

Air Pollution Trend in Major Cities in India

I. Introduction

As everyone is aware, the amount of air pollution is rising daily. Particularly if I discuss India, which, according to the Global Scenario's World Air Quality Report, is the third-most polluted nation in the world and it is increasing day by day. In this article we are going to see how what are the trends of major Indian cities for Air Pollution. Which city is emitting which harmful element and in what amount. The data which is used for this taken from Kaggle which is from 1998 to 2015.

The dataset which we used consists primarily 5 different types pollutants (NO_2 , SO_2 , rspm, spm, PM 2.5) measured over the years in different states and cities of India. Where SO_2 and NO_2 are harmful gaseous emissions; rspm, spm and pm2_5 come under suspended air pollutants. Let's take a look some basic details of these pollutants:

A. NO_2 :

NO_2 stands for Nitrogen Dioxide and is emitted mostly from combustion from power sources or transport.

B. SO_2 :

SO_2 stands for Sulphur Dioxide and is emitted mostly from coal burning, oil burning, manufacturing of Sulphuric acid.

C. spm:

spm stands for Suspended Particulate Matter and are known to be the deadliest form of air pollution. They are microscopic in nature and are found to be suspended in earth's atmosphere.

D. rspm:

rspm stands for Respirable Suspended Particulate Matter. It is sub form of spm and are responsible for respiratory diseases.

E. PM 2.5:

PM 2.5 is a Suspended Particulate Matter with diameters less than 2.5 micrometres. They tend to remain suspended for longer durations and potentially very harmful.

II. Trends In Air Pollution: -

For finding the trends from the data, we first loaded the dataset, then we pre-processed the dataset so that can visualize it and find the trends from that dataset. The first trend which we found from the data is that there is some independence between SO_2 & NO_2 but no trend can be seen for pm2.5, there is some relation of spm with NO_2 & SO_2 and rspm is independent of SO_2 & NO_2 . This can be clearly analysed with the help of pairplot. If we see the below graph, SO_2 is more emission. If we see the heatmap (Fig 1) of SO_2 , NO_2 , rspm, spm, pm2.5, first highest correlation is between rspm & spm. Second highest correlation is between NO_2 & rspm and from the area plot you can clearly see the highest spm emission for each state (Fig 2).

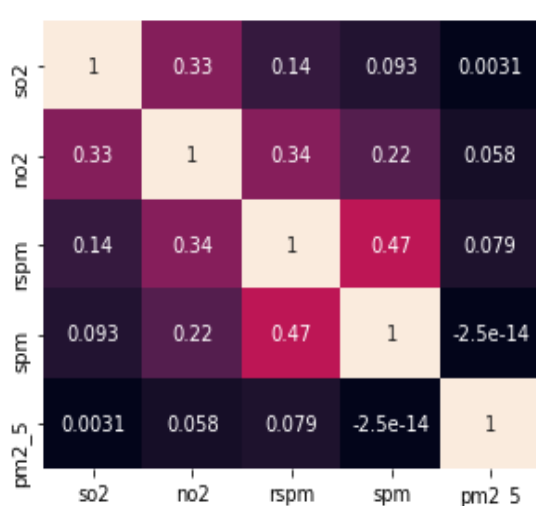


Fig 1:- Heat Map for Correlation

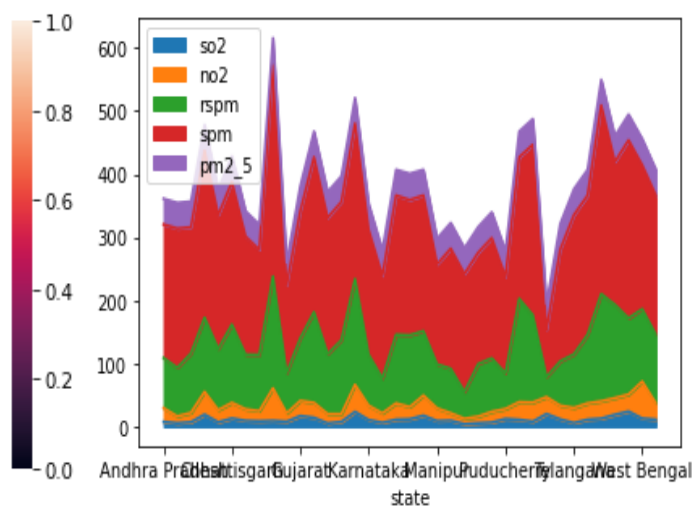


Fig 2:- Area Graph for spm emission

Top 5 states in descending order for NO_2 emission are West Bengal, Delhi, Jharkhand, Bihar, Maharashtra, for SO_2 emission are Uttaranchal, Jharkhand, Sikkim, Bihar, Uttarakhand, for rspm emission are Delhi, UP, Jharkhand, Punjab, Uttarakhand, spm emission are Delhi, UP, Uttaranchal, Rajasthan, Bihar, for pm2.5 emission are Delhi, MP, West Bengal, Telangana, Odisha. Top 5 locations in descending order for NO_2 emission are Howrah, Badlapur, Dombivli, Kolkata, Ulhasnagar, for SO_2 emission are Byrnihat, Gajroula, Jamshedpur, Nanded, Dharuhera, for rspm emission are West

Singhbhum, Ghaziabad, Allahabad, Bareilly, Ludhiana, for spm emission are Meerut, Gaziabad, Dehradun, Noida, Dh aruhera, pm2.5 emission are Bhopal, Barrackpore, Gwalior, Keonjihar, Durgapur.

Till now we saw the top 10 emitting states and locations pollutant wise. Now we have to see which pollutant is emitted by which area. You can clearly see from Fig 3, that highest emission of SO₂, NO₂ and spm is by Industrial and highest emission of rspm is by Industrial Areas.

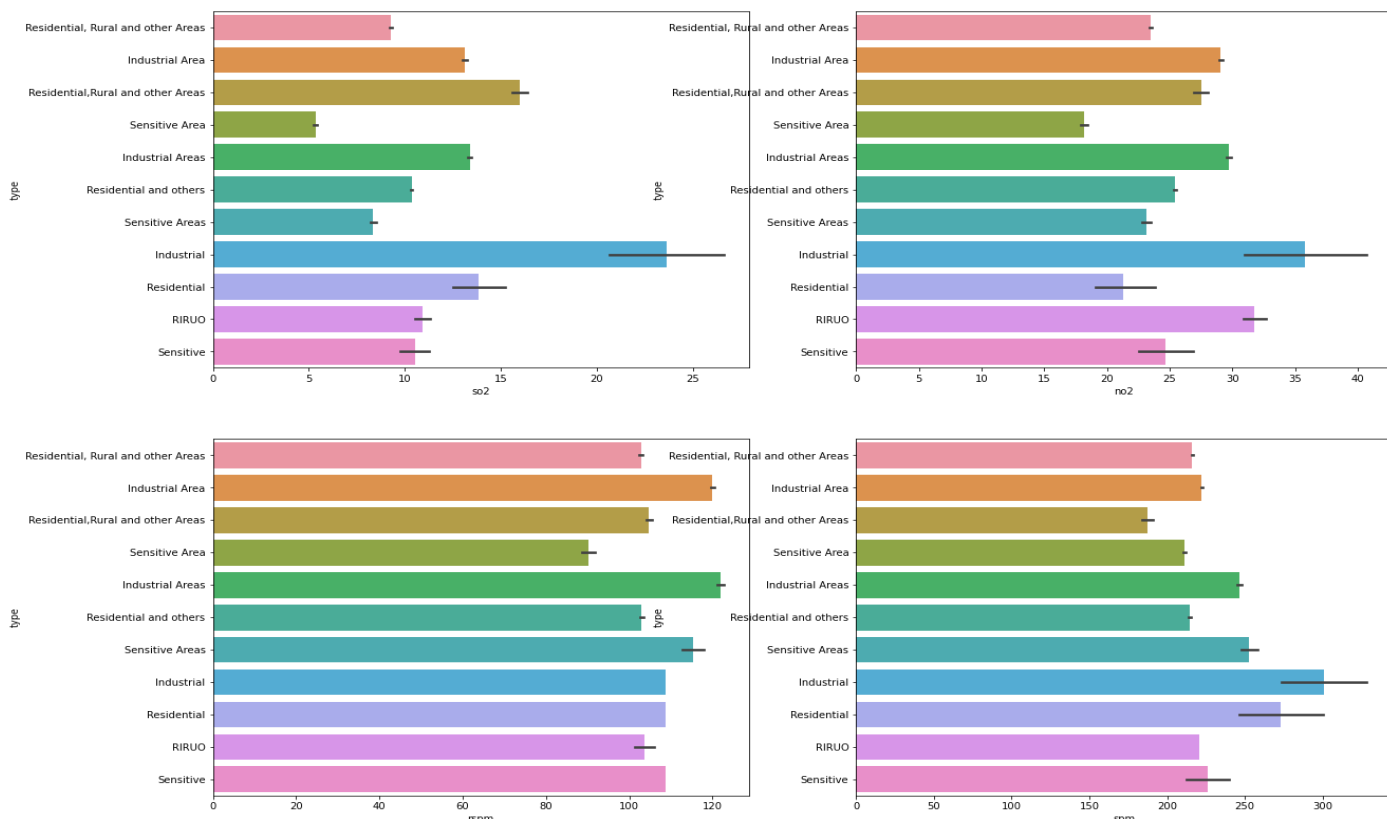


Fig 3: Bar plot representing Highest Emission of pollutant by which Area

If we see the emission trend as per the dates from 01-01-1998 to 26-10-2015, emission of spm is reduced as compared to other pollutants. This can be clearly seen from the Fig 4 and if we see the emission from Yearly - Monthly - Weekly - Daily basis higher number of outliers are there for spm this thing can be clearly seen from Fig 5.

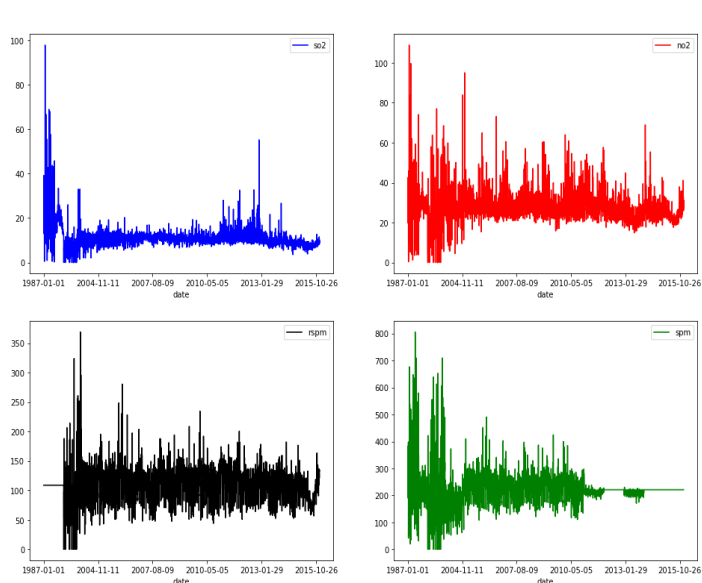


Fig 4: Emission level of pollutants by Date

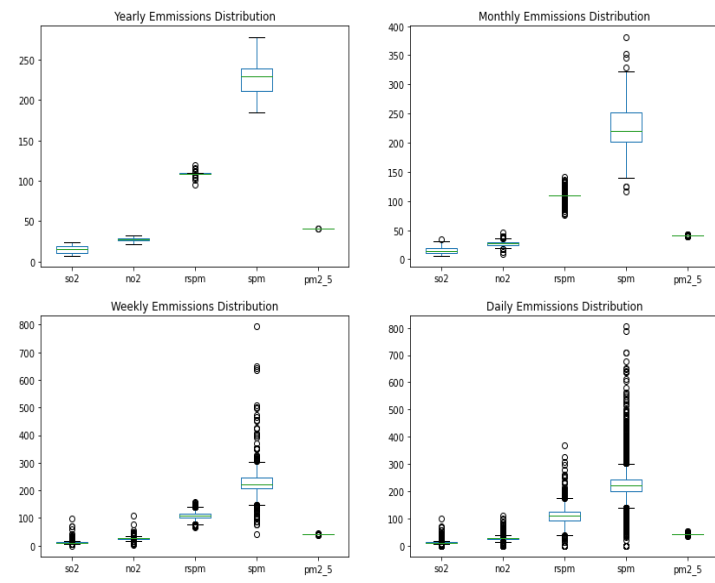


Fig 5: Emission of pollutants Yearly, Monthly, Weekly, Daily

