NASA C-MAPSS: Predictive Modeling for Intelligent Maintenance

1. Introduction

Predictive maintenance is a critical approach in industrial applications, especially in aerospace engineering. This project aims to predict the Remaining Useful Life (RUL) of aircraft engines using machine learning models.

2. Exploratory Data Analysis (EDA)

- Statistical analysis of sensor data
- Identification of constant and highly correlated sensors
- Distribution of operational cycles per engine

3. Data Preparation

- Computation of Remaining Useful Life (RUL)
- Removal of irrelevant sensors
- Splitting data into training (80%) and testing (20%)

4. Machine Learning Models

- Random Forest Regressor (Optimized)
- XGBoost Regressor (Optimized)
- Model Comparison (MAE, MSE, RMSE)
- Best Model: Random Forest

5. Results & Conclusions

- Random Forest outperformed XGBoost in predicting RUL.
- Removing redundant sensors improved model performance.
- Future work: Exploring deep learning (LSTM) for time-series forecasting.

6. Implementation & Code

- Clone the repository

- Install dependencies: `pip install -r requirements.txt`

- Run the Jupyter Notebook

7. Files

- `train_FD001.txt` - NASA C-MAPSS dataset

- `final_random_forest_model.pkl` - Trained Random Forest model

- `notebook.ipynb` - Full implementation in Jupyter Notebook

8. Author

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