5th International Electronic Conference on Water Sciences

16/11/2020 - 30/11/2020

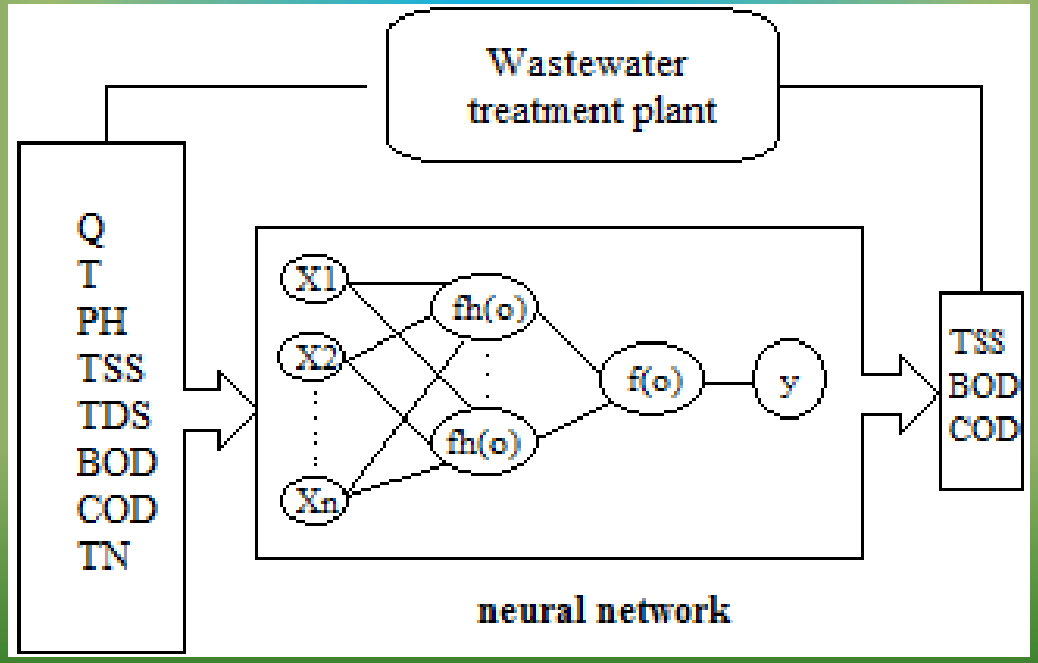
Qualitative evaluation of wastewater treatment plant performance by neural network model optimized by genetic algorithm

Sara Dadar (Department of Water Sciences and Engineering, Ferdowsi University of Mashhad, Mashhad, Iran)
Atena Pezeshki (Department of Water Sciences and Engineering, Ferdowsi University of Mashhad, Mashhad, Iran)
Bojan Đurin (Department of Civil Engineering, University North, Varaždin, Croatia)
Dragana Dogančić (Faculty of Geotechnical Engineering, University of Zagreb, Varaždin, Croatia)

Case study: waste water semi-mechanical treatment plants treatment plant Perkandabad in Mashhad, Iran:

The nominal capacity of this treatment plant is 15200 cubic meters per day and the population covered by it is equal to 100000 residents.

- The parameters examined for wastewater quality assessment were BOD_5 (Biochemical Oxygen Demand in 5 days), COD (Chemical Oxygen Demand), TSS (Total Suspended Solids), and pH.
- Meteorological data was also used, including average daily air temperature, sunshine duration, and daily rainfall.



- The genetic algorithm sought the optimal answer for 450 generations and evaluated 150 possible answers in the search space in each generation.
- Predictive results of TSS, BOD_5 and COD parameters of wastewater treatment plant:

parameter	R	MSE
BOD_5	0.89	2.3
COD	0.82	34.2
TSS	0.83	2.07

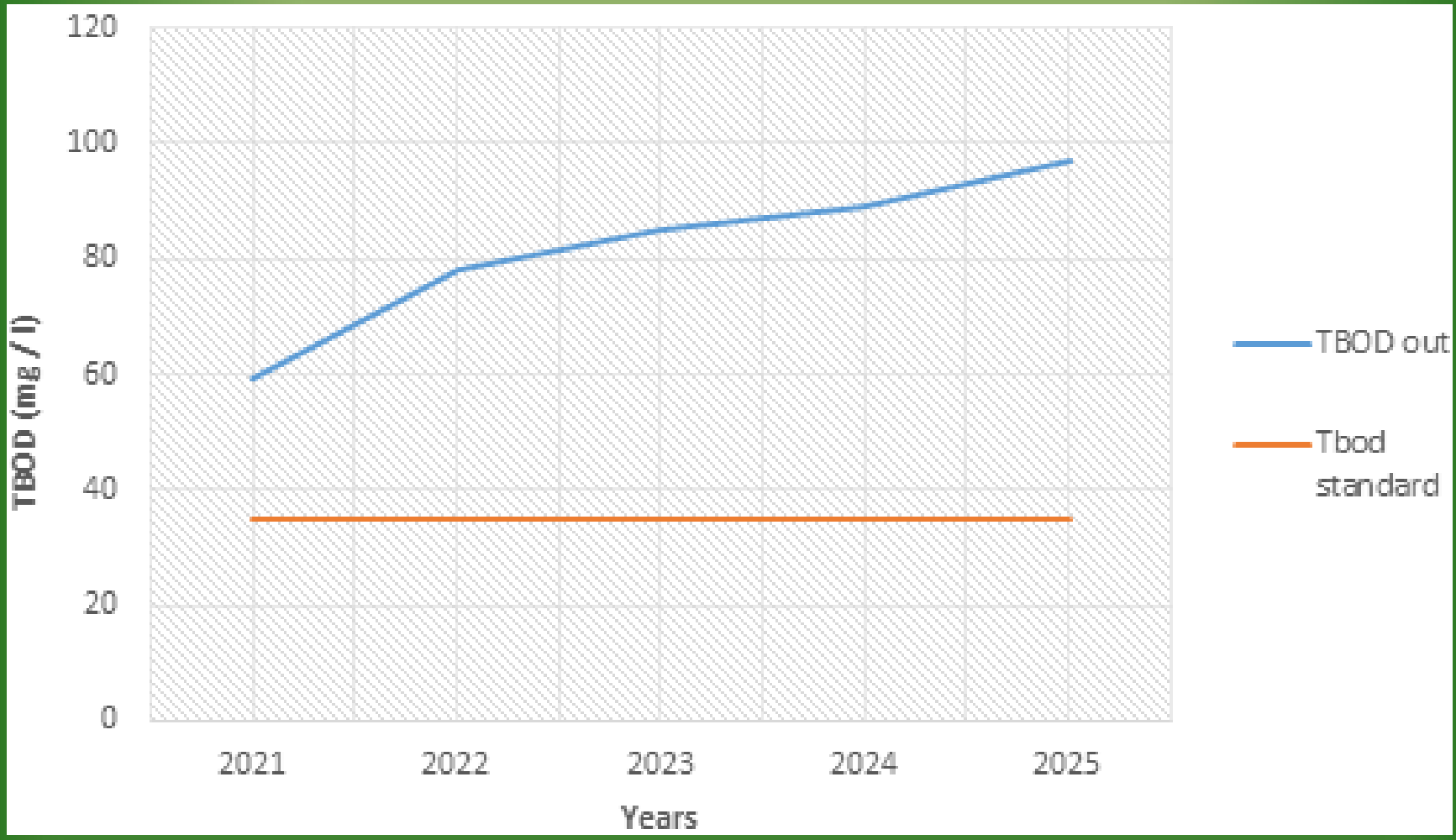
- R is correlation coefficient, MSE is mean squared error

- Examination of the number of selected neurons in the first and second hidden layers showed that in 16 % of cases, the network had two hidden layers with the average number of neurons in the first layer being 16 and in the second layer 11.
- In the remaining 84 %, the network had only one hidden layer, with an average of 14 neurons.
- On average, the best network structure had two hidden layers with an average number of neurons in the first layer of 15 and 2 in the second layer.
- Also, the network had only one hidden layer with 11 neurons at the maximum value of the correlation coefficient (R).

A summary of the effective factors in predicting the TBOD parameter of effluent along with their related weights:

Important parameters	Feature weight in predicting TBOD concentration
Q	0.8
DO	0.88
Input pollution load TBOD	0.89
Aerator Num	0.66
T_L	0.85
T_{AIR}	0.73

Predicting the average annual concentration of TBOD parameter in the effluent of the treatment plant (mg/l):



- Based on the obtained results, the most important factors affecting the performance of Mashhad treatment plant were inlet flow rate, TCODin/TBODin ratio, temperature and load of organic matter in the incoming wastewater, and among the process factors the amount of dissolved oxygen, temperature and pH in lagoon content and several active aerators.
- The neural network model singled out important parameters in predicting the concentration of $TBOD_5$ parameter in the effluent: discharge rate and a load of organic matter pollution of incoming wastewater, among process factors dissolved oxygen concentration, lagoon content temperature, and several active aerators and from climatic conditions -air temperature.

THANK YOU VERY MUCH!!!