Chapter 39
Credit Rating Forecasting Using Machine Learning Techniques

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ABSTRACT

Credit ratings are an important metric for business managers and a contributor to economic growth. Forecasting such ratings might be a suitable application of big data analytics. As machine learning is one of the foundations of intelligent big data analytics, this chapter presents a comparative analysis of traditional statistical models and popular machine learning models for the prediction of Moody's long-term corporate debt ratings. Machine learning techniques such as artificial neural networks, support vector machines, and random forests generally outperformed their traditional counterparts in terms of both overall accuracy and the Kappa statistic. The parametric models may be hindered by missing variables and restrictive assumptions about the underlying distributions in the data. This chapter reveals the relative effectiveness of non-parametric big data analytics to model a complex process that frequently arises in business, specifically determining credit ratings.

INTRODUCTION

The notion of credit rating has been present in financial markets since 1860, where H.V. Poor began publishing financial statistics about railroad companies to attract public investments (Standard & Poor's, 2016). After this development, in 1909 J. Moody, founder of Moody's Investors Service, expanded on this idea by classifying these statistics into categories represented by letters of the alphabet. This methodology was mostly used on railway bonds. After the Great Depression in the late 1930's, the bond rating

system became institutionalized in the United States. The repetitive nature of strong markets followed by crashes increased the need for a measure of risk and uncertainty for investors. Nowadays, 100 percent of all commercial papers and 99 percent of corporate bonds have been rated by at least one credit rating agency in the United States. These credit rating agencies have expanded across the globe to aid the needs of investors and corporate borrowers.

Credit ratings for companies have evolved to become an integral source of information for the financial sector. This information has a range of financial and economic benefits to society. These benefits can be categorized into three groups: benefits to investors, the company and the economy. The investors benefit from this information because it is a convenient and cost-effective source of information that allows for calculated risk. Furthermore, it encourages market confidence and entices retail investors to invest their savings into corporate securities and receive higher returns. For companies, credit ratings allow them to enter the market more confidently and raise funds at a lower cost. Companies may also use credit ratings as a means for brand repair or improvement. Lastly, with regard to the overall economy, consistent and accurate credit ratings fuel public investment in the corporate sector, which in-turn stimulates economic growth. These credit rating systems can facilitate the formation of public policy guidelines on institutional investors. They also play a vital role in investor protection by encouraging ethical behavior among corporate borrowers without putting a larger burden on the government.

Although they are not perfect, it is clear that credit ratings offer a plethora of benefits to society and are necessary to sustain strong economic growth and prosperity. These ratings are formed by incorporating a range of quantitative and qualitative variables that are gathered through public information and on-site research. However, these ratings take a substantial amount of labor and time to develop, making it a very costly process. This means it is difficult for management at many companies to afford regular credit rating updates. As a result, credit rating modelling has become a large area of research due to the economic and financial benefits associated with making credit ratings more efficient and cost-effective. With the expansion of machine learning and big data analytics over the past decade, there has been an influx of credit rating models in academic literature. As machine learning is one of the foundations of intelligent big data analytics, this chapter presents a comparative analysis of both traditional statistical models and popular machine learning models for the prediction of Moody's long term corporate debt ratings for top companies in the United States.

Moody's Rating System

Moody's, alongside Standard & Poor's and Fitch Group, is one of the three largest credit rating agencies in the world. The agencies all provide international finance research on bonds that are issued by both government and commercial entities. Moody's focuses on rating a borrower's creditworthiness based on a range of factors and rating scales that are designed to estimate the expected loss suffered by an investor in the event of a default and the probability of that event occurring. These rating systems are universally comparable, meaning they can be compared across different currencies, industries and countries. Moody's provide eight main categories of credit ratings (Moody's Investor service, 2017):

1. Moody's Long-Term Ratings
2. Moody's Short-Term Ratings
3. Moody's Bank Deposit Ratings
4. Moody's Bank Financial Strength Ratings

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