인공신경망을 이용한 EDI 통제방안의 제안

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The Design of EDI Controls using Neural Network

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EDI (Electronic Data Interchange) refers to the "interorganizational exchange of business documentation in structured, machine-readable format" (Emmelhainz, 1990). The benefits from the implementation of EDI include improved customer service, decreased administrative cost, increased sales, and improved control of data and these appear widespread in many of EDI adopters. The extent of these advantages, however, depends upon the usage of EDI controls (Lee and Han, 1997b). For instance, the retention of records on magnetic media could result in the loss or contamination of data unless specific control mechanisms are devised to protect them such as digital signature or message authentication codes (MAC) that confirm whether or not the data are valid and has been authenticated. The EDI system cannot be further integrated and utilized if it produces erroneous information to inner applications, which leads to degradation of system performance. Management should demand the assurance that adequate controls are in place in the terms of compliance before they implement the EDI system.

The tasks of designing control systems, as performed by EDI auditors, are difficult and unstructured. There exists no normative model of EDI controls. Many alternative forms of controls can exist and many environmental factors affect the design of controls. It is hard to establish if-then rules explaining the choice of controls in certain organizational context. The benefits of controls are hard to be measured quantitatively. Many organizational factors, such as volume of transactions, complexity, and the speed of processing affect the effectiveness of controls. EDINN is designed to act as a decision aid in recommending the most effective controls in certain organizational context.

The neural network model simulates the operation of human brain. An artificial neural network is a computational structure composed of many non-linear computational elements connected by links with variable weights. A neural network models are usually specified by its pattern of connections between neurons, a learning algorithm, activation function (Fausett, 1994). The network's learning algorithm adjusts the network in response to a set of facts (i.e., a set of known input values and the corresponding correct output values) that are presented successively to the network. After neural networks are "trained" to identify specific patterns and solve certain problems by producing a correct output from a new set of input values which it has not encountered previously. The strength of a neural network comes from its ability to describe nonlinear relationships that are commonly found in real life situations. They are robust to deal with incomplete and noisy data.

Neural networks have long been recommended for tasks of categorization and pattern recognition. One of the most common classification techniques is discriminat analysis. Common forms of linear discrimant analysis implicitly assume normality of variables. Further, the group dispersion (variance-covariance) needs to be equal across groups. These assumptions are frequently violated in the samples used in empirical research since many measurements are of nominal or ordinal nature at best (Eisenbeis, 1977). Because of their capability to capture non-linear relationships in data, it is held that neural networks are better than statistical models to describe the complex pattern of relationships among variables. While statistical models like regression analysis or discriminant analysis use a predefined functional form to fit the data, neural networks are able to adapt itself to changes in the data where the functional form of the underlying model is unknown and the relationships among the variables are non-linear.

Neural networks have been applied to solve many problems such as image recognition, data compression, signal classification, financial prediction, and function approximation (Fanning and Cogger, 1994; Hecht-Nielsen, 1988, 1990; Trippi and Turban, 1993; Werbos, 1988). The other promising classification applications using the neural network approach include: stock market prediction, prediction of credit card fraud, prediction of bankruptcy and financial distress, letter and word recognition, and diagnostic networks for medical diseases.

Neural networks is a problem-solving and reasoning technique that is rapidly appearing as a powerful artificial intelligence (AI) approach capable of solving expertise-driven, complex problems. Neural networks make the direct use of past experiences (cases) to predict the state of controls. They adapt these generated cases to suggest the most plausible solution to the current problem. EDI auditors collect information of organization by questionnaire and interview guides. They recommend the appropriate controls using experience based on a review of past cases. EDINN is developed to function in a manner that is compatible with the current practice in designing controls.

Rules with logical conditions need not be built by developers as neural networks investigate the empirical distribution among the variables and determine the weight values of a trained network. A neural network contains no domain knowledge in the beginning, but it can be trained to make decisions by mapping exemplar pairs of input data into exemplar output vectors, and adjusting its weights so that it maps each input exemplar vector into the corresponding output exemplar vector, approximately (Hecht-Nielsen, 1990). A knowledge base pertaining to the internal representations (i.e., the weight values) is automatically constructed from the facts presented to train the network. Neural network is useful for tasks where the rules are hard to be defined clearly as is the case in the design of EDI controls. Well-trained neural networks represent knowledge base in which knowledge is distributed in the form of weighted interconnections where a learning algorithm is better suited for unstructured problems pertaining to complex relationships among variables rather than problem domains requiring value-based human reasoning through complex issues.

The purpose of this paper is to develop EDINN, a backpropagation neural network model that is designed to recommend controls of EDI systems. This paper describes the way how EDINN (EDI-Control design using Neural Network) functions and explicates the way such a probabilistic neural network model may be utilized to support the design of EDI controls.

The database of EDINN is composed of cases that represent the state of environment and EDI controls of the companies that have successfully implemented EDI. Feedforward backpropagation neural network models are designed to predict the state of 12 modes of EDI controls. This system makes it possible to suggest EDI controls most demanded in certain organizational contexts. EDINN uses past cases to remind EDI auditors of similar cases and provides recommendations of controls. As one of the method to evaluate the effectiveness of EDINN, the predictive power of the system is compared with that of multivariate regression analysis. The results show that the neural network model outperforms regression analysis in predictive accuracy.

used to modify the knowledge base from a set of given representative cases. Neural networks might