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IITD-AIA Foundation of Smart Manufacturing

Subject: **Weekly Progress Report**

**INTP23-ML-05:** Equipment Failure Prediction for Predictive Maintenance

What is happening this week:

- Continued Learning more about Deep Learning
- Research papers
- Worked on NASA Turbofan Jet Engine Dataset
- Learning about how to deal with imbalanced dataset
- Working of Shearing machine
- Time series

My Understandings of this week:

The dataset for predictive maintenance of any machine will going to be imbalanced. For balanced data, it is easy to deal, and we can even get approximate nice accuracy but for imbalanced dataset, If the ratio of minority classes is more then there are chances that the model will be biased toward majority class (label).

So, it is important to learn how to deal with imbalanced dataset.

The various techniques to deal with it, are:

- Upsampling Minority class
- Downsampling Majority class
- Generate Synthetic data: SMOTE, (various other variations of it)
- Combing the oversampling/upsampling and down sampling techniques
- Balanced class weight

With these having good and clear understanding of dataset it is necessary to understand the problem in details. i.e., on what factor it is decided the machine needs maintenance or what factors are useful in determining occurrence of equipment failure.

Learnt about shearing machine, how it works in details and how can we predict about condition of machine based on certain given conditions.

## Week 2

12<sup>th</sup> June:

- Gone through the shared resources of Deep Learning
- Worked on the NASA turbofan jet engine dataset
- Looking for more resources because I have not worked on a real-life based project.
- explored various libraries and functions of scikit learn
- Read Research Paper on predictive maintenance to visualize and understand the concept better.

13<sup>th</sup> June:

- Gone through the resources of Deep Learning
- Worked on the NASA turbofan jet engine dataset implemented LSTM model facing some error but I will look up for some documentation to find solution of it.
- Read about SMOTE, ADASYN techniques
- Learnt about working of shearing Machine in detail
- Learnt about hydraulic shearing machine

14<sup>th</sup> June:

- Learnt from the shared resources of Deep Learning
- Learnt about working of Shearing machine
- Gone through the tutorial of Linear Regression with Time Series.
- How to deal with imbalanced dataset
- Recall-precision, confusion metrics
- SMOTE and various variants of SMOTE models

15<sup>th</sup> June:

Learning about shearing machine and how to predict the condition of balade with given data

- Learnt from the shared resources of Deep Learning
- explore more about how Shearing machine works in detail.
- Gone through the tutorial on Time Series: Trend, Seasonality, Time series as a Feature
- Referring to research papers. It helped me to understand better about the project.

16<sup>th</sup> June:

- Learnt from the shared resources of Deep Learning
- Learning about Shearing machine
- Completed the tutorial on time series, Also trying to understand it better by going through some more articles
- Worked on dataset NASA jet engine:
- implemented KNN, SVM model, also tried to get better result from random forest model

17<sup>th</sup> June:

- Learning from the shared resources of Deep Learning
- Learning about Shearing machine
- Learnt about metrics for imbalanced data
  - Macro F1
  - ROC AUC (AUC scores)
  - Average Precision score
  - Gmeans
- Worked with NASA jet engine dataset

18<sup>th</sup> June:

- Learning from the shared resources of Deep Learning
- Worked on NASA turbofan jet engine dataset
- implemented model: Random Forest, XGBoost, SVM, LSTM model
- Learning more about LSTM model and trying to understand it better.  
Tried to get more accurate result, also for imbalanced data accuracy is not a good metrics so tried to get recall, precision values
- Shearing Machine

## Reference:

- 1) [machine\\_failure/Machine Learning for Equipment Maintenance - 2022.ipynb at master · shadgriffin/machine\\_failure · GitHub](#)
- 2) <https://www.infoq.com/articles/machine-learning-techniques-predictive-maintenance/>
- 3) [MIT 6.S191: Introduction to Deep Learning - YouTube](#)
- 4) [How to Calculate Precision, Recall, and F-Measure for Imbalanced Classification - MachineLearningMastery.com](#)
- 5) [SMOTE for Imbalanced Classification with Python - MachineLearningMastery.com](#)