



# Network Analysis of Particulate Matter (PM<sub>2.5</sub>) Transportation in India

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# Introduction

Air pollution refers to the excessive release of pollutants into the atmosphere

It plays an important role in a wide range of environmental and health problems and has been one of the major problems to deal with for any nation

Air pollution fluctuations have been found to strongly depend on the changing weather dynamics

The impact of weather on the daily fluctuations of air pollution is still not clear

Effects of changing weather cause air pollution at a particular region a few days or even a week later

# Goal

The aim of this project is to create a novel multilayer and multivariable network to detect the influence of weather dynamics on the temporal variability of surface air pollution

To apply network analysis to study datasets containing PM<sub>2.5</sub> emissions from different sectors

PM<sub>2.5</sub> has significant spatial and temporal characteristics with concentrations generally being higher in the northern parts than in the southern parts of India

Meteorological conditions largely contribute to the high concentrations of PM<sub>2.5</sub> with more frequent occurrences of stagnant weather, less rainfall, and low temperature are not good for pollution dispersion.

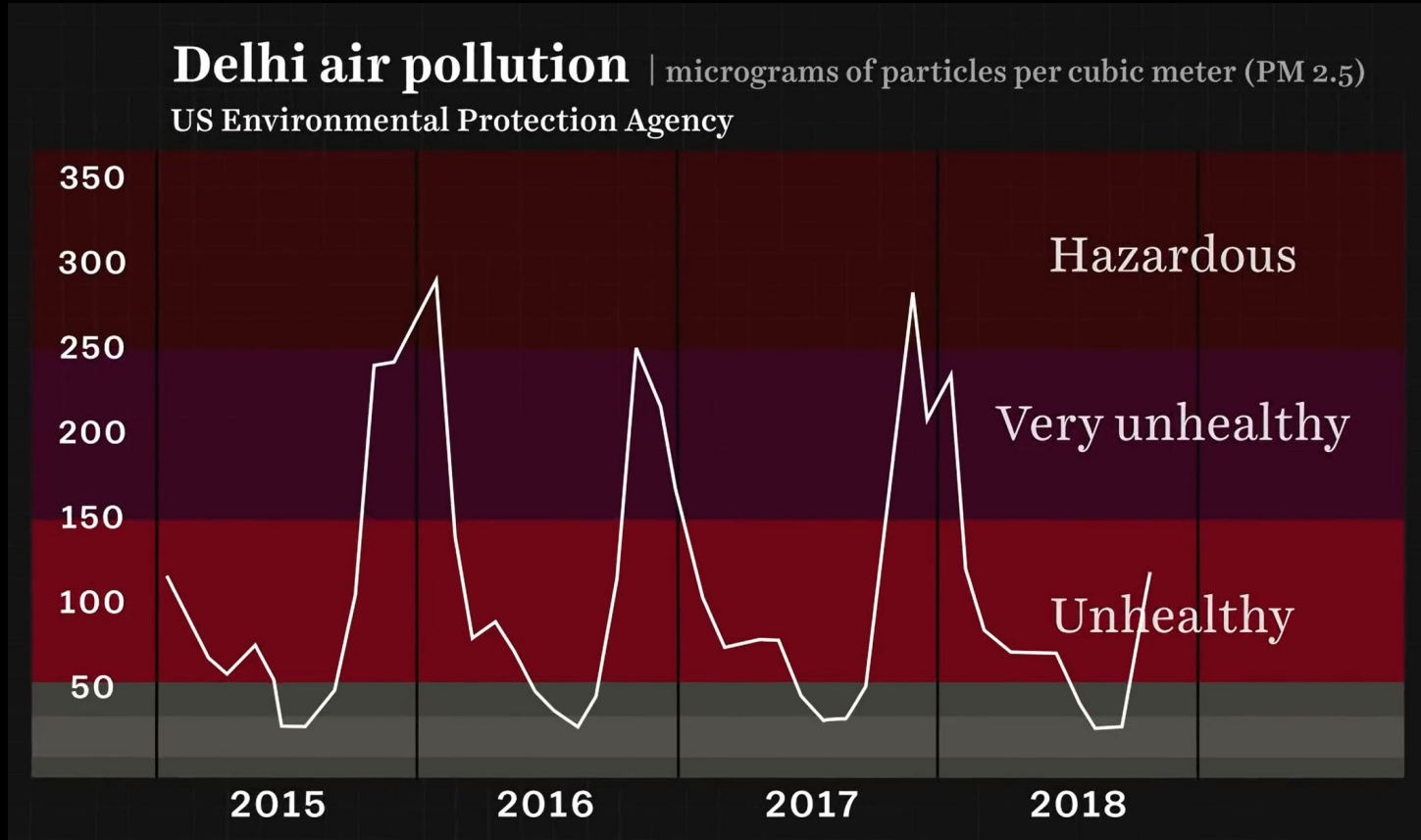
# Motivation

Air pollution has emerged as a major challenge in Delhi, India

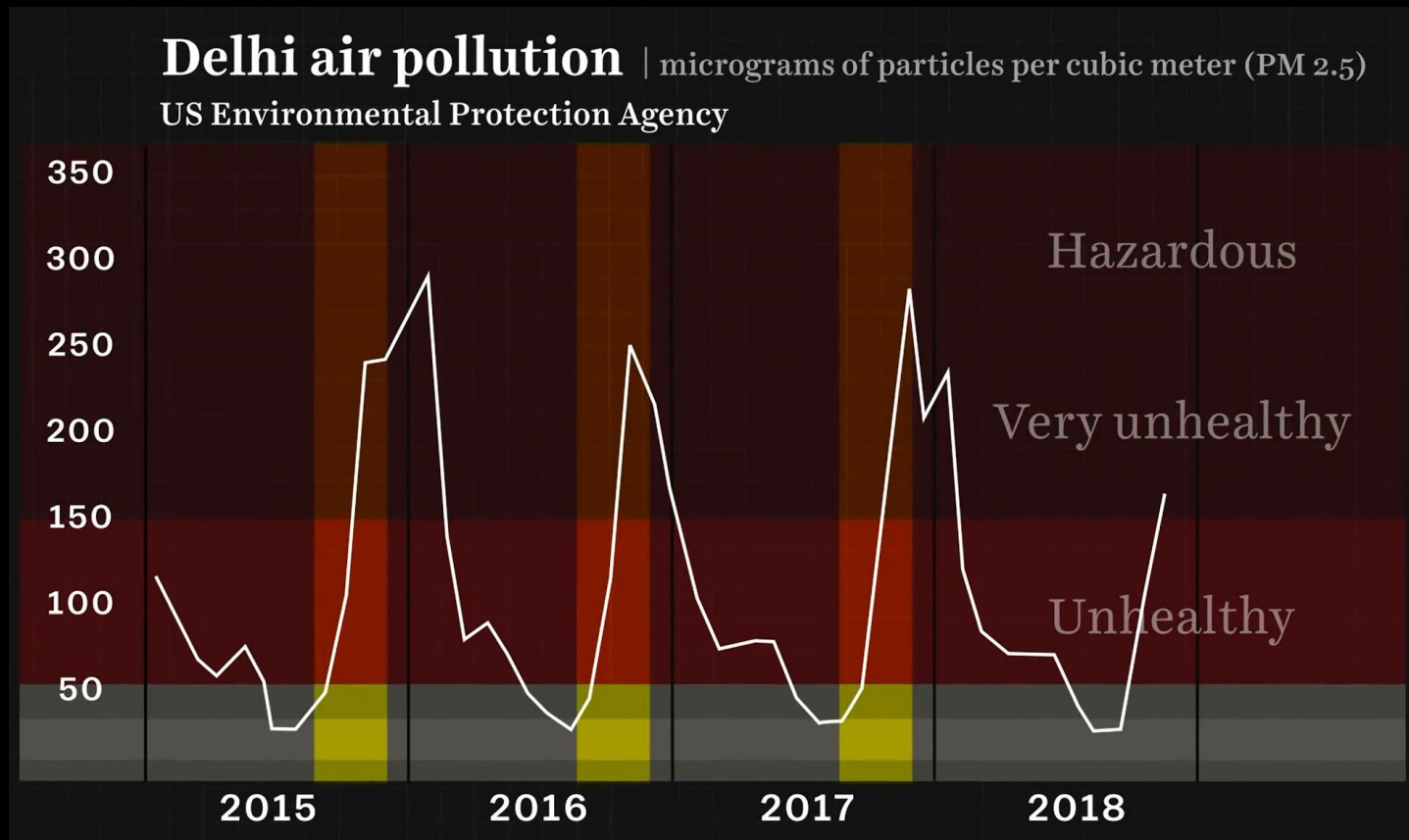
1 person dies every 2 minutes due to air pollution in India

1.2 Million deaths due to air pollution in India in 2017

# Air pollution in Delhi, India



# Air pollution in Delhi, India



# Causes of air pollution in Delhi, India





# Weather dynamics as an influencing factor





# Weather dynamics as an influencing factor



# Overview of Dataset

Air pollution data from Central Pollution Control Board, Government of India

Data from 1990 - 2015

34 States and 296 Districts across India

Nodes recording SO<sub>2</sub>, NO<sub>2</sub>, RSPM, SPM, PM<sub>2.5</sub>

# Dataset - Explorative Analysis

Please refer Python Notebook

<https://colab.research.google.com/drive/19w9ck1Ad48Sqwo0yri3tiRJarsby3Eor>

# Methods - Deterministic and Statistical Approaches

Deterministic methods mainly focus on the formation mechanism of PM<sub>2.5</sub> based on meteorological-chemistry

Statistical approaches aim to detect certain correlated patterns between air quality data and various selected predictors, thereby predicting the pollutant concentrations in future

# Network Models

Network analysis is an important and global method to study relationships between objects that can be organized into a graph

Objects are presented as nodes and relationships between two nodes are presented as edges

Network analysis groups nodes into clusters whose members have certain common characteristics

There are more connections between the nodes within a cluster than between the nodes in different clusters



# References

<https://www.nature.com/articles/srep33227>

<https://www.nature.com/articles/s41598-017-13614-7#Fig6>

<https://science.sciencemag.org/content/353/6295/163>

<https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2019GL084649>

# Thank you

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Join the fight to make the air that we breathe better!

**Q and A**

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