AIR QUALITY ANALYSIS AND PREDICTION IN TAMILNADU

**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

**Air Pollution:**

Air pollution is defined as the introduction of particulates, biological molecules, or other harmful materials into the Earth's atmosphere, possibly that cause disease, death to humans, damage to food crops, or the natural or built environment. Stratospheric ozone depletion due to air pollution has long been recognized as a threat to human health as well as to the Earth's ecosystems. Indoor air pollution and urban air quality are listed as two of the world’s worst toxic pollution problems.

**Sources:**

There are various activities or factors which are responsible for releasing pollutants into the atmosphere. These sources can be classified into two major categories.

**Anthropogenic (man-made) sources:**

These are mostly due to the burning of multiple types of fuel. Anthropogenic sources include the following

**Stationary sources:**

Include stacks of power plants, manufacturing factories, waste incinerators, furnaces and other types of fuel-burning devices. In less developed countries traditional biomass burning is the major source of air pollutants; Traditional biomass includes wood, crop waste and cow-dung.

**Mobile Sources**

include vehicles, marine vessels, and aircrafts. Fumes from paint, hair spray, varnish, aerosol sprays and other solvents also contribute towards air pollution. Waste deposition in landfills, generate methane during the breakdown of compounds. Methane being highly flammable and forms explosive mixtures with air. Methane is also an asphyxiant and displaces oxygen in an enclosed space

**Military resources:**

such as nuclear weapons and toxic gases are also key sources of air pollution.

**Natural sources:**

Dust from natural sources, mostly large areas of land with few or no vegetation. Radon gas from radioactive decay within the Earth's crust. Radon is a naturally occurring, radioactive noble gas that is formed from the decay of radium. It is considered to be a health 2 hazard. Radon gas from natural sources can accumulate in buildings, especially in confined areas is the one of the most frequent cause of lung cancer. Smoke and carbon monoxide from wildfires Volcanic activity, produces sulfur, chlorine, and ash particulates. A pollutant can be of natural origin or man-made. Pollutants are classified as primary or secondary.

**Primary pollutants** are usually produced from a process, such as ash from a volcanic eruption. Other examples include carbon monoxide gas from motor vehicle exhaust, or the sulfur dioxide released from factories.

**Secondary pollutants** are not emitted directly. Rather, they form in the air when primary pollutants react or interact. Ground level ozone is a prominent example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants. In India the Major source of air pollution include Fuel wood and biomass burning in rural and urban India, Most of India uses Fuel wood and biomass cakes for cooking and general heating needs. Cook stoves using biomass are present in over 100 million Indian households, and are used two to three times a day. Majority of Indians still used traditional fuels such as dried cow dung, agricultural wastes, and firewood as cooking fuel

**Major primary pollutants produced by human activity include:**

**Sulphur oxides (SOx)** - particularly sulfur dioxide, a chemical compound with the formula SO2 is produced by volcanoes and various industrial processes. Coal and petroleum often contain sulfur compounds, and their combustion releases sulfur dioxide. Further oxidation of SO2, usually in the presence of a catalyst such as NO2, forms H2SO4, and leads to the formation of acid rain.

**Nitrogen oxides (NOx)-**Nitrogen oxides, particularly nitrogen dioxide, are expelled from high temperature combustion, and are also produced during thunderstorms by electric discharge. It is a chemical compound with the formula NO2. It is one of the most prominent air pollutants.

**Carbon monoxide (CO)-** CO is also a toxic gas. It is a product by incomplete combustion of fuel such as natural gas, coal or wood. Vehicular exhaust is a major source of carbon monoxide.

**Volatile organic compounds**

VOCs are a well-known outdoor air pollutant. They are categorized as either methane (CH4) or non-methane (NMVOCs). Methane is a greenhouse gas which has contributed to enhance global warming. The aromatic NMVOCs such as benzene, toluene and xylene are suspected carcinogens and may lead to leukemia with prolonged exposure.

1,3-butadiene is another compound often associated with industrial use.

**Particulate Matter Particulates,**

alternatively referred to as particulate matter (PM), atmospheric particulate matter, or fine particles, are particles of solid or liquid suspended in a gas.

**Aerosols**

In contrast, aerosol refers to combined particles and gas. They can occur naturally, from volcanoes, dust storms, forest fires, and sea spray. Human activities, such as the burning of fossil fuels in vehicles, power plants and industrial processes also generate significant amounts of aerosols.

**Chlorofluorocarbons**

(CFCs) - harmful to the ozone layer. These are gases which are released from air conditioners, refrigerators. CFC's on being released into the air rises to stratosphere and react with other gases and damage the ozone layer. This allows harmful ultraviolet rays to reach the earth's surface causing skin cancer and diseases to the eye.

**Secondary pollutants include:**

Particulates created from gaseous primary pollutants are called secondary pollutants. Smog is a kind of secondary air pollution. Smog results from large amounts of coal burning in an area caused by a mixture of smoke and sulfur dioxide. Smog also comes from vehicular and industrial emissions that are acted on in the atmosphere by ultraviolet light from the sun to form secondary pollutants that also combine with the primary emissions to form photochemical smog.

**Ground level ozone**

(O3) is formed from NOx and VOCs. Ozone (O3) is a key constituent of the troposphere. It is also an important constituent of certain regions of the stratosphere commonly known as the Ozone layer.

**Peroxyacetyl nitrate (PAN)** – is also formed from NOx and VOC

**PROGRAM:**

**AQI:** The air quality index is an index for reporting air quality on a daily basis.  In other words, it is a measure of how air pollution affects one’s health within a short time period. The AQI is calculated based on the average concentration of a particular pollutant measured over a standard time interval. Generally, the time interval is 24 hours for most pollutants, and 8 hours for carbon monoxide and ozone.

We can see how air pollution is by looking at the AQI

| **AQI Level** | **AQI Range** |
| --- | --- |
| Good | 0 – 50 |
| Moderate | 51 – 100 |
| Unhealthy | 101 – 150 |
| Unhealthy for Strong People | 151 – 200 |
| Hazardous | 201+ |

**Data Set Description**

It contains 8 attributes, of which 7 are chemical pollution quantities and one is Air Quality Index. PM2.5-AVG, PM10-AVG, NO2-AVG, NH3-AVG, SO2-AG, OZONE-AVG are independent attributes. air\_quality\_index is a dependent attribute. Since air\_quality\_index is calculated based on the 7 attributes. You can download the dataset [**Here.**](https://drive.google.com/drive/folders/1-Bg11k7FAIZ5lg_bb7uovEk56-zQyvu3?usp=drive_link)

As the data is numeric and there are no missing values in the data, so no preprocessing is required. Our goal is to predict the AQI, so this task is either Classification or regression. So as our class label is continuous, **regression**technique is required.

Regression is **supervised learning technique** that fits the data in a given range. Example Regression techniques in Python:

Random Forest Regressor

Ada Boost Regressor

Bagging Regressor

Linear Regression etc.

* CODE

|  |
| --- |
| # importing pandas module for data frame  import pandas as pd    # loading dataset and storing in train variable  train=pd.read\_csv('AQI.csv')    # display top 5 data  train.head() |

**Output:**

