



Z Solutions®

A MANAGER'S GUIDE TO NEURAL NETWORKS

EXTRACTING KNOWLEDGE FROM INFORMATION

In his book, *Powershift*, Alvin Toffler writes of the power gained from knowledge. *Powershift* is the last in Toffler's trilogy preceded by *Future Shock* and *The Third Wave* and as the book ages it appears more and more visionary. In his book he predicts that the most important weapon in the war for economic supremacy in the 21st century will be the organization of knowledge. The continued existence of organizations will depend on how well they use available information.

Now looking back in the 21st century, the 90's could be called the decade of re-engineering. Work forces including white-collar staffs were reduced and re-organized. Managers now face the 21st century that Toffler discussed with streamlined staffs and reduced budgets. They are finding it difficult to determine how to best use information technology to improve performance. From the standpoint of an individual manager's team, the challenge is increasingly one of understanding and organizing large amounts of information to improve knowledge of the organization's business and markets. The manager is now faced with organizing and training a group of workers to deal with an increasing inflow of data. Improvements are needed. Without these workgroup-level improvements, the organization is at a competitive disadvantage in a changing macro-level economy.

In short, managers are faced with the task of getting more from less, often without the time and budgetary resources to develop understanding of the technology to drive the improvements needed. This includes the use of information technology. Although lack of data and facts is seldom a problem, real measurable improvements in knowledge gained from the information and the resulting decisions based on the information are hard to find.

A powerful emerging technology can be used to efficiently process information to achieve greater knowledge and improved decision making. This technology is the field of Artificial Neural Networks, commonly referred to as simply Neural Networks. Neural Networks self-adapt to learn from information, providing powerful models representing knowledge about a specific problem.

ORIGINS OF NEURAL NETWORKS

Artificial Neural Networks are the result of academic investigations that involve using mathematical formulations to model nervous system operations. The resulting techniques are being successfully applied in a variety of everyday business applications.

Neural Networks represent a meaningfully different approach to using computers in the workplace. A Neural Network is used to learn patterns and relationships in data. The data may be the results of a market research effort, the results of a production process given varying operational conditions, or the decisions of a loan officer given a set of loan applications. Regardless of the specifics involved, applying a Neural Network is a substantial departure from traditional approaches.

Traditionally a programmer or an analyst specifically "codes" every facet of the problem in order for the computer to "understand" the situation. Neural networks do not require the explicit coding of the problem. For example, to generate a model that performs a sales forecast, a Neural Network only needs to be given raw data related to the problem. The raw data might consist of: history of past sales, prices, competitors' prices, and other economic variables. The neural network sorts through this information and produces an understanding of the factors impacting sales. The model can then be called upon to provide a prediction of future sales given a forecast of the key factors.

These advancements are due to the creation of neural network learning rules, which are the algorithms used to "learn" the relationships in the data. The learning rules enable the network to "gain knowledge" from available data and apply that knowledge to assist a manager in making key decisions.

WHAT CAN NEURAL NETWORKS BE USED FOR?

Neural networks constitute a powerful tool for data mining. Data mining has become a popular term recently and really involves the extraction of knowledge from information. Organizations have more and more data from which they need to extract key trends in order to run their businesses more efficiently and improve decision-making.

Applications of Neural Networks are numerous. Many receive their first introduction by reading about the applications of the techniques in financial market predictions. It is impossible to pick up a discussion on modern methods of financial analysis without some discussion of technical analysis of financial markets and portfolio selection being performed with Neural Networks.

Other successful applications of the techniques include: analysis of market research data and customer satisfaction, industrial process control, forecasting applications, and credit card fraud identification. Neural Networks based systems are now the standard to control credit card fraud. These systems are able to recognize fraudulent use based on past charge patterns with greater accuracy than other available methods.

SHOULD I CONSIDER NEURAL NETWORKS?

When approached with a proposal to apply a Neural Network, how should a business manager evaluate the proposal? Does this new capability offer real benefits, or is this the latest example of trendy approaches and buzzwords? Most importantly, are these techniques practical or are they academic approaches that are not practical or cost effective?

Given a steady increase in successful applications, Neural Networks are for real and offer substantial benefits. The technical details of Neural Networks are beyond the scope of this article, but successful applications share certain common characteristics that may be easily understood. First, there will exist interrelationships between the explanatory factors that are used to estimate the factor we don't know -- the outcome. Having interrelationships in the data means that two or more factors work together to predict model outcome. For example, a chemical process in a production facility may be dependent on temperature and humidity. These two factors combine to affect the outcome of the process. The second condition in which Neural Networks excel is when there is a non-linear relationship between the explanatory factors and the outcome. This simply means that the nature of the relationship between the factors and the outcome changes as the factors take on different values, which is the norm for everyday problems.

In regards to the trendiness issue, yes, neural networks are presently trendy -- at least in some circles. However, the need to improve processes by doing things better and cheaper is more important than ever in today's competitive

business climate. Likewise, the desire to develop computer systems that can learn by themselves and improve decision-making is an ongoing goal of information technology. The Neural Network techniques we use today may not remain with us. However, the goal of developing computers that learn from past experience and lead to better business decisions will remain a high priority. Neural Networks now represent one of the best practices in achieving this goal. Furthermore, continued achievements toward this goal are likely to be inspired or generated from these technologies.

The answer to the question of whether these approaches are practical and cost effective is a definitive "yes", although finding documented proof of this can be a challenge. It is true that the techniques are relatively new and that experience with these techniques is not as extensive as with traditional techniques. A great deal has been published about the technical approaches, the mathematics, and the learning rules. However, little has been written about the practical application of Neural Networks. It would be highly unlikely for you to find a source describing the application of Neural Networks to your specific problem. However, there is not a dearth of successful applications. Look at it this way - how likely would it be for you to share specifics of key information learned about your markets or business with your competitors?

The fact remains, however, that neural networks are proving their worth everyday in a wide variety of business applications, and saving their users time and money in the process.

WHEN TO CONSIDER A NEURAL NETWORK

Neural Networks should be applied in situations where traditional techniques have failed to give satisfactory results, or where a small improvement in modeling performance can make a significant difference in operational efficiency or in bottom-line profits. Direct marketing is an excellent example of where a small improvement can lead to significant results. The response rate on direct marketing campaigns is usually quite low. A five percent response rate is often considered very good. By reviewing the demographic data on those that respond it may be possible to identify characteristics that would produce a 6% response rate. If a Neural Network is used to analyze the demographic characteristics and a 7% response rate is produced, then the cost of the direct mail campaign can be reduced while maintaining the same desired level of positive response from prospects.

An individual wanting to investigate this emerging technology and explore ways in which it can improve his/her organization is advised to consult with Neural Network practitioners who have experience in developing and implementing models for use in commercial applications. Z Solutions will be glad to discuss this with you.

The bottom line is that any manager interested in getting more useful information from available data should consider Neural Network technology as an option. They can be used by aggressive organizations to focus available resources more effectively, thus gaining a valuable competitive edge.

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