

MECE Breakdown for Air Pollution Data

1. Data Segmentation (Mutually Exclusive, Collectively Exhaustive)

a. By Time:

- Daily pollution levels (e.g., Date column).
- Hourly pollution variations (e.g., O3 1st Max Hour, CO 1st Max Hour).

b. By Location:

- State-level data (e.g., State column: Arizona).
- County-level data (e.g., County column: Maricopa).
- City-level data (e.g., City column: Phoenix).
- Address-specific data (e.g., Address column: exact location).

c. By Pollutants:

- Ozone (O3): Metrics like O3 Mean, O3 AQI.
- Carbon Monoxide (CO): Metrics like CO Mean, CO AQI.
- Sulfur Dioxide (SO2): Metrics like SO2 Mean, SO2 AQI.
- Nitrogen Dioxide (NO2): Metrics like NO2 Mean, NO2 AQI.

Scope (Mutually Exclusive, Collectively Exhaustive)

A. Descriptive Analysis:

- Identify average pollution levels (mean values for O3, CO, etc.).

a. Pollutant Features:

- Mean levels (O3 Mean, CO Mean, etc.).
- Max values (O3 1st Max Value, CO 1st Max Value, etc.).
- AQI values (O3 AQI, CO AQI, etc.).
- Geographic Features: Find maximum pollution values and the hours they occur.
- Track the daily AQI for each pollutant.

b. Predictive Analysis:

- Predict AQI for specific pollutants (e.g., O3 AQI).
- Forecast daily or hourly pollution levels.
- Predict the most likely pollutant contributing to poor AQI.

4. Feature Categorization (Mutually Exclusive, Collectively Exhaustive)

a. Time-Based Features:

- Date (Date column).
- Hour (O3 1st Max Hour, CO 1st Max Hour, etc.).

b. Geographical:

- State, County, City, and Address.

5. Machine Learning Task Design (Mutually Exclusive, Collectively Exhaustive)

a. Regression Tasks:

- Predict AQI for individual pollutants (e.g., O₃, CO).
- Predict the hourly maximum pollution levels.

b. Classification Tasks:

- Classify AQI into health categories (Good, Moderate, Unhealthy, etc.).
- Identify regions as high, medium, or low pollution zones.

c. Clustering Tasks:

- Group locations with similar pollution trends.
- Identify time periods with similar pollutant behavior.

6. Metrics for Monitoring (Mutually Exclusive, Collectively Exhaustive)

a. Pollutant-Specific Metrics:

- Daily mean levels (O₃ Mean, CO Mean, etc.).
- Maximum values by pollutant.
- AQI values by pollutant.

b. Aggregated Metrics:

- Total AQI as a weighted sum of individual AQIs.
- Peak pollution hours.