中華水土保持學報, 37(4): 367-376 (2006)
Journal of Chinese Soil and Water Conservation, 37 (4):*367-376* (2006)

倒傳遞類神經網路應用於石門水庫懸浮固體濃度之即時分析與預測

范正成[1]　張郁麟[2]　楊文仁[3]　劉哲欣[4]

摘　　要　水庫集水區的治理、開發與操作，常會遭遇地表土壤沖蝕所產生的非點源污染。爲了能有效防止此類災害的再次發生，並隨時監測集水區的整治情況，需要建立完備的懸浮固體濃度即時監測系統。本研究以中華民國行政院環境保護署石門水庫水質監測數據查詢資料庫中1993-2005 年間的資料來進行分析，選取比電導度、溶氧、酸鹼值、濁度、溫度、採樣月份及葉綠素 α，利用倒傳遞類神經網路來進行訓練及驗證，試驗結果顯示，即時推估懸浮固體濃度變化的趨勢十分良好，網路輸出與期望輸出的判定係數 R^2 達到 0.85，而均方差爲 23.21。將資料以移動平均濾掉人爲或儀器誤差所產生的這些短週期的訊號，判定係數 R^2 更達到 0.92。本研究進一步建置倒傳遞類神經網路模式架構使其可以對懸浮固體濃度做動態即時預測，試驗結果顯示，預測懸浮固體濃度變化的趨勢符合十分良好，網路輸出與期望輸出的判定係數 R^2 達到 0.67，而均方差 24.37。結果顯示，利用倒傳遞類神經網路配合其他現地數位化水質自動記錄監測儀可快速準確的推估預測懸浮固體濃度。

關鍵詞：倒傳遞類神經網路、懸浮固體濃度、移動平均、非點源污染、水質監測、土壤沖蝕。

Application of Back Propagation Artificial Neural Network to Real Time Analysis and Prediction of the Total Suspended Solids of the Water in Shimen Reservoir

Jen-Chen Fan[1]　Yu-Lin Chang[2]　Wen-Jen Yang[3]　Che-Hsin Liu[4]

ABSTRACT　In the management of reservoirs, non-point source pollutions caused by surface soil erosion are frequently encountered. In order to prevent this kind of problem and monitor the reservoir at any moment, it is necessary to establish a complete real time TSS monitoring system. The data of the water quality of Shimen reservoir used in this study were provided by the Environmental Protection Administration of the Executive Yuan, R.O.C., which included electrical conductivity, dissolved oxygen, pH value, turbidity, temperature, month, and chlorophyll-α, in the period from 1993 to 2005.

〔1〕國立臺灣大學生物環境系統工程學研究所教授
Professor, Department of Bioenvironmental Systems Engineering, National Taiwan University, Taipei 106, Taiwan, R.O.C.
〔2〕國立臺灣大學生物環境系統工程學研究所碩士班研究生(通訊作者)
Graduate student, Department of Bioenvironmental Systems Engineering, National Taiwan University, Taipei 106, Taiwan, R.O.C. (Corresponding Author)
E-mail:r94622020@ntu.edu.tw
〔3〕國立臺灣大學生物環境系統工程學研究所博士班研究生
Doctoral graduate student, Department of Bioenvironmental Systems Engineering. National Taiwan University, Taipei 106, Taiwan, R.O.C.
〔4〕國立臺灣大學生物環境系統工程學研究所博士班研究生
Doctoral graduate student, Department of Bioenvironmental Systems Engineering, National Taiwan University, Taipei 106, Taiwan, R.O.C.

The method of back propagation network was used to perform the training and improving. From the results, it showed that the variation tendency of real time suspended solids concentration output estimated by using network agrees well with that in expected output (R^2=0.85, MSE=23.21). When the moving average was used to reduce the short cycle signal deviation caused by man-made or device causes, the R^2 can reach 0.92. When BPN was modified to predict the real time TSS, the results showed that the predicted variation tendency of TSS in network output agrees well with that in expected output (R^2=0.67, MSE=24.37). It could be concluded that the method of BPN and other on site digital water-quality auto recorded monitors can be used to rapidly and accurately estimate TSS.

Key Words: back propagation network, total suspended solids, moving average, non-point source pollution, water quality monitoring, soil erosion.