

**EXPERT SYSTEMS COMBINED WITH NEURAL NETWORKS:
TOOLS TO BENEFIT THE MARKETING RESEARCHER**

George Aiken, D.B.A. Candidate, Nova Southeastern University
Thomas J. Smith D.B.A. Candidate, Nova Southeastern University
Sharon M. Hoffman, D.B.A. Candidate, Nova Southeastern University

ABSTRACT

For years, artificial intelligence applications, in the form of expert systems, have assisted academic and professional researchers in the creation and application of marketing system simulation. Today, due to advances in technology, neural network applications have resurfaced in the marketing literature as a useful tool for the marketing researcher. This paper describes a simulator, currently in the construction stage, which employs a combination of expert systems and neural network technologies.

INTRODUCTION

Marketing researchers have traditionally employed the notion of an open marketing system to explain the concept of marketing. In the accomplishment of the marketing concept, a marketing system is defined as a set of elements and relationships which (1) have an identifiable boundary; (2) provide a method to identify or chart the movement or flow of information, goods, and ownership; (3) include money and the risk incident to said flows (Reidenbach & Oliva, 1983).

While controversial and ill-defined, most experts agree artificial intelligence is concerned with two basic ideas: (1) studying the human thought processes to understand what intelligence is; and (2) representing these thought processes for machine use (computers, robots, etc.) (Alter, 1992, Turban, 1993).

Expert or "knowledge systems" are software systems designed to mimic the decision making of human experts (Chau, 1991; Steinberg & Plank, 1990). Unlike other software systems which use strict mathematical reasoning to perform representation, computation, and other forms of data manipulation, expert systems represent

knowledge through the heuristic manipulation of databases. Expert systems are generally dependent on "rules of thumb" developed to guide the program to a workable solution (Steinberg & Plank, 1990). Further, expert systems are based on inferential processes in contrast to the repetitive processing of standard systems.

Another field of artificial intelligence becoming popular within the marketing community is neural computing or neural networks. Neural networks, so named because these systems attempt to simulate the human brain's reasoning process, reason inductively. In contrast to the deductive reasoning processes of expert systems (Zahedi, 1991).

EXPERT NEURAL NETWORKS

A promising application mentioned in the literature is the combination of expert systems and neural networks. Labeled "expert neural networks" or "expert networks" (Caudill, 1991), these two areas of artificial intelligence complement each other while overcoming two problems: (1) the initial creation of the expert systems knowledge base, and (2) the neural network problem of "local minima" (Barker, 1990). This synergistic combination creates a potential modeling system capable of performing both inductive and deductive reasoning while disclosing intermediate steps to the user (Caudill, 1991).

THE MODEL

The model, which is currently under construction, consists of four distinct components: three expert systems components and one neural network. The expert systems components, which are labeled political/cultural, logistics, and financial, were developed utilizing Exsys, a popular expert systems shell.

The Political/Cultural Component

The political/cultural expert systems component, which is currently undergoing testing, incorporates Hofstede's (1993) five cultural dimensions: (1) power distance, (2) individualism-collectivism, (3) masculinity-femininity, (4) uncertainty avoidance, and (5) long-term/short-term orientation.

The Logistics Component

The logistics component, still in the planning stage, will be based on Bass' (1980) mathematical model of the Theory of the Timing of Adoption of Innovations, which includes learning rate and demand elasticities estimates, as well as demand and price functions. The elegance of this model is that with the employment of neural network technology, nonlinear functions can be incorporated.

The Financial Component

The financial component, also in the planning stage, will be based on the Exit Net Present Value Abandonment function developed by Aggarwal and Soenen (1989). This function incorporates discount cash flow analysis within the framework of the abandonment decision and the continuous analysis of the marketing investment.

The Neural Network Component

The neural network component consists of a maximum 8196 x 3 matrix backpropagation neural network developed in California Scientific Software Brainmaker Version 3. 1, and utilizing an ASCII bridge to each of the expert systems components. The neural network political/cultural expert systems bridge has been completed, taking 469 hours to train on an AM586x-133 MHZ processor PC. Similar training techniques are planned for the logistics and financial components.

CONCLUSION

In conclusion, it is estimated that the simulator

will be operational by Spring, 1998. Though initially created on an AM586x-133 MHZ IBM-compatible platform, future plans include transporting the simulator onto a Sun Microsystems Netra-J network (Sun SPARC STATIONS version 2.5) for integral systems testing.

REFERENCES

- Aggarwal, R. & Soenen, L. (1989) Project exit value as a measure of flexibility and risk exposure. *The Engineering Economist*, 35 (1), 39-54.
- Alter, S. (1992). *Information systems: A management perspective*. Reading, MA: Addison-Wesley.
- Barker, D. (1990) Analyzing financial health: Integrating neural networks and expert systems. *PC AI*, 4 (3), 25-27, 62-64.
- Bass, F. M. (1980) The relationship between diffusion rates, experience curves, and demand elasticities for consumer durable technological innovations. *Journal of Business*, 53 (3), S51-S67.
- Caudill, M. (1991) Expert networks. *Byte*, 16 (1), 108-116.
- Chau, P. Y. K. (1991) Expert systems and professional services marketing. *Journal of Professional Services Marketing*, 7(2), 79-86.
- Hofstede, G. (1993) Cultural constraints in management theories. *Academy of Management Executive*, 7(1), 81-94.
- Reidenback, R. F. & Oliva, T. (1983) Toward a theory of the macro systemic effects of the marketing function. *Journal of Macromarketing*, 3, 33-40.
- Steinberg, M. & Plank, R. E. (1990) Implementing expert systems into business marketing practice. *The Journal of Business and Industrial Marketing*, 5(2), 15-26.
- Turban, E. (1993) *Decision support and expert systems: Management support systems*. New York: Macmillan Publishing Company.
- Zahedi, F. (1991) An introduction to neural networks and a comparison with artificial intelligence and expert systems. *Interface*, 21 (2). 25-38.