# Air Quality Prediction Analysis of Kathmandu City: Impact of Environmental Factors in the Suspended Particulate Matters

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#### Problem: Air Pollution in Kathmandu City

Kathmandu, the capital city of Nepal is one of the fastest growing cities in south Asia which is situated within a valley and many mountain ranges around. Due to rapid growth in construction related activities, vehicles and industries, air pollution has been a quite prominent problem in this city. In 2019, Kathmandu was ranked as seventh most polluted capital city of the world in terms of Air quality index (AQI), according to research by IQ Air Visual, a Swiss-based group that gathers air-quality data globally. As of 4th January 2021, Kathmandu recorded highest AQI index of 450 The key factors of air pollution in Kathmandu might be emissions from old and outdated vehicles relying diesel fuels, open burn fires of organic garbage, dust and finely ground particles from construction sites compounded by its geographical location, lacking the elevation and wind to allow these pollutants to disperse properly, instead accumulating and rising to dangerous levels.

#### Major Pollutants

Major source of pollutant came from burning and combustion, in the form of fine particulate matter (PM) of black carbon. Particulate matter PMx are categorized based on its diameter x. The most considerable PMx are PM2.5 and PM10. PM2.5 indicates fine particles with the diameter less than or equal to 2.5 micrometer while PM10 refers to coarse dust particle having diameter 2.5 to 10 micrometer. In 2019 Kathmandu recorded PM2.5 reading of 48 μg/m³ as a yearly average, placing it into the ‘unhealthy for sensitive groups’ bracket, that requires a PM2.5 reading of anywhere between 35.5 to 55.4 μg/m³. Other pollutants arising from vehicles would include carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3) and sulfur dioxide (SO2).

#### Effect of Environmental Factors in PM10 Level

The weather factors play an important role in the transport, diffusion and distributions of air pollution. The entering of pollutants from the ground surface, their residence in the atmosphere, and the formation of secondary pollutants only depends not on the only rate of emission of the reactants into the air from the source, but might also on wind speed, direction of wind, weather temperature, relative humidity. Thus, it is often important to understand their behavior leading to an observed concentration of pollutants at a given point.

Following piece of work in intended to perform statistical analysis on Suspended Paticulate Matters and different environmental factors in kathmandu city and to develop an insight by observing their separate relationships with each other. This exercise has been organized as: A) Data Pre-Processing and B) Statistical Analysis

### Observations and Insights

From the covariance matrix plot above based on Spearman's correlation ranking, we see that the different environmental pollutant correlates with weather variables. PM10 shows positive moderate correlation with each of wind speed and temperature while it inversely correlates with relative humidity. it means PM10 level might rises with rise in wind speed and wind turbulence level and vice versa while it's concentration might fall with rise in relative humidity level and vice versa.

The PM2.5 doesn't show any significant correlation with any of the weather variables. On the other hand, TSP level shows an interesting correlation with all other variables with different degree of correlation coefficients.It shows positive moderate correlation with wind direction, wind speed and temperature while it is observed that relative humidity inversly correlates with TSP with moderate value of correlation coefficient.

The correlation of TSP with PM10 and PM2.5 is quite strong but that with PM2.5 is moderate. it can also be observed that PM10 moderately correlates with PM2.5.

From above analysis it is observed that TSP - A Particulate matter which indicates the sum of all solid and liquid particles suspended in air that contributes to air polution, significantly correlates with weather variables - Temperature, Wind speed, Wind Direction, Relative Humidity and Pollutant variables - PM10 and PM2.5. So the level of TSP(Output Variable) can be Predicted using the model that Implement Linear Regression utlizing other variables as input variables. Prediction of PM10 can also be modeled in the same fashion.

But the case of PM2.5 is different. Although it shows moderate correlation with PM10 and TSP, its functional relationship with weather variables is not trival. So, it might require some complex approaches to predict the influence of weather variables on PM2.5 levels in the air.