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8-16-1996

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Using Neural Networks as Non-Linear Statistical Techniques

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There have been numerous articles in the Artificial Intelligence/Expert Systems literature relating to artificial neural networks (ANNs). Most studies apply ANNs as extensions to previous analyses which used traditional linear statistical techniques. In most cases, the use of the ANN resulted in marginal performance improvements. In some cases, the performance of the ANN-based model was worse. In only a few situations did the ANN-based model produced significant performance improvements over the traditional statistical techniques.

This raises the question of when an ANN-based model should be used as an alternative to a traditional linear model when performing statistical analysis. The purpose of the workshop is to address this issue. It will begin by offering some selection guidelines based on the nature of the dependent and independent variables in the model, the distributional assumptions of the variables, and the nature of the relationships between the variables. For example, when the dependent and independent variables are continuous, normally-distributed variables with linear relationships, then multiple regression is the most appropriate technique. When the variables are categorical, with high correlation, and non-linear relationships are expected, then the ANN-based model may be a more appropriate technique.

The literature sometimes claims that ANNs are preferred when the modeling assumptions associated with the traditional statistical techniques cannot be met (for example, the input variables are not linearly separable). It is true that the ANN models are more robust, and provide solutions when the input variables are highly correlated and linearly dependent. However, if the intent of using the model is to perform statistical inferences, then those statistical assumptions that deal with the nature of the statistical inference (i.e., independence) must still be met.

Once a decision is made to use an ANN, the "art" of designing and training the model must be addressed. Since most attendees are familiar with regression, the workshop will focus on the backpropagation learning algorithm. It is easy to contrast this model with the regression method. The workshop will cover selection of the learning algorithm, choice of the error function, specification of the architecture, preparation of the data, and training of the ANN. Examples from the literature, and some general guidelines, will be offered for each of these areas.

The workshop will conclude with an overview of the other "types" of ANNs, provide information on where additional information may be obtained regarding both commercial and "ShareWare" ANN programs, and review some current examples of how ANNs are being used in business situations.