior computerized procurement activity.

Natural language querying of database. Many departments require frequent small computer reports to meet changing information needs. Generally, the request is to select, sort, and summarize a certain type of record from a computerized database. AI has made it possible for this task to be accomplished using ordinary English-language syntax.

Intelligent automated auditing. It is a fact of life that paybacks, padding, and other types of fraud sometimes occur in an organization where large sums of money are routinely paid to outside vendors. Auditing complex computer systems is still more art than science. Unattended AI programs that run during nonproduction hours to automatically uncover anomalies in large-scale databases are now commercially available.

Hypertext based operations manuals. The problem with most documentation is that it is too voluminous and too detailed. The user is often forced to spend hours trying to locate a few simple keywords or commands. The technology of Hypertext can solve this problem because an online manual can start with a few screenfuls of the most important information. Clicking the mouse on any indexed keyword on the screen transfers the user to a more detailed explanation.

Neural networks. Neural networks have recently reemerged as a powerful new AI technique. They have important applications in machine learning, pattern recognition, and a new type of expert system that builds its own predictive rules by analysis of thousands of prior cases. This is especially useful in the development of expert systems integrated with large-scale financial databases.

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Summary

It is clear that numerous application possibilities exist for AI and expert systems in government administration. It is likely that in the future, we will see AI techniques embedded within commercial mainframe applications on a routine basis. It is also likely that expert system tools will become modularized as users demand ways to customize their applications to suit specific needs. An AI guru once said there is no such thing as "artificial" intelligence and that if software displayed intelligence, it was because someone put it there. In this case, an awful lot of hard work faces those who take on the challenge of putting intelligence into conventional computer software applications



Joseph Weintraub is a specialist in expert system implementation planning for government and industry. He is an author of numerous articles and books on computing. Weintraub can be contacted on line via The Source as 72401,3404 or at 46-16 65th Place, Woodside, NY 11377



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