

# The pollution in rivers and lakes by using artificial neural network

[Literature](#), [Russian Literature](#)



Artificial Neural network is widely used in the prediction of different type of environmental events. The basic approach is to train an ANN unit using a set of an already known set of data to predict a similar future event. In this study feed-forward, ANN could be used to relate the DO measured at each location to predict the other quality parameters as reported. In this method, the (DO)<sub>i</sub> is considered as the input parameter to the input-neurons which would be passed into the hidden layer of neuron set after multiplying with a correction weight ( $w_{kj}$ ). The main role of the hidden neuron is to add up the weighted sum received from the input set and combines it with a bias ( $b_j$ ) to determine a net value ( $net = \sum (DO)_i w_{kj} - b_j$ ). This net value is passed into the output neuron which uses a non-linear function, say,  $f(net) = 1 / (1 + e^{-net})$  to determine the output parameters BOD, NO<sub>3</sub>, NO<sub>2</sub>, and PO<sub>4</sub> (Tayfur and Singh, 2006).

#### Using Fuzzy logic

The fuzzy logic approach for the prediction of dissolved oxygen level is based on the set of rules that is inbuilt in the model. This process is undertaken in four different steps. Allocation of partial belonging to each input variable in the form of membership function, which takes up values from 0 to 1, is the first step. This process is referred to as fuzzification. The allocation is based on intuition and linear triangular functions are the commonly adopted one. The fuzzy rule base is the next requirement to relate the input and the outputs using if-then logical relations. In the present work it could be either as - If BOD is low, NO<sub>3</sub> is low and PO<sub>4</sub> is low then DO is high - or If BOD is high, NO<sub>3</sub> is high and PO<sub>4</sub> is high then DO is low. Next is the fuzzy output subset construction by the addition of all the fuzzy subsets. The fuzzy output

function needs to be converted to a discrete form of results using fuzzification methods. The center of gravity method (COG method) could be used to this process for the present situation (Tayfur and Singh, 2006, Chen et al, 2005).

#### Regression analysis

As dissolved oxygen need to be related to another set of variables, the ideal method would be to choose multiple regression methods. Using the data obtained from the experiments multiple linear regression models could be developed using the least-squares method. Let the regression equation obtained from such an analysis could be represented as  $DO = C_0 + C_1BOD + C_2NO_3 + C_3NO_2 + C_4PO_4$  . Where  $C_i$  is the constants obtained from the regression analysis. Thus, such a model is helpful to establish a linear relationship of dissolved oxygen with the other pollution parameters and help to predict DO at a different situation. Based on the values of coefficient of correlation (which is computed as the root of R--square) determined for different combinations of independent variables the parameter that influences DO the most could also be assessed. A similar type of study has been used in analyzing the sound level subjected to a different set of physical conditions (Abo-Qudais and Alhiary, 2005).