

Technical Report - Milestone 1

Three-Phase Fault Detection

The main objective of this milestone was to implement a ‘**Hello World**’ task that can detect faults in our **three-phase induction motors**. Our focus was on establishing a foundational framework for fault detection using synthesized vibration and electrical signals collected under complex load and health conditions. Motor faults such as **broken rotor bars** in induction motors highly affect the performance and efficiency of our model. We worked with intense care to extract important features and develop variables that enhanced the accuracy of the fault detection rate.

Feature Exploration

Our goal here was to identify variables that were most correlated with rotor health and fault classification. Our dataset comprises **high-frequency time-series** data, which has both vibrational and electrical signals. These signals were sampled by our team at **7600 Hz** and **50 KHz**, respectively. Our key variables, **Health** represented the motor’s condition, and Load referred to the torque levels applied to the motor during our **data** collection process.

Feature Extraction

Synthesized features included Vib_acpi_env, a band-pass filtered vibration signal focusing on the fault frequency range of **900-1300 Hz**, and la_env_ps, which captures the envelope spectrum of electrical signals. These features were extracted using **MATLAB’s Diagnostic Feature Designer**.

We analyzed the **power spectra** of these signals. Some of our results showed highly predictive separative health conditions with Vib_acpi_env; And noticeable patterns in electrical signals with la_env_ps.

Vib_acpi and la_env_ps are identified as **top-ranked features**, showing a high distinction between healthy and faulty motor conditions.

These variables effectively reduced noise and highlighted fault-related behaviors, which got us more accurate fault classification.

Key Findings:

This milestone underscored the importance of feature engineering, our synthesized variables proved invaluable for improving classification accuracy, with Vib_acpi_env and la_env_ps having a strong separability across health classes. We faced certain challenges with handling noisy, high-frequency data and overlapping patterns in faults with similar characteristics, such as 1 vs 2 broken bars.