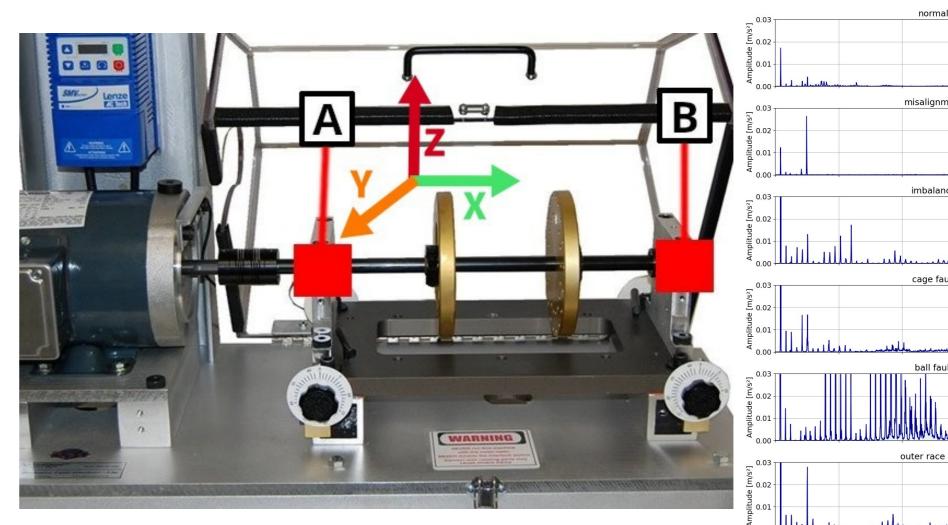
# Fault Classification of Rotating Machinery using Limited Set of Features and k-NN

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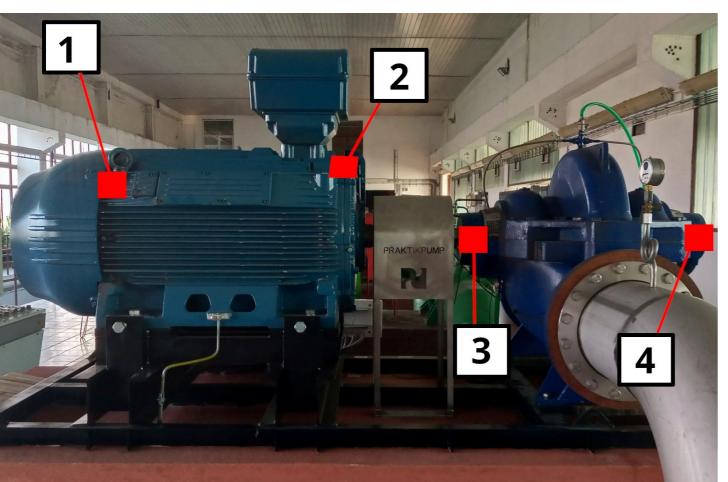
# Background

- Diagnose faults with vibration signals
- Condition-based maintenance with IoT devices can prolong life of machinery parts and save costs
- Technical standards: ISO 20816, ISO 13373
- Sensors are wideband MEMS accelerometers
  - High sampling rate > 20 kHz
  - Capture only relevant attributes on the edge device
  - Signal processing and feature engineering
- Datasets: MaFaulDa, CWRU bearings

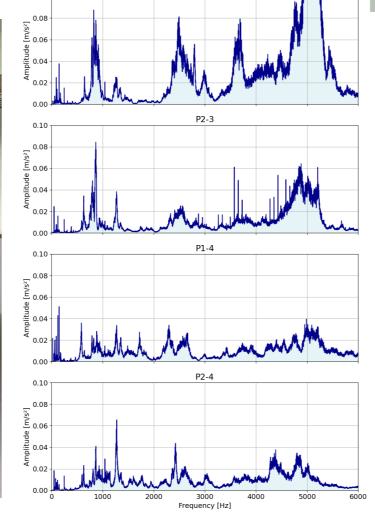


**SpectraQuest Machinery Fault Simulator** 

Labels in MaFaulDa



Pump KSB Omega and WEG W50 motor



**Spectrum of pumps** 

### Methods

- Data processing pipeline
  - 10 features in time domain
  - 11 features in frequency domain
  - Labeling and balancing MaFaulDa dataset
- k-Nearest Neighbors model evaluation with different feature subsets and k values
- History of vibrations from two same water pumps
- Create sensor device with ESP32 MCU and ST IIS3DWB accelerometer to record vibrations from water pumps

## Results

#### Graphs are for Bearing A using Euclidean norm of triaxial features Features: 3, Time domain Features: 3, Frequency domain 1.00 train - temporal test - temporal 0.9 train - spectral 0.95 test - spectral Accuracy 2.0 Accuracy 00 06 0.85 0.6 0.80 0.30 0 0.25 11 K-neighbors K-neighbors **Time domain (83.9%)** 21 25 29 K-neighbors Frequency domain Time domain K-neighbors: 5, Time domain K-neighbors: 5, Frequency domain 0.9 91<sup>92</sup>91<sup>92</sup>91 Accuracy 2.0 PCA 3 PC Best 3 features Rank product Rank product Correlation F statistic 0.6 0.10 flux 0.05 Number of features Number of features Frequency domain (79.1%) k neighbors = 5, number of features = 3







