

Abnormality Detection in Cyclone Preheater

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Data Preparation:

- Six and its data collections are indicative of a manufacturing process.
- Intentions here are to look for aberrations if any in the process, caused by these six variables beyond the ambit of tolerance.
- Identify the variables causing intolerance. Look for tangible inter relation between them if any.
- Rationalization of the Data, to ensure uniformity of fields.
- The unobservable values in the features are cleaned and new dataset is preprocessed.
- The analysis is given year wise for and the abnormality is recorded for each feature.

Analysis Strategy:

- Identify the process mean and variance for all the six variables.
- Evaluate the process behavior about at, 1 Sigma, 2 Sigma and 3 Sigma levels of the mean.
- Identify the % tolerance of the six variables, at each of the above sigma levels.
- Assumptions are ,

<u>Threshold</u>	<u>Percentage</u>
1 sigma	66.7% --- data points
2 sigma	95% --- data points
3 sigma	99.7% --- data points

Methodology:

- Z-score is a numerical measurement used in statistics of a value's relationship to the mean (average) of a group of values, measured in terms of standard deviations from the mean. If a Z-score is 0, it indicates that the data point's score is identical to the mean score.
- The Problem is approached by applying z_score analysis on the features.
- The threshold value determines the functionality of the feature and how it behaves based on the threshold input.

$$z = \frac{X - \bar{X}}{S}$$

*where z is the standard score,
S = the standard deviation of a sample,
X = each value in the data set,
 \bar{X} = mean of all values in the data set.*

Working:

Preprocessor.py

- The missing values in the dataset is been handled.
- The dataset is partitioned based on each feature.
- CSV files are generated for each feature

Abnormality_Detection.py

- The threshold value is taken as input from the user.
- All the features are scaled according to z score normalization.
- Abnormalities are detected from the scaled features with respect the threshold value.

Main.py

- Preprocessor and detector objects are called in the main.py file

Abnormality values:

File_name=Abnormality_thresh1.txt

(Sigma==1)

[time	1-18-2017 4:00
Cyclone_Inlet_Gas_Temp	1085.38
Name: 4893, dtype: object, time	1-22-2017 23:30
Cyclone_Inlet_Gas_Temp	1057.17
Name: 6278, dtype: object, time	1-25-2017 1:00
Cyclone_Inlet_Gas_Temp	1097.0
Name: 6872, dtype: object, time	1-26-2017 10:20
Cyclone_Inlet_Gas_Temp	1064.62
Name: 7272, dtype: object, time	2-8-2017 7:15
Cyclone_Inlet_Gas_Temp	1061.18
Name: 10979, dtype: object, time	3-16-2017 18:20
Cyclone_Inlet_Gas_Temp	1077.58
Name: 21466, dtype: object, time	3-16-2017 18:25
Cyclone_Inlet_Gas_Temp	1067.89
Name: 21467, dtype: object, time	3-20-2017 22:20
Cyclone_Inlet_Gas_Temp	1060.3
Name: 22666, dtype: object, time	3-21-2017 13:40

File_name=Abnormality_thresh2.txt

(sigma==2)

	[time	5-20-2017 1:50
	Cyclone_Inlet_Gas_Temp	69.35
Name: 39983, dtype: object, time		5-20-2017 1:55
	Cyclone_Inlet_Gas_Temp	68.28
Name: 39984, dtype: object, time		5-20-2017 2:00
	Cyclone_Inlet_Gas_Temp	67.06
Name: 39985, dtype: object, time		5-20-2017 2:05
	Cyclone_Inlet_Gas_Temp	66.15
Name: 39986, dtype: object, time		5-20-2017 2:10
	Cyclone_Inlet_Gas_Temp	65.37
Name: 39987, dtype: object, time		5-20-2017 2:15
	Cyclone_Inlet_Gas_Temp	64.68
Name: 39988, dtype: object, time		5-20-2017 2:20
	Cyclone_Inlet_Gas_Temp	63.98
Name: 39989, dtype: object, time		5-20-2017 2:25
	Cyclone_Inlet_Gas_Temp	63.29
Name: 39990, dtype: object, time		5-20-2017 2:30
	Cyclone_Inlet_Gas_Temp	62.57
Name: 39991, dtype: object, time		5-20-2017 2:35

File_name=Abnormality_thresh3.txt
(sigma==3)

[time	8-1-2018 0:05
Cyclone_cone_draft	-459.31
Name: 164773, dtype: object, time	9-15-2018 8:35
Cyclone_cone_draft	488.86
Name: 177835, dtype: object, time	9-15-2018 8:45
Cyclone_cone_draft	137.39
Name: 177837, dtype: object, time	8-1-2018 0:05
Cyclone_Inlet_Draft	-396.37
Name: 164772, dtype: object, time	8-23-2018 2:15
Cyclone_Inlet_Draft	-391.08
Name: 171134, dtype: object]	

Thank You