

國科會計畫

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整合頻譜集群分析與小波式核空間迴歸法建構動態財務預測與投資決策系統  
Integrating Spectral Clustering with Wavelet-Based Kernel Partial Least Square  
Regressions for a Dynamic Financial Forecasting and Trading System

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中文摘要

財務預測和交易決策是現代時間數列資料採礦中極富挑戰性的應用領域，為金融機關與企業成功獲利的根本條件。然而，因著國際金融市場的擴展與連動性的增強；另一方面，跨國界現金流動持續地增加與自由化，國際金融市場之互動關聯越來越緊密，此一連動現象有助於投資者預測未來全球指數的走勢並建構優秀的投資決策系統。本研究的目地即在建立一個以小波分析為基礎能夠萃取國際金融市場連動特徵，融合新進的核空間迴歸法，所建構之可靠精確的投資決策專家系統。本研究計畫建構之新穎性專家系統規劃如下：在資料輸入的第一級，多國籍股價指數首先經由小波分析（Wavelet Analysis）分解，變換原始資料空間至一個多重時間表尺度的特徵空間，此一空間較適合作為財務預測之使用；接著再以這些萃取的多維多時間尺度特徵進行頻譜式集群（Spectral Clustering）分析，將特徵空間依其時間數列動力特徵拆解成幾個互不相交的獨立區域，以匯集不同的股價型態區域。在第二階段，多個核空間偏最小二乘式迴歸（multiple kernel partial least square regressors）分別配適步驟一的不同區域，形成多重專家網路做出最後的預測與投資決策。與傳統類神經網絡、純粹的 SVM（Support Vector Machine）或者是 GARCH（Generalized autoregressive conditional heteroscedasticity）模型比較，我們預期本研究所提出的模型將達到最好的績效，獲得最高的報酬。

關鍵字：頻譜式集群法；核空間方法；資料採礦；小波分析；混合模型

## Abstract

Financial predictions and tradings are challenging applications of modern time series data mining, which are essential for the success of many businesses and financial institutions. However, with the expansion of international financial links and the continued liberalization of cross-border cash flows, the increasingly tight correlations among financial markets help investors for making good forecasts and trading decisions on the co-movements of stock price indices. The objective of this study is to implement a new expert system that could extract key features among international financial markets to make good predictions and trading decisions. The novel expert system will be implemented in this study is as follows: in the first stage, wavelet analysis transforms the input space of raw data to a time-scale feature space suitable for financial forecasting, and then a spectral clustering algorithm is used for partitioning the feature space into several disjointed regions according to their time series dynamics. In the second stage, multiple kernel partial least square regressors (KPLSRs) that best fit partitioned regions are constructed for final forecasting. Compared with neural networks, pure SVMs (Support Vector Machines) or traditional GARCH (Generalized autoregressive conditional heteroscedasticity) models, we expect the proposed model will perform best and achieve the highest profit.

**Key words :** Spectral Clustering; Kernel Method; Data Mining; Wavelet Analysis; Hybrid Model