Anomaly Detection In Time Series

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AIM

To detect anomalies in multivariate time series .

OBJECTIVES

- Convert multivariate to univariate time series using dimensionality reduction techniques.
- Detect anomalies in the data throughout all the features.

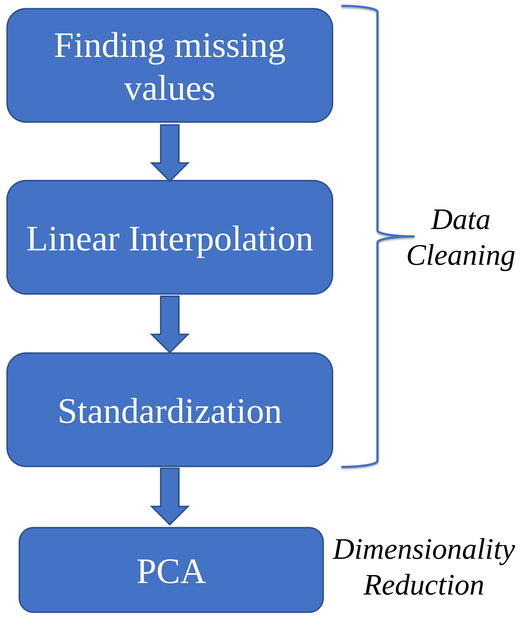
DATA

- The data consists of 6 features and a large number of sensor data , where each time stamp corresponds to 5 minutes.
- The data considered has only continuous columns.

continuous_cols

- ***Cyclone_ Inlet _Gas _Temp***
- ***Cyclone_Material_Temp***
- ***Cyclone_Outlet_Gas_Temp***
- ***Cyclone_cone_draft***
- ***Cyclone_Gas_Outlet_Temp***
- ***Cyclone_Inlet_Draft***

EXPLORATORY DATA ANALYSIS (EDA)



METHODOLOGY

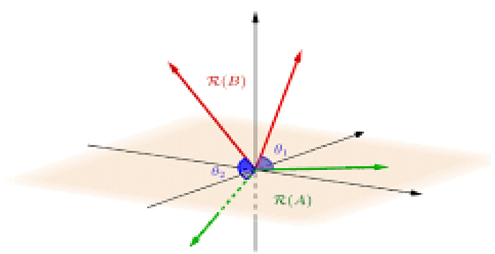
1. ***Angle between subspaces*** *:*

$$\delta_{AB} = \sqrt{1 - \lambda_{min}}$$

where,

δ_{AB} - Angle between subspaces

λ_{min} - Minimum most eigen value



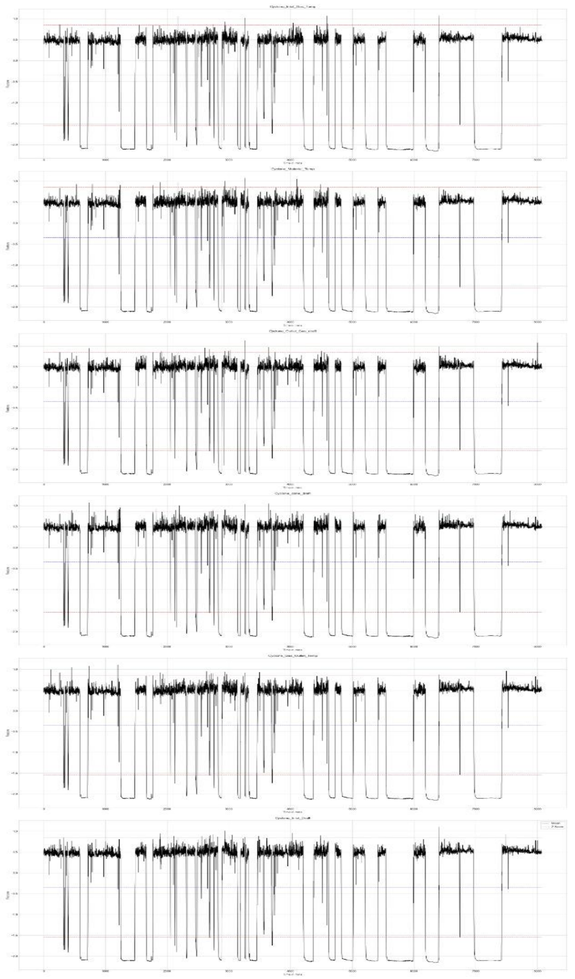
2. ***PCA between matrices***:

We consider the 30 min observation for anomaly detection , which gives us a 6*6 matrix for each 30 min time stamp. The PCA is measured between two 6*6 matrices, and the components defining maximum variance are considered.

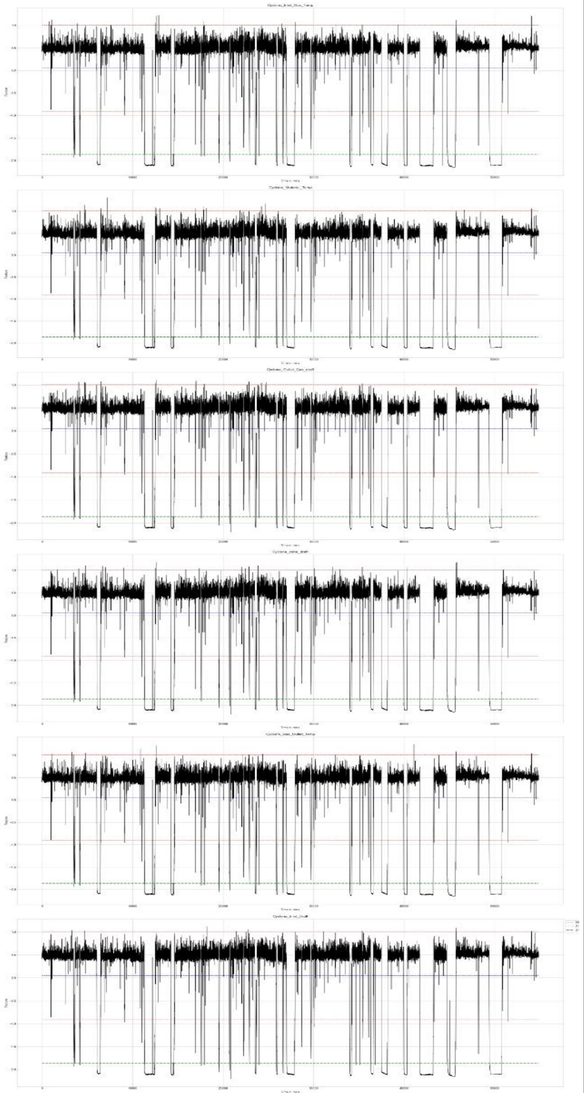
```
array([[-0.03725625,  0.06060878],
       [ 0.76312461,  0.41502158],
       [-0.0820869 , -0.08302113],
       [ 0.4796141 , -0.54785318],
       [-0.40367912,  0.34574001],
       [ 0.12856135,  0.63048544]])
```

RESULTS

Anomalies across features



Timestamps under which the powerplant works perfectly five plotted across six features.



CONCLUSION

The ratio of anomalies to non-anomalies may or may not vary with the change in duration consideration.