Air Pollution Prediction based on multicollinearity

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Overview

Problem Definition
Air pollution predictors
Challenges
Challenges
Proposed Model
Model Prediction and Evaluation
Model Prediction and Evaluation
Evaluation Results
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Problem Definition

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Defn

Predict air pollution composition in atmosphere in the future.

- Use predictors such as Temperature,Humidity,Sensor data.
- Response variables are carbon monoxide,benzene,notrous oxide

Linear Regression vs Rigid Regrssion

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Linear Regression

- Linear regression presents relationship as a straight line.
- Show correlation between two variables (one predictor for response variable/variables).
- Response should be continuous and independent variable(s) (predictor variables) can be continuous or discrete.

Rigid Linear Regression

- Use to implement multicollinearity of predictor variables which are highly correlated each other objects in the whole dataset.
- Add penalty values to reduce the loss or error of linear regression cause by bias and/or variance of the variables.

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Challenges

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multicollinearity

- Focus on correlation between predictors.

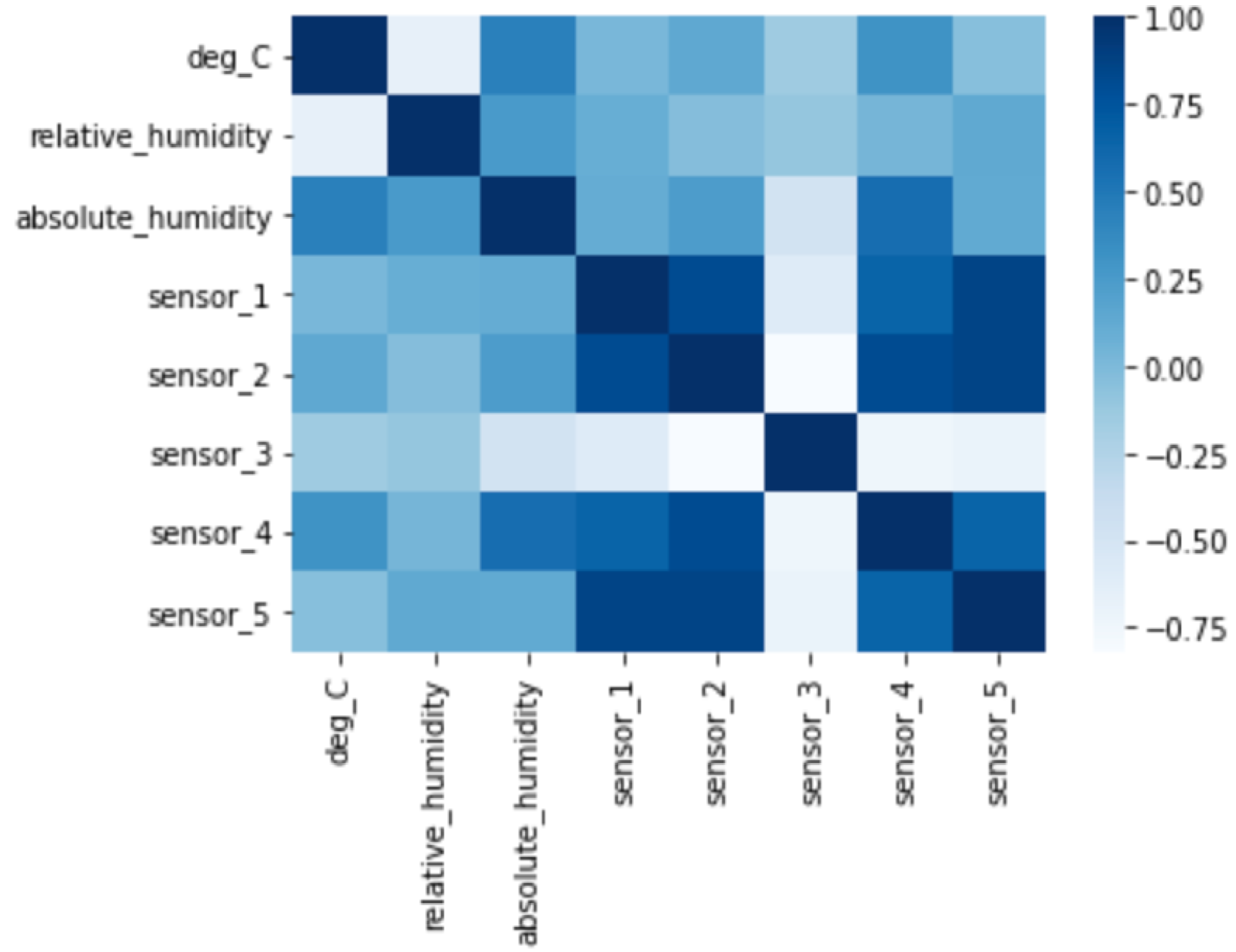

Figure 1: Framework of Model

Reasons for multicollinearity in predictors.

- Inaccurate use of different types of variables.
- Poor selection of questions or null hypothesis.
- Variable repetition.
- A dependent variable selection.
- High correlation.
- Use of dummy variables.

Challenges

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Fixing multicollinearity

- Obtain more data.
- Utilize a ridge regression.
- Utilize a partial squares regression
- Removing a variable.
- Do nothing.

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Proposed Model

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Framework of Proposed Model:

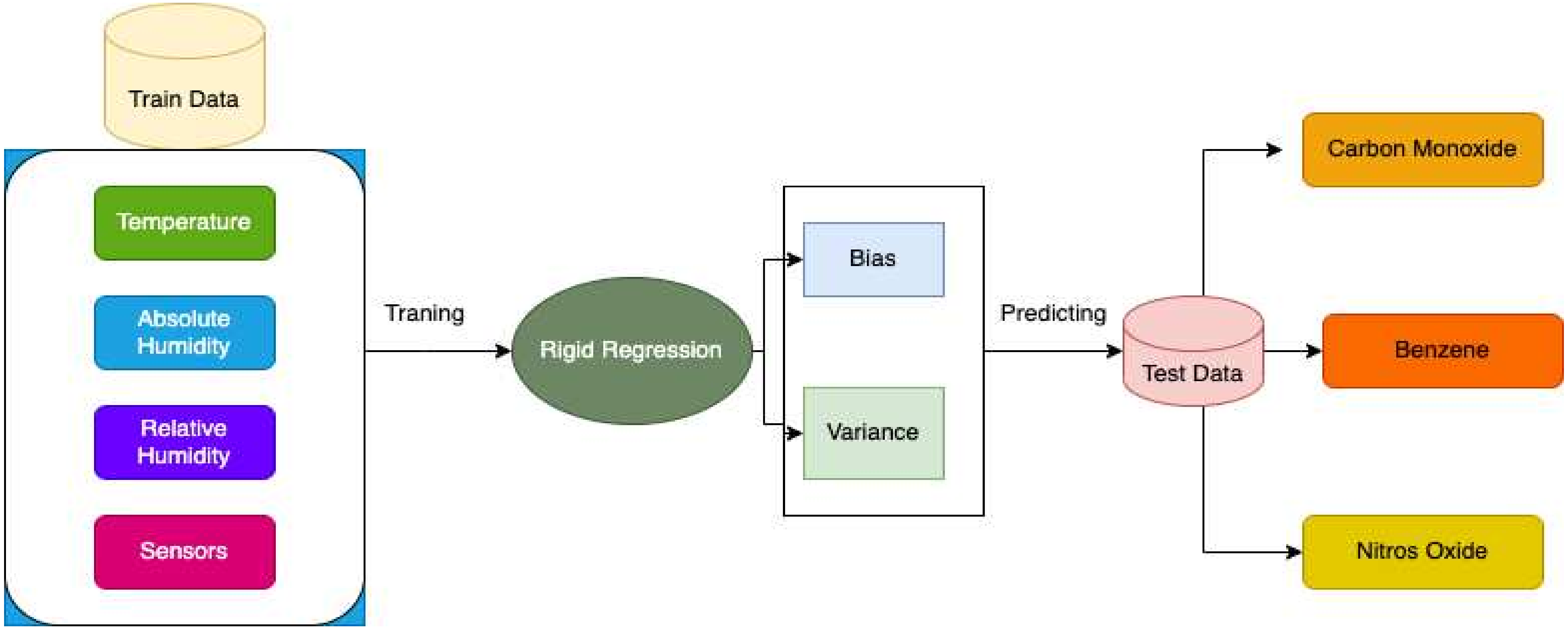

Figure 2: Framework of Model

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Bias and Variance

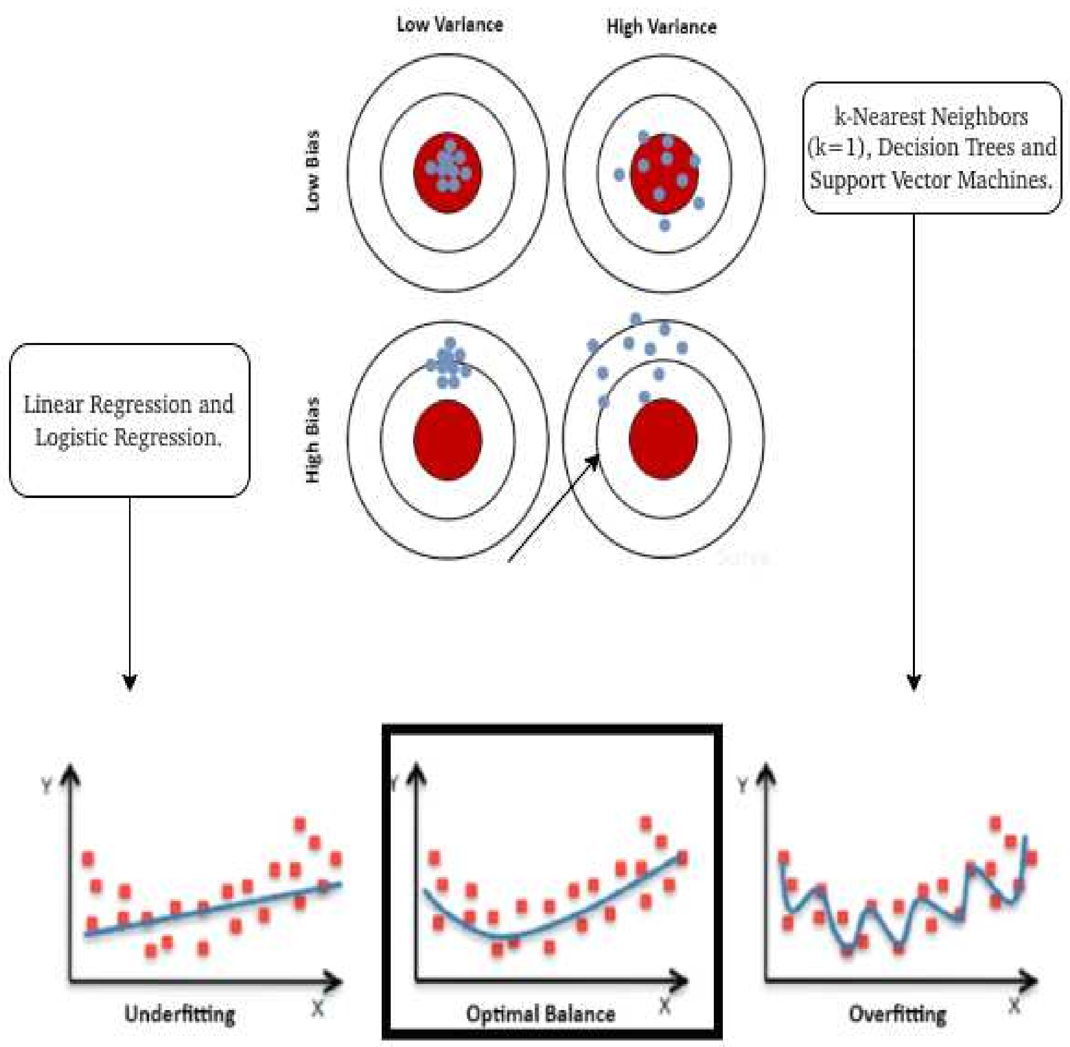

Figure 3: Bias and VAriance

Reasons for multicollinearity in predictors.

- Remove Duplicates.
- Remove unwanted columns.
- Scale for data consistency.
- Remove Outliers.

Preprocessing and Model training

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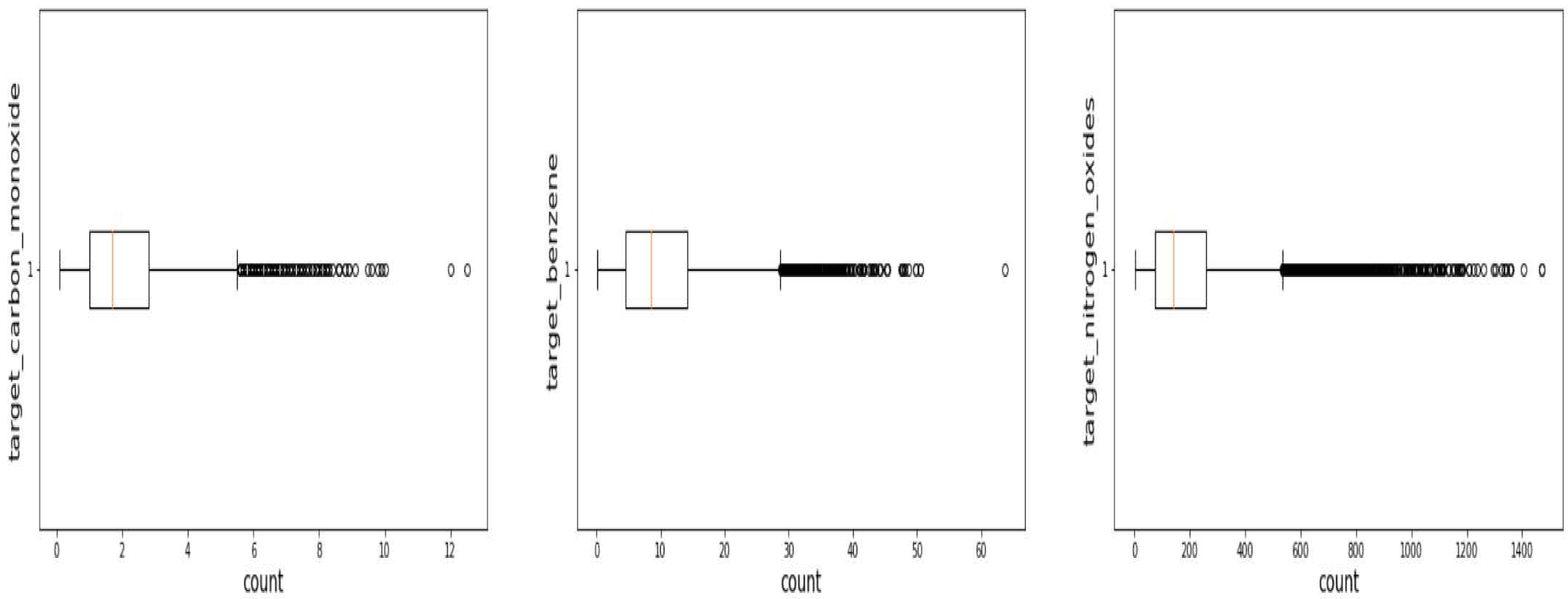

Figure 4: Response data distribution and Outlier Detection.

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- Relationships between predictors and response variables over time.

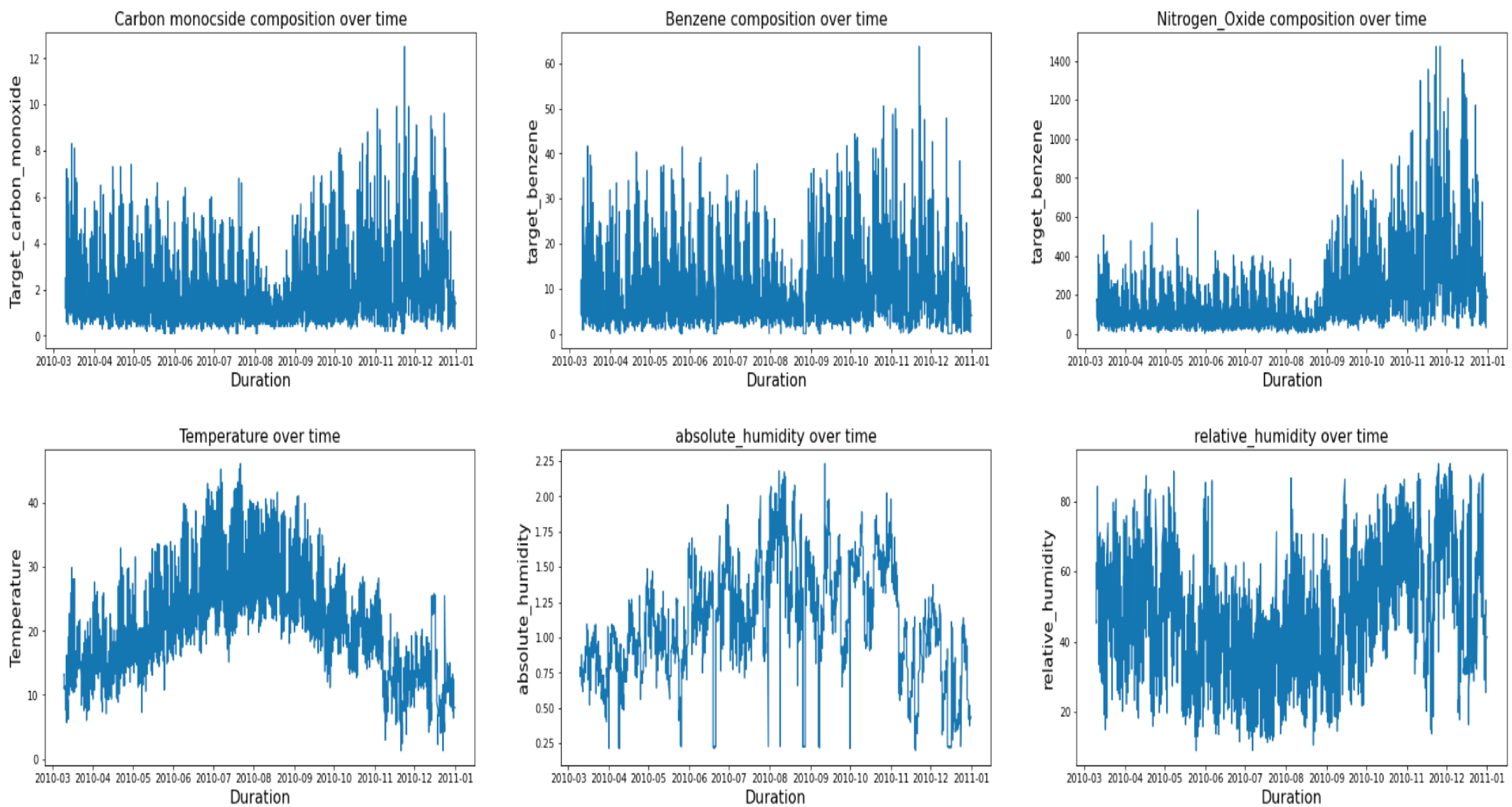

Figure 5: Relationships over the time

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- Determination of coefficient.

	CM	Benzene	NO
Bias	0.38	3.379	12916.6
Variance	0.001	0.009	30.591
CD Training	0.82	0.95	0.68
CD Testing	0.83	0.94	0.66

CD : Coefficient Determination
CM : Carbon Monoxide
NO : Nitrous Oxide

Figure 6: performance Evaluation

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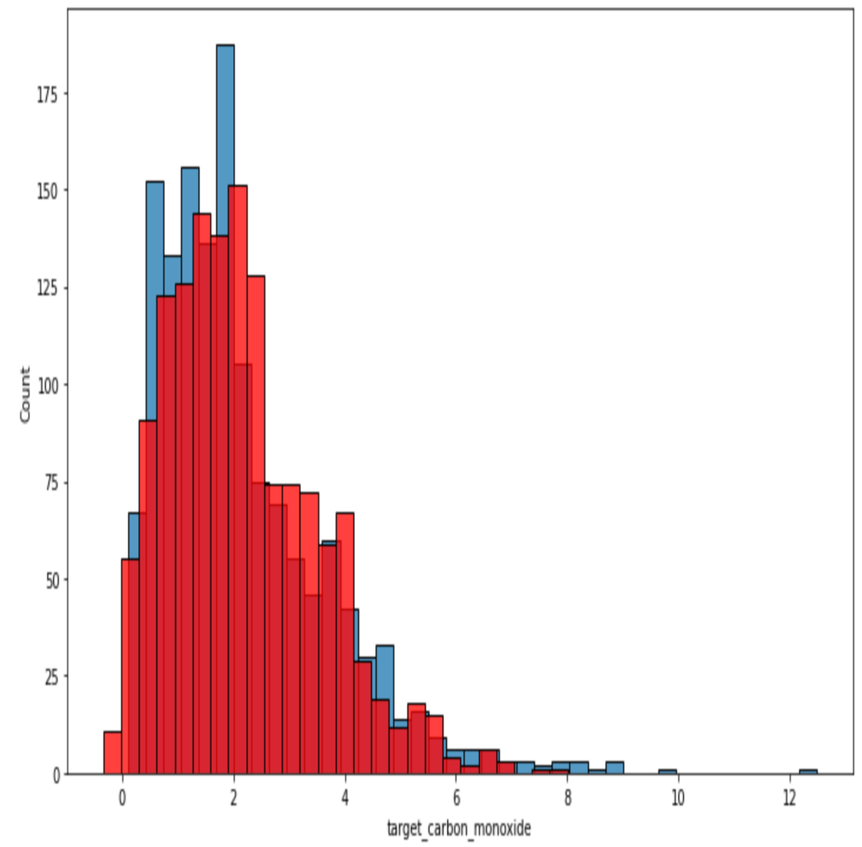
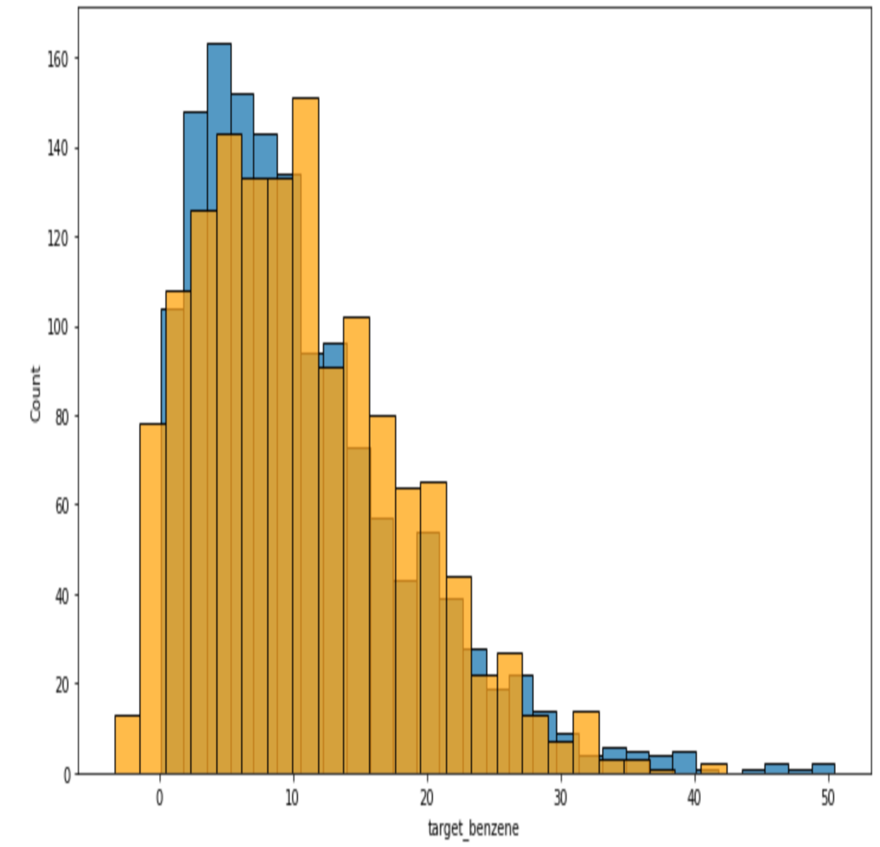
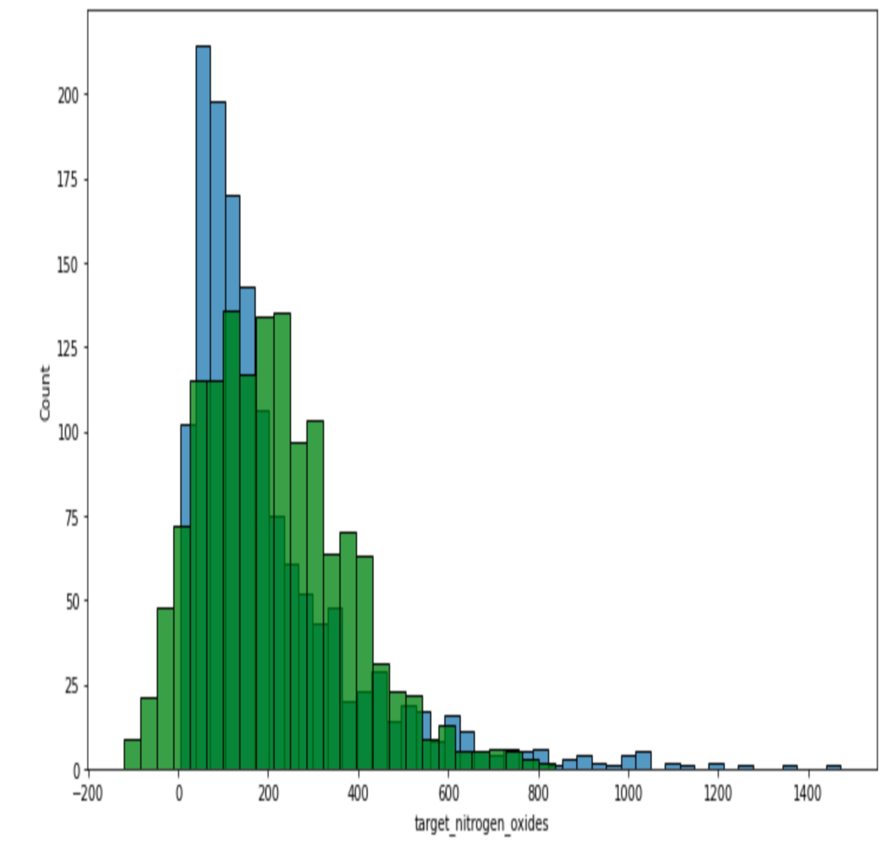


(a) Carbon_monoxide_prediction



(b) Benzene_Prediction



(c) Nitrous Oxide Prediction

Figure 7: Histogram of three test feature predictions

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- Problem Definition: we propose prediction model to predict air pollution components which are specified as carbon monoxide, benzene and nitrous oxide. Algorithm Consequently, we use rigid linear regression instead general linear regression method.
- Strategies :We uses multiple predictors such as temperature, absolute and relative humidity and five sensor data. We identify that these predictors are correlated among each other. Therefore, we reveals the need of handling multicollinearity. We clearly show the performance efficiency of proposed models using determi- nation of coefficient, bias and variance scores for each models.
- Recommendations : Evaluate how well these prediction models behave on adding more noisy data. How to affect prediction accuracy by noisy data. Increase the amount of predictors to predict air pollution

Questions?

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