# Weekly Progress Report

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Domain: Predictive Maintenance / Industrial Manufacturing

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Week Ending: 01

## I. Overview:

This week, the primary focus was on understanding project domains such as predictive maintenance and industrial manufacturing, specifically exploring concepts related to RUL (Remaining Useful Life) prediction and quality monitoring in a mining process. Additionally, efforts were made to set up the environment, review datasets, and plan initial approaches for effective contribution in the upcoming weeks.

## II. Achievements:

* 1. Turbofan Engine RUL Prediction

- Explored the NASA C-MAPSS dataset and understood engine cycles, operational settings, and sensor readings.  
- Studied fault progression behavior and how degradation patterns evolve over time.  
- Cleaned and visualized sample training data (FD001 set).  
- Identified potential modeling strategies using LSTM and regression approaches.

* 2. Mining Process Quality Prediction

- Loaded and reviewed the flotation plant dataset.  
- Understood silica concentration as the key target variable.  
- Analyzed key process variables (air flow, level, etc.) affecting ore quality.  
- Conducted exploratory data analysis (EDA) to understand correlations and missing value patterns.

## III. Challenges:

1. 1. Time-Series Complexity:

- Managing multivariate time-series data and aligning sequences across sensors was difficult, especially with different sampling rates.

1. 2. Missing and Noisy Data:

- Both datasets had some noise and missing values which require careful preprocessing.

1. 3. Real-World Data Structure:

- The flotation dataset included columns sampled at different time intervals, requiring advanced data engineering.

## IV. Lessons Learned:

- NASA C-MAPSS dataset documentation and GitHub repos for RUL prediction.  
- Research papers on predictive maintenance and LSTM-based RUL modeling.  
- Kaggle kernels and blogs related to flotation plant quality prediction.  
- Tutorials on multivariate time series using Python (e.g., from Coursera, TowardsDataScience).

## V. Next Week's Goals:

1. 1. Turbofan Engine Project

- Perform feature scaling and create time-series sequences for training.  
- Build a baseline LSTM model for RUL prediction and evaluate on FD001.

1. 2. Mining Process Project

- Handle time alignment and data imputation.  
- Train a regression model (Random Forest / XGBoost) to predict silica concentration.

## VI. Additional Comments:

Both projects are real-world and technically demanding, offering excellent exposure to industrial ML problems. Early exploration suggests these will significantly boost both practical skills and portfolio strength.