Assessing The Air Quality In Ujjain By Artificial Neural Network

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Abstract- *In the current examination an endeavor has been made for demonstrating and recreation of different air poisons utilizing Artificial Neural organization in Ujjain City. It permits the client to create multi-layered Neural Networks from matrix. Air Pollutants found in Ujjain are SOx, NOx, RSPM and SPM. Three significant territories decide for displaying are Industrial Area, Residential Area and Sensitive Area. Investigations were done at three zones to gauge toxins and information was gathered for displaying and reenactment. The ANN framework was controlled by giving information and yield information, centralization of toxins were utilized as yield information though for input we utilize meteorological information like temperature, mugginess, wind weight and precipitation which we get from State Pollution Control Board.*

Displaying and reproduction ought to be finished with various territories since centralizations of toxins are distinctive at various zones. As organization engineering, three layer perceptron models were utilized. With Residential zone we make eight organizations with all toxins, in four organizations we utilize three neurons in the info layer including temperature, mugginess and wind speed while other four organizations have four neurons in the information layer including temperature, moistness, wind speed and precipitation. The quantity of concealed layers and estimations of neurons in each shrouded layer are the boundaries to be picked in the model. Hence, a couple of shrouded layers and distinctive estimation of neurons were picked to improve the ANN execution. The last layer is the yield layer, which comprises of the objective of the expectation model. Here, SOx, NOx, RSPM and SPM were utilized as the yield variable. Hyperbolic digression sigmoid capacity was utilized as the exchange work. The information base was separated into three segments for early halting. Half of the information was utilized in preparing the organizations, 25% were assigned as the approval set, and the staying 25% were utilized in testing the organizations. The mean square mistake (MSE) was picked as the factual standards for estimating the organization execution. Feed–forward neural organization has been applied in this investigation. The transig and purelin capacities were utilized for the neurons in the concealed layer and yield layer individually. The info and target esteems were standardized in the scope of [0, 1] in the pre-handling stage.

The loads and inclinations were balanced dependent on angle drop back-proliferation in the preparation stage. The mean square blunder was picked as the factual standards for estimating of the organization execution.

Keywords- transig and purelin capacities, SOx, NOx, RSPM and SPM, ANN framework

I. PREAMBLE

Artificial neural organization applications have, as of late got extensive consideration. The procedure of displaying or assessment is to some degree practically identical to factual demonstrating (Smith, 1993). Neural organizations ought not, notwithstanding, be proclaimed as a substitute for measurable demonstrating but instead as a reciprocal exertion (without the prohibitive presumption of a specific factual model) or an elective way to deal with fitting non-straight information. The most sensitive piece of neural organization demonstrating is speculation, the improvement of a model that is solid in anticipating future mishaps. Overfitting (for example getting loads for which E is so little on the preparation set that even irregular variety is represented) can be limited by having two approval tests notwithstanding the preparation test. As indicated by Smith (1993), the informational collection ought to be partitioned into three subsets : 40% for preparing, 30% to forestall overfitting and 30% for testing. Preparing on the preparation set should stop at the age when the blunder E registered on the subsequent set starts to rise (the subsequent set isn't utilized for preparing yet only to choose when to quit preparing). At that point the third set is utilized to perceive how well the model performs. The cross-approval assists with enhancing the fit in three different ways: by restricting/upgrading the quantity of concealed units by restricting/streamlining the quantity of emphasess and by repressing organization utilization of huge loads.

A fake neural organization frequently just called a neural organization is a numerical model propelled by natural neural organizations. A neural organization comprises of an interconnected gathering of fake neurons and it measures data utilizing a connectionist way to deal with calculation. As a rule a neural organization is a versatile framework that changes its structure during a learning stage. Neural organizations are utilized to demonstrate complex connections among information sources and yields or to discover designs in information.

1.1. Applications: The utility of counterfeit neural organization models lies in the way that they can be utilized to gather a capacity from perceptions. This is especially helpful in applications where the unpredictability of the information or errand makes the plan of such a capacity by hand illogical.

1.1.1.1 Real-life Applications: The undertakings counterfeit neural organizations are applied to will in general fall inside the accompanying general classes:

- Function estimation, or relapse examination, including time arrangement forecast, wellness guess and displaying.
- Classification, including example and succession acknowledgment, oddity location and consecutive dynamic.
- Data handling, including sifting, bunching, dazzle source division and pressure.
- Robotics, including coordinating controllers, Computer mathematical control.

1.2 AIR POLLUTION: "Air contamination implies the presence in the outside environment of at least one contaminants, for example, dust, exhaust, gas, scent, smoke or fume in amounts with attributes for terms, for example, to be damaging to human, plant or creature life or to property or which irrationally meddle with the agreeable pleasure throughout everyday life and property".

The present-day climate is very unique in relation to the common air that existed before the Industrial Revolution as far as synthetic arrangement. On the off chance that the characteristic air is viewed as "spotless", at that point this implies clean air can't be found anyplace in the present environment.

Characterizing "air contamination" isn't straightforward. One could guarantee that air contamination began when people started consuming powers. As such, all man-made (anthropogenic) outflows into the air can be called air contamination, since they adjust the concoction arrangement of the normal environment. The expansion in the worldwide convergences of ozone depleting substances CO2, CH4 and N2O can be called air contamination utilizing this methodology, despite the fact that the focuses have not discovered to be poisonous for people and the biological system. One can refine this approach and just think about anthropogenic emanations of hurtful synthetics as air contamination.

In many urban areas air quality has improved (considerably) over the previous decades. The obvious and observable air contamination (smoke, dust, exhaust cloud) has vanished from numerous urban communities because of neighborhood, public and European activities. Periodically air quality represents a quick danger : during modern occurrences or contamination scenes. Luckily this is uncommon. By and by the current air quality actually influences individuals' wellbeing. In numerous European urban areas, air quality is a worry and it is consequently observed nonstop. In many urban communities, modern air contamination is, or will in general be supplanted by traffic related air contamination. Air quality is along these lines a typical issue to practically all significant urban communities.

1.3 AIR POLLUTANTS: A contamination is substance or vitality brought into the condition that has undesired impacts or antagonistically influences the helpfulness of an asset. A contamination may cause long or transient harm by changing the development pace of plant or creature species or by meddling with human civilities, solace, and wellbeing or property estimations. There are two sorts of poisons:

1.3.1 Primary Pollutants: Primary air poisons are produced legitimately into the air from sources. They can have impacts both straightforwardly and as antecedents of auxiliary air contaminations.

i. Sulphur dioxide (SO2) created from consuming of coal predominantly in warm force plants. It causes exhaust cloud and corrosive downpour.
ii. Nitrogen dioxides (NO2) cause brown haze and corrosive downpour. It is created from consuming fills including petroleum, diesel and coal.
iii. Carbon monoxide (CO) is an item by inadequate ignition of fuel, for example, flammable gas, coal or wood.
iv. Chlorofluorocarbons (CFCs) delivered predominantly from refrigeration. These gases consolidate with scarcely any different gases, which prompt a decrease of the ozone layer that shields the earth from the unsafe bright beams of the sun.
v. Carbon dioxide (CO2) an ozone depleting substance produced from burning.
vi. Suspended particulate issue (SPM) incorporate smoke, residue and fume that can stay suspended for

expanded periods and can presented in the earth as essential just as auxiliary poisons.

vii. Toxic metals, for example, lead cadmium and copper can enter to the earth through petroleum, hair color items, paints, batteries and so forth.

viii. Volatile natural mixes (VOC, for example, hydrocarbon fuel fumes and solvents.

ix. Ammonia (NH3) discharged from horticultural cycles.

x. Odors, for example, from trash, sewage, and mechanical cycles.

xi. Radioactive poisons delivered by atomic blasts and war explosives, and characteristic cycles, for example, radon.

1.3.2 Secondary Pollutants: Secondary air pollutants are produced in the air by the interaction of two or more primary pollutants or by reaction with normal atmospheric constituents with or without photo activation.

i. Particulate matter formed from gaseous primary pollutants and compounds in photochemical smog, such as nitrogen dioxide.

ii. Ground level ozone O_3 formed from NO_2 and VOCs.

iii. Peroxyacetyl nitrate (PAN) similarly formed from NO_2.

III. EXPERIMENTAL SETUP & METHODOLOGY

3.1 FACTORS FOR CONSIDERATION: Factors to be considered for industrial area location while selecting a site from the point of air pollution control, the following factors should be taken into consideration to avoid costly control measures, improve public relations and prevent litigation :

- Existing levels of air contaminants
- Potential effects on the surrounding area
- Meteorological factors and climate
- Topographical features
- Clean air available

Some of the measures that can be taken for air pollution control by planning and zoning are :

- Decentralization of industry
- Creation of a green belt between industry and receptor areas
- Regulations over automobile exhausts
- Traffic control
- Creation of smokeless zones in selected areas by limiting industries and residences in those zones to the use of certain specific smokeless fuels.
- Prohibiting use of volatile fuels.

3.2 CLASSIFICATION OF SAMPLING METHODS: The sampling methods used for the study of air pollution can be classified under three different headings.

1. Sampling of impurities of every nature (ranging from matter to gases).
2. Sampling under various environmental conditions (ranging from samples taken from chimneys to samples taken in the open air).
3. Sampling methods varying according to the time factor (ranging from intermittent to continuous sampling).

i. Basic Considerations of Air Sampling: The sample collected must be representative in terms of time and location.

ii. The sample volume should be large enough to permit accurate analysis.

iii. The sampling rate must be such as to provide maximum efficiency of collection.

iv. The duration of sampling and frequency of sampling should reflect accurately the occurrence of fluctuations in pollution levels.

v. The contaminants must not be modified or altered in the process of collection.

3.2.1 Location of Sampling :

(i) To gather information on the nature and magnitude of the emission from principle sources of pollution.

(ii) To review the available climatologically and meteorological data.

(iii) To gather data on the concentration of pollutants in areas of severe and slight pollution.

3.3 MONITORING AND ANALYSIS: Principles of monitoring methods:

Table-3.1 : Physical Principles Involved in Various Monitoring Methods

S. No.	Physical principle	Illustrations
01	Molecular absorbance (UV/visible/IR)	SO_2, NO_2, H_2S, CO
02	Atomic absorption (AAS)	SO_2, Hg, Pd
03	Atomic emission (ICP AES)	SO_2 metal pollutant
04	Molecular luminescence (Fluorescence)	SO_2, NO_2, H_2S
05	Light scattering (Nephelometry and Turbidimetry)	Particulates SPM,
06	Magnetic resonance/Electron spin resonance(NMR/ESR)	Organics
07	Polar graph amperometry (diffusion current)	Pesticide, metals
08	Conductance, high frequency light (conductivity)	SO_2
09	Potential – pH measurement, ion selective electrodes (e.m.f.)	NO-NO_x, metals
10	Coulometer – anodic stripping voltammeter (ASV)	SO_2, anions
11	Radio analytical (NAA/IDM)	Radioactive pollutants
12	Gas chromatography (GC)	Organics volatile complexes

3.4 MONITORING OF GASEOUS POLLUTANTS:

The measurement of pollution in working area of worker is called an in plant monitoring. One which keeps track of exposure of an individual leads to what is called as personal monitoring? It is possible to fix, threshold limiting value of toxic pollutant from the knowledge of personal monitoring. Whatever strategies were used for air pollution analysis can be exhausted for air pollution monitoring? Broadly the air pollutants can be classified due to presence of particulate matter, sulphur compounds, hydrocarbons (HC), nitrogen compounds, halogens, carbon compounds, inorganic compounds and organic compounds in the atmosphere. The monitoring of air quality parameters is usually done according to importance of pollutants like suspended particulate matter, SO_2, hydrocarbons, carbon dioxide, carbon monoxide, oxides of nitrogen and ozone.

3.4.1 Monitoring of Sulphur Oxides and Nitrogen Oxides: Various methods are used for the monitoring of SO_x and NO_x. The important methods are based upon measurement of either color or electrical conductance or use of electrochemical transducer. The techniques of the chemiluminescence's technique, NDIR spectroscopy or gas chromatography are also used.

3.5 AIR POLLUTION PROCESS AND MONITORING:

3.5.1 Air Pollution Monitoring Instruments: The monitoring instrument is usually composed of three components, air remover, transducer and recorder. The air remover component consists of a flow meter and a pressure gauge. It measures rate of flow of air passing and the pressure under which gas pollutants exist. Transducer in fact is the heart of the instrument, which measures a physical property, while the recorder notes change in physical property of gaseous pollutant, e.g. flow colorimeters or spectrophotometers are used to measure the concentration of the pollutant. The instrument should be checked for response time, specificity, sensitivity, noise level, maintenance and downtime and overall accuracy.

Table-3.2 : Air Pollution Monitoring Instruments and Their Range

S. No.	Instrument	Pollutant measured	Range (ppm)
01	IR gas analyzer	CO, CH_4 and HC	10 1000
02	NDIR analyzer	CO, CO_2	10 – 1000
03	Car exhaust meter	Auto exhaust analysis	–
04	CO monitor	Catalytic oxidation	0 – 50
05	SO_2 monitor	Calorimetric titration	0 – 40
06	O_3 monitor	Chemiluminescence's	0 – 0.1
07	NO NO_x monitor	Chemiluminescence's	0 – 0.5
08	H_2S analyzer	Colorimeter	0 – 40

Table-3.3 : Air monitoring instruments and techniques of analysis

S. No.	Instrument	Pollutant measured	Range (ppm)
01	Conductometric analyzer	SO_2	Conductometric measurement
02	Continuous SO_2 monitor	SO_2	Calorimetric measurement
03	Gas liquid chromatograph	CO, NO, organics hydrocarbons	Gas chromatography with different detectors
04	Nitric oxide monitor	NO NO_x	Fluorescence technique
05	O_3 analyzer	O_3 in atmosphere	Emission spectrography
06	Ozone monitor	O_3	Chemiluminiscence
07	Infrared gas analyzer	CO, CH_4 and other hydrocarbons	Infrared absorption NDIR technique
08	Fluorescence spectroscopy	Organic pollutants	Fluorescence phosphorescence
09	Smoke meter	Smoke, smog	Light scattering technique
10	Atomic absorption (AAS)	Trace metals analysis	Atomic absorption (AAS) spectroscopy
11	Spectrography at tracer levels	Metal pollutants	UV visible spectroscopy

IV. METROLOGICAL SETUP AND METHODOLOGY

4.1 WEATHER VANE: A climate vane is an instrument for demonstrating the course of the breeze. They are commonly utilized as an engineering trimming to the most noteworthy purpose of a structure.

4.1.1 Operational working: The plan of a breeze vane is with the end goal that the weight is equitably circulated each side of the surface, yet the surface territory is inconsistent partitioned, so the pointer can move openly on its hub. The side with the bigger zone is overwhelmed from the breeze heading. The pointer is accordingly consistently on the littler side (a north wind is one that blows from the north). Most wind vanes have directional markers underneath the bolt, lined up with the geographic headings. Wind vanes, particularly those with whimsical shapes, don't generally show the genuine bearing of an extremely delicate breeze. This is on the grounds that the figures don't accomplish the important plan balance: an inconsistent surface zone however adjusted in weight. To get an exact perusing, the breeze vane must be found well over the ground and away from structures, trees, and different articles which meddle with the genuine breeze bearing. Altering twist course can be significant when composed with other obvious sky conditions, empowering the client to make basic short range figures. From the road level the size of numerous weathercocks is tricky.

4.2 WINDMILL ANEMOMETER: different types of mechanical speed anemometer might be depicted as having a place with the windmill type or propeller anemometer. In the Robinson anemometer the hub of turn is vertical, yet with this region the pivot of revolution must be corresponding to the bearing of the breeze and accordingly flat. Moreover, since the breeze differs in course and the pivot needs to follow its changes, a breeze vane or some other creation to satisfy a similar reason must be utilized. An aerovane joins a propeller and a tail on a similar pivot to get exact and exact breeze speed and bearing estimations from a similar instrument. In situations where the bearing of the air movement is consistently the equivalent, as in the ventilating shafts of mines and structures for example, wind vanes, known as air meters are utilized, and give most good outcomes.

4.3.1 Psychrometers: In a psychrometer, there are two thermometers, one with a dry bulb and one with a wet bulb. Vanishing from the wet bulb brings down the temperature, so the wet-bulb thermometer generally shows a lower temperature than that of the dry-bulb thermometer, which estimates dry-bulb temperature. At the point when the air temperature is beneath freezing, be that as it may, the wet bulb is secured with a meager covering of ice but might be hotter than the dry bulb. Relative dampness is registered from the encompassing temperature as appeared by the dry-bulb thermometer and the distinction in temperatures as appeared by the wet-bulb and dry-bulb thermometers. Relative stickiness can likewise be controlled by finding the crossing point of the wet and dry-bulb temperatures on a psychrometric graph. One gadget that utilizes the wet/dry bulb strategy is the sling psychrometer, where the thermometers are appended to a handle or length of rope and spun around noticeable all around for a couple of moments.

4.3.2 Psychrometer Calibration: Accurate alignment of the thermometers utilized is obviously principal to exact moistness assurance by the wet-dry strategy; it is likewise significant for the most precise outcomes to shield the thermometers from brilliant warmth and guarantee an adequately fast of wind stream over the wet bulb. One arrangement some of the time utilized for precise dampness estimation when the air temperature is underneath freezing is to utilize a thermostatically-controlled electric radiator to raise the temperature of outside air to above freezing. In this game plan, a fan draws outside air past (1) a thermometer to quantify the surrounding dry-bulb temperature, (2) the warming component, (3) a subsequent thermometer to gauge the dry-bulb temperature of the warmed air, at that point at long last (4) a wet-bulb thermometer. As indicated by the World Meteorological Organization Guide, "The standard of the warmed psychrometer is that the water fume substance of an air mass doesn't change in the event that it is warmed. This property might be misused to the benefit of the psychrometer by dodging the need to keep up an ice bulb under freezing conditions." Since the mugginess of the encompassing air is determined by implication from three temperature estimations, in such a gadget precise thermometer adjustment is significantly more significant than for a two-bulb setup.

4.4. Difficulty of Accurate Humidity Measurement: Humidity estimation is among the more troublesome issues in essential meteorology. As per the WMO Guide, "The attainable exactnesses (for mugginess assurance) recorded in the table allude to great quality instruments that are all around worked and kept up. Practically speaking, these are difficult to accomplish." Two thermometers can be looked at by submerging them both in a protected vessel of water and mixing vivaciously to limit temperature varieties. A great fluid in-glass thermometer whenever maneuvered carefully should stay stable for certain years. Hygrometers must be adjusted in air, which is a significantly less successful warmth move medium than is water, and numerous sorts are liable to float so require ordinary recalibration. A further trouble is that most hygrometers sense relative stickiness rather. The outright measure of water present, however relative dampness is an element of temperature and supreme dampness content, so little temperature varieties inside the air in a test chamber will convert into relative mugginess varieties.

4.5 RAIN GAUGE: The standard downpour measure, created around the beginning of the twentieth century, comprises of a pipe joined to a graduated chamber that fits into a bigger holder. In the event that the water floods from the graduated chamber the external holder will get it. At the point when estimations are taken, the chamber will be estimated and afterward the abundance will be placed in another chamber and estimated. By and large the chamber is set apart in mm and in the image above will match 25 mm (0.98 in) of precipitation. Every level line on the chamber is 0.2 mm (0.007 in). The bigger holder gathers any precipitation sums more than 25 mm that streams from a little gap close to the head of the chamber. A metal line is joined to the holder and can be changed in accordance with guarantee the downpour measure is level. This line at that point fits over a metal pole that has been put in the ground. Checking the quantity of 'clicks' in a brief period the eyewitness can choose the character of the downpour. Remedy calculations can be applied to the information as an acknowledged strategy for revising the information for significant level precipitation power sums. Current tipping precipitation measures comprise of a plastic authority adjusted over a turn. At the point when it tips, it incites a switch, (for example, a reed switch) which is then electronically recorded or communicated to a far off assortment station.

V. RESULTS AND DISCUSSION

In the current examination an endeavor has been made for displaying and reproduction of different air contaminations utilizing Artificial Neural organization in Ujjain City. It permits the client to deliver multi-layered Neural Networks from lattice. Air Pollutants found in Ujjain are SOx, NOx, RSPM and SPM. Three significant zones decide for demonstrating are Industrial Area, Residential Area and Sensitive Area. Examinations were done at three regions to quantify contaminations and information was gathered for demonstrating and reenactment. The ANN framework was controlled by giving info and yield information, centralization of contaminations were utilized as yield information though for input we utilize meteorological information like temperature, dampness, wind weight and precipitation which we get from State Pollution Control Board.

Displaying and reenactment ought to be finished with various zones since groupings of toxins are diverse at various zones. As organization design, three layer perceptron models were utilized. With Residential region we make eight organizations with all contaminations, in four organizations we utilize three neurons in the info layer including temperature, mugginess and wind speed while other four organizations have four neurons in the information layer including temperature, moistness, wind speed and precipitation. The quantity of concealed layers and estimations of neurons in each shrouded layer are the boundaries to be picked in the model. Accordingly, a couple of concealed layers and diverse estimation of neurons were picked to upgrade the ANN execution. The last layer is the yield layer, which comprises of the objective of the expectation model. Here, SOx, NOx, RSPM and SPM were utilized as the yield variable. Hyperbolic digression sigmoid capacity was utilized as the exchange work. The information base was isolated into three areas for early halting. Half of the information was utilized in preparing the organizations, 25% were assigned as the approval set, and the staying 25% were utilized in testing the organizations. The mean square blunder (MSE) was picked as the factual rules for estimating the organization execution. Feed–forward neural organization has been applied in this examination. The transig and purelin capacities were utilized for the neurons in the concealed layer and yield layer individually. The info and target esteems were standardized in the scope of [0, 1] in the pre-handling stage. The loads and predispositions were balanced dependent on angle plunge back-spread in the preparation stage. The mean square mistake was picked as the factual rules for estimating of the organization execution.

5.1 INDUSTRIAL AREA: Network model for SOx: Two individual organizations for SOx utilizing Artificial Neural Network were created. The examination was centered on assessment of mean square blunder. Here are the outcomes gotten from ANN while taking SOx as a yield boundary

5.1.1 Network Structure is 04-05-01

Mean Square Error comes to be 0.006

Epochs : 10000

Parameter : 0.20000

#o-units : 1

#patterns : 104 (total: 104)

epoch:	SSE	MSE	SSE/o-units
Train10000:	0.65564	0.00630	0.65564
Train 9000:	0.65513	0.00630	0.65513
Train 8000:	0.65462	0.00629	0.65462
Train 7000:	0.65410	0.00629	0.65410
Train 6000:	0.65358	0.00628	0.65358
Train 5000:	0.65306	0.00628	0.65306
Train 4000:	0.65253	0.00627	0.65253
Train 3000:	0.65199	0.00627	0.65199
Train 2000:	0.65145	0.00626	0.65145
Train 1000:	0.65091	0.00626	0.65091
Train 1:	0.65036	0.00625	0.65036

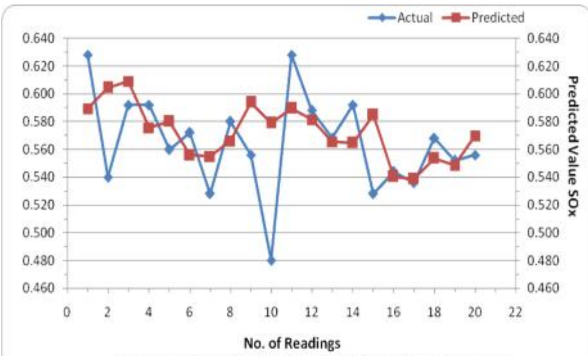

Fig.5.1 : Model Performance for Network Structure 4-5-1

Above figure shows the exhibition of organization with four neurons in input layer factors including temperature, mugginess, wind weight and precipitation while taking Sox as yield in which greatest real blunder was discovered to be 0.62 while least real mistake was 0.48 though the most extreme anticipated mistake was 0.609 while least anticipated mistake was 0.53.

Second Network model for SOx :

Here are the outcomes acquired from ANN while taking SOx as a yield boundary including three information sources temperature, wind weight and mugginess.

5.1.1.2 Network Structure:

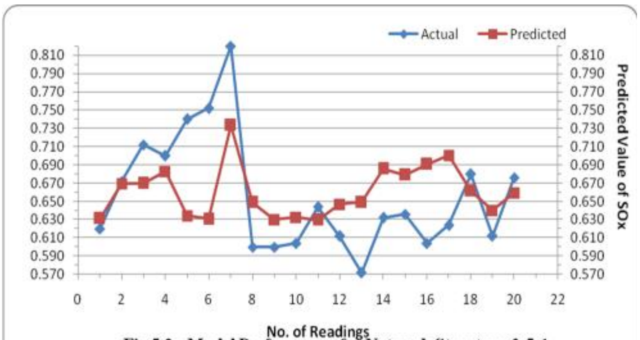

Fig 5.2 : Model Performance for Network Structure 3-5-1

Above figure shows the performance of network with three neurons in input layer variables including temperature, humidity and wind pressure while taking SO_x as output in which maximum actual error was found to be 0.82 while minimum actual error was 0.60 whereas the maximum predicted error was 0.733 while minimum predicted error was 0.63.

5.1.3 Network Structure: Network Model for NO_x

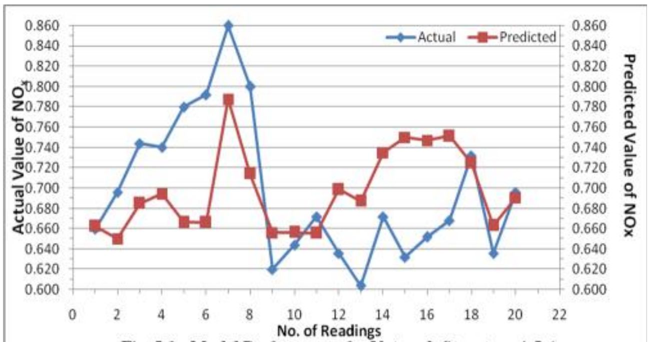

Fig 5.3 : Model Performance for Network Structure 4-5-1

Above figure shows the performance of network with four neurons in input layer variables including temperature, humidity, wind pressure and rainfall while taking Nox as output in which maximum actual error was found to be 0.86 while minimum actual error was 0.6 whereas the maximum predicted error was 0.78 while minimum predicted error was 0.65.

5.1.4 Network

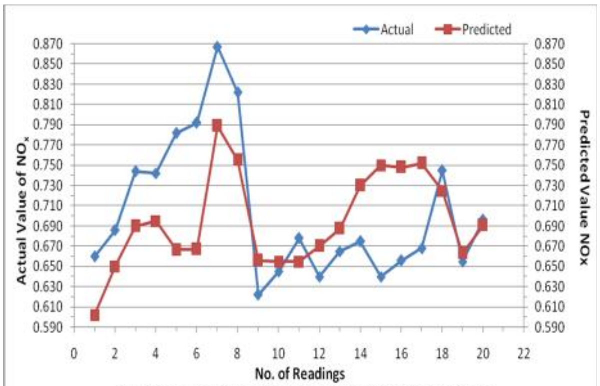

Fig 5.4 : Model Performance for Network Structure 3-5-1

Above figure shows the performance of network with four neurons in input layer variables including temperature, humidity and wind pressure while taking NO_x as output in which maximum actual error was found to be 0.867 while minimum actual error was 0.622 whereas the maximum predicted error was 0.789 while minimum predicted error was 0.602.

5.1.5 Network Model for RSPM

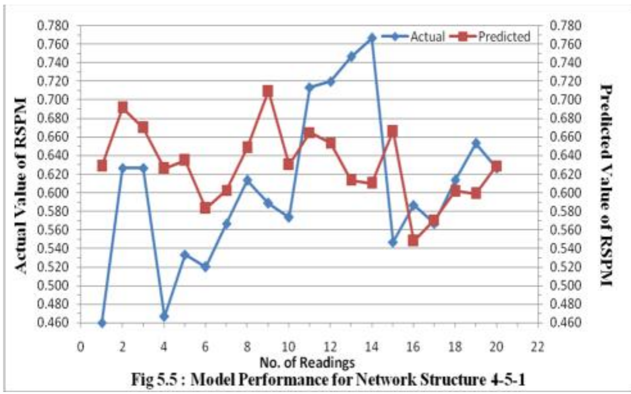

Fig 5.5 : Model Performance for Network Structure 4-5-1

Above figure shows the performance of network with four neurons in input layer variables including temperature, humidity, wind pressure and rainfall while taking RSPM as output in which maximum actual error was found to be 0.76 while minimum actual error was 0.46 whereas the maximum predicted error was 0.709 while minimum predicted error was 0.54.

5.1.6 Network Structure is 03-05-01

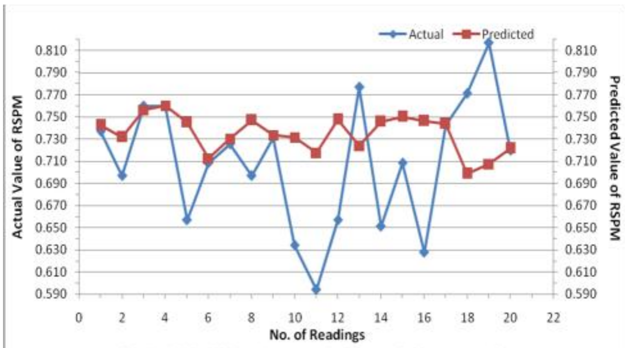

Fig 5.6 : Model Performance for Network Structure 3-5-1

Above figure shows the performance of network with four neurons in input layer variables including temperature, humidity and wind pressure while taking RSPM as output in which maximum actual error was found to be 0.817 while minimum actual error was 0.59 whereas the maximum predicted error was 0.76 while minimum predicted error was 0.699.

5.1.7 Network Model for SPM

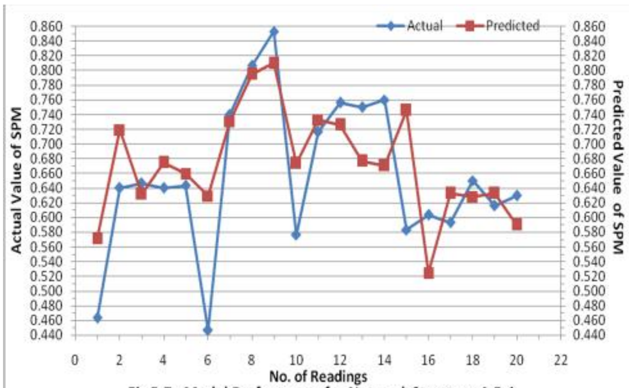

Fig 5.7 : Model Performance for Network Structure 4-5-1

Above figure shows the performance of network with four neurons in input layer variables including temperature, humidity, wind pressure and rainfall while taking RSPM as output in which maximum actual error was found to be 0.853 while minimum actual error was 0.447 whereas the maximum predicted error was 0.810 while minimum predicted error was 0.525.

5.1.8 Network Model for SPM :

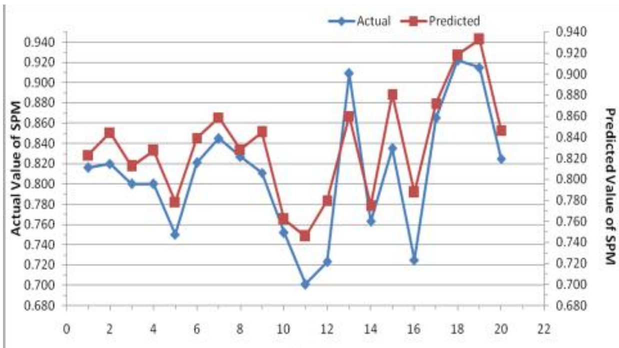

Fig 5.8 : Model Performance for Network Structure 3-5-1

Above figure shows the exhibition of organization with three neurons in input layer factors including temperature, mugginess and wind pressure while taking SPM as yield in which greatest real mistake was discovered to be 0.922 while least genuine blunder was 0.701 though the most extreme anticipated blunder was 0.933 while least anticipated blunder was 0.746.

VI. END AND FUTURE SCOPE OF WORK

6.1 Conclusion: Neural organizations are reasonable for anticipating time arrangement primarily in view of gaining just from models, with no compelling reason to include extra data that can bring more disarray than expectation impact. Neural organizations can sum up and are impervious to commotion. Then again, it is commonly unrealistic to decide precisely what a neural organization realized and it is likewise difficult to appraise conceivable forecast blunder.

We in this proposition have inspected the different causes which are really liable for the air contamination. Further metropolitan and mechanical air contamination has influenced individuals' wellbeing generally. Danger to life has been improved by the outflow of toxic substances through the businesses and vehicles. Moreover we have experienced the specialized parts of different Control measures, which ought to be considered, so as to check the contamination. We have seen different choices for the ordinary fuel, and assembling measure, that many cycle businesses are receiving so as to diminish air contamination close to zero outflow level, as they have as of now secure their belts towards "Green Concept". Perception of regular air marvels has prompted improvement in our comprehension of metrology transport and scattering of air toxin. The barometrical disturbance that prompts scattering of contamination was scaled in to steadiness classes. In displaying input metrological boundaries that are required breeze speed, moistness, downpour, wind bearing, surrounding temperature. Under this plan of steadiness grouping a wide variety in metrology is estimated as a solitary class. There by decreasing the affectability of the model. Air quality displaying in India is required for metropolitan air quality administration ecological effect appraisal examines and so on. Model created showed up as far as rate blunder of forecast. The age of information utilizing a demonstrating approach is very valuable. Displaying results must be deciphered with alert by neural organization.

Based on the strategy embraced for the improvement of models following ends can be drawn.

1. Efficiency of neural organization models relies on the quantity of preparing sets and speculation utilized in age of preparing informational collection. More is the quantity of preparing informational indexes, the neural organization will more effective so we have taken numerous sets to get almost precise outcomes.
2. Neural organization models have been created for Ambient Air quality information boundaries are encompassing temperature, wind speed, stickiness, and downpour.
3. For the source information the outcomes got by 4-5-1 organization (4 information sources, 5 neurons concealed layers and 1 yield) give the most precise outcome.
4. The mistake for the organization created for the model is 3.9 % maxi to diminish 0.18 % min.
5. ANN required enormous measure of preparing information for emphasis for limit blunder.

In utilizing such models care has been taken that these are Ambient Air quality explicit. For creating models for a specific treatment office input information for that area is basic.

6.2 Future Scope of work: Our counterfeit neural organization models were all around adjusted and performed well on inconspicuous information from various focuses. These issues have not been tended to limited and determined in past investigations. Nonetheless, and dissimilar to in past investigations, we didn't discover the presentation of counterfeit neural organization models to be altogether not quite the same as that of reasonably upgraded calculated relapse models. The measures contamination determining models are produced for Ujjain city utilizing information driven methodologies of Artificial Neural Networks. The apparatus worked sensibly well as far as forecast precision for the dataset of 2006-2019. The Genetic Programming method works better than ANN. Hereditary Programming being a generally new methodology, should be investigated further for present moment just as long haul figure of rules toxins with specific contemplations, for example, climatic conditions, occasional varieties.

REFERENCES

[1] Akeredoiu, F.A., Oluwole, A.F., Betika, E.A. and ogunsola, O.J., 1994. Modeling of carbon monoxide concentration from motor vehicles travelling near roadway intersections in Lugos, Nigeria. In : Baldanano, J.M., Brebbia, C.A., Power, H. and Zannetti, P. (Eds.), Air Pollution II: Pollution Control and Monitoring, Vol. 2, Computational Mechanics Inc., Southampton, Boston, pp. 149-157.

[2] Alexopolos, A., Assimacopolus, D. and Mitsoulis, E., 1993. Model for traffic emissions estimation. Atmospheric Environment, 27B (4), 435-446.

[3] Aron, R.H. and Aron, I.M., 1978. Statistical forecasting models: carbon monoxide concentrations in the Los Angeles basin. Journal of Air Pollution Control Association, 28(7), 681-684.

[4] Bardeschi, A., Colucci, A., Granelle, V., Gangnetti, M., Tamponi, M. and Tebaldi, G., 1991. Analysis of the impact on air quality of motor vehicle traffic in the Milan urban area. Atmospheric Environment, 25B, 415-428.

[5] Benarie, M.M., 1982. Air pollution modeling operations and their limits. In : Fronza, G and Melli, P. (Eds.), Mathematical models for planning and controlling air quality, Pergamon press, New York, pp. 109-115.

[6] Benson, P.E., 1992. A review of the development and application of the CALINE-3 and CALINE-4 Models. Atmospheric Environment, 26B (3), 379-390.

[7] Cadle, S.H., Chock, D.P., Heuss, J.M. and Manson, P.R., 1976. Result of the General Motors sulfate dispersion experiments, General Motors Research Publication, GMR-2107, General Motor Corporation, Warren, USA.

[8] Calder, K.L., 1973. On estimating air pollution concentrations from a highway in an oblique wind. Atmospheric Environment, 7 (9), 863-868.

[9] Cernuschi, S., Giugliano, M., Lonati, G. and Marzolo, F., 1998. Development and application of statistical models for CO concentration and duration events in the Milan urban area. The Science of the Total Environment, 220(2-3), 147-156.

[10] Chen. T.C. and March, F., 1971. Effect of highway configurations on environmental problems dynamics of highway associated air pollution. In: England, H.M. and Berry, T. (Eds.), 2nd International Clean Air Congress, Academic Press, New York, pp. 35-40.

[11] Chock, D.P. 1977a General Motors sulfate dispersion experiment : Assessment of the EPA HIWAY model. Journal of Air Pollution Control association, 27, 39-45.

[12] Chock, D.P. and Winkler, S.L., 1997. Air quality prediction using a fixed layer depth vertical structure in the urban airshed model. Environmental Science and Technology, 31(2), 359-370.

[13] Chock, D.P., 1982a. General Motors sulfate dispersion experiment an analysis of the wind field near the road. In: Modeling of Dispersion of Transport Pollution. Symposium Proceedings Series No. 22, Institute of Mathematics and its Applications, UK. Pp. 1-37.

[14] Chock, D.P., 1985, Statistics of extreme values of air quality - a simulation study. Atmospheric Environment, 19(10), 1713-1724.

[15] Clifford, M.J., Clarke, R. and Riffat, S.B., 1995. Local aspects of vehicular pollution. Atmospheric Environment, 31(2), 271-276.

[16] Cohn. L.F. and Gaddipati, S.R., 1984. An interactive graphics method for use in highway air quality analysis. Journal of Air Pollution Control Association, 34 (11), 1137-1139.

[17] Colwill, D.M., Middleton, D.R. and Bulter, J.D., 1979. A Gaussian plume dispersion model applicable to a complex motorway interchange. TRRL Supplementary Report 505, Crowthorne, Berkshire.

[18] Cooper, D.C., 1989. Persistence factor for mobile sources (roadway) carbon monoxide modeling. Journal of the Air and Waste Management Association, 39(5), 714-720.

[19] Csanday, G.T., 1972. Crosswind shear effects on atmospheric diffusion. Atmospheric Environment, 6 (3), 221-232.

[20] Dabberdt, W. F., Ludwing, F. L. and Jr. Jhonson, W. B., 1973. Validation and application of an urban diffusion model for vehicular pollutants, Atmospheric Environment, 7(7), 603-618.

[21] Derwent, R.G. Middleton, D.R., Field, R.A., Goldstone, M.E., Lester, J.N. and Perry, R., 1995. Analysis and Interpretation of air quality data from an urban roadside location in central London over the period from July 1991 to July 1992. Atmospheric Environment, 29(8), 923-946.

[22] Detar, D.F., 1979. A new model for estimating concentrations of substances emitted from a line sources. Journal of the Air Pollution Control Association, 29(2), 138-141.

[23] Dilley, J.F. and Yen, K.T., 1971. Effect of mesoscale type wind on the pollutant distribution from a line source. Atmospheric Environment, 5(10), 843-851.

[24] Dorzdowicz, B., Benz, S.J., Sonta, A.S. and Scenna, N.J., 1997. A neural network based model for the analysis of carbon monoxide concentration in the urban area of Rosario. In : Power, H. Tirabassis, T. and Brebbia, C.A. (Eds.), Air Pollution V, Computational Mechanics Inc., Southampton, Boston, pp. 677-685.

[25] Egan, B.A., Epstein, B.A., Keefe, M., League, J. and Lavery, T.C., 1973. Develpoment of procedure to simulate motor vehicle pollution levels. Environment Research and Technology, Inc., Report No. ERT-P-343F, Lexington, MA.

[26] Eskridge, R.E. and Hunt, J.C.R., 1979. Highway modeling –I: prediction of velocity and turbulence fields in the wake of vehicles. Journal of Applied Meteorology, 18(4), 387-400.

[27] Eskridge, R.E. and Rao, S.T., 1983. Measurement and Prediction of traffic induced and velocity fields near roadways. Journal of Climate and Applied Meteorology, 22. 1431-1443.

[28] Eskridge, R.E. and Rao, S.T., 1986. Turbulent diffusion behind vehicle : ezperimentally determined mixing parameters. Atmospheric Environment, 20(5); 851-860.

[29] Esplin, G.L., 1995, Approximate explicit solution to the general line source problem. Atmospheric Environment, 29(12), 1459-1463.

[30] Fay, T.A. and King, D. Eng., 1975. Wake induced dispersion of automobile exhaust pollutants. Journal of Air Pollutants. Journal of Air Pollution Control Association, 1(1), 44-75.

[31] Finzi, G. and Tebaldi, G., 1982. A mathematical model for air pollution forecast and alarm in an urban area. Atmospheric Environment, 16 (9), 2055-2059.

[32] the multilayer Perceptron – a review of applications in atmospheric sciences. Atmospheric Environment, 32 (14/15), 2627-2636.

[33] Georgopoulos, P.G. and Seinfeld, J.H., 1982. Statistical distribution of air pollutant concentrations. Environmental Science and Technology, 16, 401-416A.

[34] Glen, W.G., Zelenka, M.P. and Graham, R.C., 1996. Relating meteorological variables and trend in motor vehicle emissions to monthly urban carbon monoxide concentrations. Atmospheric Environment, 30(25), 4225-4232.

[35] Green, N.J., Bullin, J.A and Polasek, J.C., 1979. Dispersion of carbon monoxide from roadways at low wind speeds. Journal of Air Pollution Control Association, 29(10), 1057-1061.

[36] Gronskei, K.E., 1988. The influence of car speed on dispersion of exhaust gases. Atmospheric Environment, 22 (2), 273-281.

[37] Gualteri, G. and Tartaglia, M., 1998. Predicting urban traffic air pollution : a gas fame work. Transportation Research, D5, 337-347.

[38] Hickman, A.J. and Colwill, D.M., 1982. The estimation of air pollution concentration from road traffic. TRRL Laboratory Report No. 1052, Crowthorne, Berkshire.

[39] Hirtzel, C.S. and Quon, J.E., 1979. Statistical dependence of hourly carbon monoxide measurements. Journal of Air Pollution Control Association, 29(2), 161-163.

[40] Hlavinka, M.W. Korpics, J.J. and Bullin, J.A., 1987. TEXIN -2 : a versatile model fir predicting carbon monoxide concentrations near intersections. Journal of Air Pollution control Association, 37(7), 819-822.

[41] Hornik, K., Stinchcombe, M. and White, H., 1989. Multilayer feed-forward networks are universal approximators. Neural Networks, 2, 359-366.

[42] Hoydysh, W. Orentlicher, M. and Dabberdt, W., 1987. Air movement and vehicular pollution in urban street canyons. In : Sterrett, F.S., (Eds.), Environmental Sciences Vol.2, The New York Academy of Sciences, New York.

[43] Jakeman, A.J., Bai, J. and Miles, G.H., 1991. Prediction of seasonal extremes of 1-hour average urban CO concentrations. Atmospheric Environment, 25B (2), 219-229.

[44] Kapoor, S.G. and Terry, W.R., 1985. A Comparison of two automatic systems for building reactor time-series models in an air pollution research. In: Anderson, D.D. (Eds.), Time Series Analysis: Theory and Practice, Vol.7, Elsevier Science Publishers, Cincinnati, OH, pp. 200-211.

[45] Karpinnen, A., Kukkonen, J., Kontinen, M., Rantakrans, E., Valkonen, E., Harkonen, J., Koskentalo, T. and Elolahde, T., 1997. Comparison of dispersion model predictions and the results from an urban air quality measurement network. In: Power, H. Tirabssis, T and Brebbia, C.A. (Eds.), Air Pollution- V, Computational Mechanics Inc., Southampton, Boston. Pp.405-411.

[46] Khalil, M.A.K. and Rasmussen, R.A. 1988. Carbon monoxide in an urban environment: application a receptor modl for source apportionment. Journal of Air Pollution Control Association, 38 (7), 901-906.

[47] Kretzschmar, J.G., de Baere, G. and Vandervee, J., 1976. Validation of the emission frequency distribution model in the region of Antwerpen, Belgium. In : Proceedings Seventh International Technical Meetings on Air Pollution Modeling and its Application, Airlie House (Virginia), NATO/CCMS Publication N 51, pp. 235-270.
[48] Kunler, M., Kraft, J., Koch, W. and Windt, H., 1988. Dispersion of car emissions in the vicinity of a highway. In : Grefen, K and Lobel, J. (Eds.), Environmental Meteorolgy, Kulwer Academic Publishers, London.
[49] Lamb, R.G. and Neiburger, M., 1971. An interim version of a generalized urban air pollution model. Atmospheric Environment, 5(4), 239-264.
[50] Ledolter, J. and Tiao, G.C., 1979. Statistical models for ambient air pollution, with spatial reference to the Los Angeles catalyst study (LSCS) data. Environmental Science and Technology, 13(10), 1233-1240.