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Week 3

# Air Quality in Bogotá Colombia

# W3 Lesson 1

## Designing and Implementing Your Air Quality Project



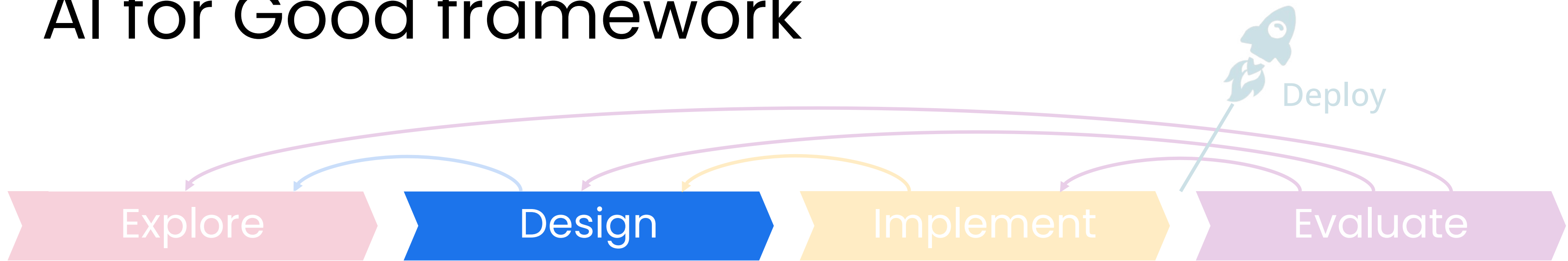
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# AI and Public Health

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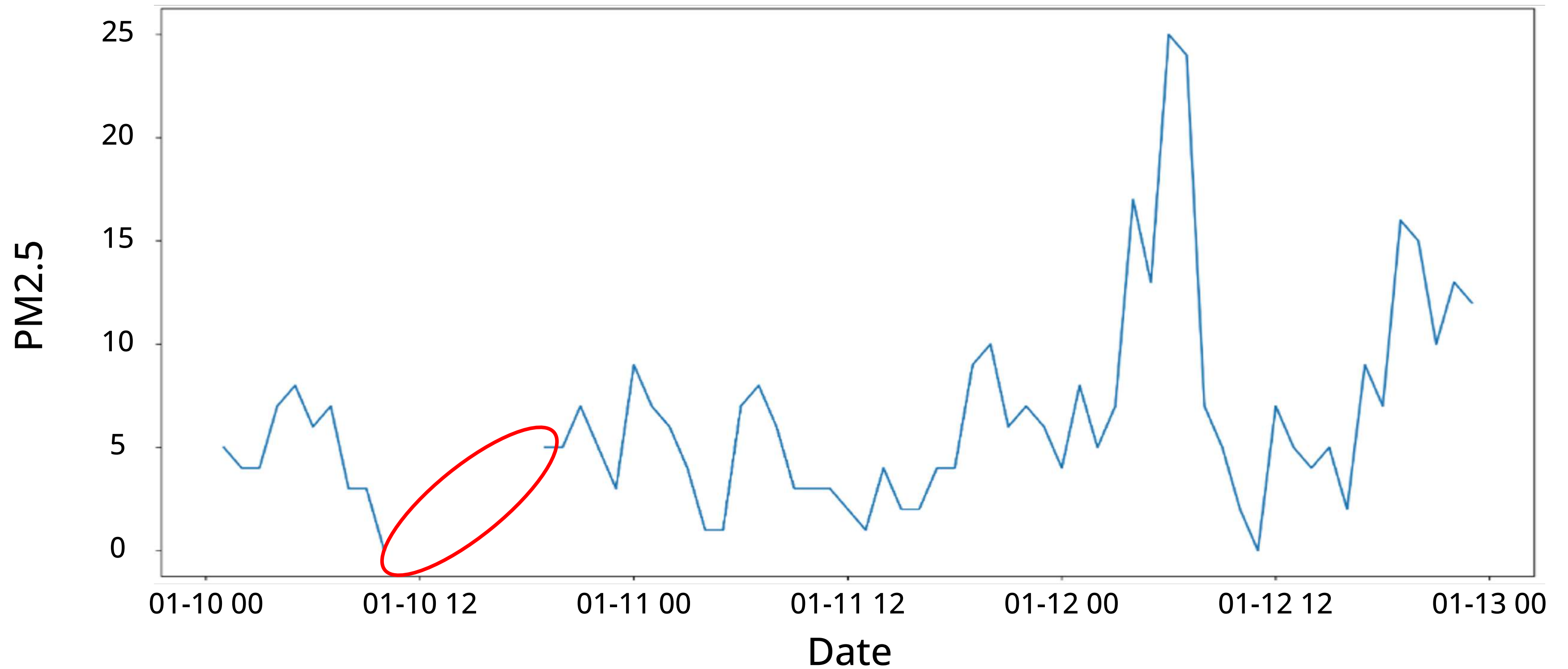
## **Air Quality Design and Implement Phases**

# AI for Good framework



1. Prototype your solution
2. Ensure data privacy
3. Design the user experience

# Temporal change of PM2.5

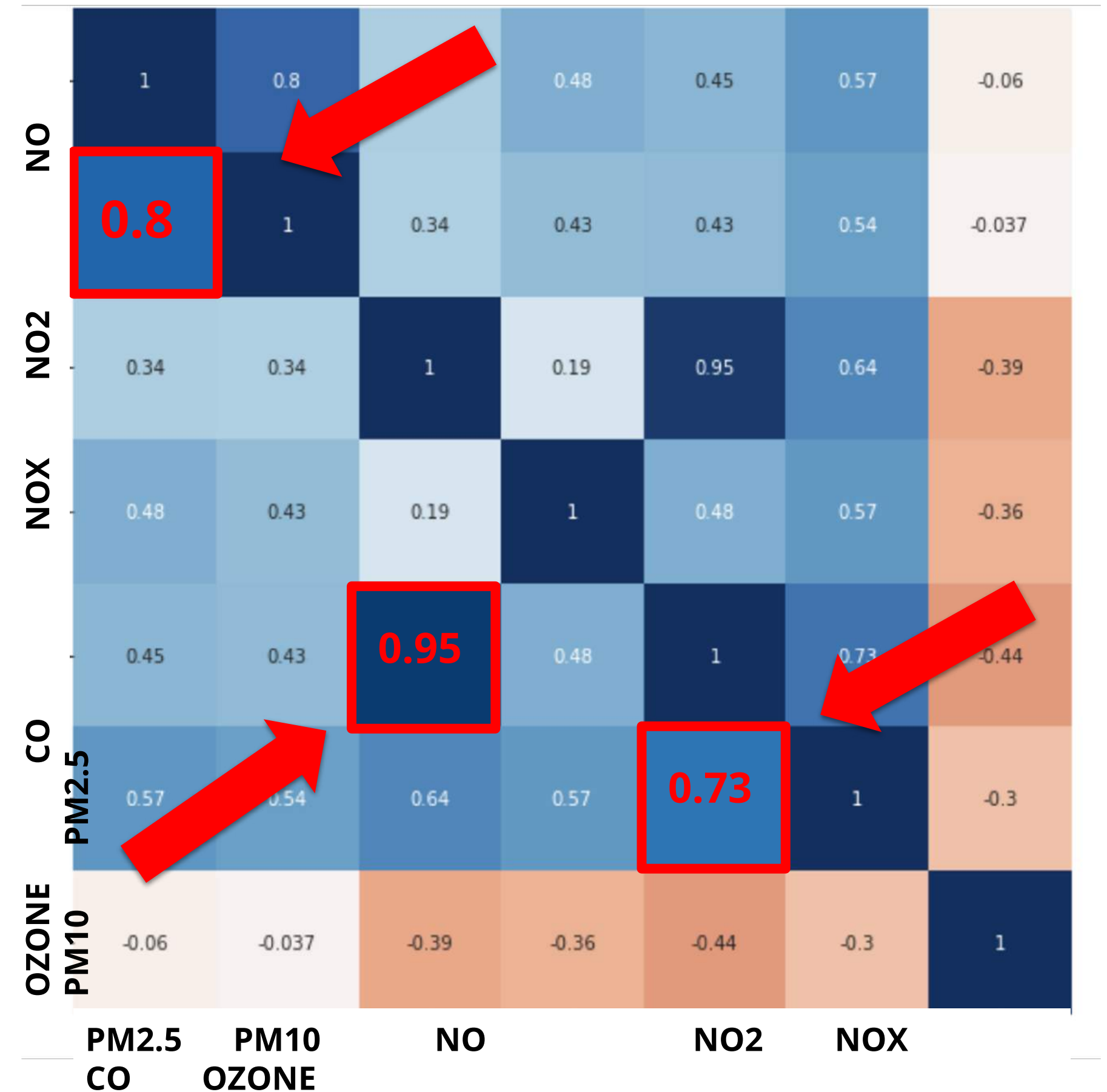


# Pollutant correlation

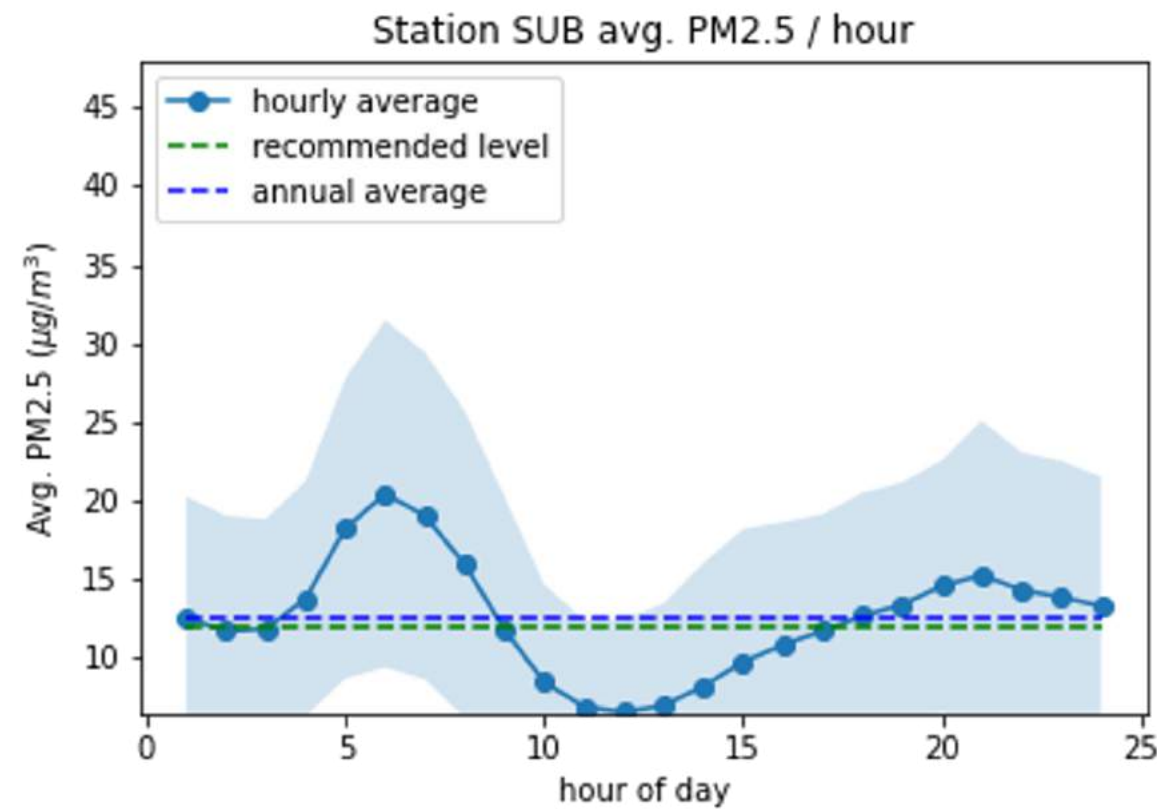
**NOX & NO: 0.95**

**PM10 & PM2.6: 0.8**

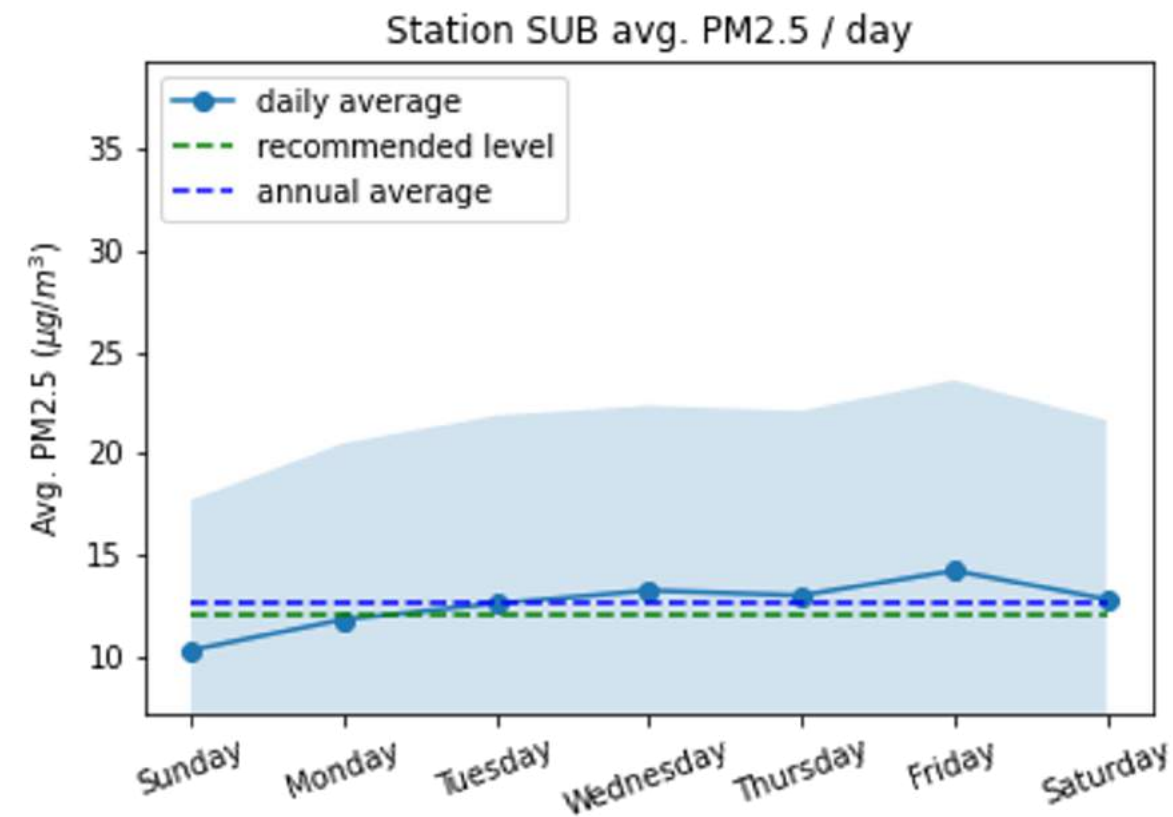
**CO & NOX: 0.73**



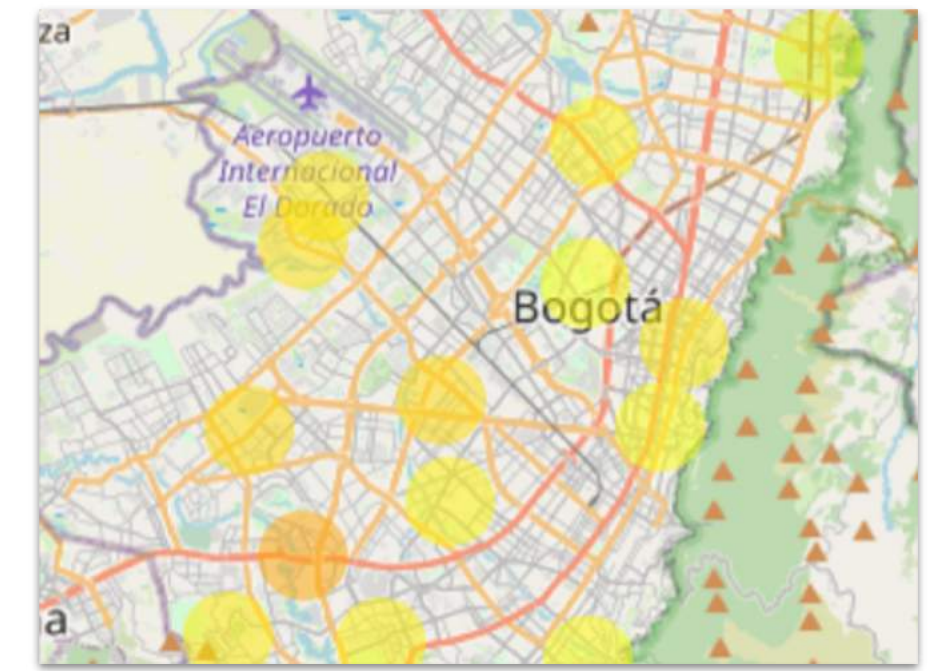
# Some factors that affect pollution levels



**Hour of day**



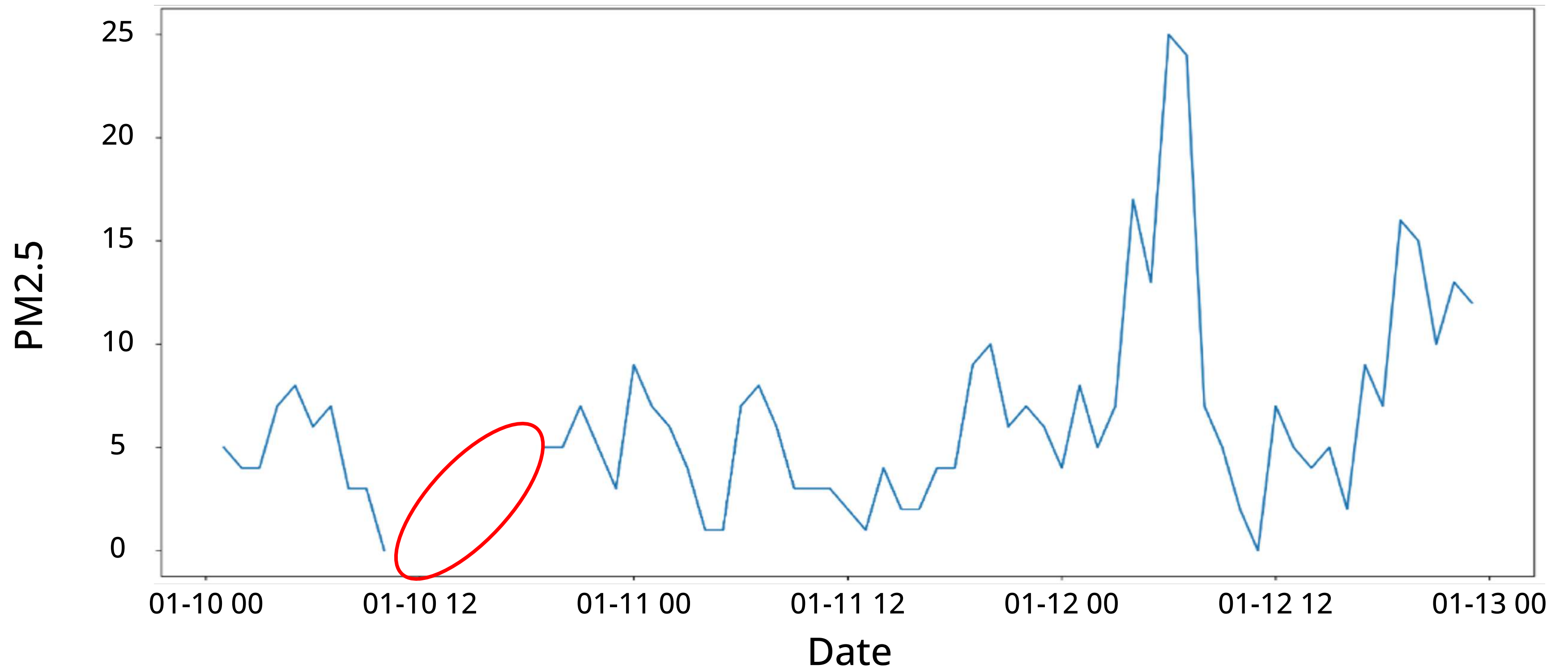
**Day of week**



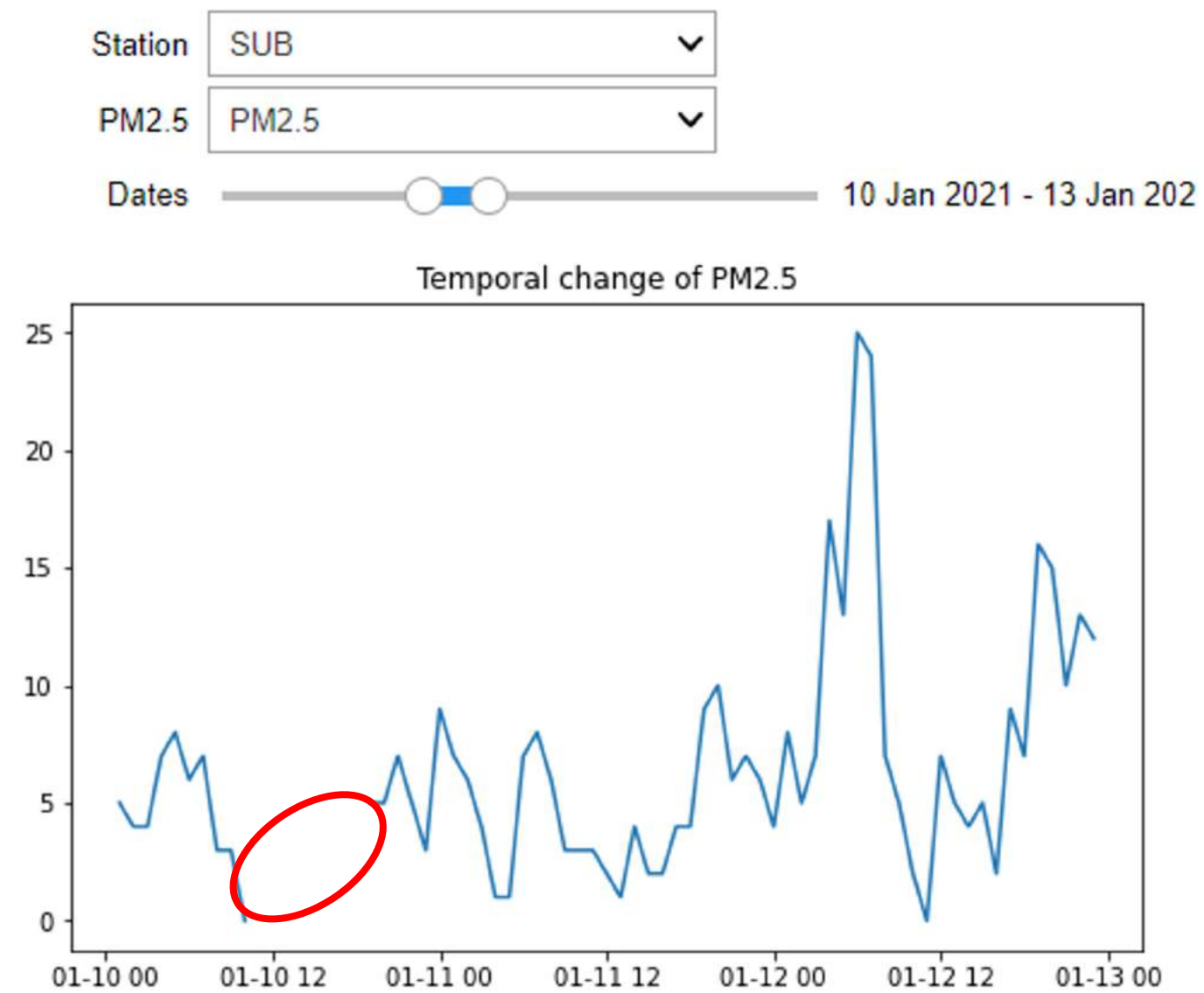
**Location**



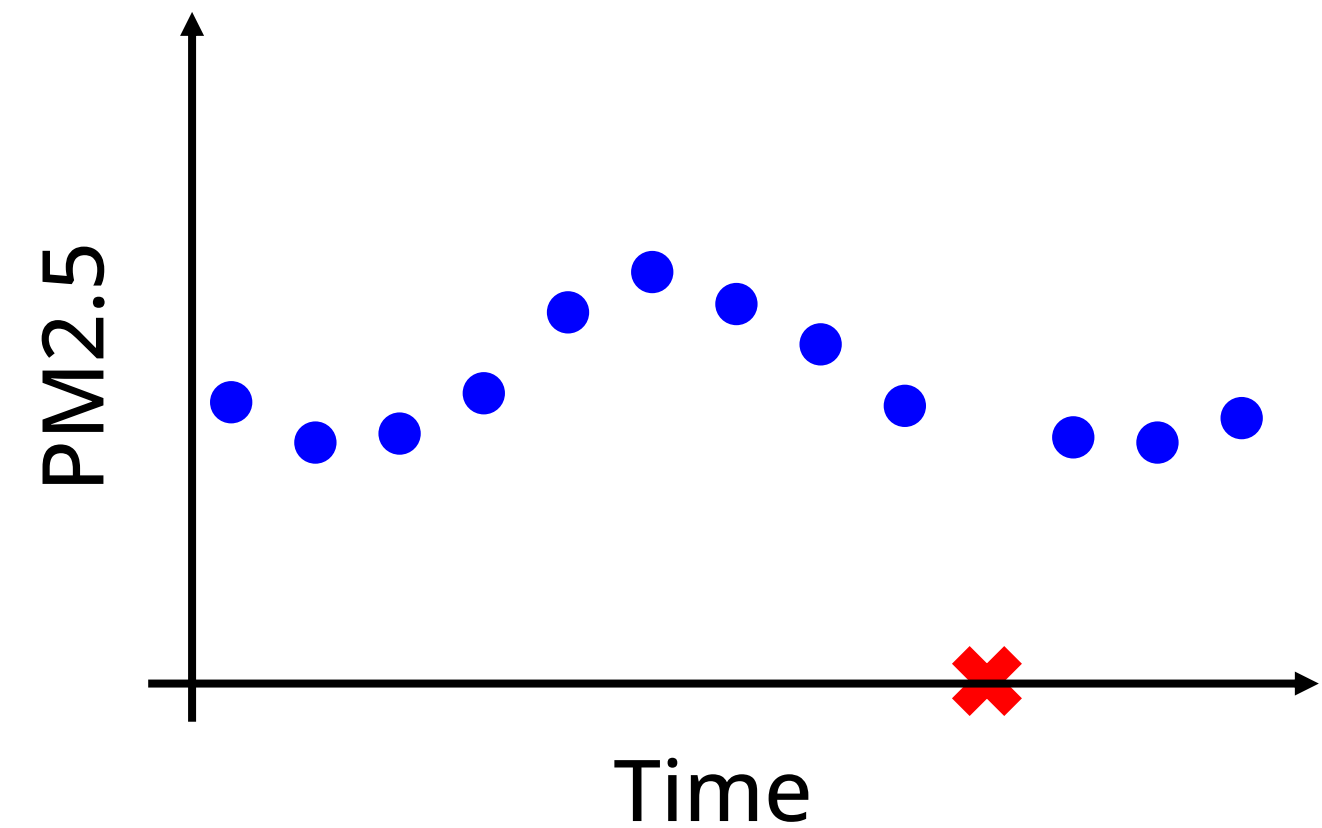
# Temporal change



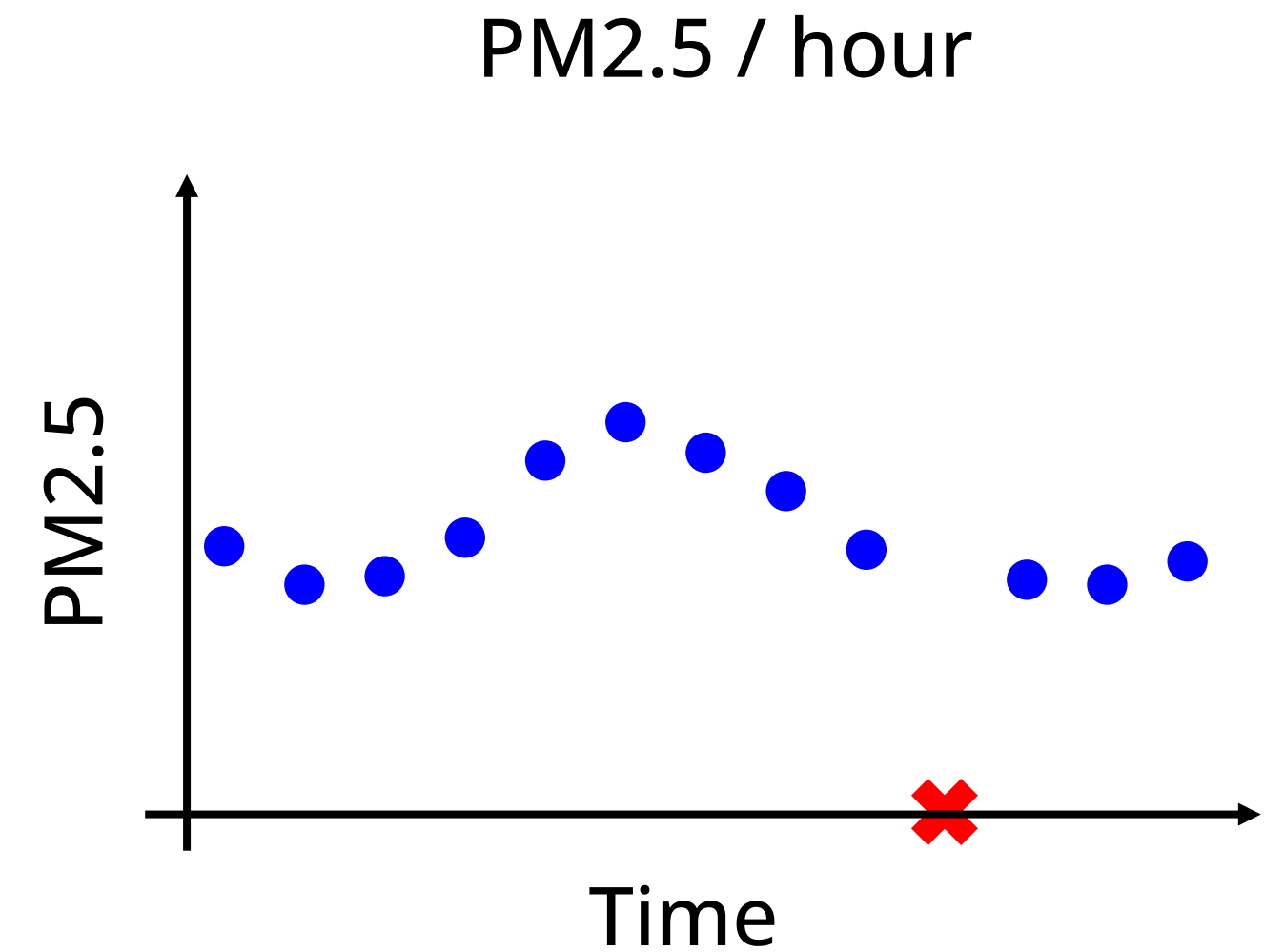
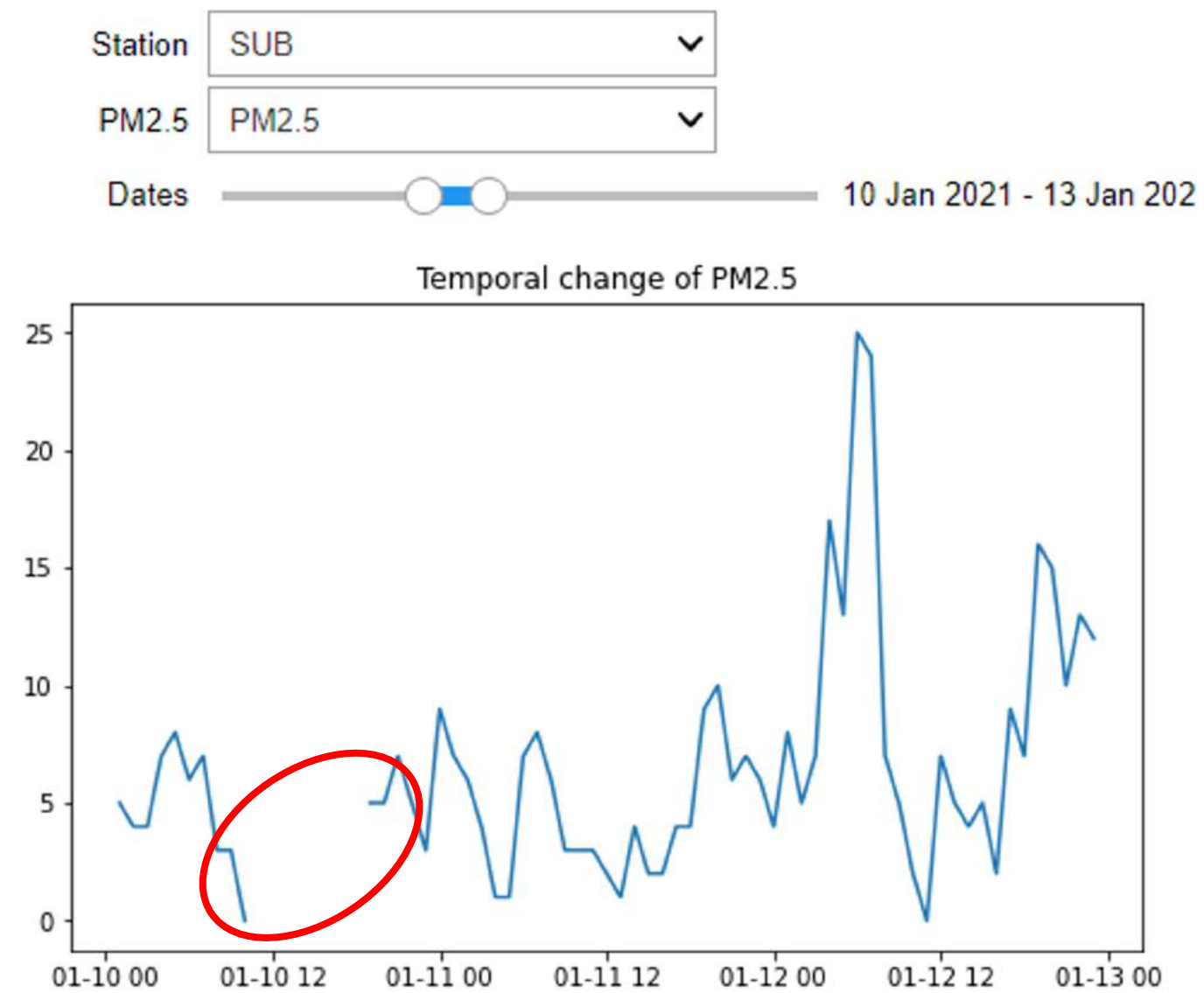
# Baseline model



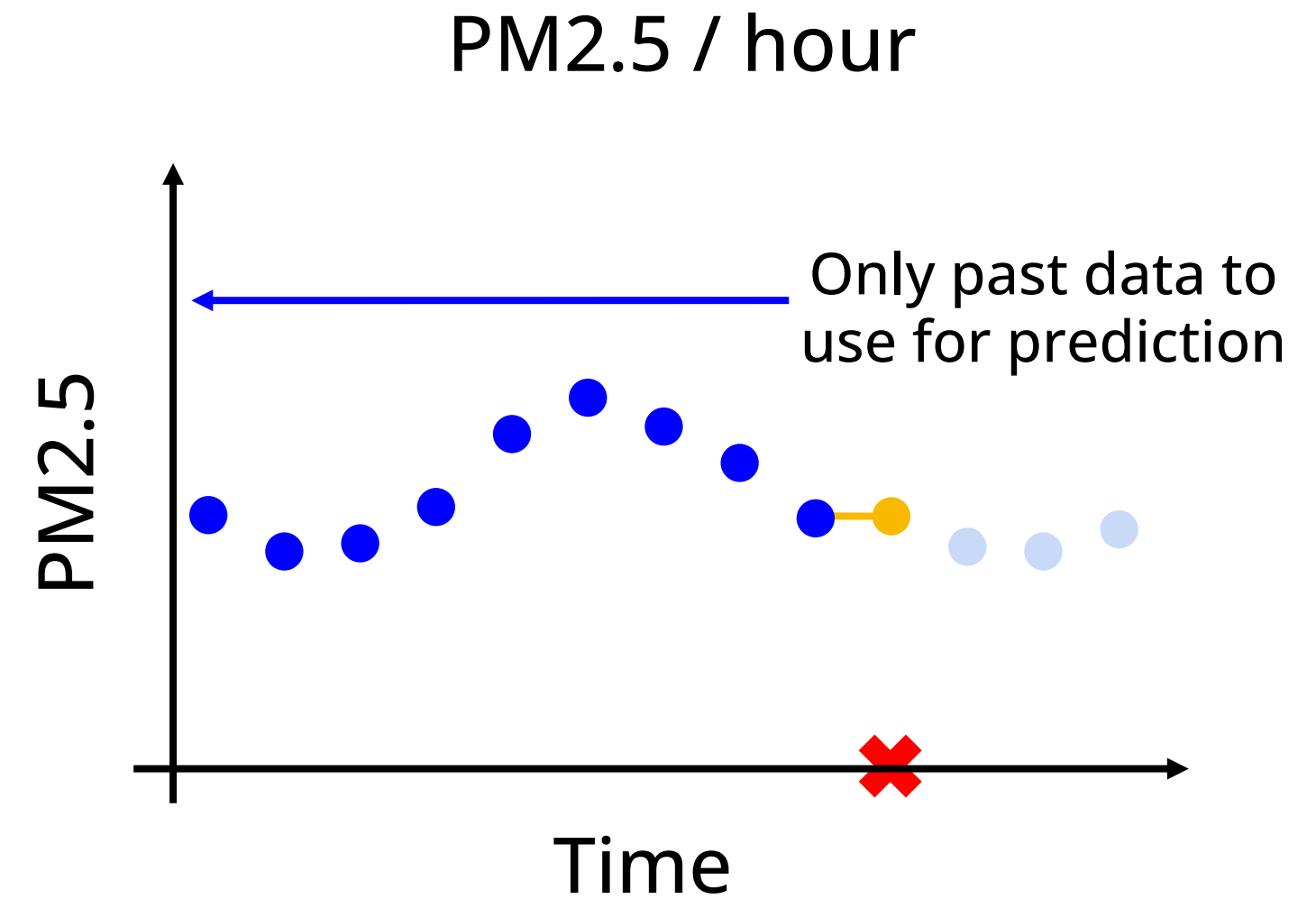
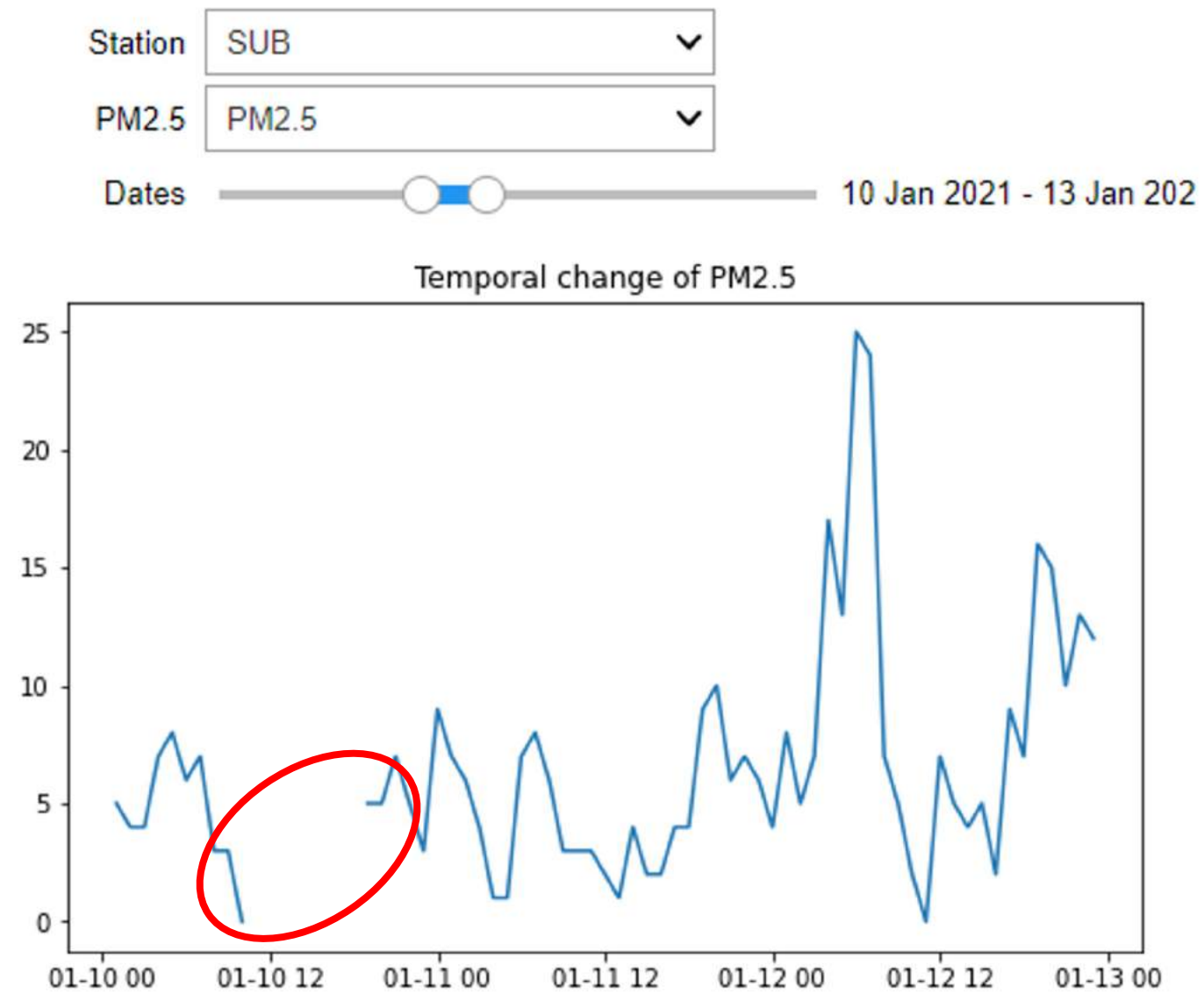
Station SUB PM2.5 / hour



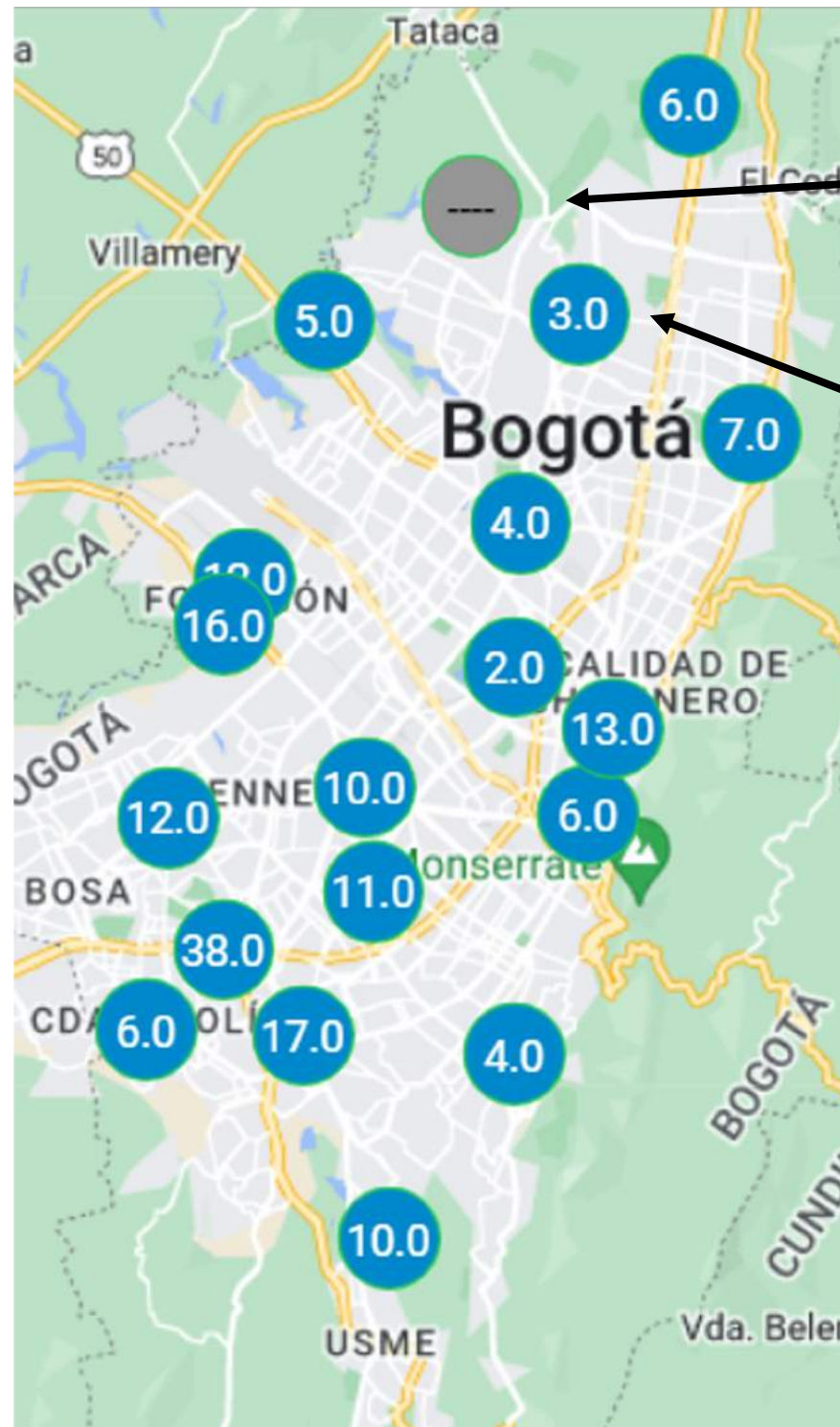
# Baseline model: Last value



# Baseline model: Last value

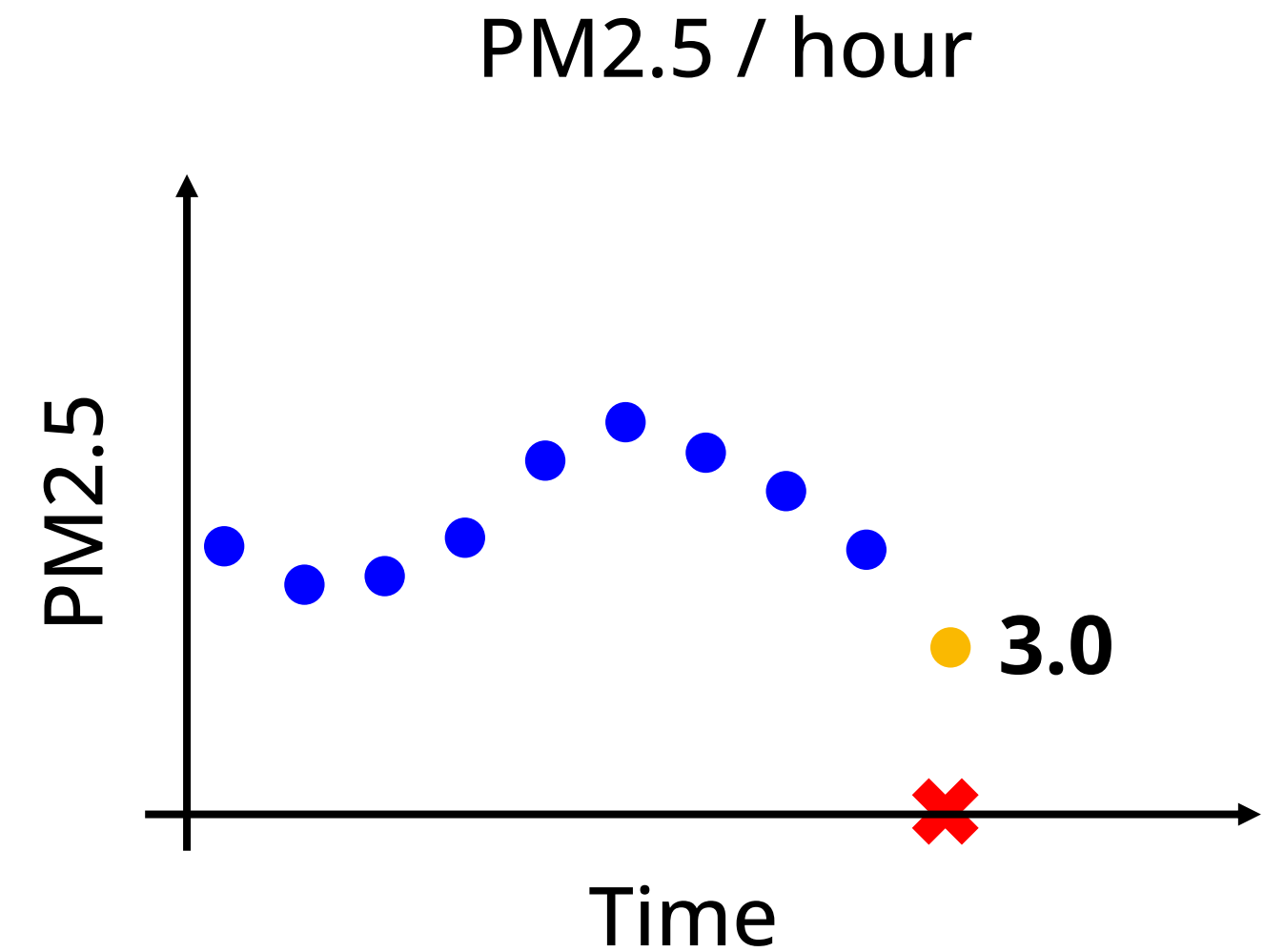


# Baseline model: Nearest station



Offline station

Nearest active station



## **Last value**

Past measurement,  
same location

## **Nearest station**

Current measurement,  
different location



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# AI and Public Health

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**Air Quality**  
**Establish a Baseline**





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# AI and Public Health

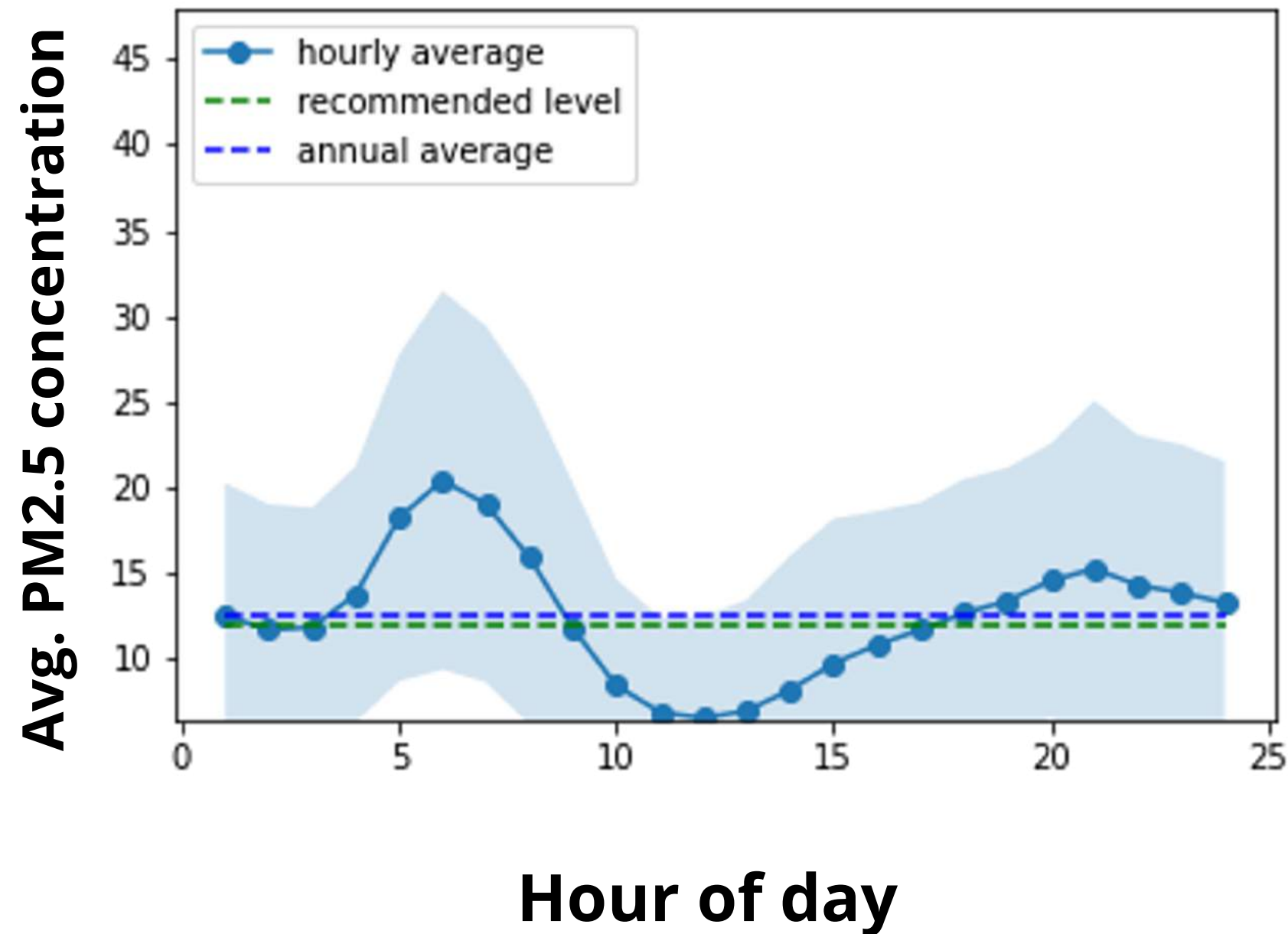
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**Air Quality**  
**Train and Test a**  
**Neural Network**

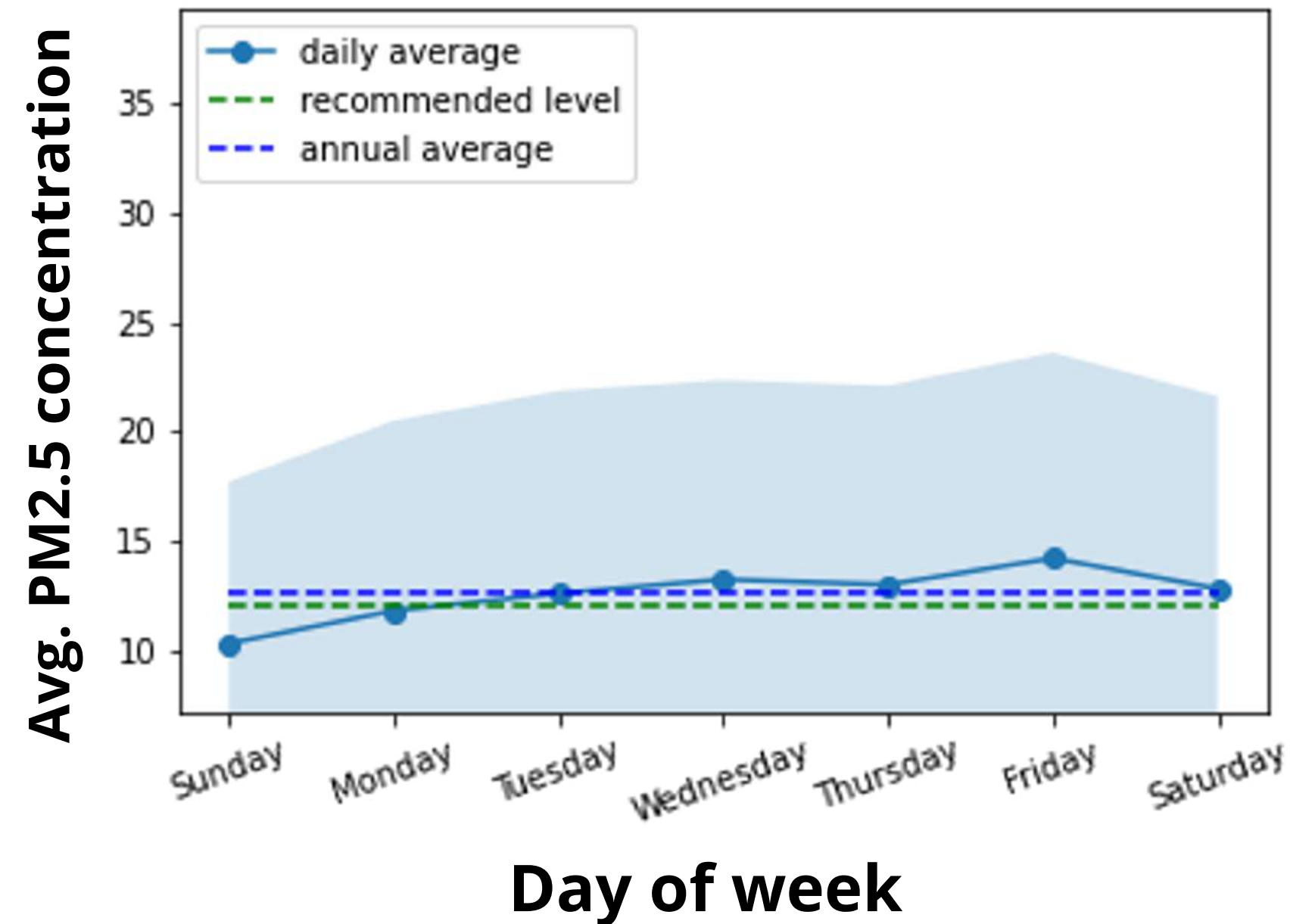


# Observing patterns in the data

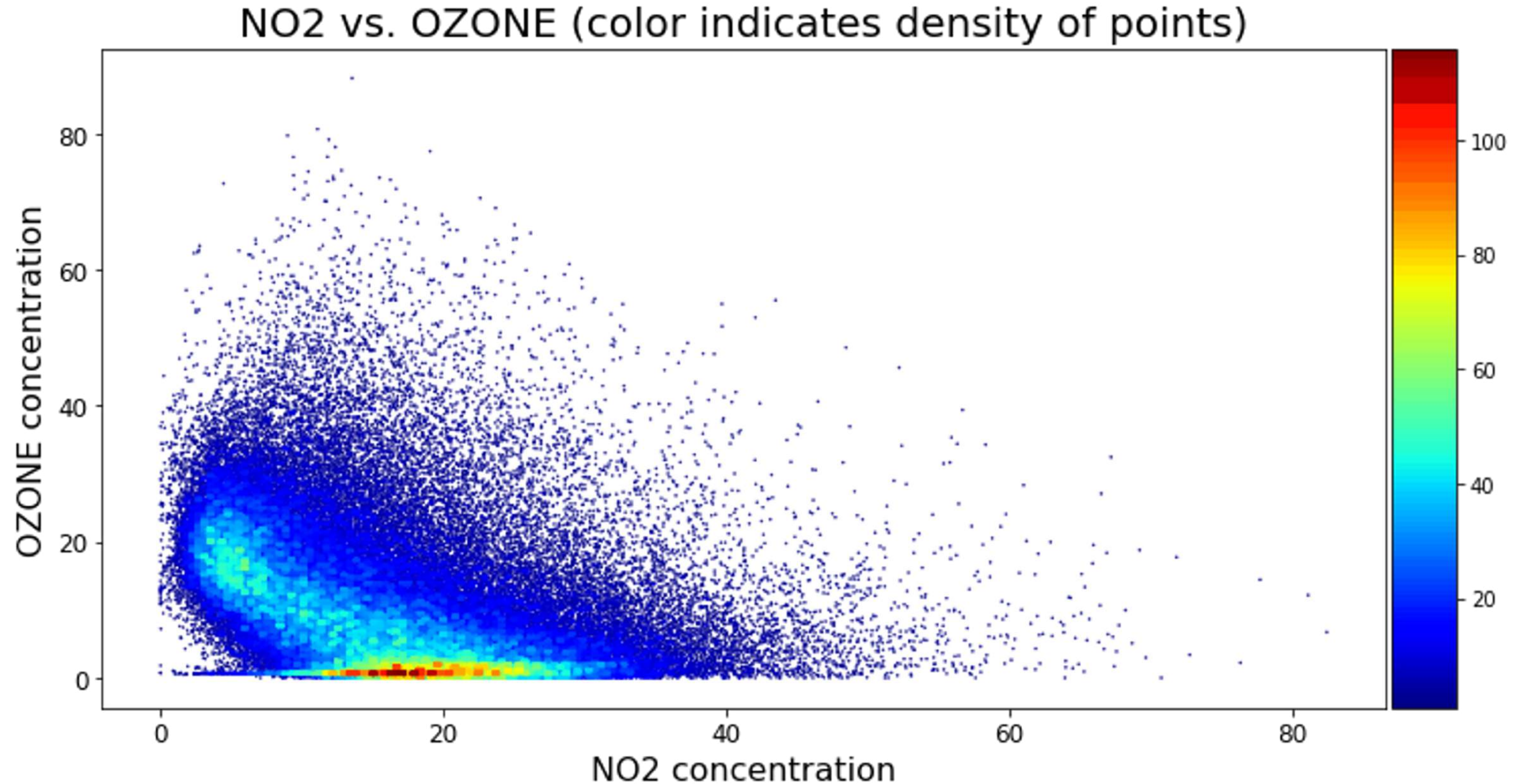
Station SUB avg. PM2.5/hour



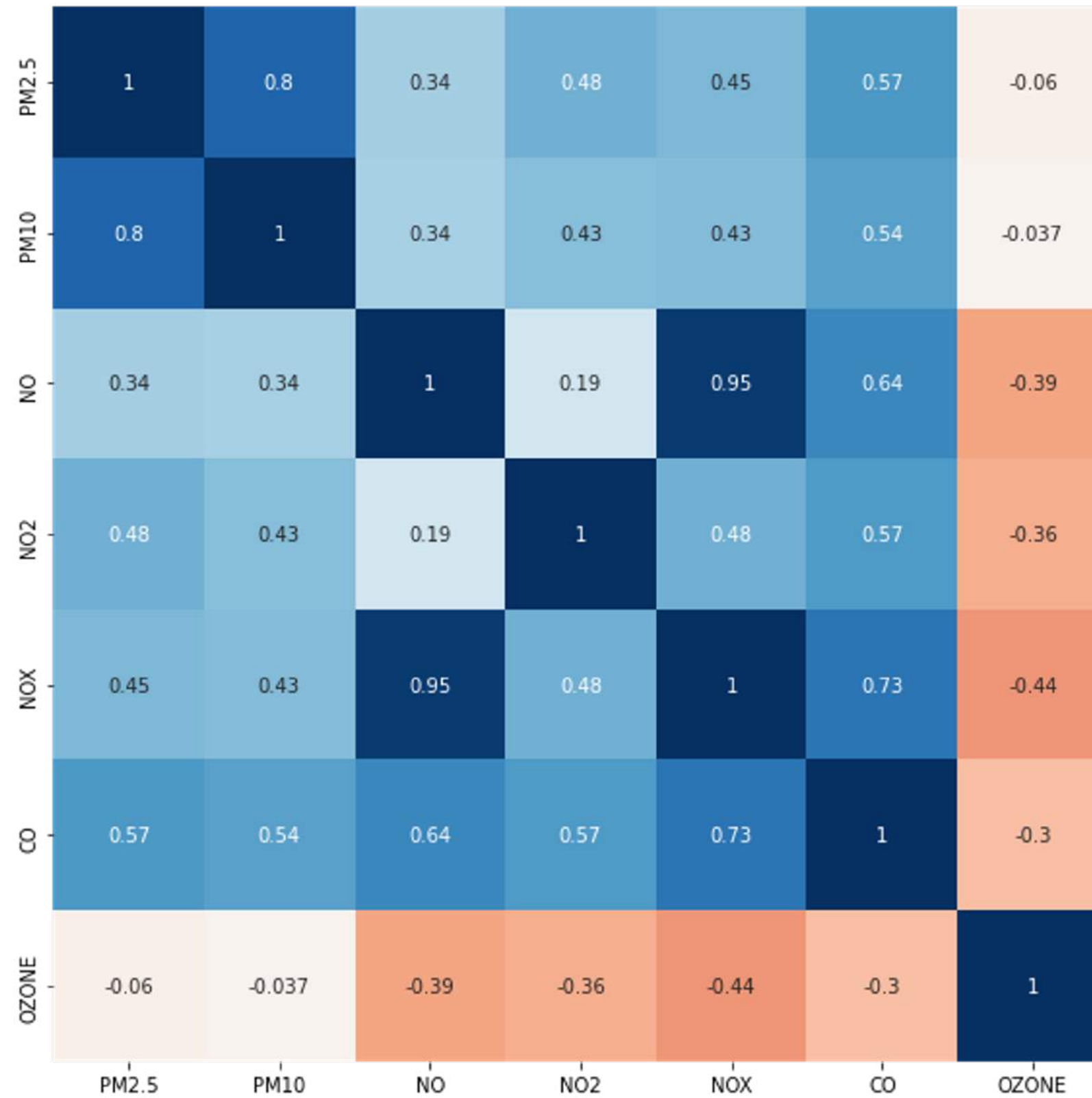
Station SUB avg. PM2.5/day



# Observing patterns in the data

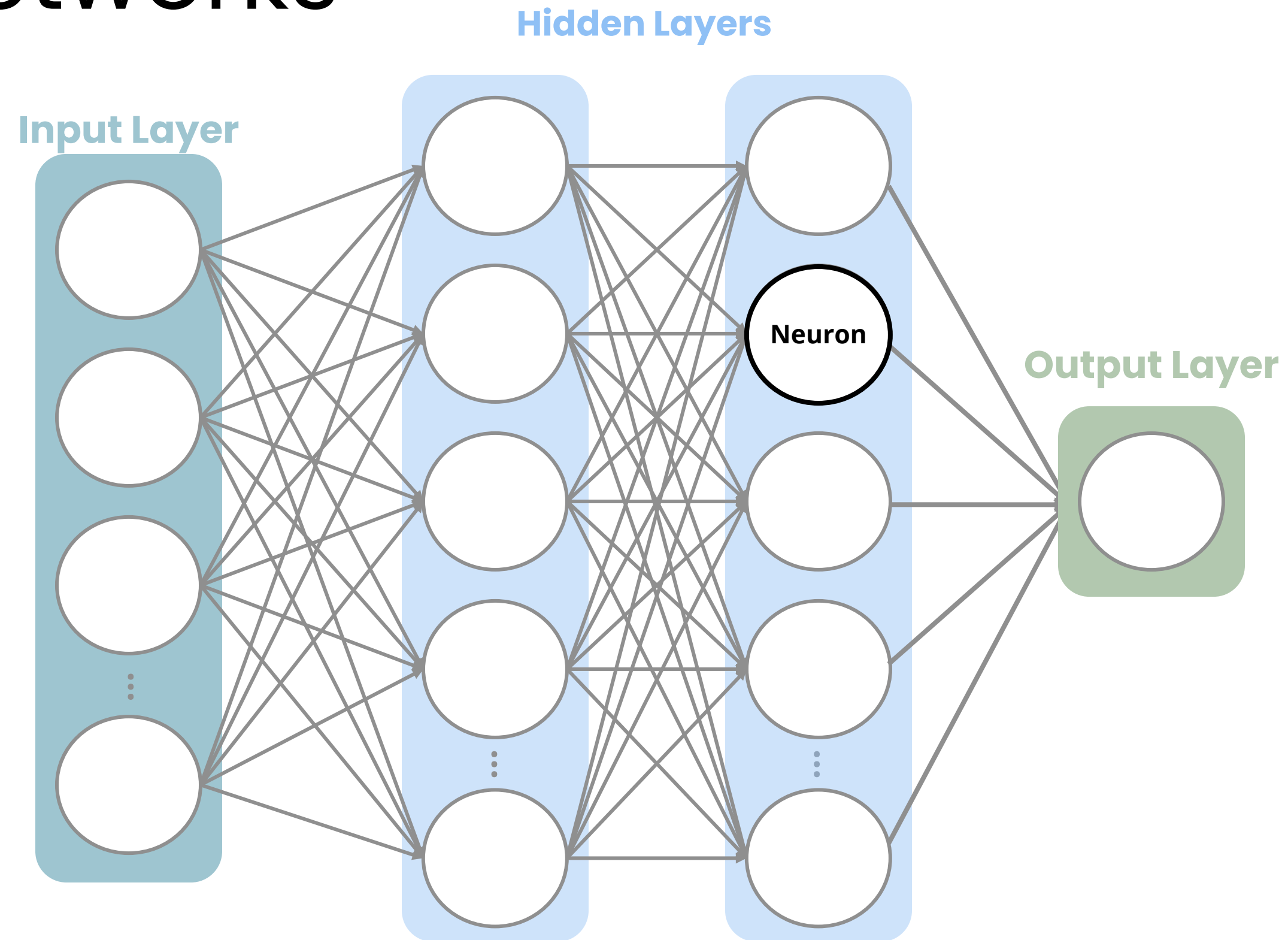


# Correlations between different pollutants

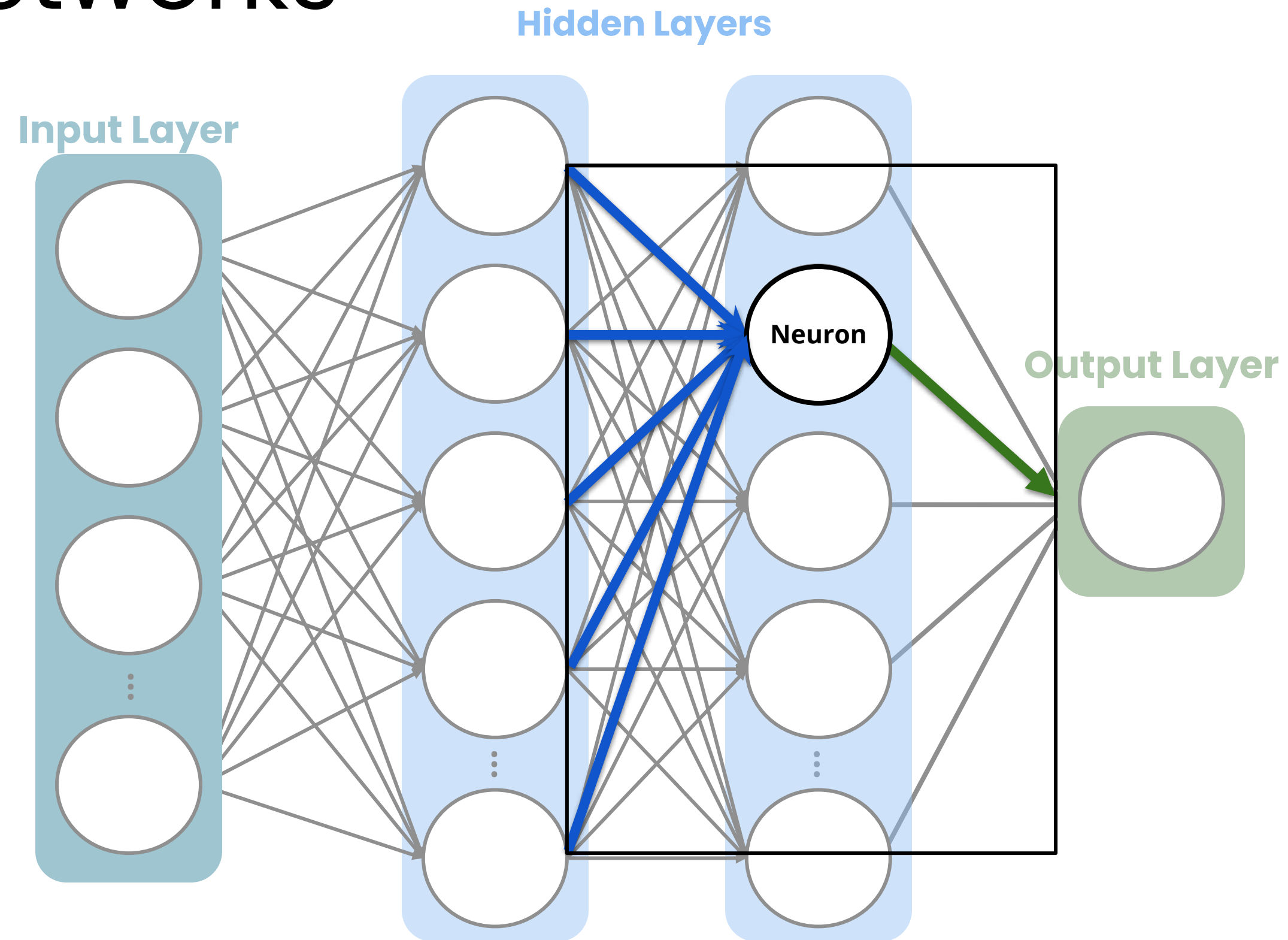




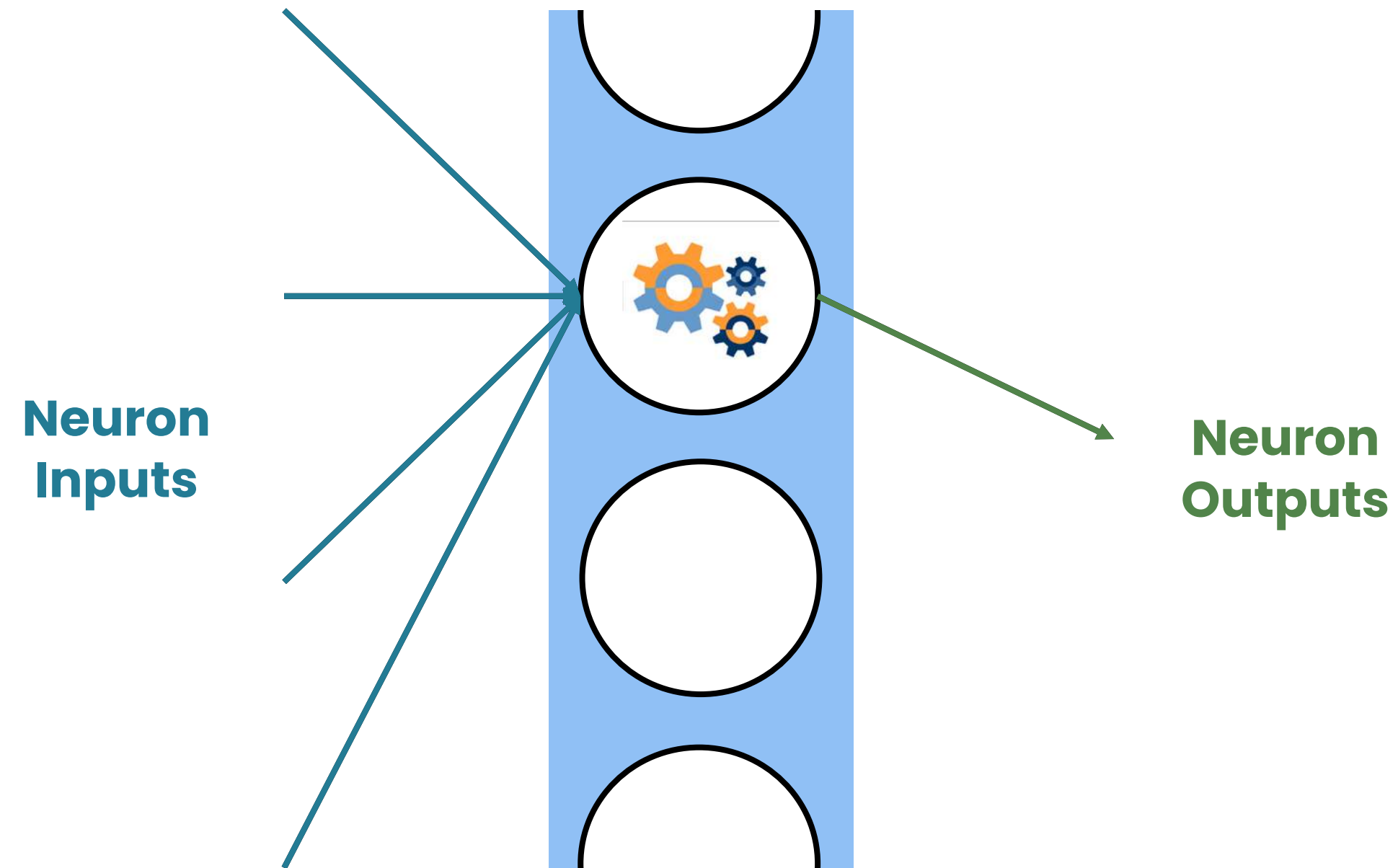
# Neural networks



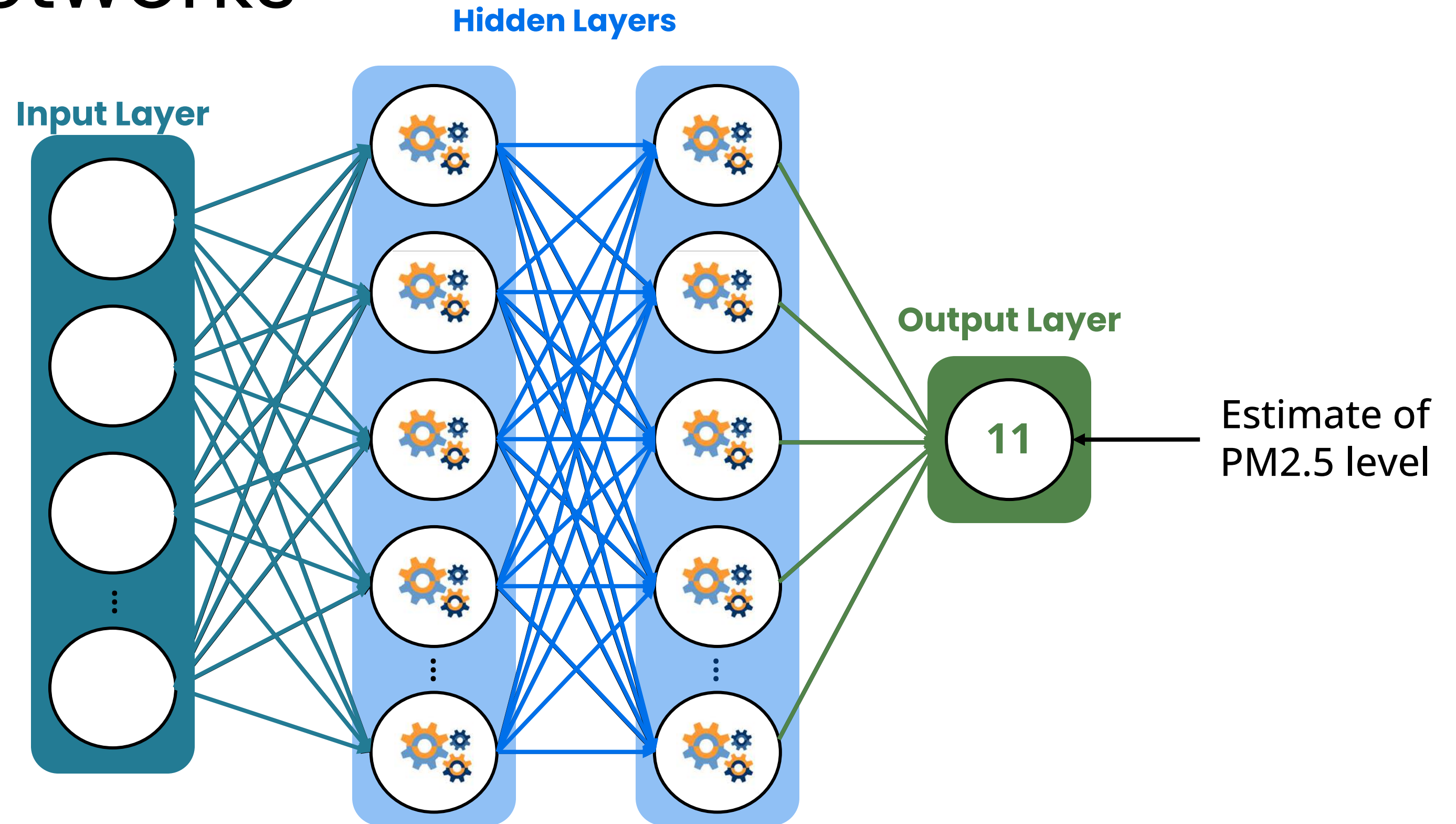
# Neural networks



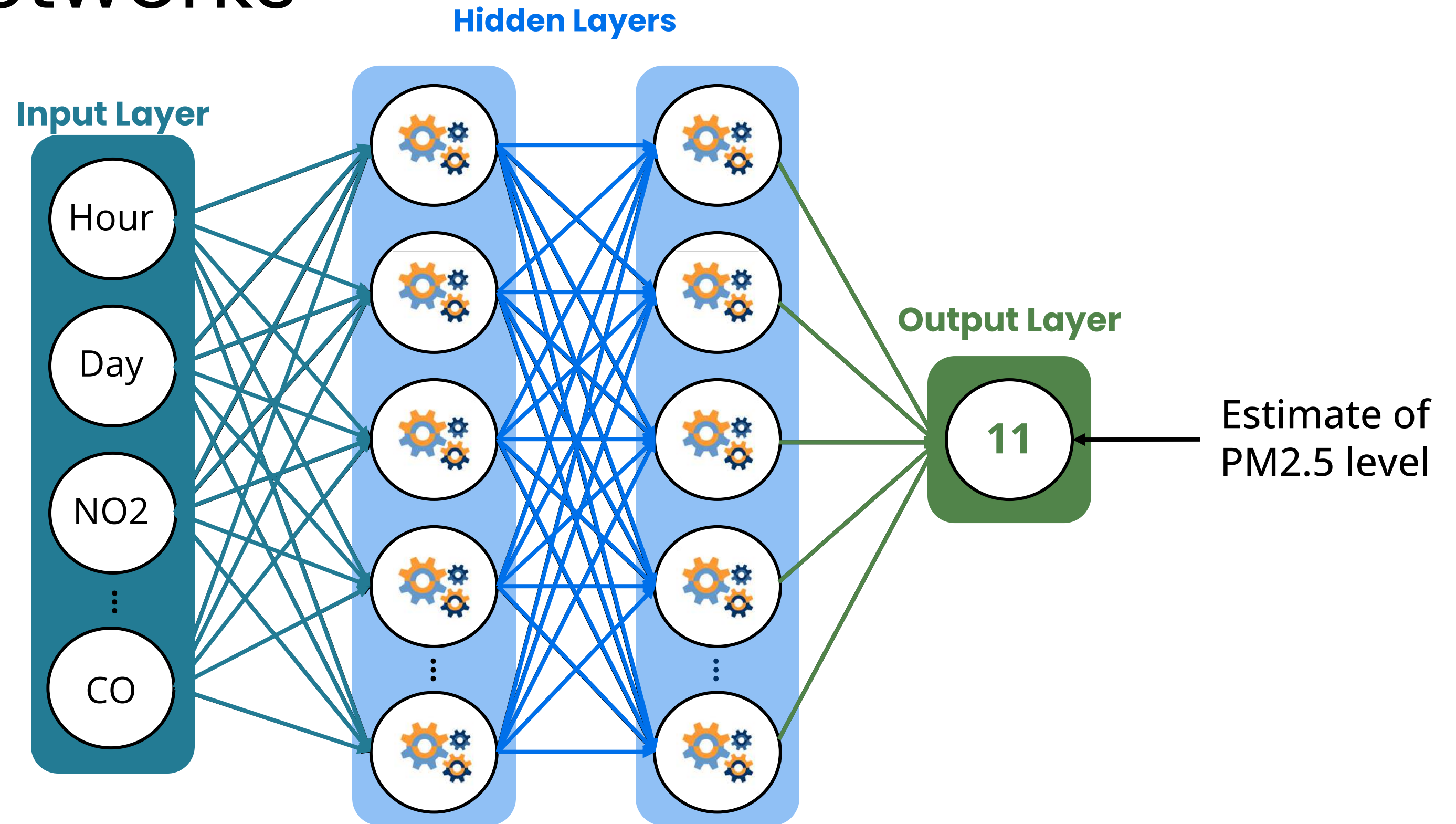
# Neural networks



# Neural networks



# Neural networks





# Baseline Model

- Nearest station model

# Neural Network Model

- Station location
- Time of day
- Day of the week
- Other pollutant values



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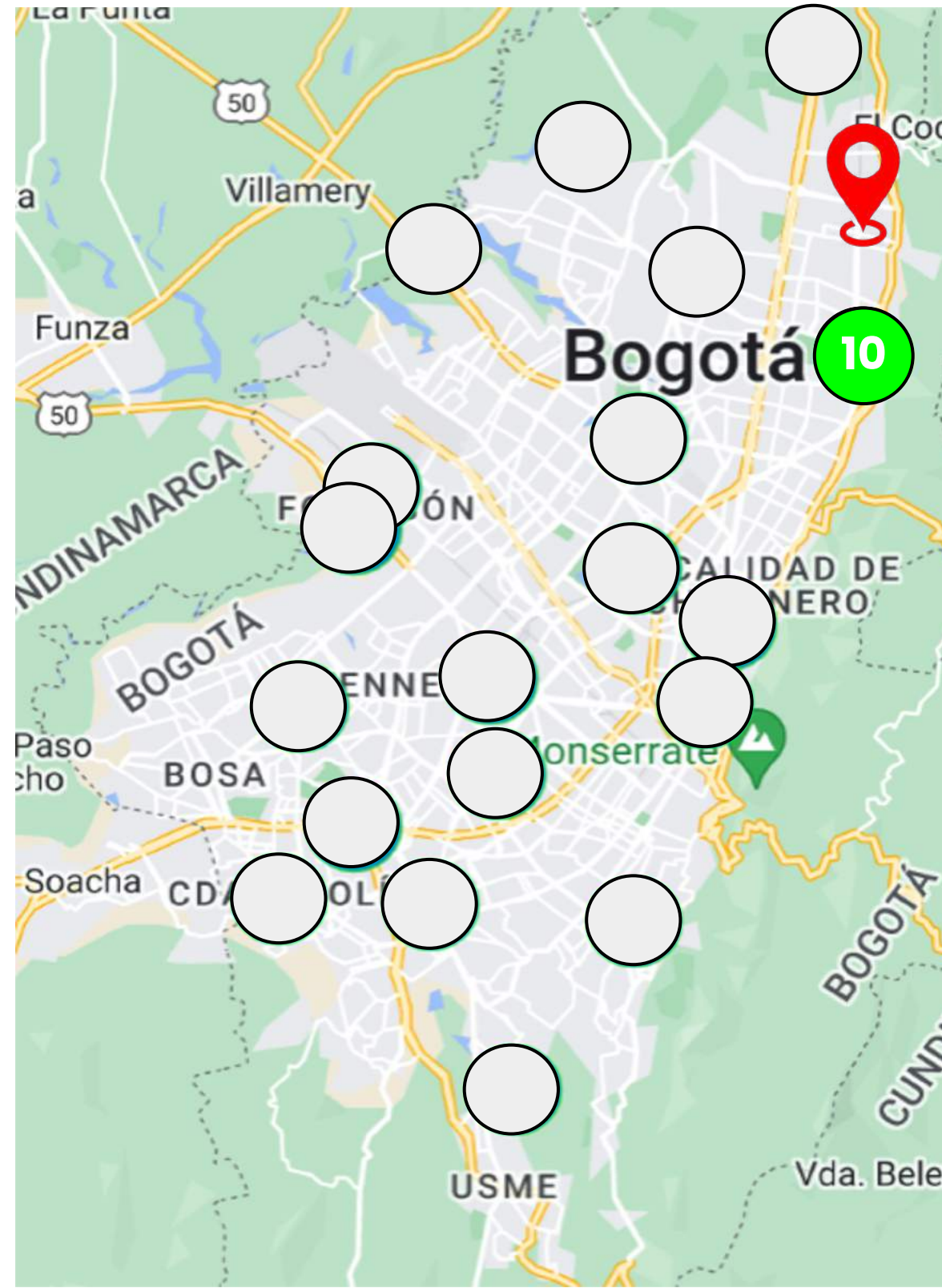
# AI and Public Health

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## **Air Quality**

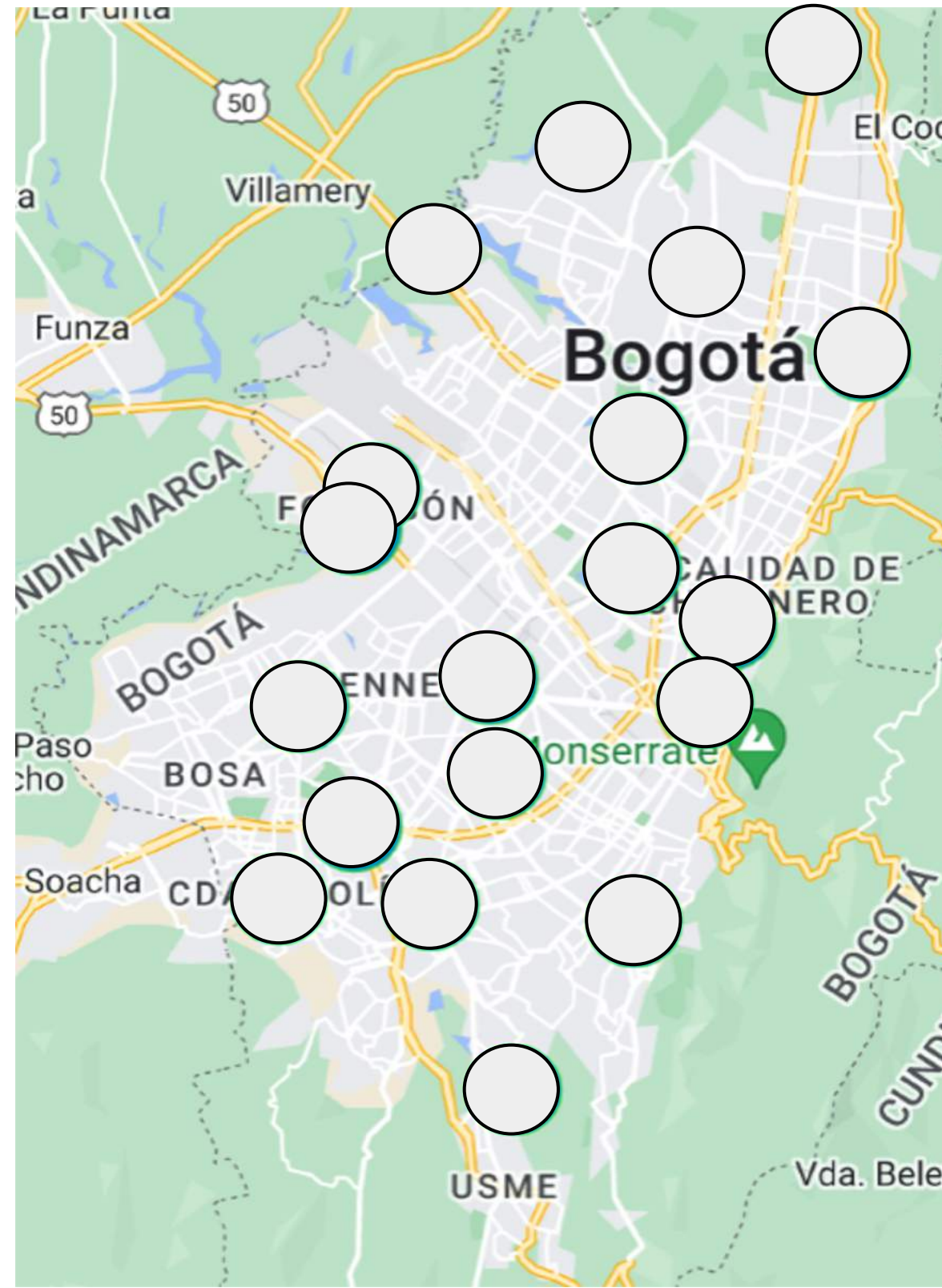
### **Nearest Neighbor Method**

# Nearest neighbor



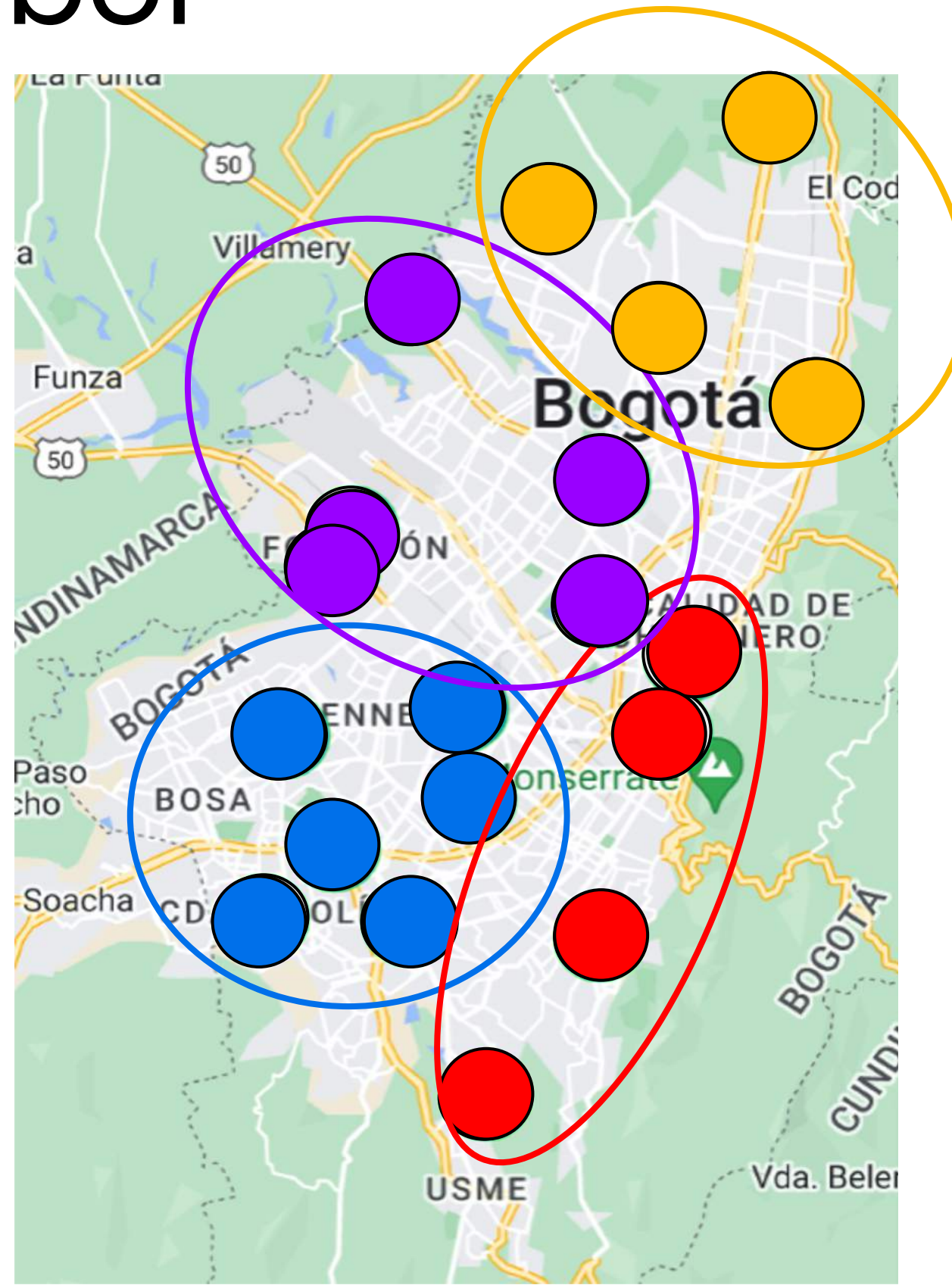
**Nearest  
neighbor**

# Nearest neighbor

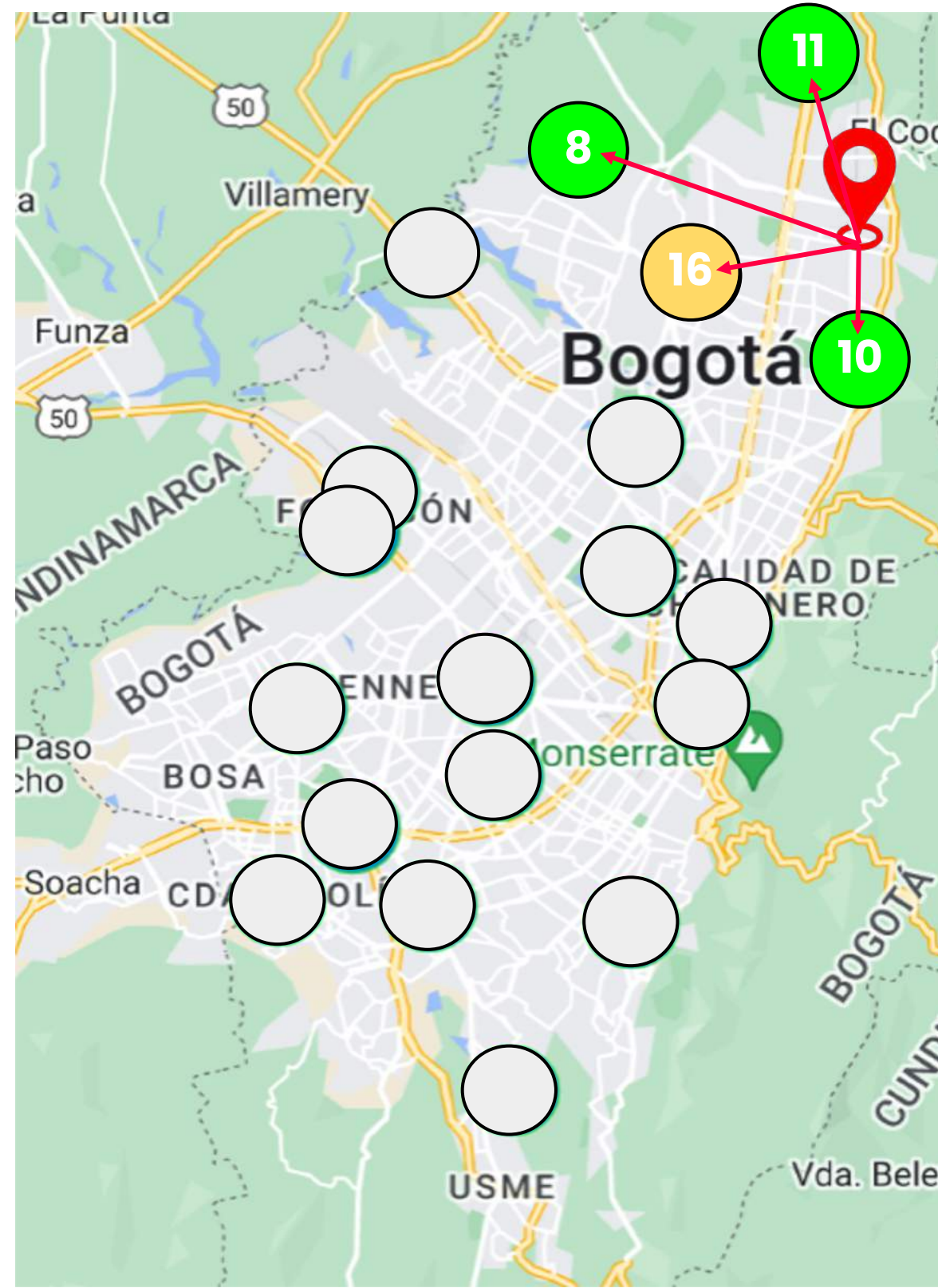




# Nearest neighbor



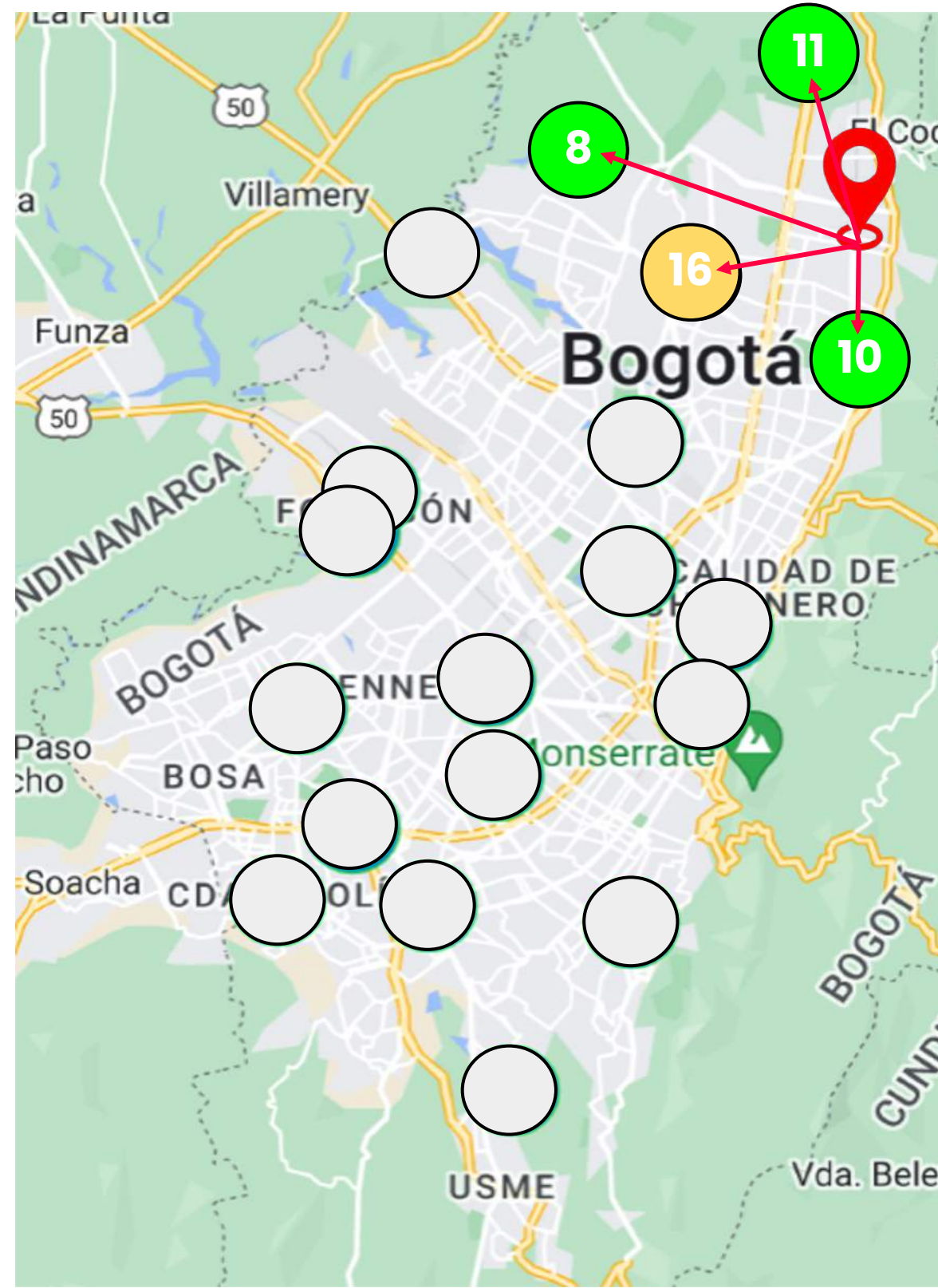
# Nearest neighbor



**Nearest  
neighbor**



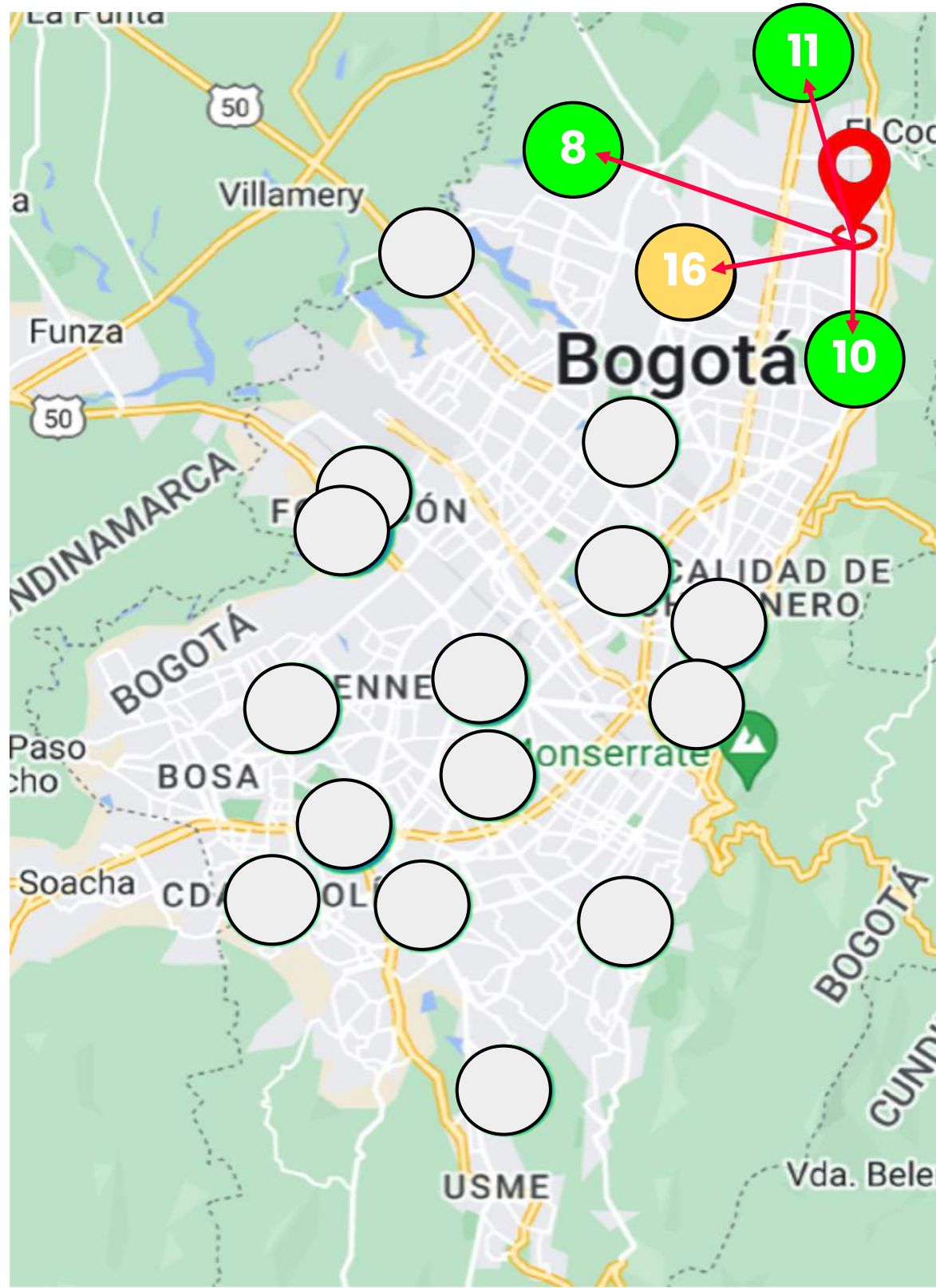
# K-Nearest Neighbor (kNN)



**K-nearest  
neighbor  
(KNN)**

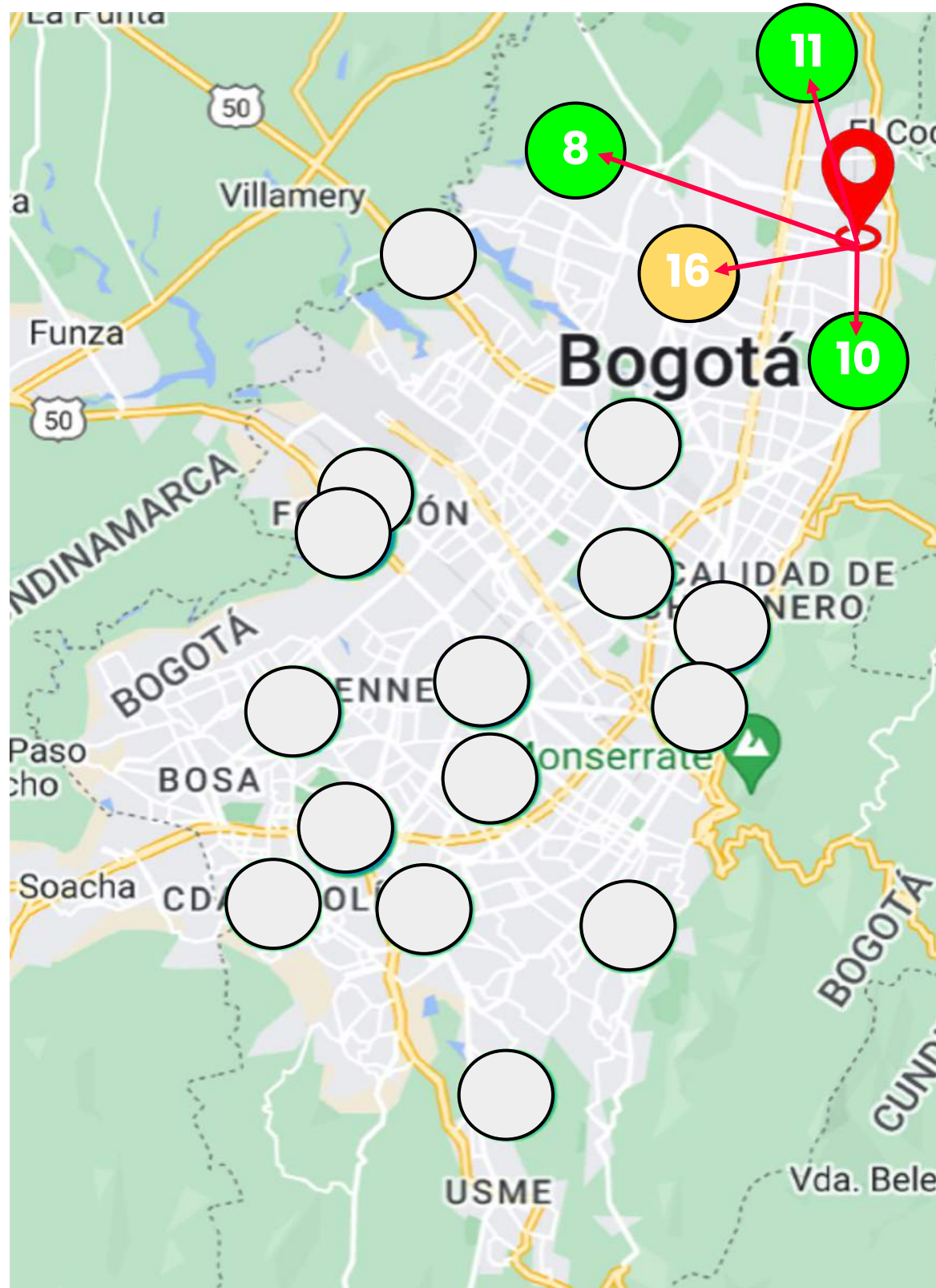


# K-Nearest Neighbor (kNN)



$$\frac{10 + 16 + 11 + 8}{4} = 11.25$$

# K-Nearest Neighbor (kNN)



$$10 + 16 + 11 + 8$$

**Inverse distance weighting**

$$weight = \frac{1}{d^2}$$



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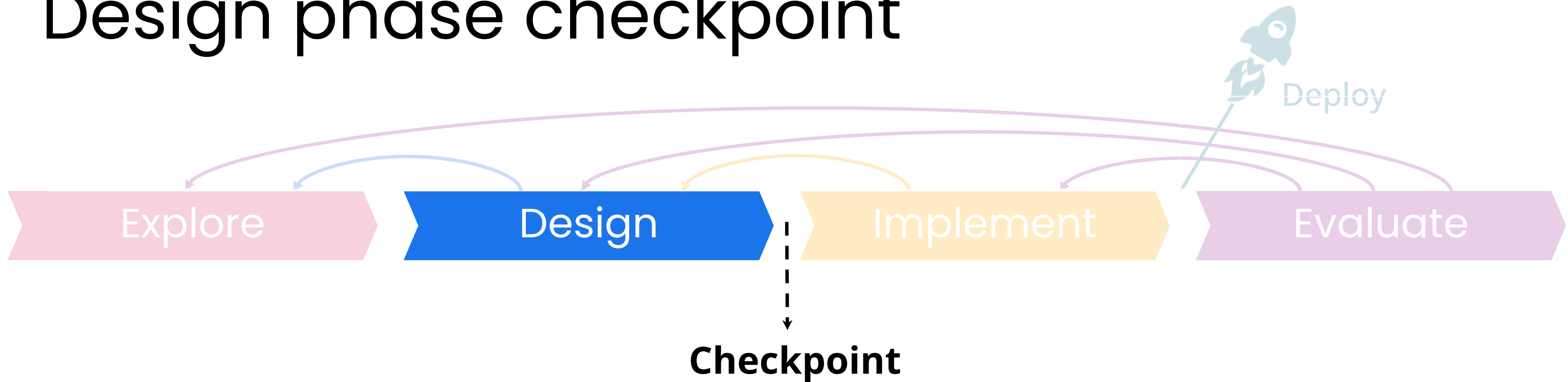
# AI and Public Health

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## **Air Quality**

### **Design Phase Checkpoint**

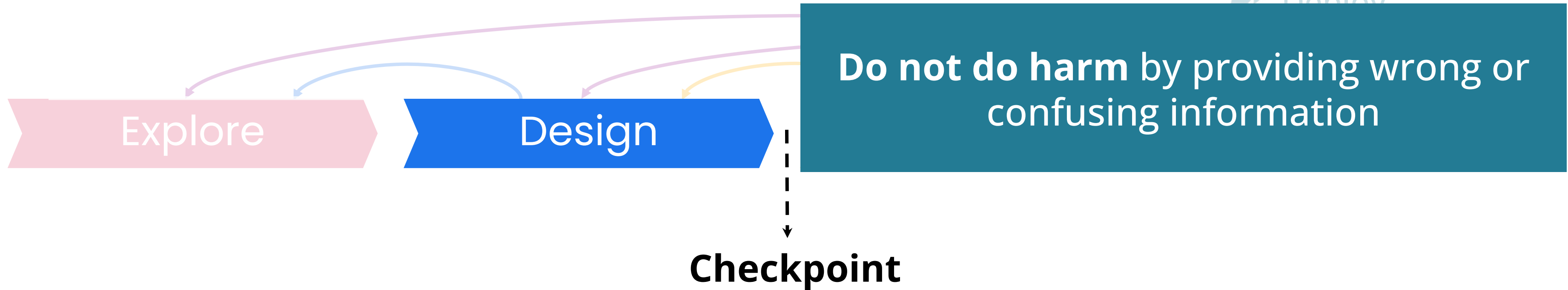
# Design phase checkpoint



- How will you address issues with imbalances, biases, privacy, or other concerns with your data?
- What kind of model will you implement, and how will you measure its performance?
- How will your design address the problem you set out to work on?
- How will the end user interact with your system?

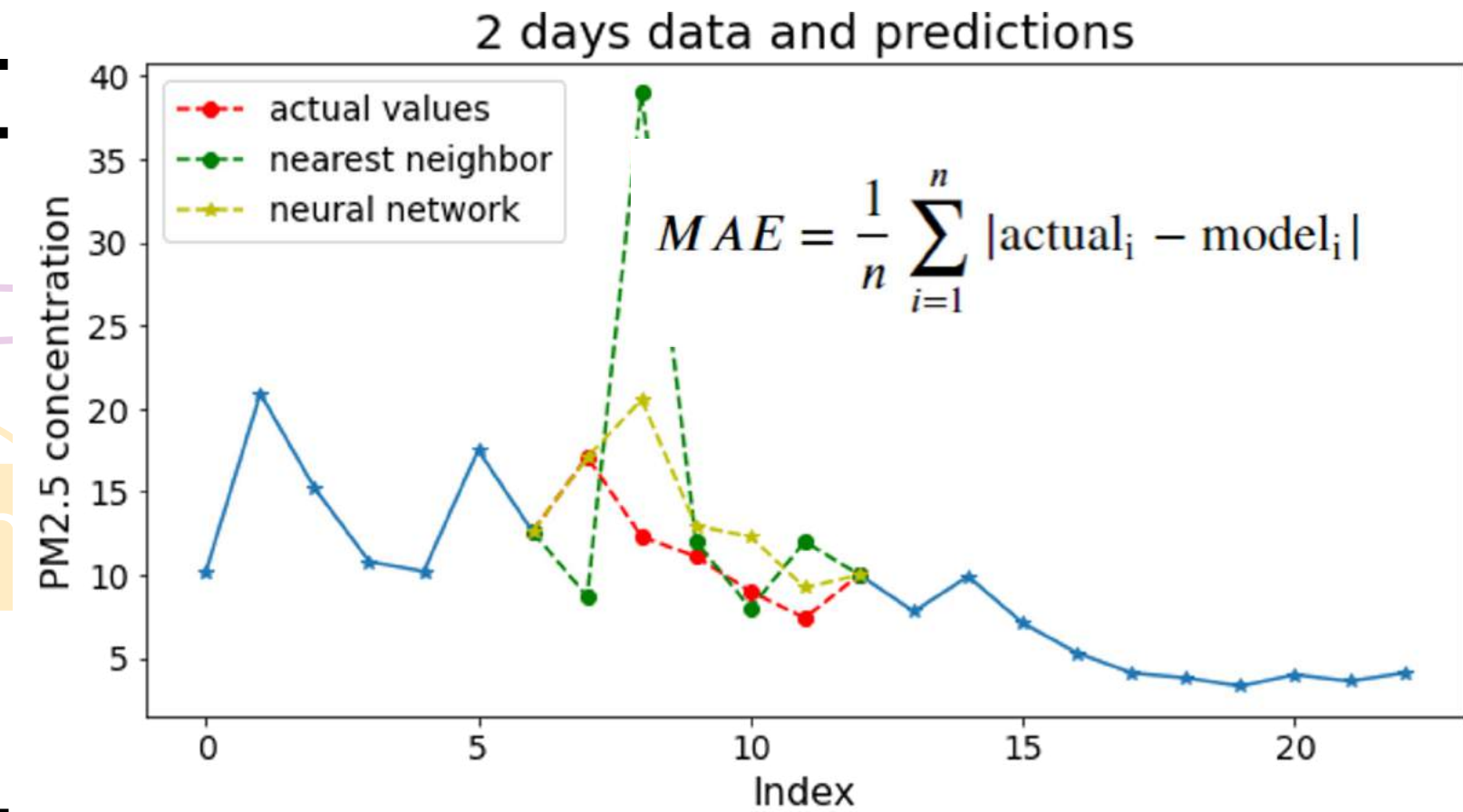
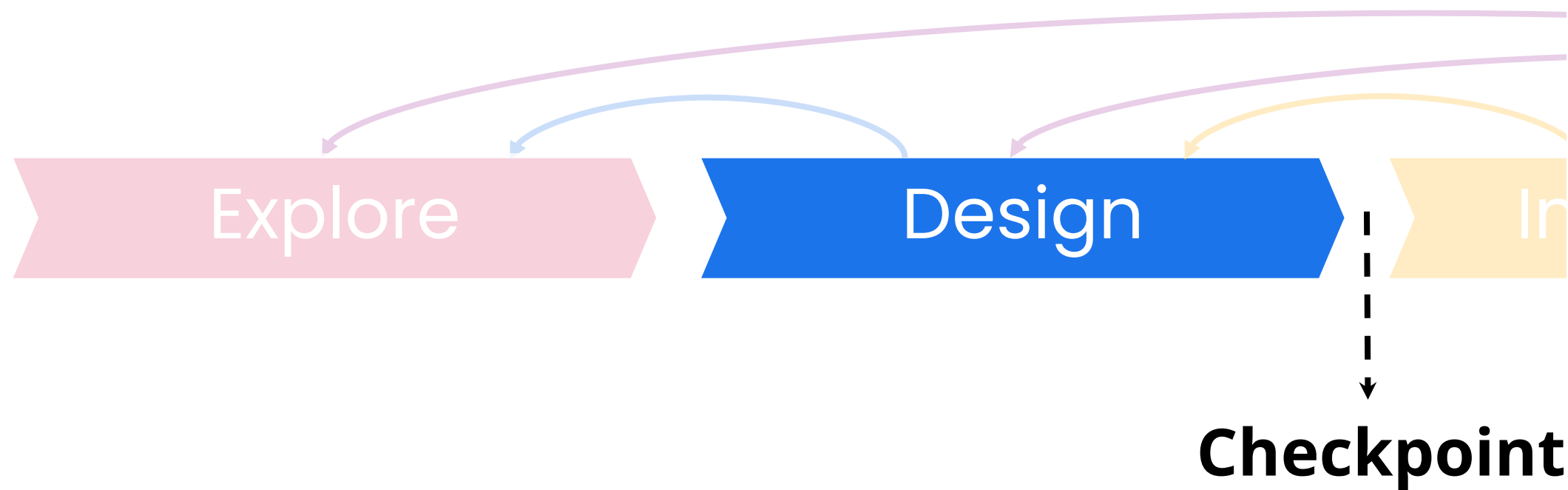


# Design phase checkpoint



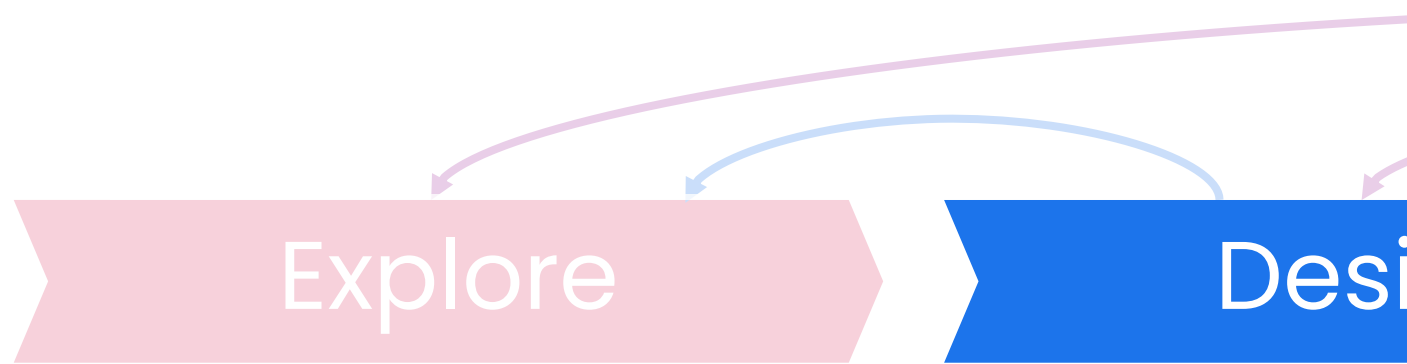
- How will you address issues with imbalances, biases, privacy, or other concerns with your data? ✓
- What kind of model will you implement, and how will you measure its performance?
- How will your design address the problem you set out to work on?
- How will the end user interact with your system?

# Design phase checkpoint



- How will you address issues with imbalances, biases, privacy, or other concerns with your data? ✓
- What kind of model will you implement, and how will you measure its performance? ✓
- How will your design address the problem you set out to work on?
- How will the end user interact with your system?

# Design phase checkpoint

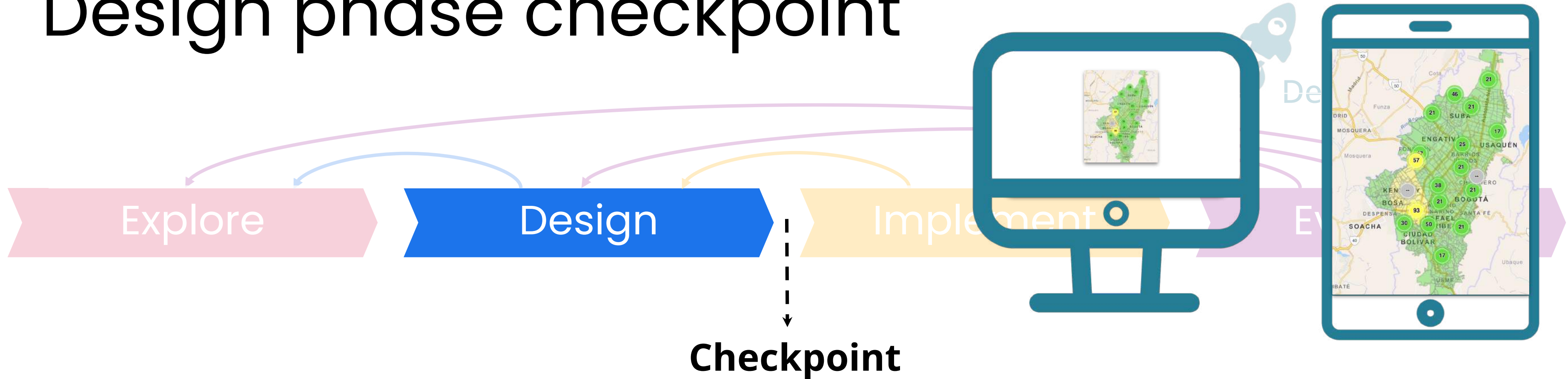


“Public health professionals working with the city of Bogotá need to be able to provide **real time estimates of air quality** throughout the city so that citizens can be aware of any health risks due to poor air quality and plan their outdoor activities accordingly.”

## Checkpoint

- How will you address issues with imbalances, biases, privacy, or other concerns with your data? ✓
- What kind of model will you implement, and how will you measure its performance? ✓
- How will your design address the problem you set out to work on? ✓
- How will the end user interact with your system?

# Design phase checkpoint



- How will you address issues with imbalances, biases, privacy, or other concerns with your data? ✓
- What kind of model will you implement, and how will you measure its performance? ✓
- How will your design address the problem you set out to work on? ✓
- How will the end user interact with your system? ✓





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# AI and Public Health

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## **Air Quality Implement Phase**



range of dates. It's also possible to edit the `start_date` and `end_date` values and run the code cell again to start with a different date range. Have a look across different pollutants and different stations. Note that you may have missing data in your dataset, so for some combinations of dates, pollutants and stations, there will be nothing to display!

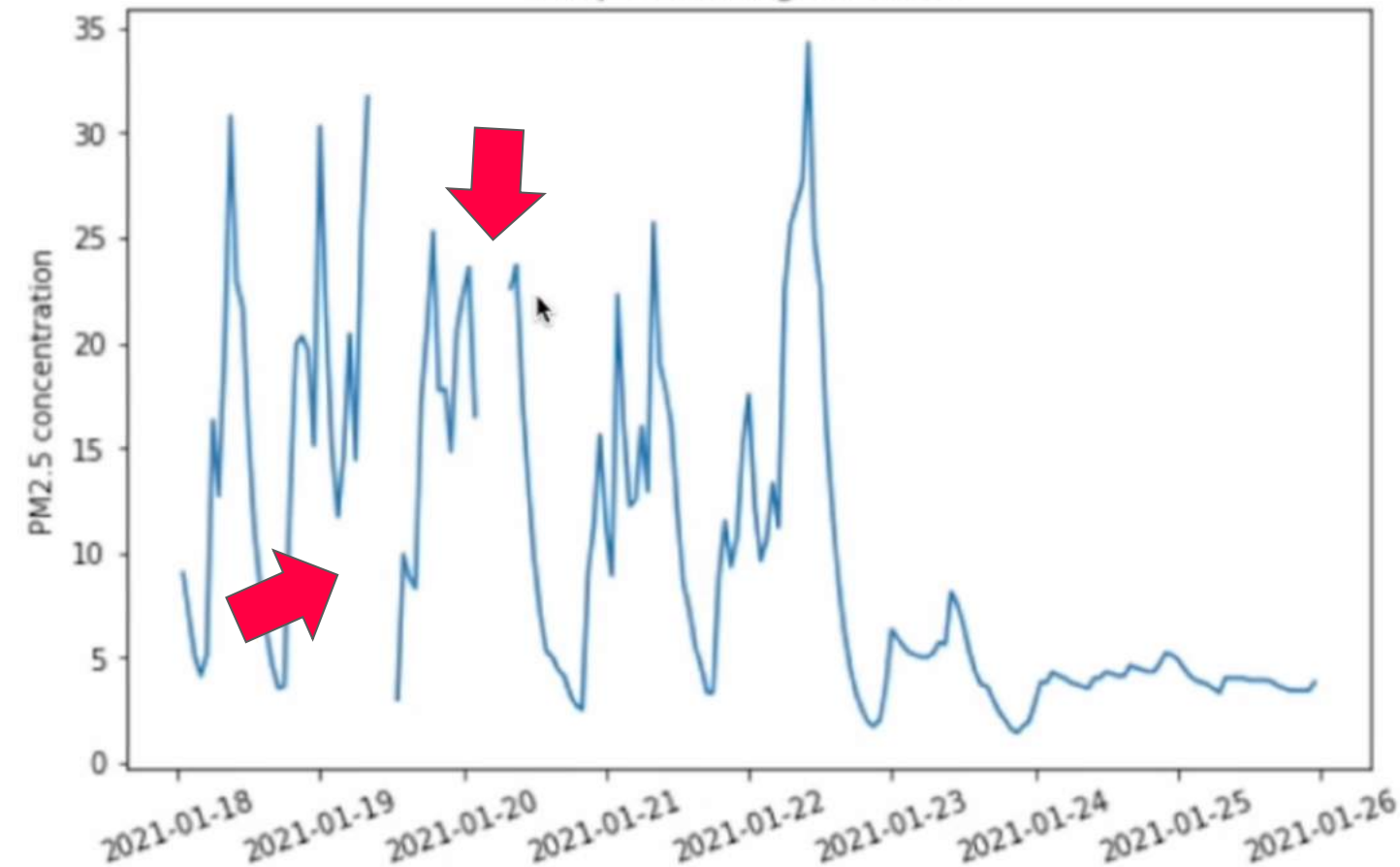
```
In [9]: # define the date range to show in the plot
start_date = datetime(2021, 1, 1)
end_date = datetime(2021, 1, 31)
# generate a time series plot of pollutant data for a particular station
utils.create_time_series_plot(raw_data, start_date, end_date)
```

Station

Pollutant

Dates

Temporal change of PM2.5





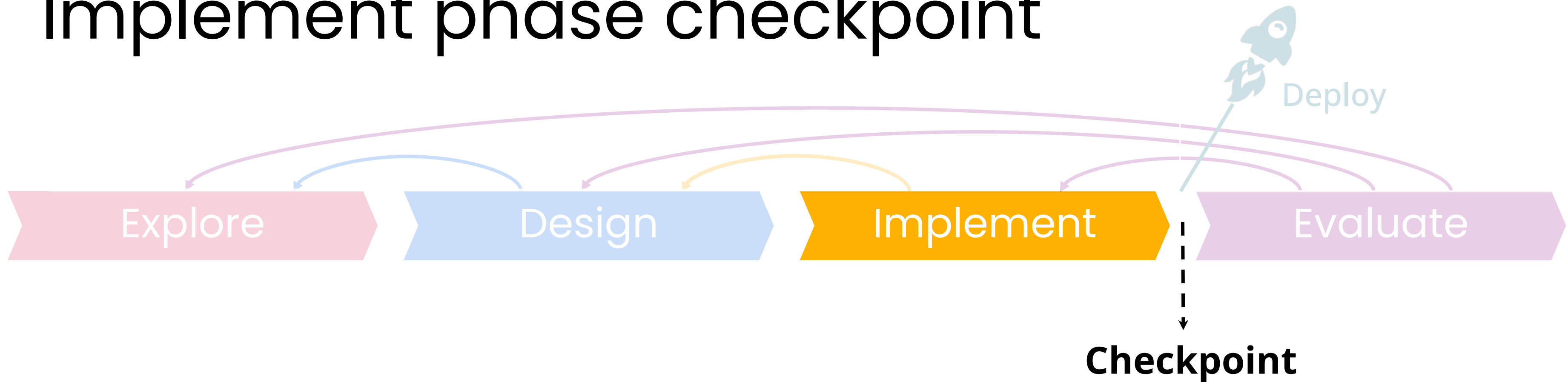
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# AI and Public Health

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## **Air Quality Project Wrap Up**

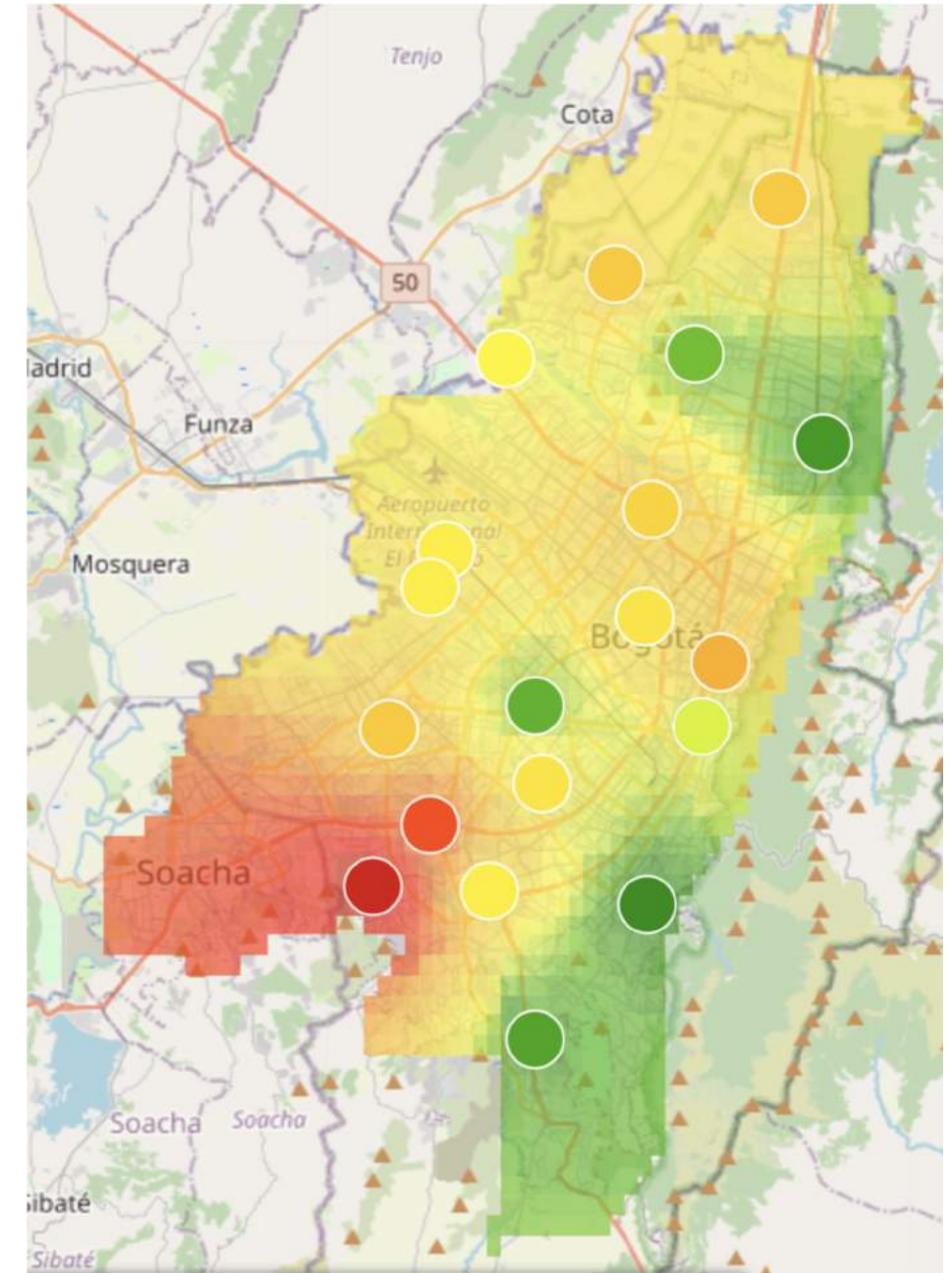
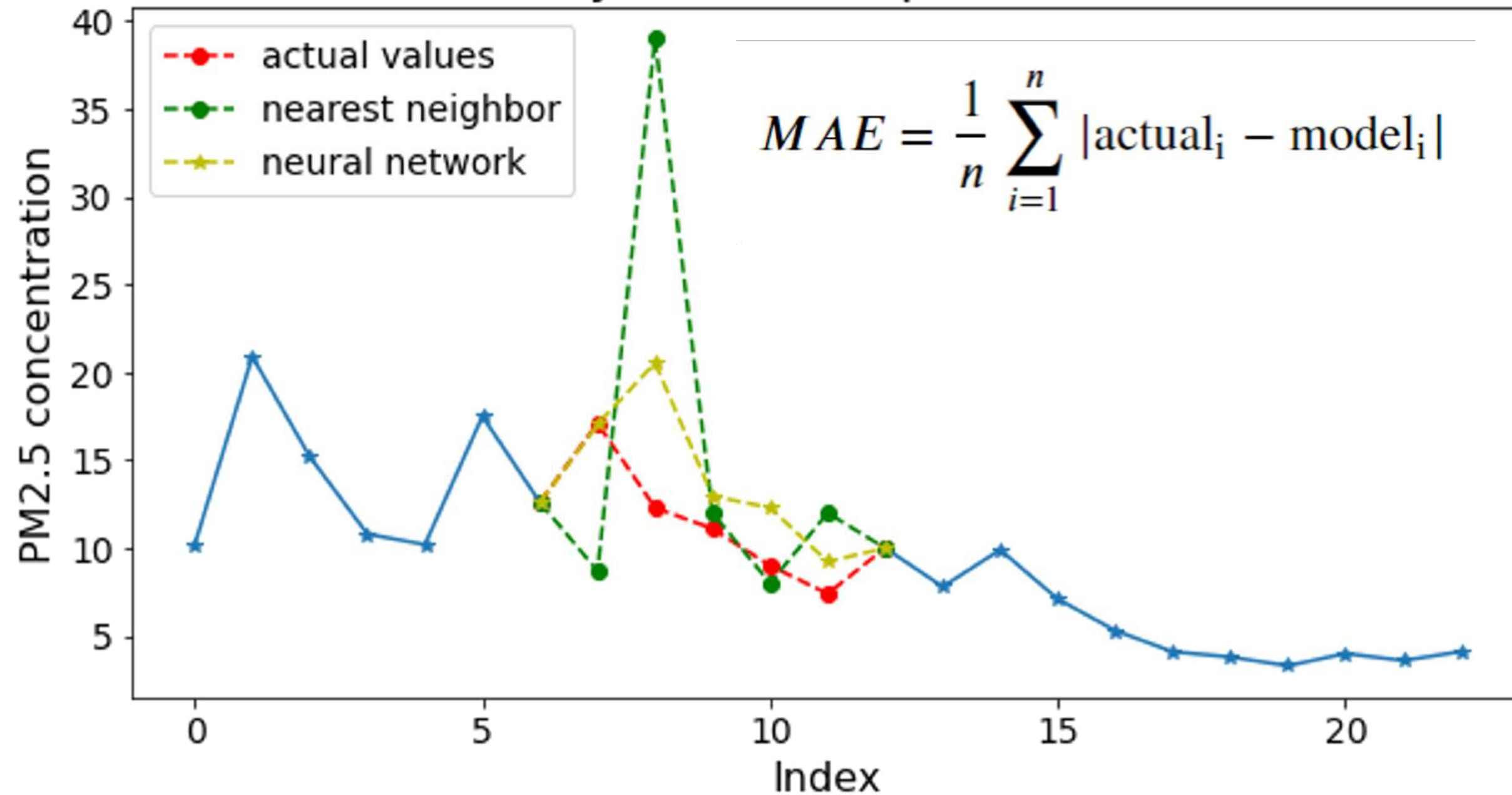
# Implement phase checkpoint



- Is your model performance acceptable?
- Are end users able to successfully use your system?

# Is your model performance acceptable?

2 days data and predictions



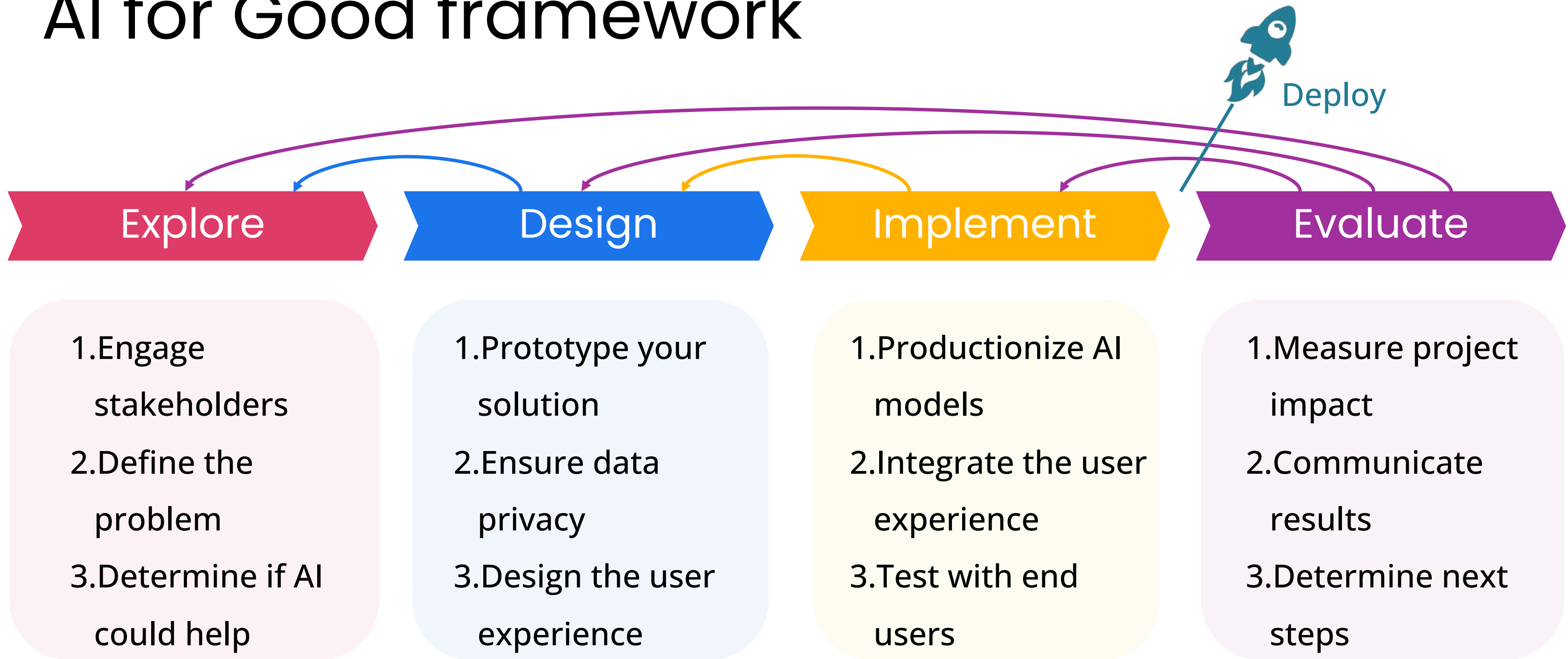


# Implement phase checkpoint

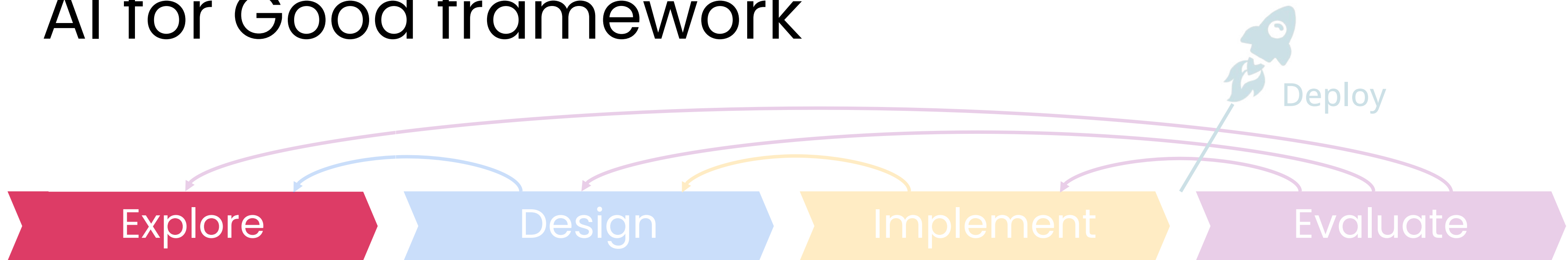



1. Measure project impact
2. Communicate results
3. Determine next steps

# AI for Good framework



# AI for Good framework



- 
- 1. Engage stakeholders
  - 2. Define the problem
  - 3. Determine if AI could add value



# AI for Good framework

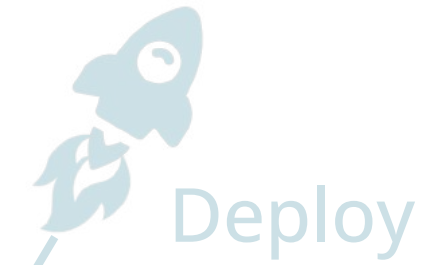


Explore

1. Engage stakeholders
2. Define the problem
3. Determine if AI could add value

“Public health professionals working with the city of Bogotá need to be able to provide **real time estimates of air quality** throughout the city so that citizens can be aware of any health risks due to poor air quality and plan their outdoor activities accordingly.”

# AI for Good framework



Explore

1. Engage stakeholders
2. Define the problem
3. Determine if AI could add value

B:B fx PM2.5										
	A	B	C	D	E	F	G	H	I	
1	PM10	PM2.5	NO	NO2	NOX	CO	OZONO	Station	DateTime	
2	56.6	32.7	7.504	15.962	23.493	0.44924	2.431	USM	01-01-2021 1:00	
3	59.3	39.3	16.56	17.866	34.426	0.69832	1.121	USM	01-01-2021 2:00	
4	96.4	70.8	22.989	17.802	40.791	0.88243	1.172	USM	01-01-2021 3:00	
5	108.3	81	3.704	9.886	13.591	0.29549	6.565	USM	01-01-2021 4:00	
6	87.7	56.1	2.098	9.272	11.371	0.16621	9.513	USM	01-01-2021 5:00	
7	74.4	38.6	2.249	11.064	13.313	0.22534	5.466	USM	01-01-2021 6:00	
8	60.4	27.2	11.49	14.675	26.165	0.41357	2.467	USM	01-01-2021 7:00	
9	51.9	29.5	5.864	7.348	13.212	0.20784	10.8	USM	01-01-2021 8:00	
10	38.1	21.6	3.506	4.266	7.773		17.161	USM	01-01-2021 9:00	
11	28.9	23.1	4.343	3.866	8.209		19.674	USM	01-01-2021 10:00	
12	22	17.5	5.878	4.03	9.907		19.842	USM	01-01-2021 11:00	
13	20.9	12.3	1.98	2.529	4.509		20.958	USM	01-01-2021 12:00	
14	18.9	9.8	1.095	1.979	3.075		21.33	USM	01-01-2021 13:00	
15	17	7.7	3.625	3.536	7.161		19.957	USM	01-01-2021 14:00	
16	14.1	6.3	6.586	6.544	13.131		18.004	USM	01-01-2021 15:00	
17	10.6	5.1	9.439	8.191	17.63		16.753	USM	01-01-2021 16:00	
18	20.2	4	6.055	5.69	11.745		16.814	USM	01-01-2021 17:00	
19	24.2	7.2	10.031	9.301	19.332		13.337	USM	01-01-2021 18:00	

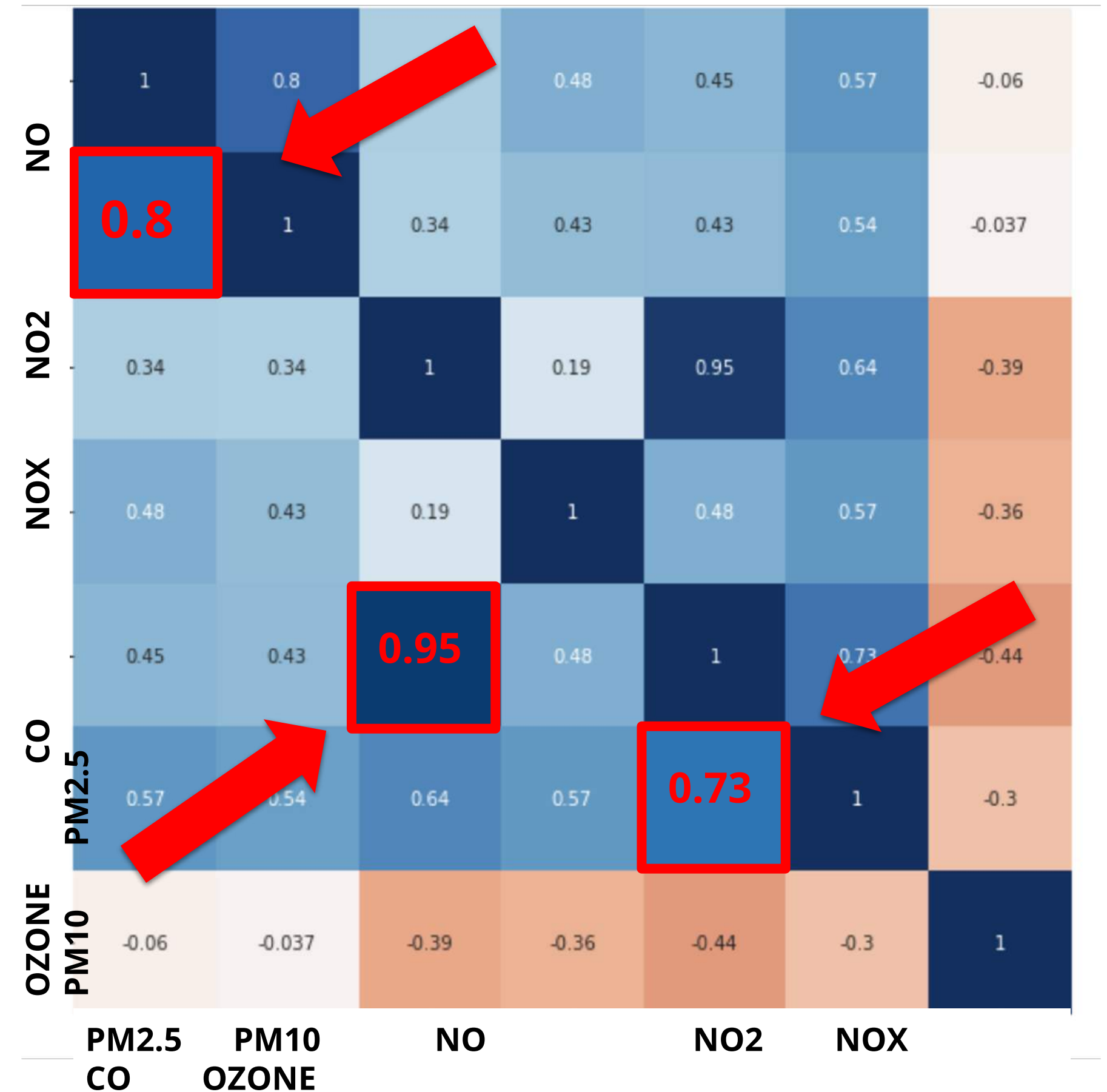


# Pollutant correlation

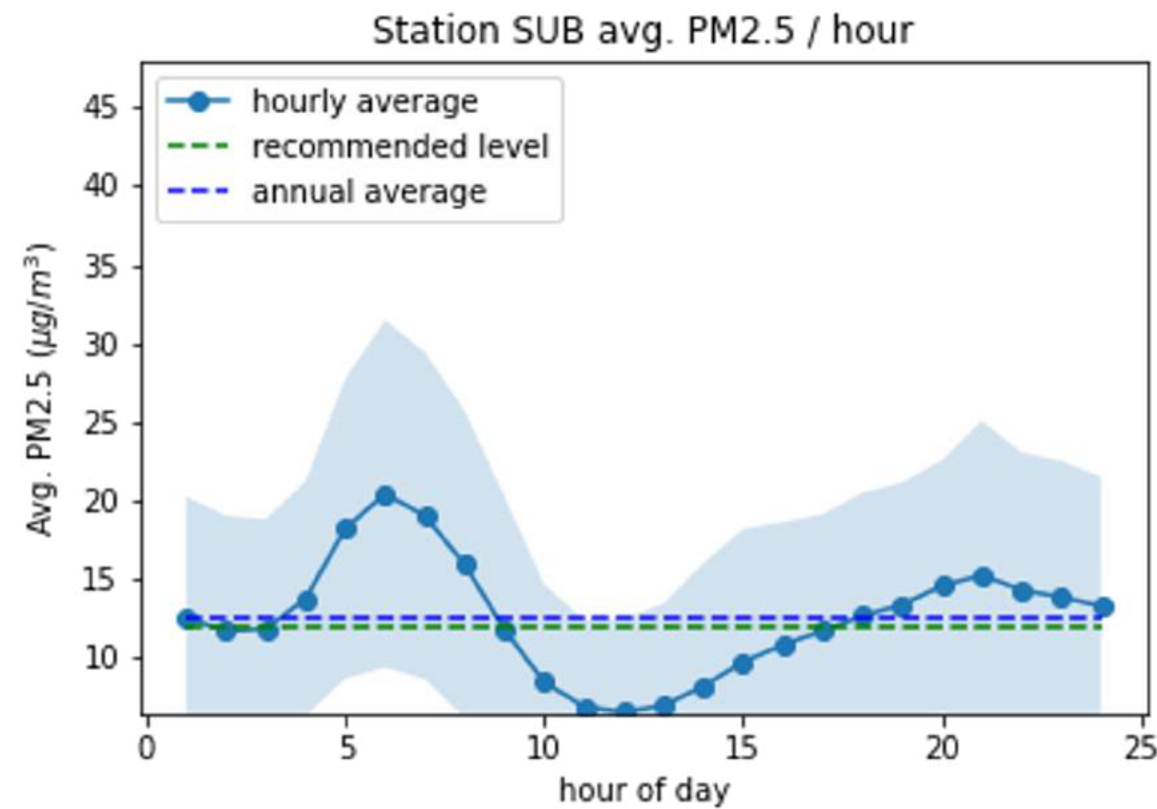
**NOX & NO: 0.95**

**PM10 & PM2.6: 0.8**

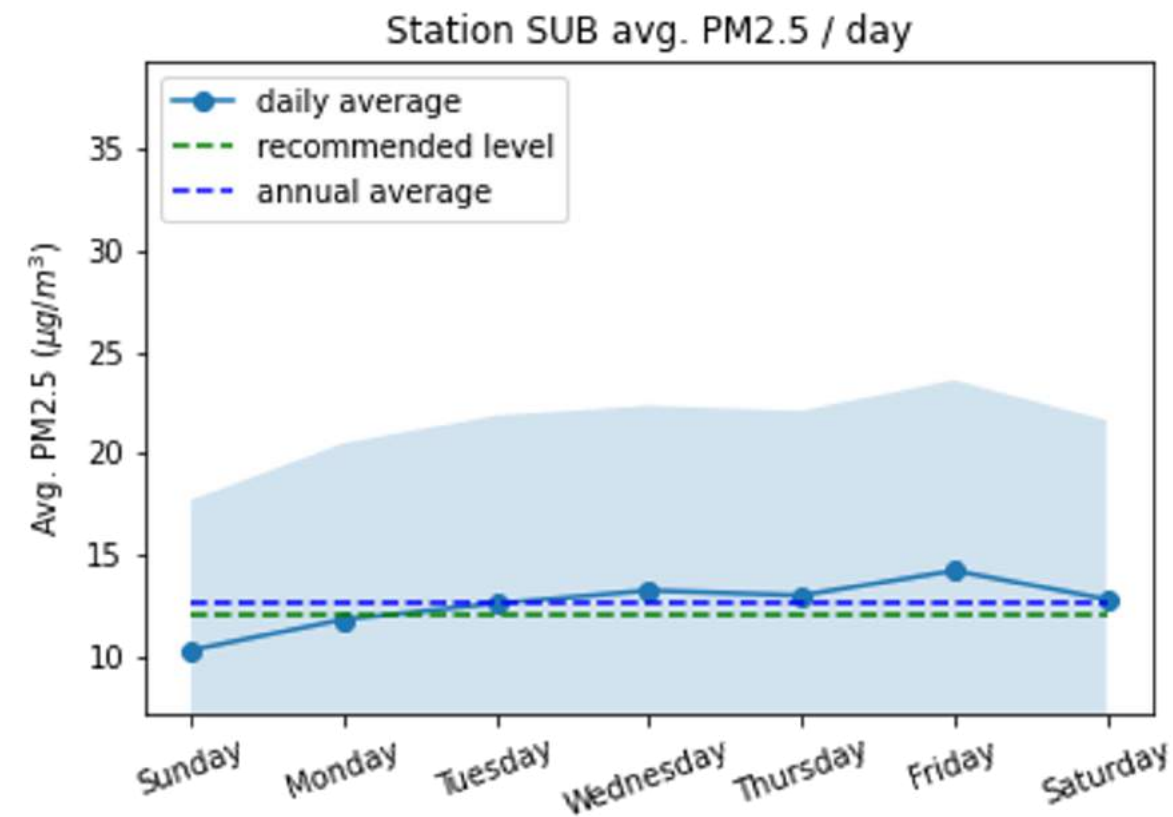
**CO & NOX: 0.73**



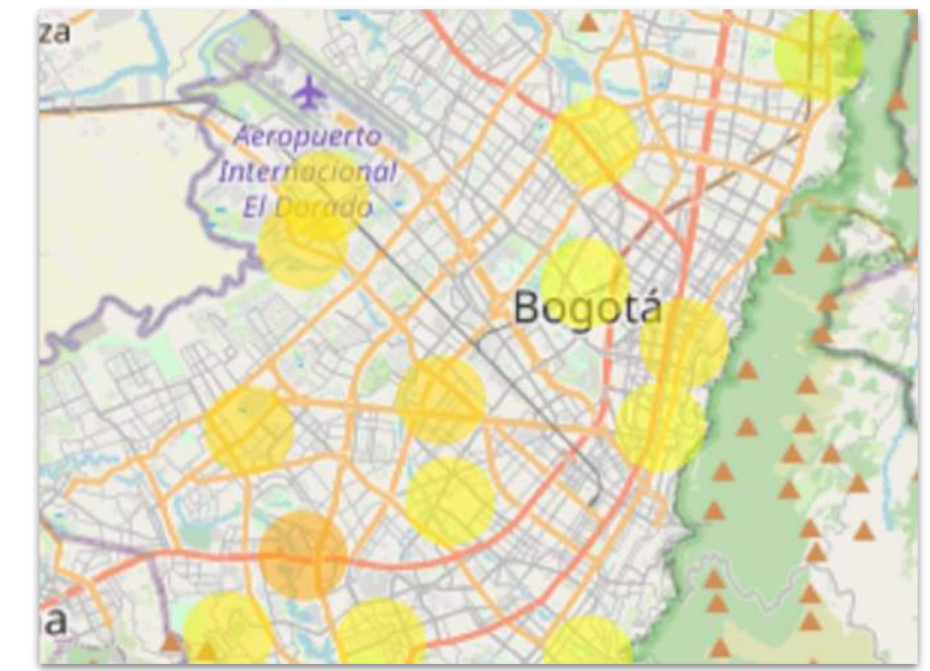
# Some factors that affect pollution levels



**Hour of day**



**Day of week**



**Location**

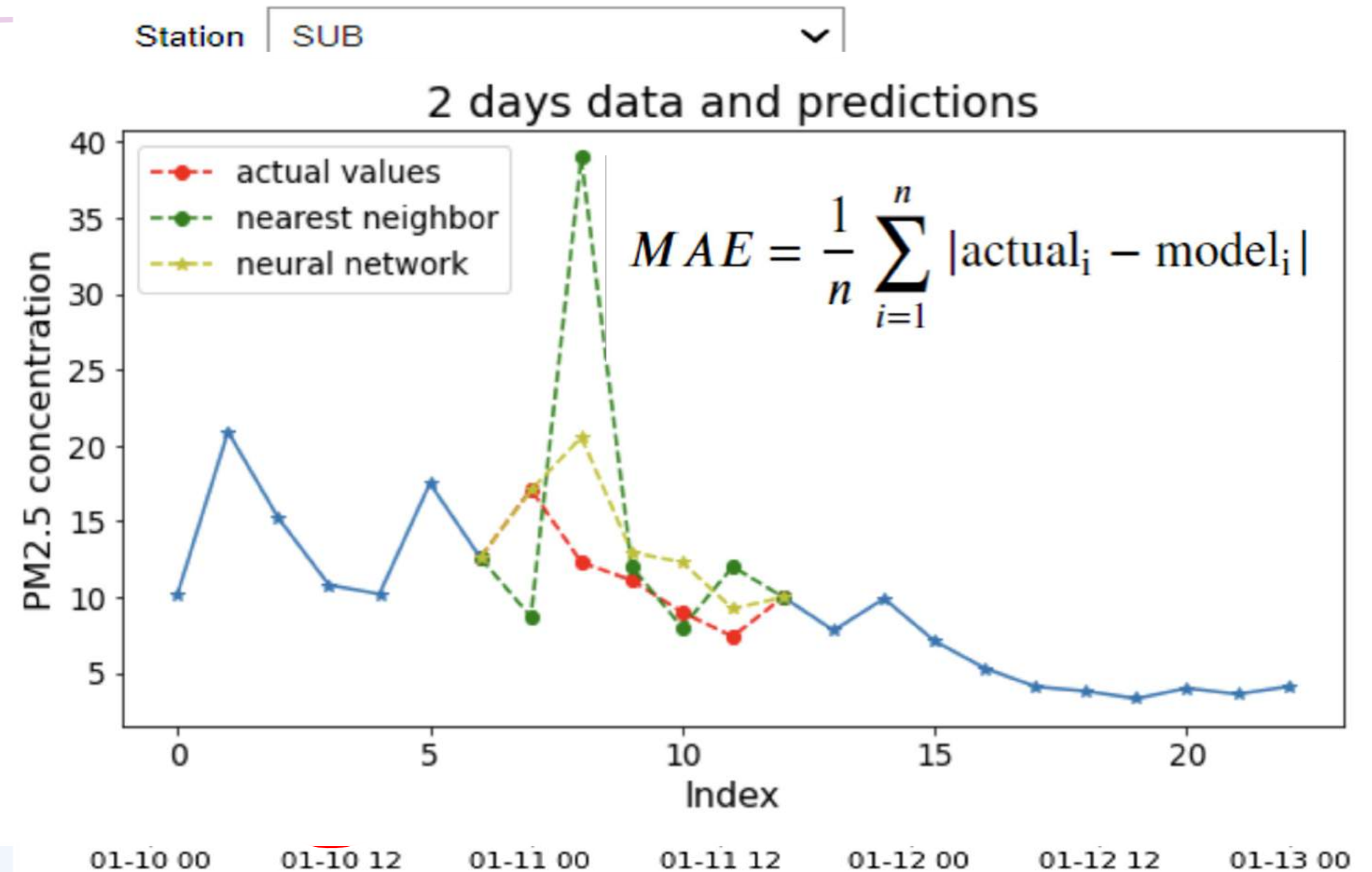
# AI for Good framework



Explore

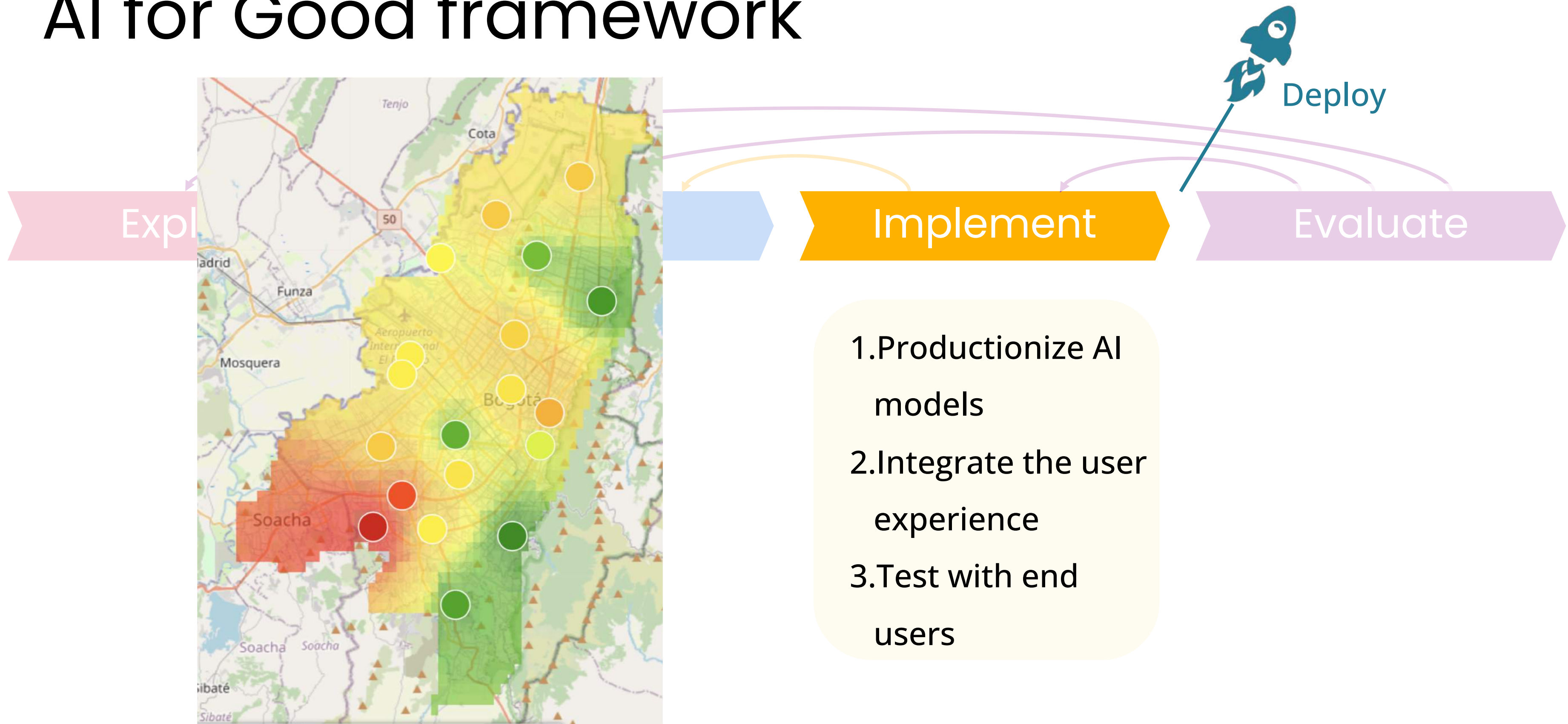
Design

1. Prototype your solution
2. Ensure data privacy
3. Design the user experience





# AI for Good framework





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# AI and Public Health

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**Project Spotlight:  
Air pollution in South Africa  
– Tapiwa Chiwewe**



# Air pollution

**6.7 million**  
premature deaths  
annually

**98% of urban  
areas** don't meet  
accepted quality  
standards

1\$ invested  
=  
**30\$ benefit**

# Guidelines for success

**1. Could AI add value? Where and how specifically?**

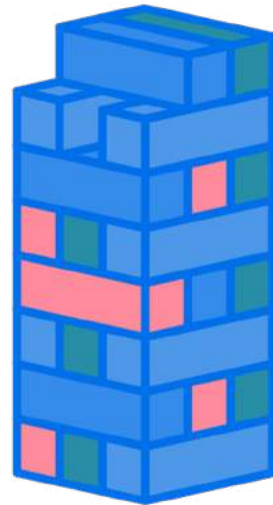


# Guidelines for success

**1. Could AI add value? Where and how specifically?**



**2. Build on existing Infrastructure**

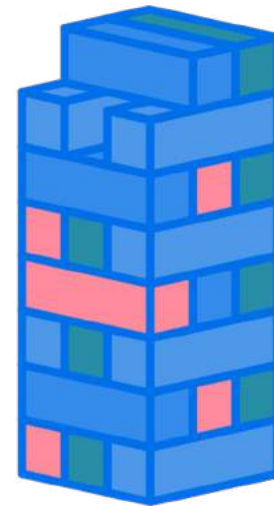


# Guidelines for success

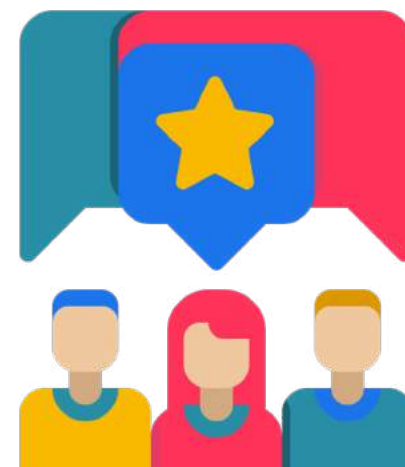
**1. Could AI add value? Where and how specifically?**



**2. Build on existing Infrastructure**



**3. Collaborate for success**





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# AI and Public Health

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## Course 1 Wrap Up



# AI for Good framework

