**Prediction of Air Quality in Urban Area, Chennai**

**Abstract :**

The quality of air in Alandur, Chennai is polluted by Particulate Matter (PM2.5) over the years. Reports prove that particulates affect the health of humans and environment. Development of accurate forecasting models to find PM2.5 concentration in air helps to take control measures, early warning and mitigative measures. In this study, the performance of non-linear model (Feed Forward Back Propagation using LEARNGD function) with meteorological data and gaseous pollutants as input parameters from the year 2015–2019 at Alandur with different surrounding activities of urban area. In this paper, the prediction of PM2.5 in the study area is mainly focused to find the effects of harmful emissions. To predict PM2.5, an artificial neural network (ANN) prediction model is developed. The data obtained from the monitoring station on the Alandur Bus depot of Alandur area in Chennai is given as input variable. The prediction model is validated and evaluated by statistical calculations, and then it was found that it performed well in the prediction of PM2.5. The performance of the developed model was evaluated by Mean Square Error (MSE) and value of R2 .

**INTRODUCTION**

Technological advancements lead to the emissions of air pollutants over the decades. Major concerns in industrial cities which experience air pollution, can be harmful not only for the environment but also for human health. Due to this urban resident are more likely to live in less polluted neighborhoods to avoid the health impact of air pollution. Atmospheric pollution can be classified into three types based on the sources mobile, stationery and area sources. Mobile sources are due to the motor vehicles, airplanes, locomotives and other engines and equipment that are able to move to different locations.

Stationary sources include foundries, fossil fuel burning, food processing plants, power plants, refineries and other industrial sources. Area sources is caused by certain local actions. Air pollution can be caused due to the pollutants which are emitted directly from a source or which are not directly emitted as such.

It can result in the degradation of ambient air quality in the industrial cities. Also daily exposure of people to air pollution results in diseases like asthma, wheezing, and bronchitis. Air pollutants such as sulphur dioxide (SO2), nitrogen oxide (NOx), nitric oxide (NO), nitrogen dioxide (NO2), carbon monoxide (CO), Ozone (O3), respirable suspended particulates (RSPs) are some of the major airborne pollutants which exerts impact on physical and biological environment. Air quality monitoring data are used to check the concentration with the ambient air quality standards provided by the government.

The purpose of prediction is to develop effective emission control strategies and also helps to find the contribution of each source causing pollution. There are two types of prediction methods, deterministic and stochastic. In this work, deterministic method is used for the prediction. This methods works on the basis of physical and chemical transportation process of pollutants with the influences of meteorological variables, by mathematical models. Artificial neural networks help to forecast the pollutants in complicatednon-linear functions. The accuracy of prediction by artificial neural networks is higher than other methods.

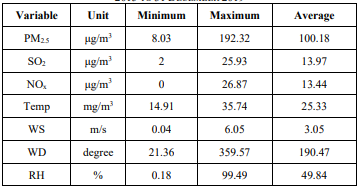
The learning process of ANN is similar to animal brain and it can process nonlinear and complex data. It can learn and identify correlated patterns for input data sets to corresponding target values. After training, ANN is used to predict the output of new independent input data.

In this research, feed-forward back propagation neural network model is used for prediction of air quality where data collected for the last five years is prediction. This research is done due to the lack of awareness about the real time air quality status among the society. The prediction model by ANN is done by MATLAB software. The objective is to collect the PM2.5 and meteorological data that play a major role in ambient air pollution and to predict the concentration of PM2.5 by ANN.

The capital of Tamil Nadu in India is located on the Coromandel Coast off the Bay of Bengal. It is the economic and educational centre of south India. Chennai lies on the south–eastern coast of India.

**Data Sets**

The first and foremost step in modelling is to collect and group the relevant data, both past data and data from air quality monitoring. The data is collected from the website of Central Pollution Control Board. It is very important that the required data and the factors that cause pollution are collected. The daily 24-hour average data for five years (2015-2019) is collected for the following parameters; wind speed, relative humidity, wind direction, temperature, sulphur dioxide, oxides of nitrogen, PM2.5. The five year mean of above parameters.



**Software**

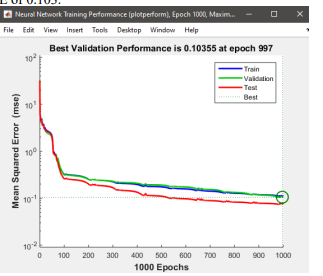
The Neural Network Toolbox from MATLAB (The MathWorks Inc. USA) is used for developing prediction model.

**RESULT AND DISCUSSION**

Feed-forward Back propagation neural network have been used in the development of neural network model. Tansig and purelin transfer functions were used for the neurons in the hidden layer and output layer. The input and target values were normalized into the range of [-1,1] in the pre-processing phase. Based on Gradient descent with momentum backpropagation, the weights and bias were adjusted in the training phase. In training, the performance criteria mean square error (MSE) is used.

For training process, a database with daily maximum temperature values (°C), oxides of nitrogen (NOX), sulphur dioxide (SO2), wind Speed (km/h), relative humidity (%), wind direction and PM2.5 for the period 2015–2019 is used. The database contains 2065 validated data for each variable. The learning and training function used are Learngdm and Traingdx respectively.

The continue employment experience to input vectors and target vectors established as continued to training and validating that the network is extrapolating and stopping trains already at overfitting and at ending the independent .



**CONCLUSION**

The prediction of PM2.5 is done. Prediction is one of the application of artificial neural networks. The main objective of this research was to develop the model to predict of PM2.5 in Alandur location based on data from monitoring stations.

The developed model can be used as a decision making tool to create early warning about the pollution of air in the particular area. Based on the analysis, the model having PURELIN transfer function in the neural network structure produces the best performance in the prediction of air quality compared to the network structure that uses TANSIG transfer function based on the values of R and the prediction accuracy. This model produces R of 0.965 which shows a good agreement between the targets and predicted outputs. However, this model produced good results for air quality forecasting.

This type of model is simple and cost efficient, the model capability is associated with their performance. The produced model is more reliable for urban air quality characterization. And it insists to allow the further developments in order to produce best integrated air quality surveillance system for the Alandur area, since it reflects the problems due to the urban features, such as traffic and industries.

REFERENCES

[1] Afshin Khoshand, Mahshid Shahbazi et al., “Prediction of GroundLevel Air Pollution using Artificial Neural Network in Tehran,” Anthropogenic Posllution Journal, vol.1(1), 2001)