ANOMALY DETECTION FOR PREDICTIVE MAINTENANCE

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BLUEPRINT FOR ANOMALY DETECTION SYSTEM

- Data Preparation.
- Data Cleaning and Preprocessing
- Feature Selection
- Machine Learning Techniques
- Evaluation
- Detection and Alert.

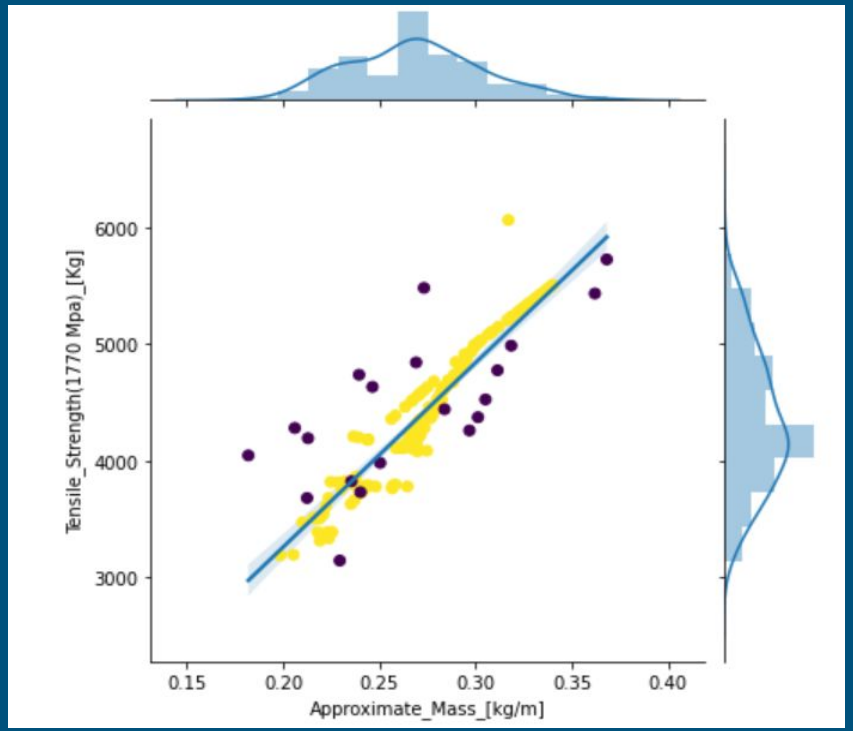
DATA PREPARATION

- Extracted data with nominal diameter of wire rope as 8mm.
- Created synthetic dataset using SMOTE to increase the data samples.
- Generated noisy data by computing the gaussian noise and assigned it to a variable "Noise" with noise scale factor as 0.8 and 1.0.
- Added the 20% noisy samples to the dataset (Dataset = Dataset + Noise).

DATA-PREPROCESSING

- Dealing with Null Values.
- Dealing with Categorical Variables.
  - Frequency Encoding.
- Dealing with Nominal variables.
  - Min-Max Scaling.

FEATURE SELECTION (DATA VISUALIZATION)



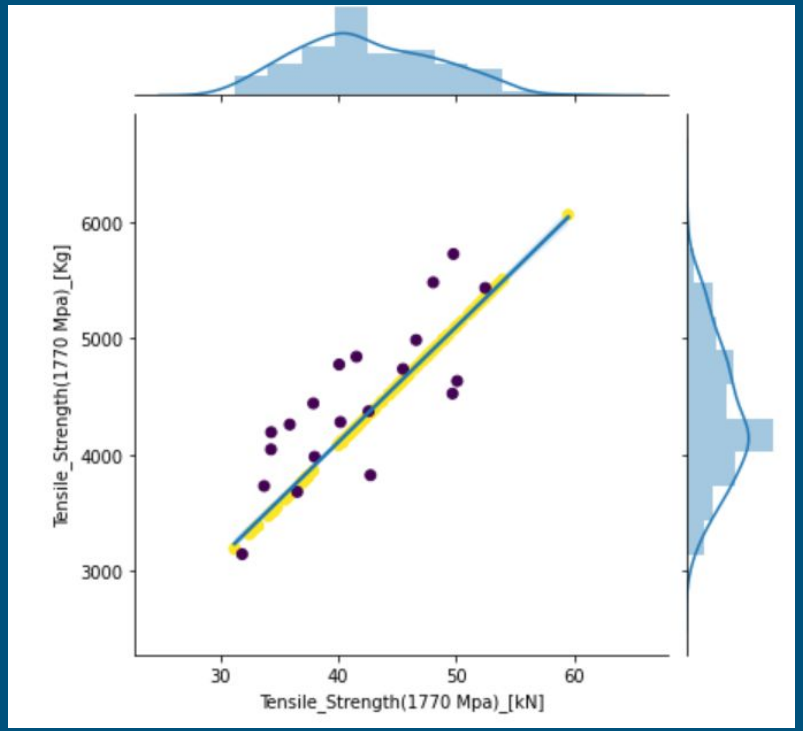


Figure -1: Scatter -Plots b/w Tensile Strength and Approximate mass of Steel-Wire rope.

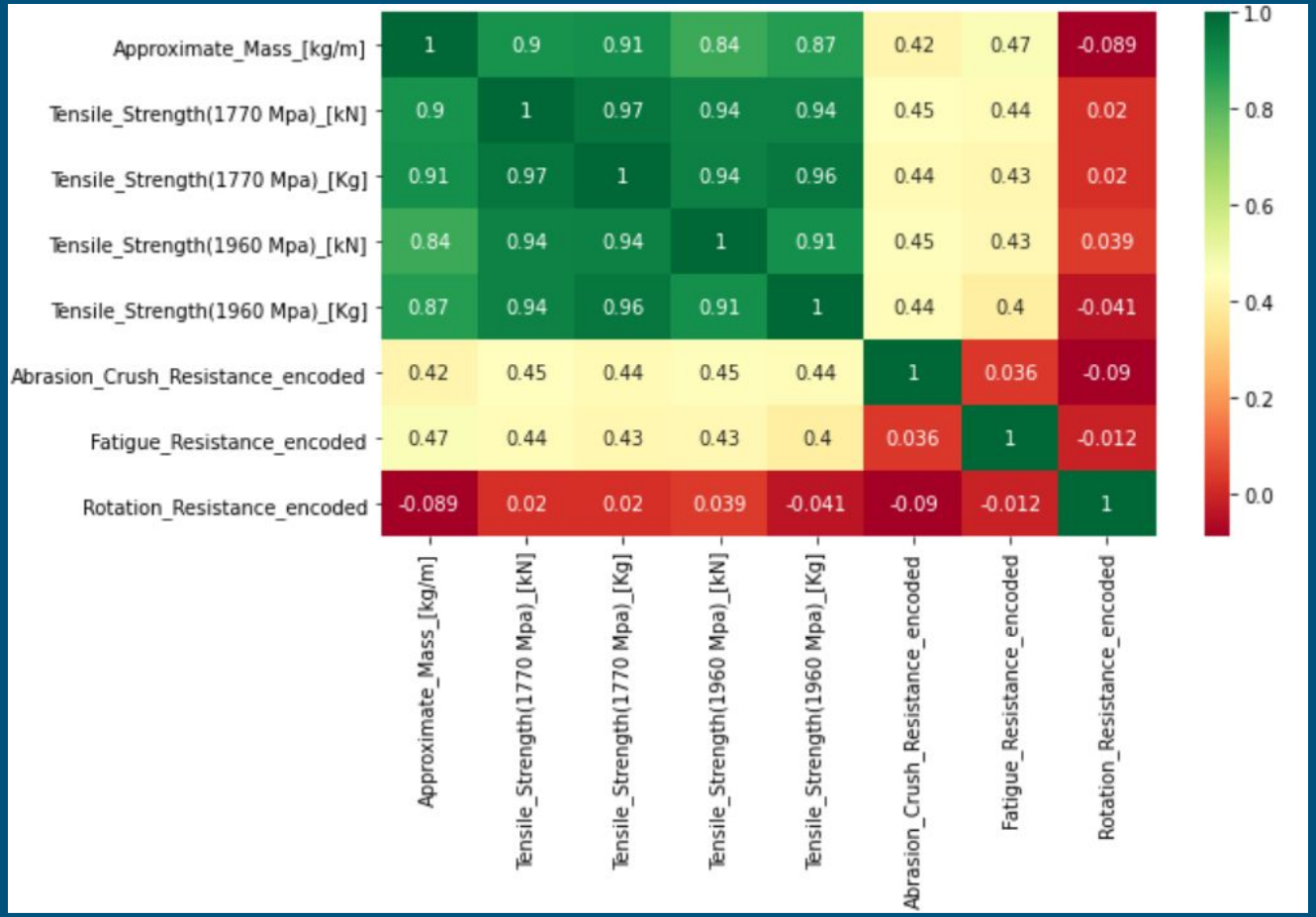


Figure-2 : Coorelation Matrix Heatmap between features.

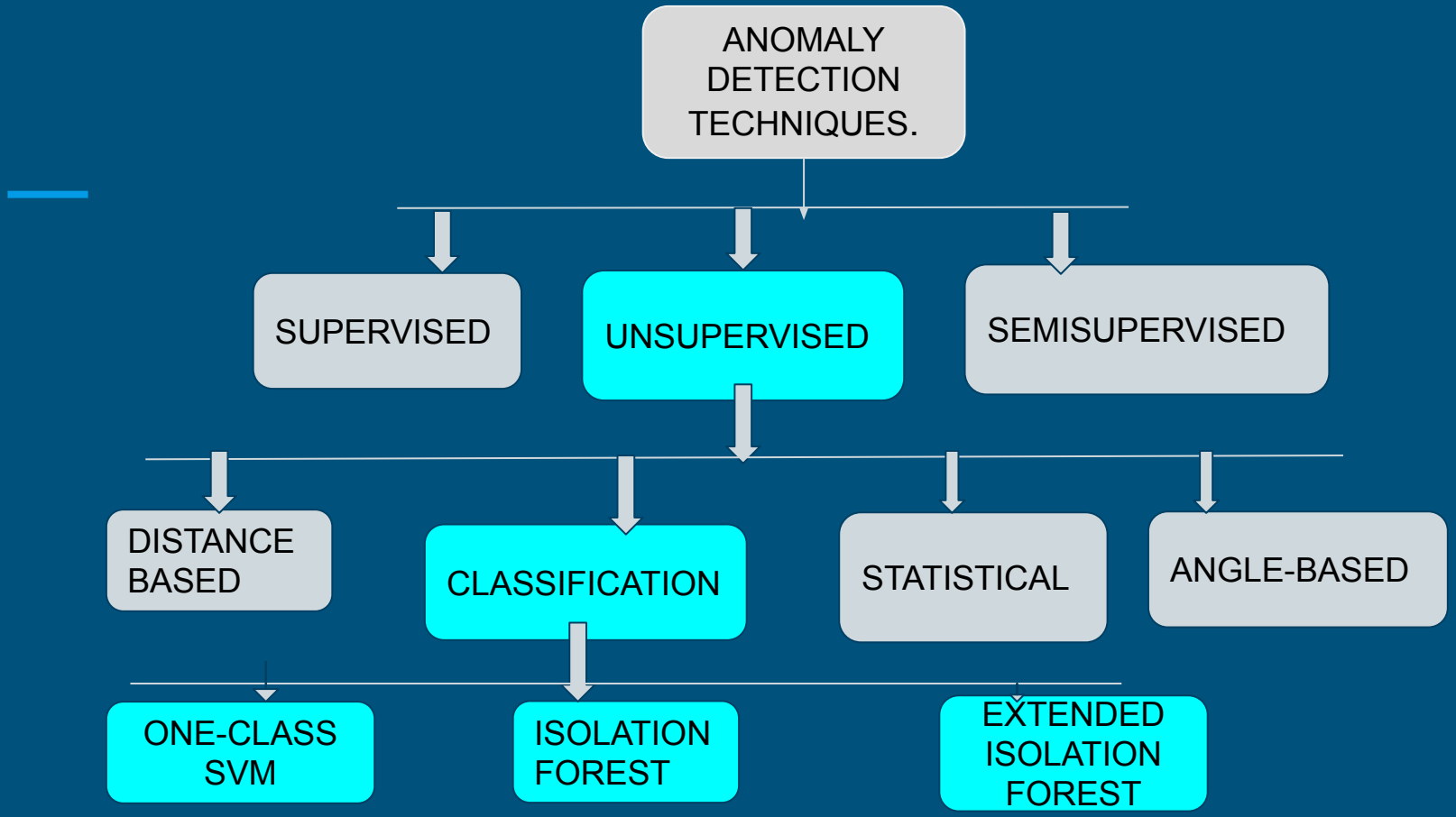


Figure-3: Chart outlining the Algorithms used for Anomaly Detection.

EVALUATION

Using K-Fold Cross-Validation

- K-Fold CV is where a given data set is split into a ***K*** number of sections/folds where each fold is used as a testing set at some point.
- K-fold Cross validation is performed on machine learning models.
  - One-Class SVM.
  - Isolation Forest.
  - Extended Isolation Forest.

Results

Accuracy Observed with the Noise introduced in Data for different algorithms.

Scale-Factor for Noise\ Algorithm Applied	One-class svm	Isolation Forest	Extended Isolation Forest
0.8	0.72	0.83	0.85
1.0	0.84	0.89	0.93