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701 E. Chocolate Avenue, Suite 200, Hershey PA 17033-1240, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.idea-group.com

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Chapter X

Soft Computing Approach for Bond Rating Prediction

J. Sethuraman, Indian Institute of Management, Calcutta, India

Abstract

Soft computing is popularly referred to as a collection of methodologies that work synergistically and provide flexible information processing capabilities for handling real-life situations. Its aim is to exploit the tolerance for imprecision, uncertainty and approximate reasoning in order to achieve tractability and robustness. Currently, fuzzy logic, artificial neural networks, and genetic algorithms are three main components of soft computing. In this chapter, we show the application of soft computing techniques to solve high dimensional problems. We have taken a multi-class classification problem of bond rating prediction with 45 input variables and have used soft computing techniques to solve it. Two techniques, namely dimensionality reduction technique and variable reduction techniques, have been tried and their performances are compared. Hybrid networks are found to give better results compared to normal fuzzy and ANN methods. We also have compared all the results with normal regression techniques.

Introduction

Soft computing is popularly referred to as a collection of methodologies that work synergistically and provide flexible information processing capabilities for handling real-life situations. Its aim is to exploit the tolerance for imprecision, uncertainty, and approximate reasoning in order to achieve tractability and robustness. Currently, fuzzy logic (Wang, 1997), artificial neural networks (Mehrotra, 1997; Hassoun, 1995), and genetic algorithms (Deb, 2001) are three main components of soft computing. ANN is suitable for building architectures for adaptive learning, and GA can be used for search and optimization. Fuzzy logic provides methods for dealing with imprecision and uncertainty. The analytic value of each one of these tools depends on the application.

Neural networks learn from experience, especially used in pattern recognition (Mehrotra, 1997; Hassoun, 1995). This distinguishes neural networks from traditional computing programs, which simply follow instructions in a fixed sequential order. Fuzzy inference systems (Wang, 1997) are useful for situations where human expertise (that cannot be translated into a set of equations) needs to be incorporated into a decision-making, automated process (e.g., power plant control). Evolutionary programming, evolutionary strategies, and genetic algorithms (Wang, 1997) are useful for optimization problems where their particular difference is in how they avoid local extrema (i.e., error minimization for parameter estimation).

We term high dimensional problems as those problems which have a relatively greater number of input variables.

Proposition 1: A problem with n input variables is said to be an n-dimensional problem.

In this chapter, we have used soft computing techniques to handle high dimensional problems. We have taken an example of bond rating prediction problem (Sehgal, Ramasubramanian, & Rajesh, 2001; Chaveesuk, Srivaree-ratana, & Smith, 1999). Bond rating prediction is a multi-class classification problem which makes it a really tough problem to solve.

According to Standard & Poor's (S&P), "The bond or credit rating is an opinion of the general creditworthiness of an obligor with respect to a particular debt security or other financial obligation, based on relevant risk factors."

When investors lend money to companies or governments it is often in the form of a bond, a freely tradable loan issued by the borrowing company. The buyers of the bond have to make a similar assessment on creditworthiness of the issuing company, based on its financial statement (balance sheet and income account) and on expectations of future economic development. Most buyers of bonds do not have the resources to perform this type of difficult and time-consuming research.

Fortunately, so-called rating agencies exist that specialize in assessing the creditworthiness of a company. The resulting credit or bond rating is a measure for the risk of the company not being able to pay an interest payment or redemption of its issued bond. Furthermore, the amount of interest paid on the bond is dependent on this expected