Chapter 27
Prediction of L10 and Leq Noise Levels Due to Vehicular Traffic in Urban Area Using ANN and Adaptive Neuro-Fuzzy Interface System (ANFIS) Approach

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ABSTRACT

Recently in urban areas, road traffic noise is one of the primary sources of noise pollution. Variation in noise level is impacted by the synthesis of traffic and the percentage of heavy vehicles. Presentation to high noise levels may cause serious impact on the health of an individual or community residing near the roadside. Thus, predicting the vehicular traffic noise level is important. The present study aims at the formulation of regression, an artificial neural network (ANN) and an adaptive neuro-fuzzy interface system (ANFIS) model using the data of observed noise levels, traffic volume, and average speed of vehicles for the prediction of L10 and Leq. Measured noise levels are compared to the noise levels predicted by the experimental model. It is observed that the ANFIS approach is more superior when compared to output given by regression and an ANN model. Also, there exists a positive correlation between measured and predicted noise levels. The proposed ANFIS model can be utilized as a tool for traffic direction and planning of new roads in zones of similar land use pattern.

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1. INTRODUCTION

In recent times, there is an exponential rise in the number of vehicles on the roads which leads to an increase in the vehicular traffic noise levels (Choudhary & Gokhale, 2018). The high noise levels have been appeared to influence the health and prosperity of an impressive segment of society, particularly those living in the nearness of highways as well as urban roads (De Coensel, Brown, & Tomerini, 2016). In India, the transportation part is developing quickly and the quantity of vehicles on Indian roads is expanding at a quick rate prompting overcrowded roads and noise pollution (Konbattulwar, Velaga, Jain & Sharmila, 2016; Leung, Chau, Tang & Xu, 2017). The traffic situation is regularly not the same as different nations because of the prevalence of an assortment of bikes which has multiplied in the most recent decade and structures a noteworthy lump of the heterogeneous volume of vehicles (Shukla, Jain, Parida & Srivastava, 2009). The distinctive kinds of vehicles handling on the Indian roads incorporate bikes, three-wheelers, cycle rickshaws, animal trucks, autos, trucks, transports and horticultural tractor trailers (Ramírez & Domínguez, 2013). The presence of a wide range of vehicles on the roads, topology of the roads and crossing points, pavement surfaces, driving propensities for individuals and (Givargis & Karimi, 2010) huge number of vehicles because of the regularly expanding populace make the traffic conditions and traffic attributes very extraordinary and impossible to miss to the Indian sub-landmass (Chang, Lin, Yang, Bao & Chan, 2012; Rajkumara & Gowda, 2008). The noise pollution principles have been characterized by the administration of India under 'the noise pollution (direction and control) rules'. Numerous scientists have detailed diverse noise expectation models for various nations, in view of traffic flow data and field estimation of different roadway noise descriptors (Delany, Harland, Hood & Scholes, 1976). Albeit, distinctive specialists have created diverse noise forecast models to suit neighborhood traffic conditions, due to heterogeneous nature of traffic flow on Indian roads same model can't be utilized as it is for Indian traffic conditions (Nedic, Despotovic, Cvetanovic, Despotovic & Babic, 2014).

This record contains the endorsed noise level limits in various business and private zones amid day and evening time (Di et al., 2018). Additionally, the kind of vehicles, synthesis of traffic and type of road surface and status of the road surface can vary from nation to nation (Dai, He, Mu, Xu & Wu, 2014). Nashik city has been announced as one of the quickest developing urban areas in India (Brown, & De Coensel, 2018). The fast development of the city has resulted into an expansion in the vehicle populace (Cho, & Mun, 2008). In this work, three diverse soft computing methods have been utilized for model development, by considering the factors (Kalaiselvi, & Ramachandraiah, 2016) as traffic volume, the percentage of heavy vehicles and average speed of vehicles in Nashik city, accepting it as a representative set of the traffic conditions in India (Steinbach & Altinsoy, 2019). The experimental values of these variables along with the equivalent continuous sound pressure level (Leq) values establish the data set that has been utilized to build up the models and to approve them (Patil & Nagarale, 2015). The present examination expects to build up a dependable and precise ANN and ANFIS model for noise prediction of urban zones by considering regularly utilized noise descriptors, for example, Leq, L10 as a yield parameter (Zhao, Ding, Hu, Chen & Yang, 2015). The paper is structured as follows: section 2 explains the existing papers related to road traffic noise prediction with different simulation models, section 3 explains the existing problems related to vehicular traffic noise prediction models, section 4 portrays the proposed prediction modeling, and section 5 describes the results and discussion. At last, the conclusion part is described in section 6.