Stormwater Treatment Area Performance Prediction Using Artificial Neural Networks

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The objective of this project was to train three artificial neural networks (ANNs) for treatment cells 1, 2, and 3 of Stormwater Treatment Area 2 that would be capable of accurately predicting the outflow total phosphorous (TP) concentration of the cells in terms of inflow rate 7-days prior, average 3-day depth, inflor TP concentration 7-day prior and outflow TP concentration 7-days and 14-days prior. The raw data was downloaded from DBHYDRO, a South Florida Water Management District database, and organized into an input matrix and a target matrix. Using MATLAB, the input and target matrices were used to train three ANNs for each cell. During the training, the best ANN configurations were determined by the minimum Mean Square Error (MSE) and the maximum correlation coefficients. The best ANN configuration would be the one that had the smallest MSE and the largest correlation coefficient. The three trained ANNs were accurate, with high correlation coefficients and low mean square error. The resulting overall correlation coefficients for the three cells were .980, .830, and .760, respectively. These results were also very satisfactory. When the two were compared, the predicted outflow TP concentrations matched the actual measured values closely. Because of this, the trained ANNs can be applied to predict real time outflow TP concentration, thereby reducing monitoring costs. They can also be used as a tool to optimize the STA operations by altering the inflow rate and water depth in the treatment cells to maximize the amount of phosphorous removed.

Awards Won:

American Statistical Association: Certificate of Honorable Mention

Patent and Trademark Office Society: Second Award of $500