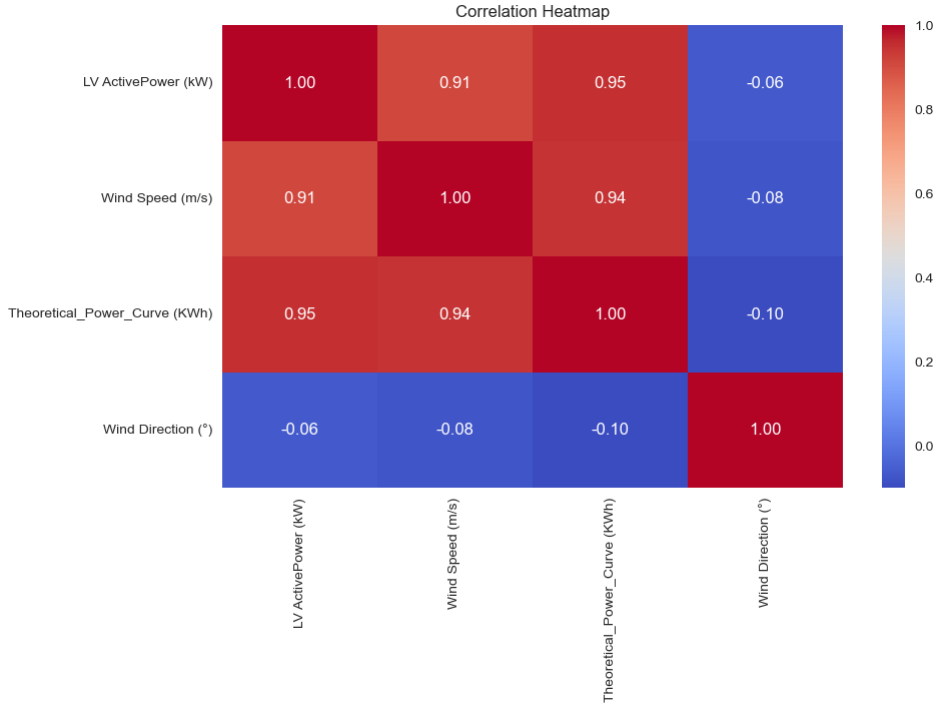
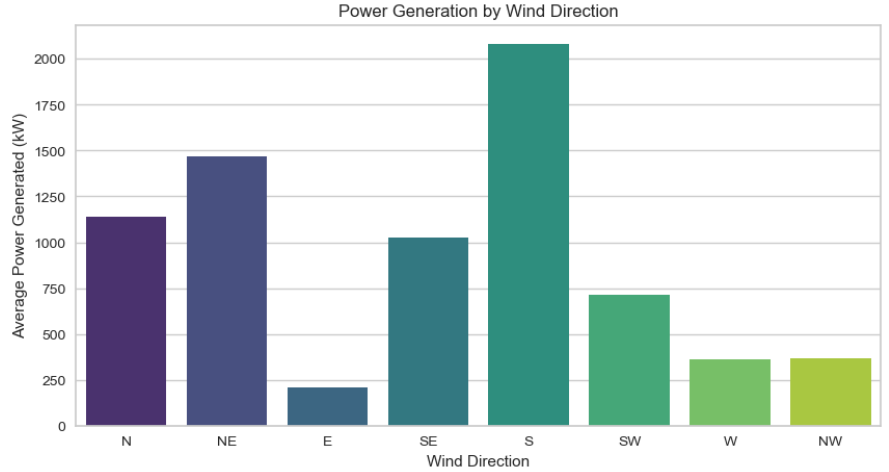
PREDICTIVE MAINTENANCE & DIGITAL TWIN FOR WIND TURBINES

HARSH MEHTA

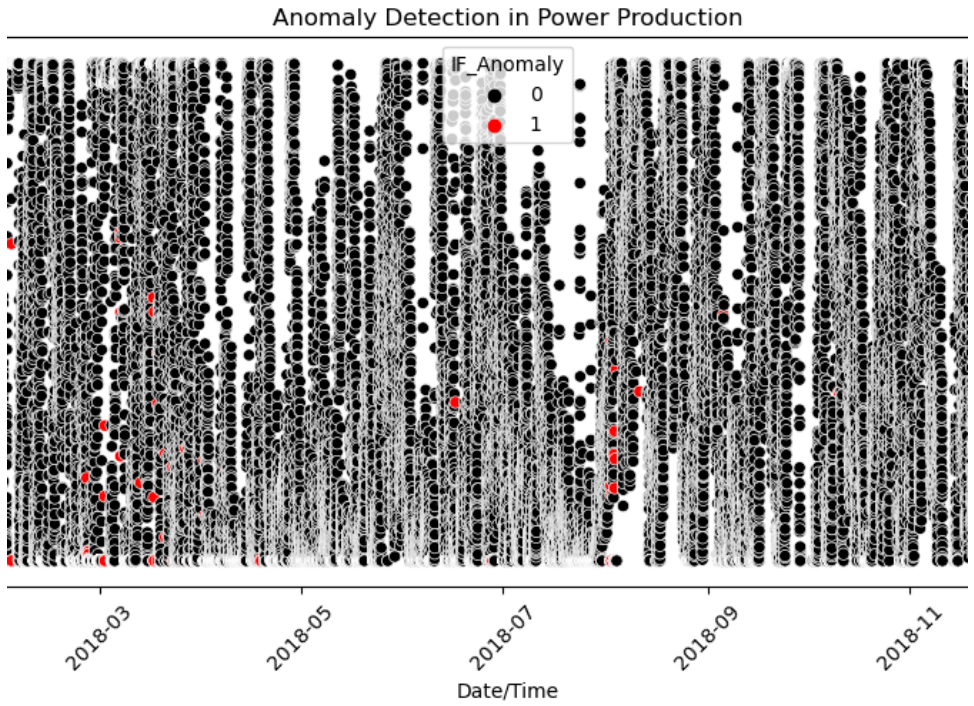


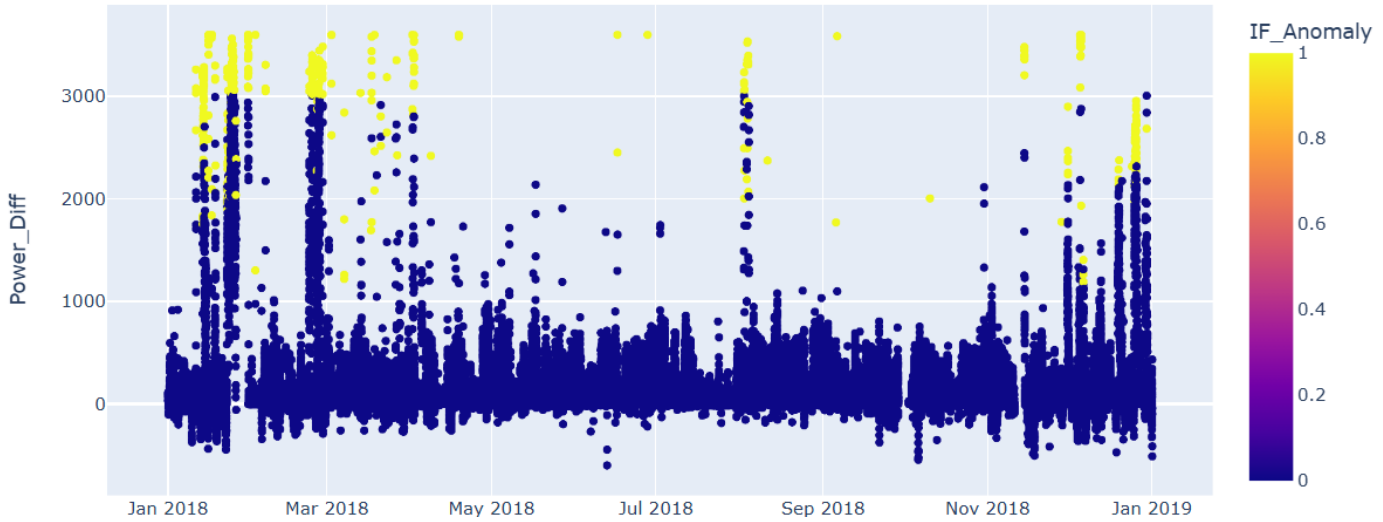


EDA INSIGHTS

- LOW POWER PRODUCTION FOR CERTAIN WIND DIRECTIONS
- HIGH CORRELATION BETWEEN WIND SPEED AND POWER GENERATED
- POWER PRODUCTION TROUGH OUT THE DAY AND YEAR IS NOT CONSTANT
- NO SEASONALITY IN THE POWER PRODUCTION

ANOMALY DETECTION:
USED ISOLATION FOREST TECHNIQUE WITH CONTAMINATION=0.01 AND FOUND THAT THE ABNORMAL READINGS ARE IN THE READINGS WHERE THE DIFFERENCE BETWEEN POWER GENERATED AND EXPECTED POWER IS VERY HIGH.





FEATURE ENGINEERING

- We are using random forest regressor to predict failure within 24 hours
- Features like Date/time are removed but we extracted important features like Month and hour from it

Adding features

- Using rolling aggregation and lag function
- Extracting features like hour and month

Removing features

- Ensure to remove features which can led to data leakage

Split the data

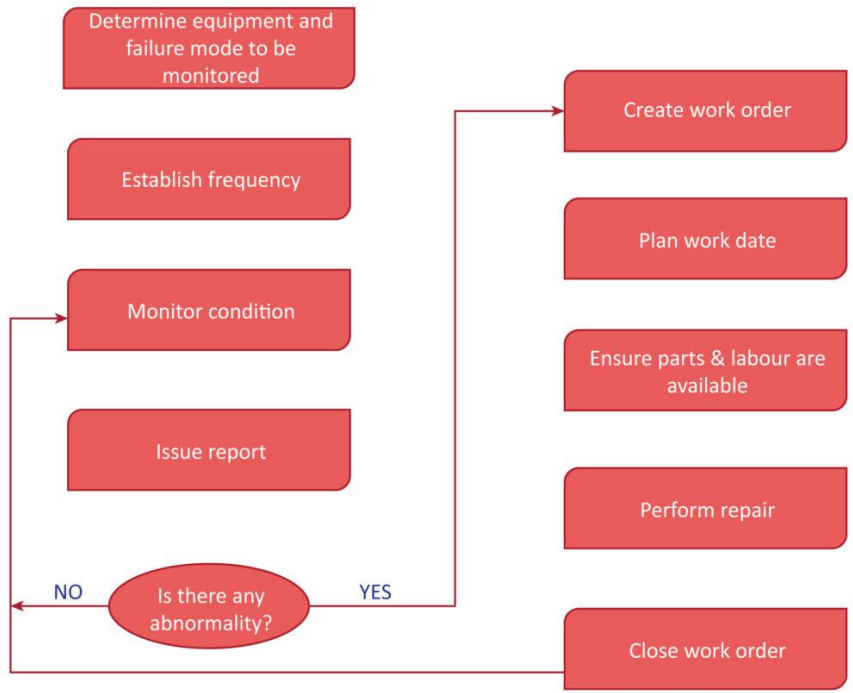
- Splitting the data into test and train set with

EVALUATION OF THE MODEL

- The accuracy is high because majority of the readings in test set is non-anomaly readings.
- The model can only predict 34% of anomaly correctly.
- This model can be further trained with different sets of features.
- We can also use more sophisticated models to catch the underlying pattern.

Evaluation metrics	score
Accuracy	97%
Recall	66%
Most important feature	Power generated
Recall for non anomaly	100%

DIGITAL TWIN ROADMAP



- PdM receives an enhancement through Digital Twins that simulate wind turbines using actual sensor measurements combined with predictive analysis.
- This can significantly optimize productivity and reduce cost