Forecasting Of Greenhouse Gases and Air Quality Prediction Using Matlab Analytics

R. Sivaprasad[a], Dr. B. Meenakshi [B], Amruta R [C], Kowsalya S[d],Nivetthini A[e]

[a] Associate Professor, Department of Electrical and Electronics Engineering, Sri Sairam Engineering College, Chennai, India
[b] Professor, Department of Electrical and Electronics Engineering, Sri Sairam Engineering College, Chennai, India
[c,d,e] Undergraduate Student, Department of Electrical and Electronics Engineering,Sri Sairam Engineering College, Chennai, India

Abstract: Examining and maintaining air quality is the most essential activity in many industrial and urban areas today. Air pollution is a serious danger, which influences both man's health and ecosystem. It is the circumstance at which the presence of harmful substances in the aerosphere, due to various activities of mankind and nature like volcanoes eruptions, led to degrading effects on nation's welfare and also the living ecosystem. Human activities are major air pollutants which includes combustion of fossil fuels, industrial activities like manufacturing, refining, mining etc. Amongst the air pollutants nitrogen oxides, sulphur oxides, carbon monoxides, ozone and organic compounds can volatilize and enter the atmos. According to the reports collected from the World Health organization, 2.4 million individuals die due to air pollution annually and out of these 1.5million from indoor air pollution. Consequently, there are more road accident deaths because of low visibility of roads resulting from poor air quality. There is an emerging need of a system to alert and also predict quality of air to avoid these mortal dangers.

INTRODUCTION

With the increasing air contamination, there is a requirement of predictive models that can record information about day to day and also future concentrations of pollutants (CO2, NO2) in air. The harmful greenhouse gases deposition in the atmosphere affects human health as well as environment. As a preventive measure air pollution monitoring networks across regional, national as well as international have been developed that informs and alerts population about major pollutants concentrations. In the recent years, the employment of artificial neural networks (ANNs) has paved the way to resolve environmental engineering problems. The system aims to come about an air quality prediction model using artificial neural schema which considers and evaluates parameters such as sulphur dioxide (SO2), carbon monoxide (CO), nitrogen dioxide (NO2), nitric oxide (NO), temperature, relative humidity and air velocity. Performance assessment is done by the Mean Square Error measurement and coefficient of relation R2

LITERATURE SURVEY

1.Mrs. A. GnanaSoundariMtech, (Phd) ,Mrs. J. GnanaJeslin M.E, (Phd), Akshaya A.C. "Indian Air Quality Prediction And Analysis Using Machine Learning".International Journal of Applied Engineering Research ISSN 0973-4562 Volume 14, Number 11, 2019 (Special Issue)

They say that this model is capable of successfully predicting the air quality index of a total county or any state or any bounded region provided with the historical data of pollutant concentration.

2.Suhasini V. Kottur , Dr. S. S. Mantha. "An Integrated Model Using SVM And Kriging For Forecasting Air Pollutants Using Meteorological Data". International Journal of Advanced Research in Computer and Communication Engineering ISSN (Online) : 2278-1021 ISSN (Print) : 2319-5940 Vol. 4, Issue 1, January 2015

This system presents an integrated model using SVM and Kriging to predict the level of air pollutants at various locations in Mumbai and Navi Mumbai using past data available from meteorological department and Pollution Control Board.

3.RuchiRaturi, Dr. J.R. Prasad ."Recognition Of Future Air Quality Index Using Artificial Neural

4. Aditya C R, Chandana R Deshmukh, Nayana D K, Praveen Gandhi Vidyavastu ." Detection and Prediction of Air Pollution using Machine Learning Models". International Journal of Engineering Trends and Technology (IJETT) – volume 59 Issue 4 – May 2018

This system does two important tasks (i). Detects the levels of PM2.5 based on given atmospheric values. (ii) Predicts the level of PM2.5 for a particular date. Logistic regression is used to detect whether a data sample is either polluted or not poll

SOFTWARE REQUIREMENTS:

    OS: WINDOWS 7/8/8.1/10

    TOOL: MATLAB 2019a

    TOOL BOX: Deep learning Tool Box

PROPOSED SYSTEM

    In a proposed system we used ANN and Levenberg-Marquardt backpropagation for training the system and create a Windows based graphical user interface for prediction. Based on the prediction value we forecast the air quality of a region and understand the need urgent attention to avoid devastating effects of air pollution

    a)   Pre-process the data - this data contain missing values or negative values, we process the data and replace with NAN values and approximate them.

    b)Analyse the data – After finalize the data we are going to give the values to the classifiers to process the data and it convert year data into single value.

   c)Prediction - based on the classifier process we are going to find the future air quality values
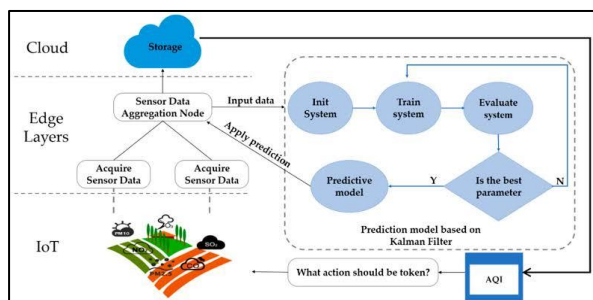
Based on the prediction value we forecast the air quality of a region and understand the need urgent attention to avoid devastating effects of air pollution
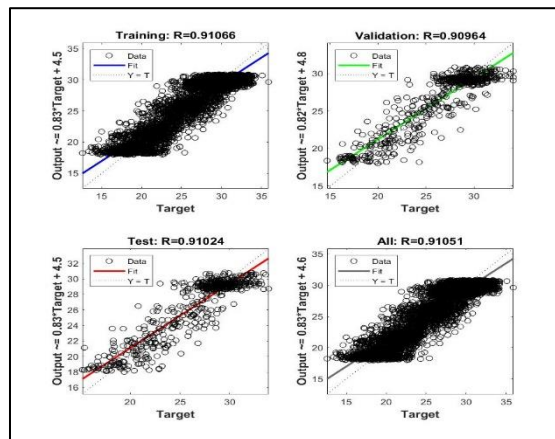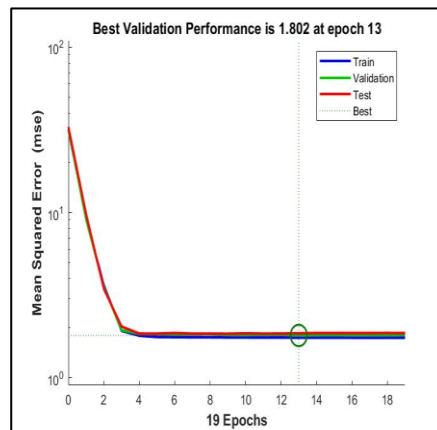
I.   Results

   a)   Artificial Neural Network Model

An artificial neural network (ANN) is the division of artificial intelligence which is capable of simulating the functioning of a human brain. Processing units in ANN comprises inputs and outputs. ANN is a three-layer perceptron Model which has 4 layer of input, 4 hidden layer and one output layer. Training is done by Levenberg-Marquardt (trainlm) algorithm.
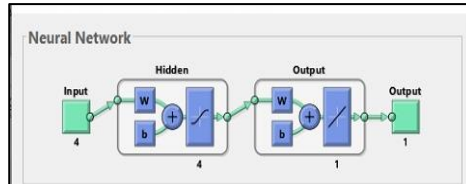

   b)   Testing and Validation:

After Training is done, validation process takes place which gives the model performance. From the figure, the green colored line intersecting with black line represents the performance of network. The best validation performance is obtained in 1.802 at 13 epoch.

The correlation between the actual and prediction result can be evaluated from the f correlation coefficient, R value.

The best performance by the algorithm is shown by the dashed line. It is seen that the system produces lowest mean square error and R=0.91

c) GUI Model
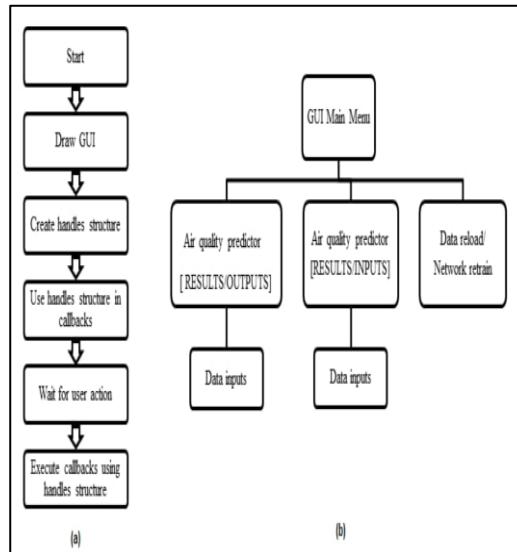
d) Prediction Model

The figure shown below is the Graphical User Interface created to generate the prediction report. It consists of several buttons with specific functionalities. The import button imports the data set of a specific region. The fix button fixes the data and checks for infinite or missing values. The reduce button replaces the missing values with none variables. The finalize data generates the finite datasets. Then Neural Network is added using the Add NN button. After which the system is trained and tested using the specific buttons.
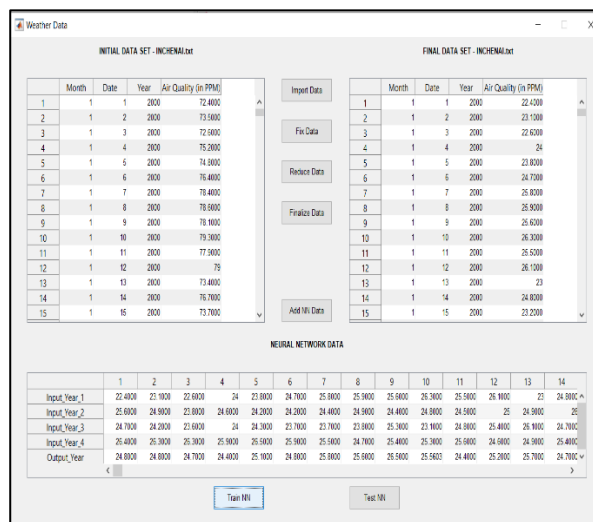
CONCEPTUAL BRIEFING:

Design and implementation of the system is done efficiently using ANN in the deep learning toolbox of MATLAB 2019a. Our model of prediction is user-friendly, cost effective as MATLAB is an open-source software, reliable and can be utilized in the future to analyse and forecast the monthly or annual region's air quality.

CONCLUSION

By creating a graphical user interface, an air quality prediction system is developed which can retrieve and manage the overall air quality index data. A database is created in the system to store all the data as well as a graphical user interface with plotting module is created in the system to can graphically analyse the database. This model will help to forecast the necessity to conserve air quality. In addition, the designed module has an ability to store all the data collected in the database on daily basis, this data will also be helpful in future prediction. The collected inputs are then mathematically designated by the notations x(n) for every n number of inputs. Levenberg-Marquardt algorithm (LMA) is transcending than other training algorithm. This model yields to corelation coefficient (R) around 0.91066 which shows a precise relation between the targets and predicted outputs. Also, features like display of air quality information and databases is done in a real time using GUI. Since the designed module has the flexibility to measure the air quality from any desired location, an app can be developed for users to get instant air quality updates and also alerts regarding future air quality standards.

REFERENCES

[1] BO LIU, SHUO YAN , JIANQIANG LI , GUANGZHI QU(2019).A Sequence to Sequence Air Quality Predictor based on the n-Step Recurrent Prediction.
[2] Dong-Her Shih , Po-Yuan Shih(2018). An Infrastructure of Multi-pollutant Air Quality Deterioration Early Warning System in Spark Platform
[3] Sicard, P., Talbot, C., Lesne, O., Mangin, A., Alexandre, N., &Collomp, R. (2012). The Aggre gate Risk Index: An intuitive tool providing the health risks of air pollution.
[4] Stieb, D. M., Burnett, R. T., Smith-Doiron, M., Brion, O., Shin, H. & Economou, V. (2008). A new multipollutant, no-threshold airquality health index based on short-term associations observed in daily time-series analyses. Journal of the Air & Waste Management Association
[5] Background information on urban outdoor air pollution http://www.who.int/phe/health_topics/outdoorair/databases/background_information/en/
[6] Home Indoor Air Quality https://www.ashrae.org/resources--publications/free-resources/10-tips-for-home-indoor-air-quality
[7] Basic information on Air and Radiation https://www3.epa.gov/air/basic.html
[8] Advanced Sense, Direct Sense, Indoor Air Quality Meters- Brochure
[9] https://www.wolfsense.com/pdf/GrayWolf-Indoor-Air-Quality-IAQ-Meter-Brochure-lo.pdf
[10] [Advanced Sense, Direct Sense, Toxic Gas Test Meters- Brochure, https://www.wolfsense.com/pdf/GrayWolf-Toxic-Gas-Test-Meter-Brochure-lo.pdf