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Chapter XI

Predicting Credit Ratings with a GA-MLP Hybrid

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Abstract

The practical application of MLPs can be time-consuming due to the requirement for substantial modeler intervention in order to select appropriate inputs and parameters for the MLP. This chapter provides an example of how elements of the task of constructing a MLP can be automated by means of an evolutionary algorithm. A MLP whose inputs and structure are automatically selected using a genetic algorithm (GA) is developed for the purpose of predicting corporate bond-issuer ratings. The results suggest that the developed model can accurately predict the credit ratings assigned to bond issuers.

Introduction

This chapter demonstrates the capability of a backpropagation-trained, multi-layer perceptron (MLP) to accurately model the corporate bond-issuer credit rating process. Although MLPs have been widely applied to real-world problems, the development of a quality MLP model for a specific task can be time-consuming, as the modeler must decide which inputs to use and what internal architecture to employ in the MLP. In the application in this chapter, an evolutionary algorithm (the genetic algorithm) is used to automate components of these tasks.

Most large firms raise both share and debt capital to provide long-term finance for their operations. Debt capital may be provided by a bank, or may be obtained by selling bonds directly to investors. As an example of the scale of the U.S. bond markets, the value of bonds issued in the first quarter of 2003 totalled $1.70 trillion (Bond Market Statistics, 2003). When a publicly traded company wants to issue traded debt or bonds (a bond is defined as a debt security which constitutes a promise by the issuing firm to pay a stated rate of interest based on the face value of the bond, and to redeem the bond at this face value at maturity), it must obtain a credit rating for the issue from at least one recognised rating agency such as Standard and Poor's (S&P), Moody's, or Fitches'. The credit rating represents the rating agency's opinion at a specific date, of the creditworthiness of a borrower in general (known as an issuer credit rating), or in respect of a specific debt issue (a bond credit rating). The rating serves as a surrogate measure of the risk of non-payment of the interest or non-repayment of the capital of a bond.

Several categories of individuals would be interested in a model which could produce accurate estimates of bond ratings. Such a model would be of interest to firms which are considering issuing debt as it would enable them to estimate the likely return investors would require, thereby providing information for the pricing of their bonds. The model also could be used to assess the creditworthiness of firms which have not issued debt, and hence do not already have a published bond rating. This could be useful to bankers or other companies which are considering whether they should extend credit to that firm. Much rated debt is publicly traded on stock markets, and bond ratings are typically changed infrequently. An accurate bond rating prediction model could indicate whether the current rating of a bond is still justified. To the extent that an individual investor could predict a bond rerating before other investors foresee it, this may provide a trading edge.

Motivation for Study

There are a number of reasons to suppose *a priori* that the combination of an evolutionary algorithm with a MLP can prove fruitful in the prediction of issuer bond ratings. The application domain is characterised by the lack of a strong theoretical framework and has a multitude of plausible, potentially interacting, explanatory variables. The first problem facing the modeler is the selection of a good subset of these variables, and the second problem is the selection of an appropriate model form. In applications of MLPs this is not a trivial task as many choices are open to the modeler, including the nature of the connection structure, the form of activation function at each node, and the choice of learning algorithm and its associated parameters. The selection of quality explanatory variables and model form represents a high-dimensional combinatorial problem, giving rise to potential for an evolutionary methodology which could automate this process (Mitchell, 1996). Such automated methodologies have clear potential for extension to a variety of data-mining applications. To date, only a relatively limited number of studies

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