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# **An Analysis of Applying Artificial Neural Networks for Employee Selection**

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## **Abstract**

*This paper describes the research and development of an artificial neural network system as a decision aid for employee selection. The ability of the artificial neural network to recognize patterns even using noisy data for employee selection and performance evaluation suggests this framework has significant potential advantage over traditional statistical models, such as regression analysis. Further, the neural model eliminates several methodological problems associated with the use of multiple regression, including non-linearity, incorrect function form specification, and heteroskedasticity.*

## **Introduction**

Decisions relating to employee selection are among the most important a firm can make. Current business trends, such as downsizing, cannot lessen the importance of labor as a primary input for the firm.

Given the importance of labor as an input of production, the process for selecting the right employee for the right job is more important than ever before. The importance of employee selection can be further emphasized by pointing to the relatively high cost of labor, the relatively high cost of employee training, and an observed increase in the level of litigation that is evident when businesses terminate employees.

Neural networks have the potential to be used as decision aids for employee selection. These models have been shown to work relatively well in an environment characterized by complex, noisy, irrelevant, or incomplete data. These types of data typically reflect the data obtained during employee interviews and performance reviews. The objective of this paper is to describe the research and development of an artificial neural network for hiring and performance evaluation.

## **Current Employee Selection and Performance Appraisal Criteria**

Typically, employee selection consists of six interrelated steps. The steps include 1. job analysis, 2. task analysis, 3. determining minimal selection criteria 4. recruitment, 5. selection, and 6. validation of the selection techniques [9]. The relationships between selection criteria and job performance are then evaluated to determine the relative predictive value of the selection criteria.

Bryars and Rue [10] point out that the employee selection process requires a decision maker to distinguish between successful and unsuccessful job performance and to forecast future performance. The selection criteria include education, previous work experience, test scores, application data, interview results, and previous performance evaluations. For example, some characteristics might include interpersonal skills, intelligence, appropriate goals, motivation, and creativity. [14]

Selection criteria are expected to vary as a function of job description. For example, Puetz and Thomas suggest when hiring a new employee for a hospital four additional characteristics other than excellent clinical skills be considered such as interpersonal skills, intelligence, appropriate goals, motivation, and creativity. [14]

Due to the inconsistency, complexity, and diversity of predictors used in employee selection procedures, data are often complex noisy and incomplete. While other techniques such as the stochastic methods and deterministic optimization techniques are available to access relationships between predictors and criteria, the neural network model may work better because non-linear relationships with multiple outcomes can be handled. [2]

## A Neural Network as an Potential Employee Evaluation Tool

Use of an ANN in the employee selection process could assist the evaluator in an interview situation. Most firms collect performance appraisal data. These historical data can be used to train and test the model by mapping the interview data to performance appraisal data. The neural network map can then be applied to new candidates to predict future performance.

A mathematical representation for a neural network of this type is:

$$S_i = f(X_{ij})$$

where  $S_i$  is the score of a performance appraisal at a point in time for employee  $i$ .  $X_{ij}$  represents a set of pre-employment predictor variables with  $j$  being the predictor variable for employee  $i$ .

Because a neural network is not necessarily limited to one dependant variable or output, a neural network model can be used to predict more than one performance appraisal variable for a potential employee. For example, for a computer programmer job the multi-dimensional model can predict many performance outcomes such as, programming skills, logical troubleshooting skills, writing skills, etc.

## Conclusions and Future Directions

The ability of the artificial neural network to recognize patterns even in the case of noisy data suggests this framework has significant advantages over traditional statistical models. A neural network model is less plagued by methodological problems such as, function form misspecification, non-linearity, and heteroskedasticity.[2]

The initial design of the Employee Evaluator represents a beginning in the application of neural networks to employee selection. As a potential benefit to business it can help to improve the bottom line. As a potential benefit to employees, the neural network model is expected to predict relative success and failure for potential candidates given the success of those who have come before.

It should be pointed out that very little or no research and/or application has been found in the area of applying neural networks to employee selection. This project, if not the first of its kind, is probably one of the first for this type of application

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