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Research Article

Evaluation and prediction of consumption of volatile organic compounds in refueling situations using neural network model

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1. ABSTRACT

One of the most important pollutants that cause air pollution in cities is volatile organic compounds that cause many complications in people. Gasoline pumps as well as cars are among the most important sources that cause the accumulation of these pollutants and due to the increasing number of cars, gasoline pumps have become a dangerous place that should be taken into consideration.

Since air pollution is a very complex process that depends on many factors, it is very difficult and expensive to predict such data, which have nonlinear dynamics. In this research, by collecting experimental data from three gas stations in Zanjan and identifying the influencing parameters, modeling has been done using artificial neural network. Two multilayer perceptron models and radial basis function were investigated. In the statistical part of this research, the correlation coefficient and the sum of squared errors were used as necessary criteria to measure the accuracy of the two mentioned models. The results and analysis conducted in this study showed that the pollution resulting from the consumption of gasoline includes two stages, one at the time of refueling and the other after refueling. Also, in the summer, the concentration of volatile organic compounds is higher than in the winter, and this amount of pollution is observed more in the morning and evening.

Keywords: Air Pollution, Volatile Organic Compounds, Gas Station, Neural Network

1. INTRODUCTION

Continuous monitoring and control of air quality in urban areas, in order to determine the emission pattern and dispersion of pollutants emitted from mobile sources, is an expensive measure. Therefore, the use of modeling methods as a logical solution is prioritized [1].

Among air pollutants, volatile organic compounds are among the most dangerous pollutants that are abundantly produced at fuel stations. Also, the lifetime range of volatile organic compounds in the air varies from several hours to several days. Many volatile organic compounds are unstable in the air and are considered important precursors for creating surface ozone.

2. MATERIALS AND METHODS

The study area: Zanjan city is located in the northwest of the Iranian plateau and is geographically located at the longitude coordinates of 48.480939 meters and the latitude coordinates of 36.670781 meters.

Modeling with artificial neural network: In this research, two types of neural networks including MLP and RBF have been used [8]. In the implementation of the used neural networks, for their training and evaluation, the ANN toolbox of MATLAB neural network was used. The basis of choosing the best network structure is to create the least error. Considering the use of two types of neural networks, multilayer perceptron and radial basis function in winter and summer seasons, to interpret the modeling results, first the winter season is explained with the multilayer perceptron network model and then the interpretation of the basis function radially and the same process has been repeated in the summer season [2].

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The input data to the neural network must be in the range of 0 to 1. To normalize an element, the desired element must be given from the minimum and divided according to the change.

3. RESULTS AND DISCUSSION

3.1. MLP modeling in winter season:

In order to determine the best RBF architecture compared to MLP neural network, considering the flexibility of the neural network, this network was tested in terms of the hidden layers number, the training algorithm and the number of hidden layer neurons. A model with one hidden layer and the number of 13 neurons, in which two hyperbolic tangent sigmoid activation functions are used for both the middle layer and the output layer [3].

To work with a neural network, 60% of the data should be used for neural network training, because the basis of neural network work is based on guesswork and error, the more training data, the better performance of the neural network.

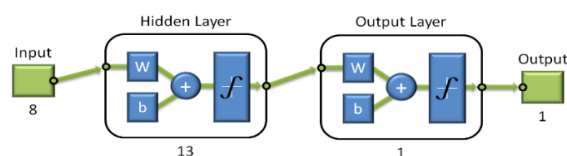


Figure1. General schematic of single layer perceptron artificial neural network with 13 neurons

4. CONCLUSION

In this research, using the measurement of volatile organic compounds and neural network modeling, the exact amount of air pollution caused by volatile organic compounds and its effects on the environment were investigated.

According to the investigations, the pollution resulting from gasoline consumption consists of two stages, one is during refueling and the other is after fueling. In this research, the correlation coefficient and the sum of squared errors were used as necessary criteria to measure the accuracy of the two mentioned models.

5. REFERENCES

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