ABSTRACT

Point forecasting provides important information during decision-making processes, especially in economic developments, population policies, management planning or financial controls. Nevertheless, the forecasting model constructed only by single values may not demonstrate the whole trend of a daily or monthly process. Since there are so many unpredictable and continuous fluctuations on the process to be predicted, the observed values are discrete instantaneous values which are insufficient to represent the true process. Therefore, the collected information is generally vague and incomplete so that the real number system is not sufficient to express the forecasting model. In additional, due to the business marketing is full of uncertainty and the continuous fluctuations, intervals are used to express and establish the forecasting model to estimate the prediction values.

This dissertation investigates the dynamic trend of interval time series and the performance evaluation of interval forecasting. It consists of three parts: the analysis and forecasting of interval time series, the evaluation of forecasting performance for interval data, and the calculation of the fuzzy correlation coefficient.

First of all, we propose the conception of fuzzy for interval and propose interval forecasting approaches, such as the interval moving average, the weighted interval moving average, and the *ARIMA* interval forecasting. The soft computing technique as well as the model simulation is used to carry out the interval forecasting. The forecast results are compared by the mean squared interval error and the mean relative interval error. Finally, we take two practical cases study. By the comparison of forecasting performance, it is found that the *ARIMA* interval forecasting provides more efficiency and flexibility than the traditional ones.

Secondly, we concentrated on the forecasting performance evaluation for interval data. The evaluation techniques are developed to determine the validity of the forecast results. The

forecast results are compared by three criteria which are the mean squared error of interval, mean relative interval error, and the mean ratio of exclusive-*or*. It is found that the empirical studies show that the mean ratio of exclusive-*or* can provide a more objective suggestion in interval forecasting for policymakers.

The third part considers the evaluation of the correlation coefficient interval by collecting sample data whose types are real and interval. When an interval is considered as a fuzzy number, the aspect of fuzzy can be utilized to construct the fuzzy correlation coefficient for interval data. As compared with the traditional correlation coefficient, the fuzzy correlation coefficient can demonstrate conservative correlation coefficient and provide an objective statistical method for discovering the correlation between two variables.

Keywords: Interval time series, fuzzy statistics, *ARIMA* interval forecasting, mean squared error of interval, mean relative interval error, mean ratio of exclusive-*or*, fuzzy correlation coefficient, correlation coefficient interval.

摘要

近年來隨著科技的進步與工商業的發展，預測技術的創新與改進愈來愈受到重視。相對地，對於預測準確度的要求也愈來愈高。尤其在經濟建設、經營規畫、管理控制等問題上，預測更是決策過程中不可或缺的重要資訊。然而僅用單一數值形式收集來的資料，其建立的模式是不足以描述每日或每月的發展趨勢。因爲有太多模糊且不完整訊息，以致於無法用傳統以點資料建構的系統來進行預測。基於點預測的不確定性，因此嘗試以區間資料來建構模式並進行預測。本論文探討區間時間序列之動態走勢及預測結果之效率性，共三部份，分別爲區間時間序列之分析與預測、區間預測準確度之探討和計算區間資料的相關係數。

第一部份，利用區間具有模糊數的特質，將其分解成區間平均數及區間長度，提出區間時間數列建構過程及預測方法，如區間移動平均、區間加權移動平均、*ARIMA* 區間預測等方法。並藉由模擬方式設計出數組穩定及非穩定之區間時間數列，再利用本文所提出的區間預測方法進行預測。根據這些計算預測結果效率性的方法，發現 *ARIMA* 區間預測，提供了較傳統的預測方法更爲準確及具有彈性的預測結果。

第二部份，我們特別針對區間預測結果的準確度提出效率性的分析，如平均區間預測誤差平方和、平均相對區間誤差及平均 *XOR* 比率。而在預測效率性的實證分析上，平均 *XOR* 比率能給與決策者更正確的資訊，做出更客觀的判斷。

第三部份，在探討如何將區間資料應用在計算相關係數。利用單一數值資料的收集 ，並以傳統的相關係數 r 來說明兩變數之間是否相關? 是較爲便利且易懂的統計方法。但資料是否足以代表母體特性？這樣求出來的相關係數值會不會太主觀?有鑑於此，以區間就是模糊數的概念，建構模糊相關係數。最後舉出應用實例，比較模糊相關係數與傳統的相關係數的差異性，在說明兩變數關係的強弱程度，模糊相關係數提供了一個較有彈性的統計分析方法。