"Gheorghe Asachi" Technical University of Iasi, Romania

COMBINATION OF ARTIFICIAL NEURAL NETWORKS AND GENETIC ALGORITHM - GAMMA TEST METHOD IN PREDICTION OF ROAD TRAFFIC NOISE

Leila Khouban[1*], Abbas Ali Ghaiyoomi[2], Mohammad Teshnehlab[3], Abbas Tolooei Ashlaghi[4], Majid Abbaspour[5], Parvin Nassiri[6]

[1]Department of the Environment and Energy, Science and Research Branch, Islamic Azad University (IAU), Tehran, Iran
[2]Department of Management and Human Sciences, North Branch of Islamic Azad University, Tehran, Iran
[3]Department of Electronic and Electrical Engineering, Khaje Nasir Toosi University of Technology, Tehran, Iran
[4]Department of Management and Human Sciences, Research and Science Campus, Islamic Azad University, Tehran, Iran
[5]Department of Mechanical Engineering, Sharif University of Technology, Tehran, Iran
[6]Department of Occupational Health, The School of Public Health, Tehran University of Medical Sciences, Iran

Abstract

This paper proposes an expert system based on Artificial Neural Networks (ANNs) to model road traffic noise. Feed-Forward Neural Networks (FFNNs) that are trained with the Levenberg-Marquardt back-propagation algorithm were used. Models were evaluated using mean squared error (MSE) and coefficient of determination (R^2) as statistical performance parameters. In traffic noise modelling, the noise level at a receptor position due to the source of traffic emission is modelled as a function of the traffic conditions, road gradient, road dimensions, speed and height of buildings around the road. The curse of dimensionality problems is caused by the large number of input variables in the ANN model. The Hybrid Genetic Algorithm-Gamma Test (GA-GT) as a data pre-processing method for determining adequate model inputs was also evaluated. Genetic algorithms are frequently used for the selection of input variables, and, therefore, reduce the total number of predictors. Through the hybrid model, six out of twelve sets of predictor candidates were introduced as input variables in the ANN model. Comparing the results of the hybrid model (ANN-GA-GT) with those of the ANN model indicates that the hybrid model has more advantages, such as improving performance prediction, reducing the cost of future measurements and less computational and data storage requirements. Consequently, the ANN-GA-GAMMA model is recommended as a proper method for predicting traffic noise level.

Key words: back propagation network, expert system, genetic algorithm, neural network modelling, noise pollution

Received: September, 2011; Revised final: August, 2012; Accepted: September, 2012

---

[*] Author to whom all correspondence should be adressed: e-mail: Leila_kh758@yahoo.com; Phone: +98 912 5127592