



## Use Case

**Predicting CO and NO<sub>x</sub> emissions from Gas Turbines**

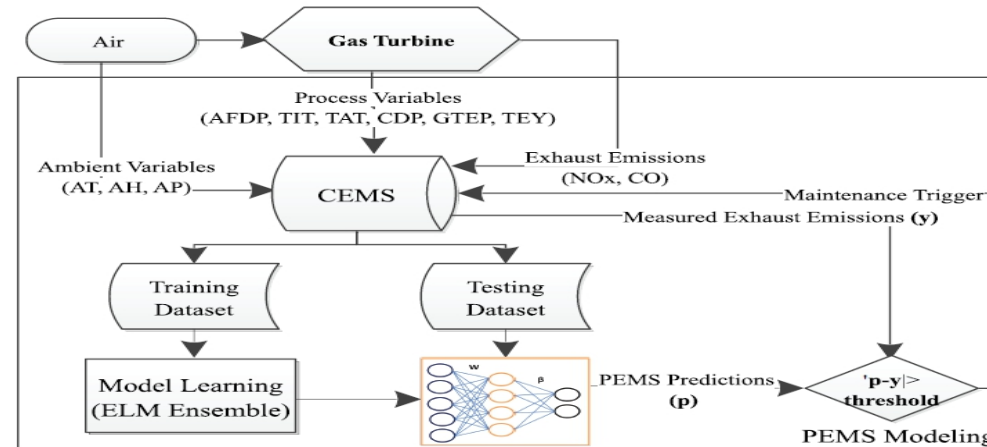
# Predicting CO and NOx emissions from gas turbines

## Objective:

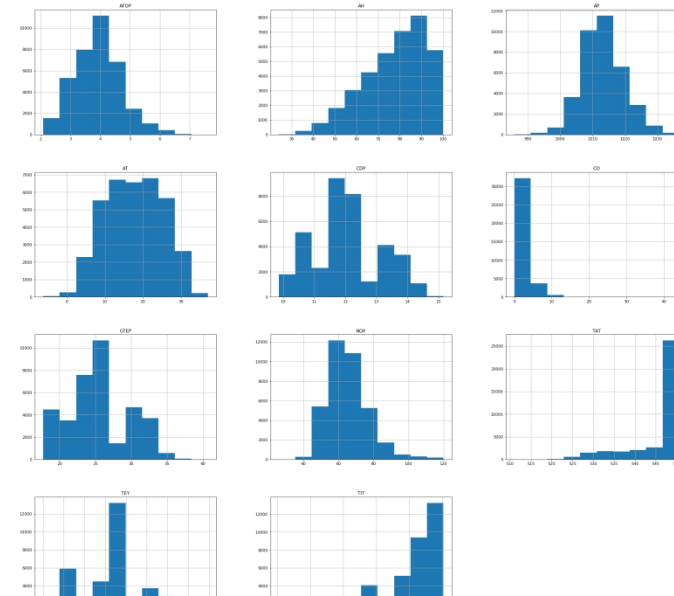
- Identify the important Process Parameters (KPI's)
- Prediction/ building Soft Sensors for CO and NOx

## Collected Data

- Ambient temperature(AT) in °C
- Ambient pressure(AP) in mbar
- Ambient humidity (AH) (%)
- Air filter difference pressure(AFDP) in mbar
- Gas turbine exhaust pressure (GTEP) in mbar
- Turbine inlet temperature(TIT) in °C
- Turbine after temperature(TAT) in °C
- Compressor discharge pressure(CDP) in mbar
- Turbine energy yield(TEY) in MWH
- Carbon monoxide(CO) in mg/m3
- Nitrogen oxides(NOx) in mg/m3



Data Pipeline and Model Prediction Diagram

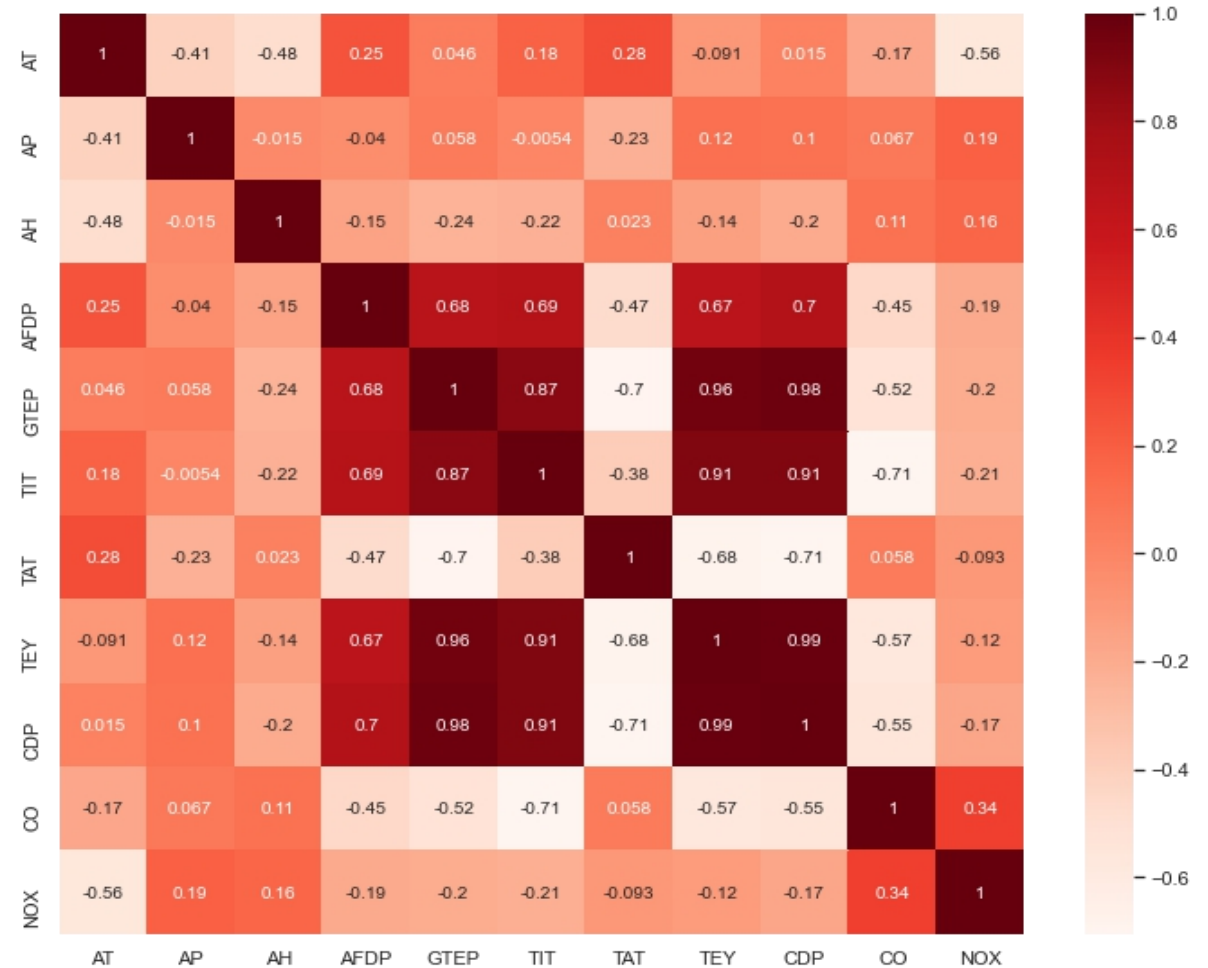


Dataset Distribution analysis

# Predicting CO and NOx emissions from gas turbines

## Correlation analysis:

- Correlation analysis was carried out to estimate the extent of linear interactions and to eliminate any multi-collinearity
- Gas turbine exhaust pressure (GTEP) in mbar & Turbine inlet temperature (TIT) in °C seems to be heavily correlated to each other
- Gas turbine exhaust pressure (GTEP) in mbar is also heavily correlated with Compressor discharge pressure (CDP) in mbar & Turbine energy yield (TEY) in MWH
- CO and NOx doesn't correlate with any of the process parameters in linear fashion. It indicates that there is presence of non-linearity among the target emission parameters and input parameters



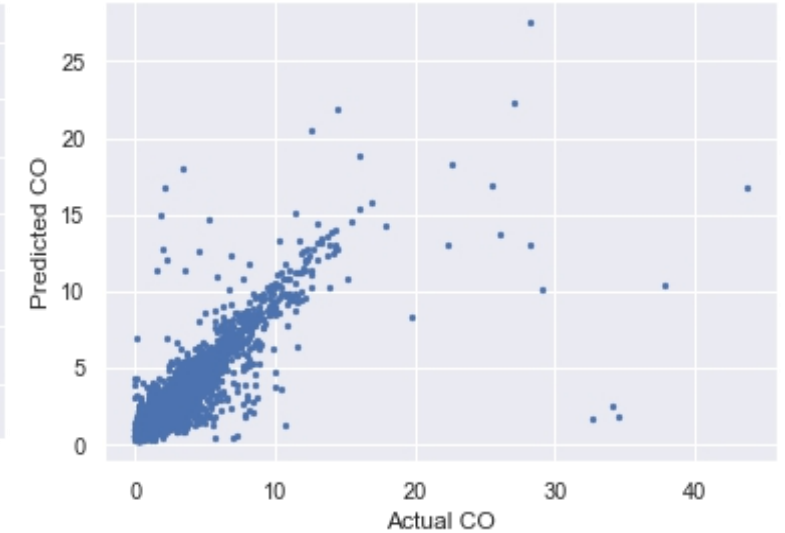
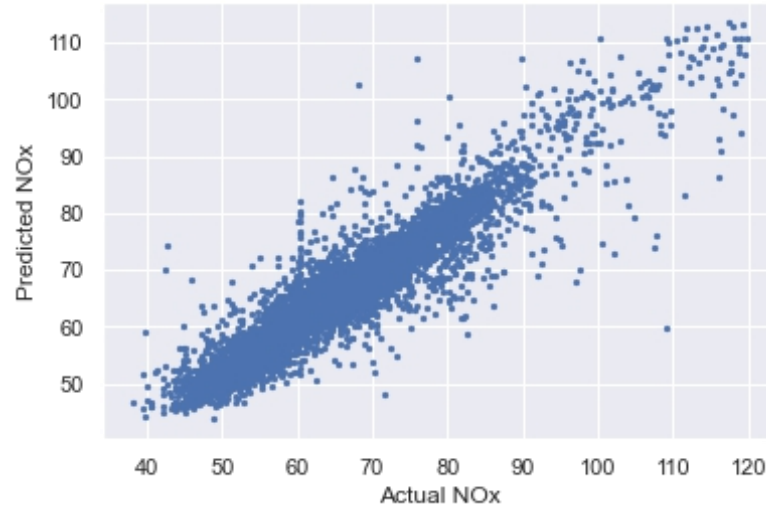
Correlations Matrix

# Predicting CO and NOx emissions from gas turbines

## Emission Model

### 1. NOx Emission Model:

- Linear Regression, Decision Tree and Random Forest were considered for building the prediction model
- Random Forest performed the best with accuracy of around 78 %
- The plot on the left indicates the scatter plot between the Predicted NOx and actual NOx for validation purpose



Prediction and Data insights using Python

### 2. CO Emission Model:

- Linear Regression, Decision Tree and Random Forest were considered for building the prediction model
- Random Forest performed the best with accuracy of around 92 %
- The plot on the left indicates the scatter plot between the Predicted CO and actual CO for validation purpose

Metric (NOx)	Value
R2	0.78
RMSE	4.89

Metric (CO)	Value
R2	0.92
RMSE	2.55

Prediction summary