



Forecasting Air Pollution in Beijing for United Nations Environment Programme

Presented by: Juana Tavera

About Me



Juana Tavera

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Education: Georgia State University, Bachelor of Science in Computer Science, concentration in Databases & Knowledge-Based Systems

Background: Software Engineering and Web Development

Agenda

1. Organizational Objective
2. Main Findings
3. Data Analysis
4. Model Analysis
5. Recommendations
6. Future Insights



Organizational Objective

- Air pollutant PM₁₀ is associated with wheezing, heart attacks, and even premature death
- Keep exposure levels of PM₁₀ below 54 $\mu\text{g}/\text{m}^3$
- Beijing districts average above 100 $\mu\text{g}/\text{m}^3$



Main Findings

1. Best Forecasting: Models Including Seasonality
2. NO₂ has a Positive Linear Relationship with PM₁₀
3. Air Pollution is Decreasing



Data Analysis

1. Data Overview
2. Population and Districts
3. Weekly Average Air Quality No Obvious Patterns
4. Trends and Seasonality



Data Overview

DATA

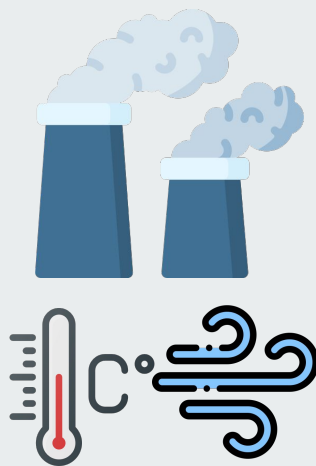


Beijing Municipal
Environmental
Monitoring
Center

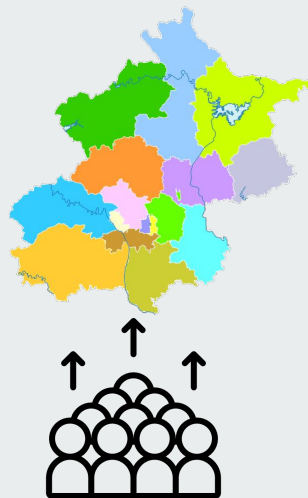
TIME RANGE

MARCH 3rd,
2013
-
MARCH 5th,
2017

FEATURES



LIMITATIONS

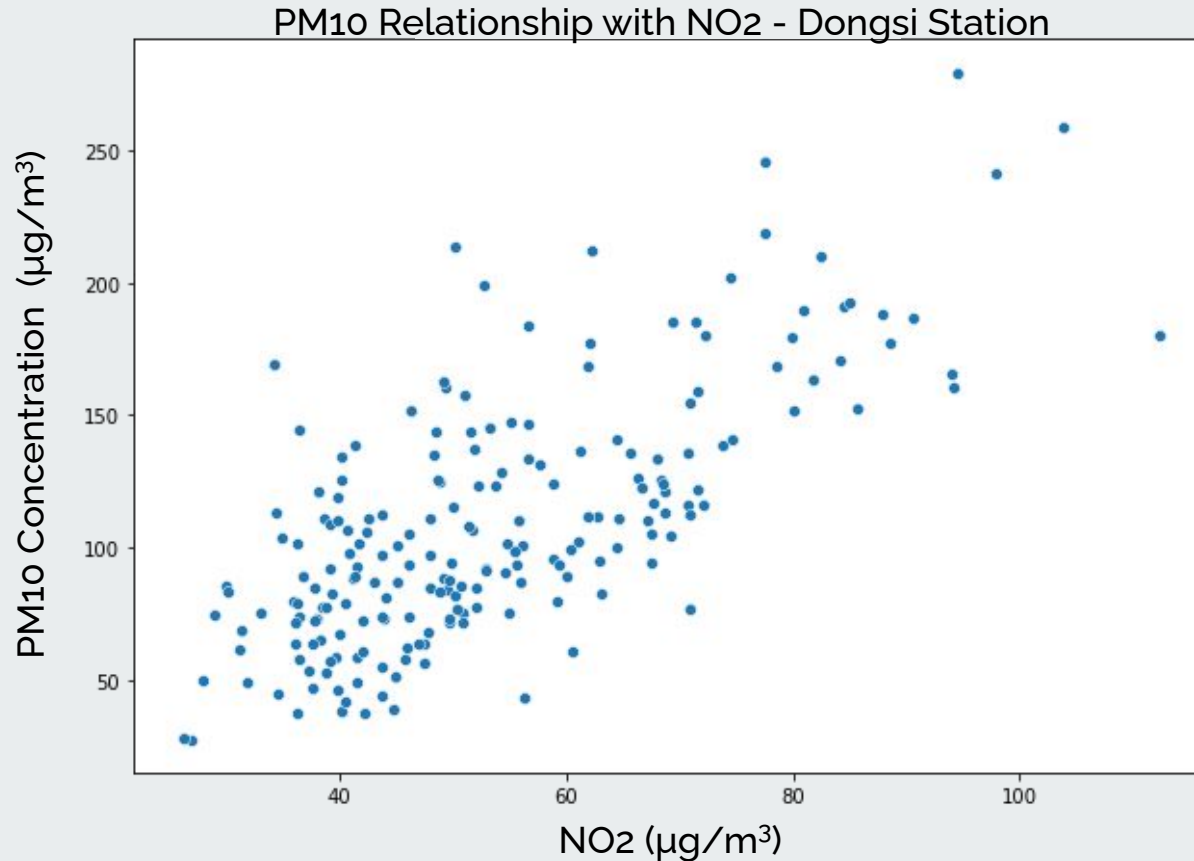


Population and Districts of Stations

Station Name	Median of PM10 ($\mu\text{g}/\text{m}^3$)	Population (2016)	District
Dongsi	101.5	878,000	Dongsheng
Wanliu	102.9	3.593 million	Haidian

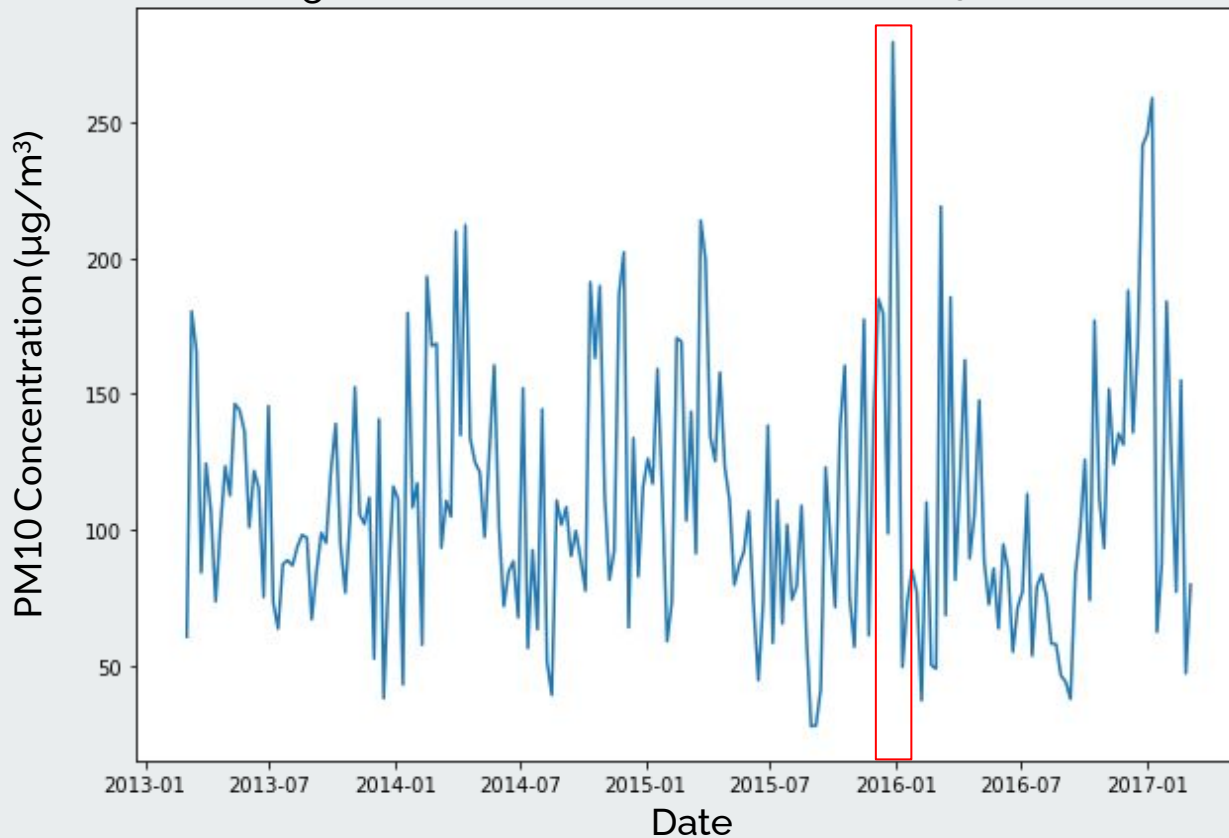


As NO₂ Increases PM₁₀ Increases for the Stations



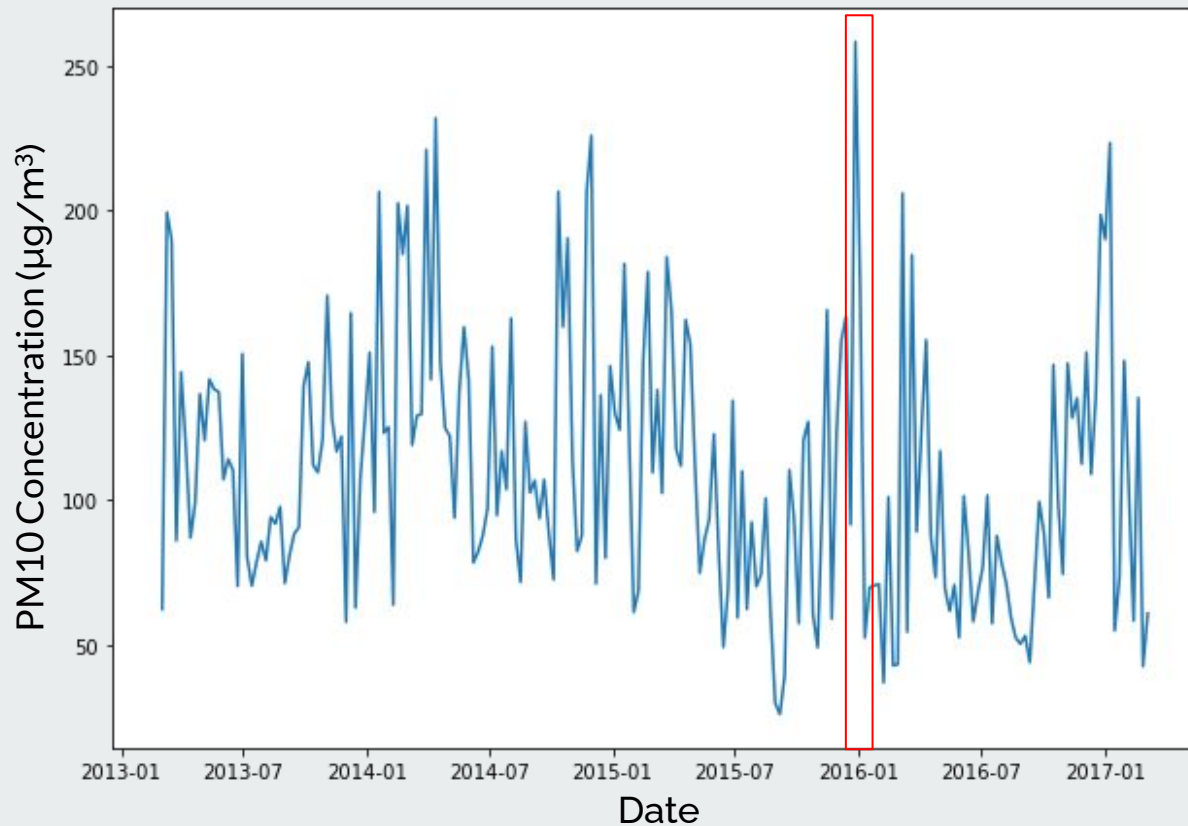
Weekly Average Air Quality - No Obvious Patterns

Dongsi Station - PM₁₀ Concentration (2013 - 2017)



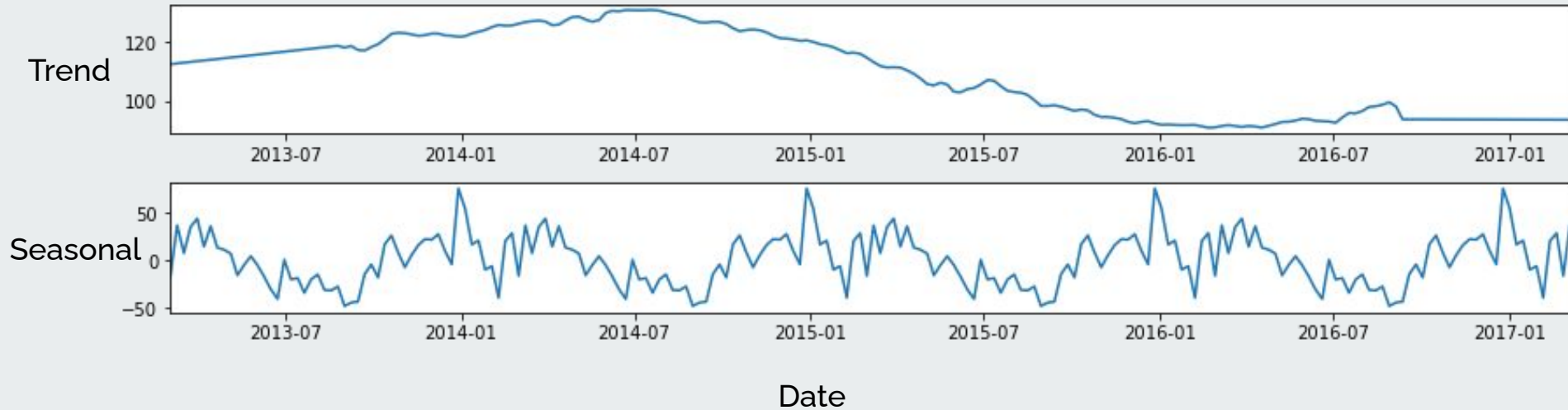
Weekly Average Air Quality - No Obvious Patterns

Wanliu Station - PM10 Concentration (2013 - 2017)



Decreasing Trend Over the Years & Maximum Value of PM10 at the Start of the Year

Wanliu Station PM10 Concentration (2013 - 2017)



Model Analysis

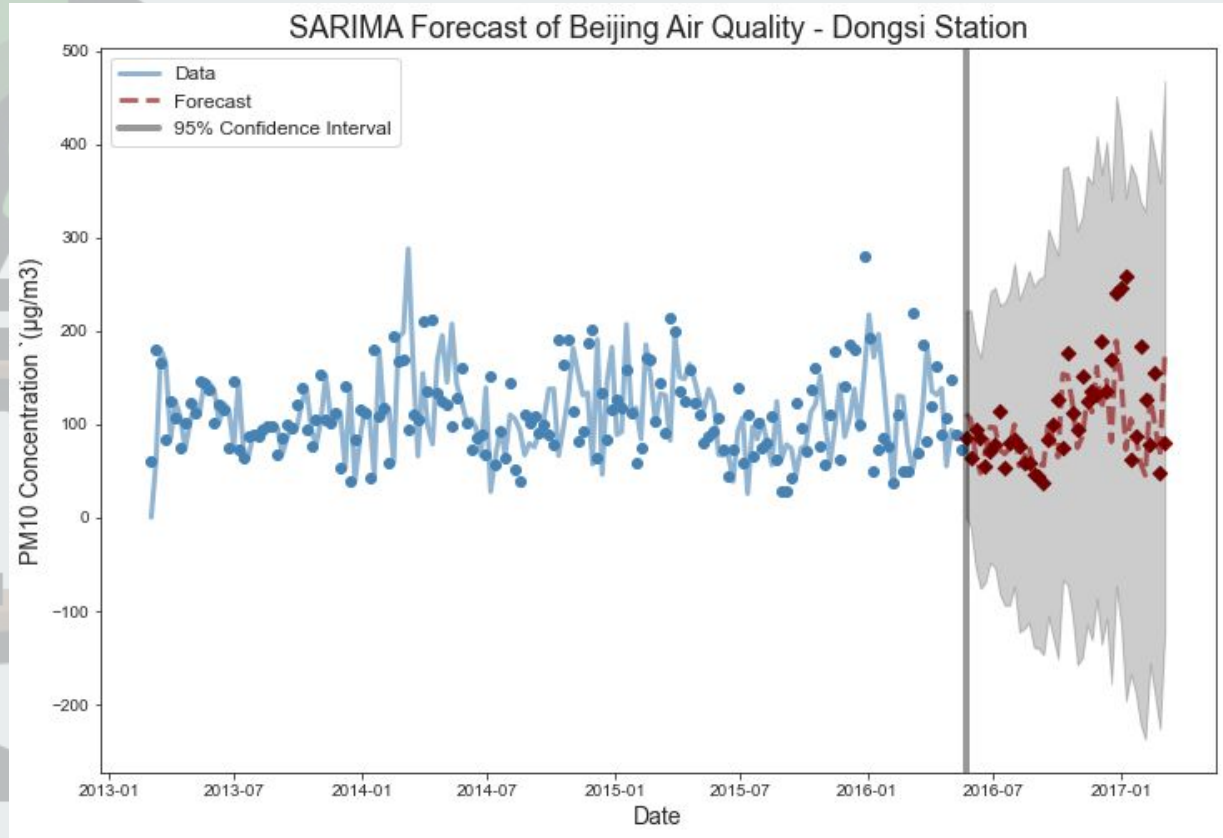
1. Dongsi Station
2. Wanliu Station



Dongsi Station Predictions (May 2016 - March 2017)

RMSE:

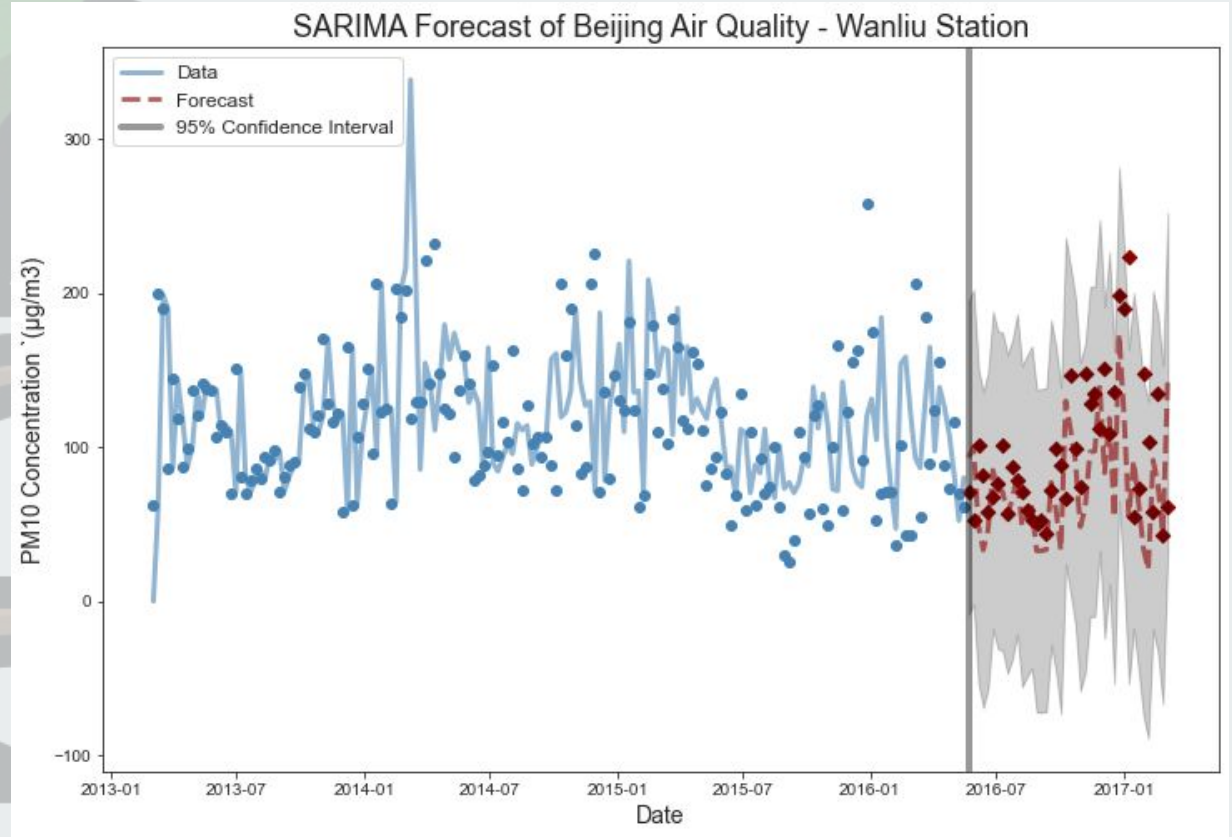
- 54.7
 $\mu\text{g}/\text{m}^3$



Wanliu Station Predictions (May 2016 - March 2017)

RMSE:

- **51.2**
 $\mu\text{g}/\text{m}^3$



Final Thoughts

1. Recommendations
2. Future Steps
3. Questions



Recommendations

1. SARIMA model type provides the best forecasting
2. Implement a similar program to the Toxics Release Inventory (TRI)
3. Team up with tech giants to plan for carbon neutrality



Future Steps



Analyze current air
pollution trends



Include health data
of each district



Monitoring equipment
data of each station

Thank You



Juana Tavera

Platforms:

- GitHub: [tvrjuana](#)
- LinkedIn: [juanatavera](#)
- Medium: [tvrjuana](#)



Questions?

(Please submit in Q&A chat below)



Appendix

- Population data: <https://www.ceicdata.com/en/china/population-municipality-district>
- Tech companies: <https://www.unep.org/news-and-stories/story/new-pact-tech-companies-take-climate-change#:~:text=The%20tech%20sector%20is%20responsible,of%20global%20greenhouse%20gas%20emissions.>
- PM10 health effects <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>
- Icons: <https://www.flaticon.com/>
- Toxics Release Inventory (TRI): <https://www.epa.gov/toxics-release-inventory-tri-program>
- Walking in heavy smog photo: <https://time.com/4167351/beijing-air-quality-pollution/>
- Air pollution photo: <https://www.nrdc.org/stories/air-pollution-everything-you-need-know>
- Child with asthma photo: <https://www.istockphoto.com/photo/asian-little-cute-girl-6-years-old-using-asthma-inhaler-on-white-background-gm1217268456-355255863>
- Monitoring equipment photo: <https://aqicn.org/products/monitoring-stations/>

Disclaimer

For the purpose of this project, my chosen stakeholder was the United Nations Environment Programme. I am **NOT** affiliated with UNEP **nor** did they ask this of me.