Optimised neural network model for river nitrogen prediction utilizing a new training approach

ABSTRACT

In the past few decades, there has been a rapid growth in the concentration of nitrogenous compounds such as nitrate-nitrogen and ammonia-nitrogen in rivers, primarily due to increasing agricultural and industrial activities. These nitrogenous compounds are mainly responsible for eutrophication when present in river water, and for 'blue baby syndrome' when present in drinking water. High concentrations of these compounds in rivers may eventually lead to the closure of treatment plants. This study presents a training and a selection approach to develop an optimum artificial neural network model for predicting monthly average nitrate-N and monthly average ammonia-N. Several studies have predicted these compounds, but most of the proposed procedures do not involve testing various model architectures in order to achieve the optimum predicting model. Additionally, none of the models have been trained for hydrological conditions such as the case of Malaysia. This study presents models trained on the hydrological data from 1981 to 2017 for the Langat River in Selangor, Malaysia. The model architectures used for training are General Regression Neural Network (GRNN), Multilayer Neural Network and Radial Basis Function Neural Network (RBFNN). These models were trained for various combinations of internal parameters, input variables and model architectures. Post-training, the optimum performing model was selected based on the regression and error values and plot of predicted versus observed values. Optimum models provide promising results with a minimum overall regression value of 0.92.