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智慧型信用評等預測系統之建構---整合非線性監督式最大變異展開降維法與多種核空間分類器

An Intelligent Credit Forecasting and Decision Support System--- Integrating Supervised Maximum Variance Unfolding and Kernel Classifiers

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中文摘要

巴賽爾銀行監理委員會 (Basel Committee on Banking Supervision) 於 2001 年提出『新巴賽爾資本協定』，要求全球金融機構建立內部信用評等評估系統，以精確評量其持有資產部位隱含之信用風險，於是信用風險管理議題為當前學界與業界所重視。再則 2007 年下半年以來，次級房貸風暴興起，嚴重打擊美國銀行業，更加深金融機構對智慧型信用評等系統之殷切需求，藉以提供其內部進行風險管理與授信決策之依據。目前擁有最準確信貸風險評估決策系統的銀行，將是最賺錢的銀行。進行信用評等分類時，由於輸入變數是高維度的財務資訊，經常需面對降低資料維度的問題。最大變異展開 (Maximum Variance Unfolding，MVU) 是集群分析方面最有效的非線性降維法之一。本研究計劃結合一新的監督式版本的最大相異展開法 (Supervised-MVU，S-MVU) 與多種核空間分類器（Kernel Classifier） (著名的核空間分類器如支援向量機，Support Vector Machine，SVM) 發展一個全新的智慧型信貸等級評估系統：首先，S-MVU 降低非線性輸入資料的維度，然後核空間分類器進行最後的分類。S-MVU 利用類別資訊導引代表性低維流形或子空間之建立，可有效對付資料中之雜訊。我們預期實證的結果將顯示本研究之智慧型預測系統將勝過純核空間分類器與傳統的分類器(例如：貝氏網路，羅吉式回歸和最小近鄰法)。與其他降維法相比，S-MVU 對於分類器的性能提升是顯著而穩健的。

關鍵字：非線性降維法; 核空間分類器; 支援向量機; 信用等級評估預測

Abstract

The New Basel Accord for bank capital regulation is designed to better align regulatory capital to the underlying risks by encouraging better and more systematic risk management practices, especially in the area of credit risk. Credit rating forecasting had been a critical issue in the banking industry. All banking institutes and their regulators attempt to search for a precise internal credit system to capture the credit quality of their evaluation borrowers. Furthermore, subprimemortgage crisis in the later half of 2007 have heavily threatened the U.S. banking sector. Credit risk profoundly impacts the banking sector. The bank with the most accurate estimation of its credit risk will be the most profitable. When performing credit rating classification, one often confronts the problem of dimensionality reduction due to the high dimensional financial input data. Maximum variance unfolding (MVU) is one of the most promising nonlinear dimensionality reduction techniques in clustering. By integrating a supervised variant of maximum variance unfolding (S-MVU) with kernel classifiers (such as support vector machines, SVMs), this study develops a new model for credit rating forecasting: first, S-MVU reduces the high dimensionality of nonlinear distributed input data, and then kernel classifiers perform the final classification. Using the class information of given data to guide the manifold learning, S-MVU helps to deal with the noise in the data and thus makes kernel classifiers more robust in classification. Empirical results will indicate that kernel classifiers with S-MVU outperform pure kernel classifiers and traditional classifiers such as Bayesian networks, logistic regressions, and the nearest neighbors method. Compared with other dimensionality reduction methods the performance improvement owing to S-MVU is significant and robust.

Key words：Nonlinear Dimensionality Reduction; Kernel Classifier; Support Vector Machine; Credit Rating Forecasting