Project 7: Predict Life Time of a Bearing in Manufacturing Industry

Company: Uniconverge Technologies Pvt. Ltd.

# Background

Bearings are essential components in rotating machinery, and their failure can lead to unplanned downtime and costly repairs in manufacturing industries. Predicting the remaining useful life (RUL) of bearings can enable predictive maintenance strategies, thereby increasing operational efficiency.

# Problem Statement

Develop a machine learning-based model that can accurately predict the remaining life cycle of bearings under real-world operating conditions. The dataset contains vibration signals recorded during bearing test-to-failure experiments.

# Design

The dataset was collected from three test-to-failure experiments involving four bearings. Each test file contains 20,480 time-domain vibration signal samples. The data was preprocessed to extract statistical features such as mean, standard deviation, skewness, and kurtosis from each file.

# Implementation Details

Data was loaded and organized by test set. Feature extraction was performed for each signal using numpy statistics. A RandomForestClassifier was trained using the combined labeled features from all three datasets. The model was evaluated using a confusion matrix and classification report.

# Results

The RandomForest model achieved an accuracy of 98.66%. The classification report showed strong precision, recall, and F1-score across all three bearing failure classes. The confusion matrix indicated minimal misclassifications.

# Learnings

Through this project, we gained hands-on experience with signal processing, feature engineering for time-series data, and machine learning classification techniques. We also learned how to work with raw vibration signals and structure them effectively for predictive maintenance tasks.