Air Quality Modeling and Monitoring of SIDCO Industrial Estate Coimbatore for the Year 2015

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Abstract— Air being one of the essential for the survival of human life in the earth. WHO demands the indoor as well as outdoor ambient air quality pureness in which the human inhales. Our intended project dealt with air quality Monitoring and modeling of SIDCO industrial cluster of Coimbatore. SIDCO(Small Scale industrial developmental corporation) of Coimbatore is a 450 acres of area stretch located nearby the heart of the city. Which is Governmental organized industrial cluster. Completely for the year 2015 at SIDCO industrial estate and modeled the range of pollutants by using modeling prediction software for its future effects. On the monitoring station we used equipment's like respirable dust sampler, Fine dust sampler and particulate matter measurer for PM2.5 and PM10.The study showed the Air quality index(AQI) for the overall industrial cluster area and the inferred readings were compared with the air quality index of EPA(Environmental Protection agency Standards) and Central Pollution Control boards(CPCB) India.

Key words: SIDCO (Small Scale industrial developmental corporation), AQI (Air quality index), EPA (Environmental Protection agency), CPCB (Central Pollution Control board), PM2.5 (Particulate matter of Size 2.5µm), PM10 (Particulate matter of Size 10µm), SPM (Suspended Particulate Matter), TSPM (Total suspended particulate matter)

I. INTRODUCTION

A. *General*

Air is one of the five essentials (air, water, food, heat, and light) for the human beings. Mahad s. Baawain et al., used a statistical approach to predict the ground level air pollution around an industrial cluster using artificial neural networks. Sincere model has been developed to make prediction models based on artificial neural networks. Man breaths nearly 22,000 times in a day and inhales approximately 15 kg of air per day Mouhammd alkasassbeh et al., used artificial neural networks to predict the concentrations of PM10 and TSPM air pollution parameters. A data set collected at al-fuhais cement plant for over one-year period (2006-2007) by eight monitoring stations were used for that study.

B. *Industrial Air Pollution*

Boznar et al., used neural networks to predict inhalable SO2 concentrations and its traces in highly polluted industrial areas of terrain around the slovenian thermal power plant at sostanj, india. Because the usual methods for air pollution modeling, such as dispersion models, were not reliable in topography, neural networks were applied to predict so2 pollution. Industrial pollution is a major pollution generated by the man-made activities. Among the industries, thermal power plants, chemical plants, cement plants, paper mills, textile mills and tanneries etc.

1) Pollutants from Industries

Major pollutants from industries are particulate matter, oxides of nitrogen, and sulphur dioxide (SO2).

2) Particulate Matter

Particulate pollutants are finely divided solid or liquid particles. Particulates can be composed of inert or extremely reactive materials of size from 0.0002 to 500 microns.

3) PM10

These are the particulate matters having diameter of 10 µm or less. These are small enough to get freely suspended in the atmosphere, and can travel over longer distances through air.

4) PM2.5

These are the particulate matters having a diameter of below 2.5 µm. It is composed of a mixture of primary and secondary particles and have long life times in the atmosphere

5) Sulphur-Di-Oxide (SO2)

It is gas with a stingy smell and suffocating odour. The gas is produced by the combustion of fossil fuels. Sources include industrial activities.

1.2.1.5 Oxides Of Nitrogen (Nox):

The most abundant nitrogen in the atmosphere is nitrous oxide (N2O). This is chemically rather non reactive, and is formed by natural microbiological processes in the soil.

C. *Objectives Of This Project*

In this project, emphasis is made on the prediction of levels of air pollution in Tamilnadu small industries development corporation limited (Tansidco) industrial cluster, Coimbatore based on the data Monitored for the year 2015.

- Monitoring the ambient air quality standards at SIDCO estate.
- To develop models using artificial neural network.
- Model 1: to establish the relationship between PM10, PM2.5 and TSPM with the months for the year 2015.
- The models are developed to minimal the possibility of error and making the absolute amount of pollution level.

D. *General*

Artificial neural network modeling was done for the air quality data which were sampled in sidco, coimbatore. The data consists of the concentrations of particulate matter pm10 and pm2.5 and total suspended particulate matter, these were taken as inputs. On the other hand, months (1-12) were given as output.

E. *Sampling Location – SIDCO*

In coimbatore, sidco is located at 10°55'11"n and 76° 57'35"e comprising of industrial chambers. these industrial clusters are located away from coimbatore at a distance of 8kms. The sidco coimbatore comprises combination of both governmental and private firms. this industrial cluster area

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extends about 200acres. This cluster comes under the active business juncture point at t municipality. This industrial cluster is located on the national highway from coimbatore to pollachi.

F. Software Used

MATLAB 7.12.0.635 (R2011a) Software Was Used For Carrying Out The Artificial NeurNetwork Combined bias and weight layer frames out the regression plot.

1) Data

The basic air quality Pollutants Such As Particulate Matter PM10, PM2.5, And Total Suspended Particulate Matter Were Obtained From Experimental Studies Of Air Quality Monitoring At SIDCO.

2) Data Collection

Data collection is one of the critical and the most important step while modeling through artificial neural network, because it has an immense impact on the success and the performance of the concentrations of the particulate matter PM10, PM2.5 and TSPM for the entire year of 2015. Data preparation was done according to the model which is to be run. One models were developed for establishing the relationship between the pm10, pm2.5 and TSPM with the months. In model i, pm10, pm2.5 and TSPM were taken as inputs and months were taken as outputs.

Month	PM_{10} µg/M^3	$PM_{2.5}$ µg/M^3	TSPM µg/M^3
1	118	41	314
1	122	43	295
1	121	48	320
1	126	49	327
1	123	51	332
1	87	39	258
1	94	38	267
2	120	38	237
2	130	51	288
2	94	39	201
2	116	41	275
2	138	51	295
2	113	42	212
2	103	34	285
2	119	49	287
3	126	50	279
3	131	48	247
3	111	41	252
3	118	47	278
3	102	43	285
3	165	57	214
4	136	52	199
4	124	59	249
4	125	40	230
4	140	49	257
4	122	47	256
5	196	59	484
5	169	62	508
5	162	75	555
5	178	52	475
5	172	59	480
6	151	42	294
6	170	57	365
6	153	45	298
6	144	42	345
6	166	63	349
6	168	65	376
6	167	54	323
6	169	50	285
7	98	46	180
7	121	58	183
7	114	72	194
7	138	53	232
7	152	56	225
7	126	49	176
7	144	51	230
7	155	52	197
8	188	67	198
8	147	49	175
8	142	48	210
8	146	45	205
8	160	60	205
8	112	60	246
8	117	63	219
8	174	57	246
9	117	45	210
9	123	54	274
9	125	57	211
9	131	45	277
9	122	67	210
9	119	71	176
9	115	48	278
9	138	44	220 300
10	122	45	210
10	121	42	145
10	109	43	142
10	109	57	195
10	102	56	210
10	110	41	214
10	98	39	149
11	107	41	236
11	126	43	172
11	85	42	198
11	113	40	205
11	137	45	299
11	147	39	304
11	100	56	231
11	102	54	223
11	78	42	199
11	120	54	184
12	103	45	277
12	130	57	385
12	136	43	326
12	109	44	302
12	111	49	232
12	139	60	357
12	103	58	215
12	105	59	222
12	135	44	293
12	112	47	332

Table 1: Data Collected From The Monitoring station

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3) *Training*

Levenberg-marquardt back propagation algorithm was used for training the model while training with the help of this algorithm, the weights and biases are regenerated.

Model No.	Model Inputs	Model Targets
I	$PM_{2.5}$, PM_{10}, TSPM	Months

Table 2: Predictor Variables Proposed For Each Model

4) *Model I*

This model was developed to establish a relationship between the months monitored and the concentration values obtained from the monitoring location.the model was trained with different hidden layers to get considerable R2 value.

II. RESULTS AND DISCUSSION

A. *General*

Ambient air quality data like concentrations of pollutants were used to run the artificial neural network. One models was developed, in which the models Used Concentrations Of Pollutants PM10, PM2.5 And TSPM As Input feed value And Months As Output feed value

B. *Predictions For Model I*

Artificial neural network model was run with the concentrations of particulate matter PM10, PM2.5 And TSPM as inputs and months as the output. Table 2.1 shows the best architectures for the model for randomly selected hidden layers.the corresponding R-value was ranging from 0.50785 to 0.93345. The best R-value was obtained at the hidden layer of 7 and 8.

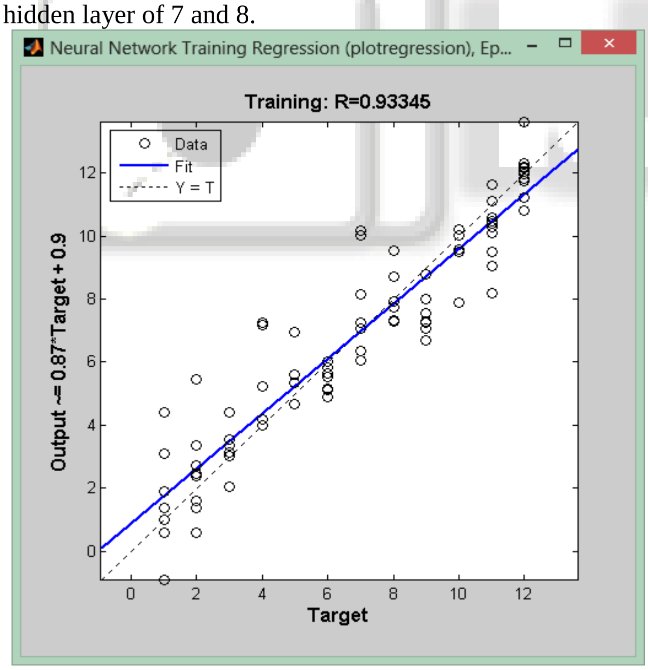

Fig. 1: Regression Plot For Model I

Hidden Layers	R- Value
2	0.52510
3	0.55597
4	0.61869
5	0.61869
6	0.62366
7	0.62664
8	0.62654
9	0.62730

Table 3: Best Architectures For Model I

III. CONCLUSION

Air pollution monitoring seems to be an essential and inevitable process which should confirms the purity of the air which we inhales..In The Present Work, The Most Convincing Advantage Of ANN Model Is That This Model Can Be Used In Two Ways, First We Can Predict The Month For A Particular Concentration Of PM2.5, PM10 And TSPM. And then we can predict the range of concentration values which varies with the current monitored value.Best model regression value has been found in between the hidden layers of 7 and hidden layer of 8.The over all trained regression value got for the intended training values is 0.93345.

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