

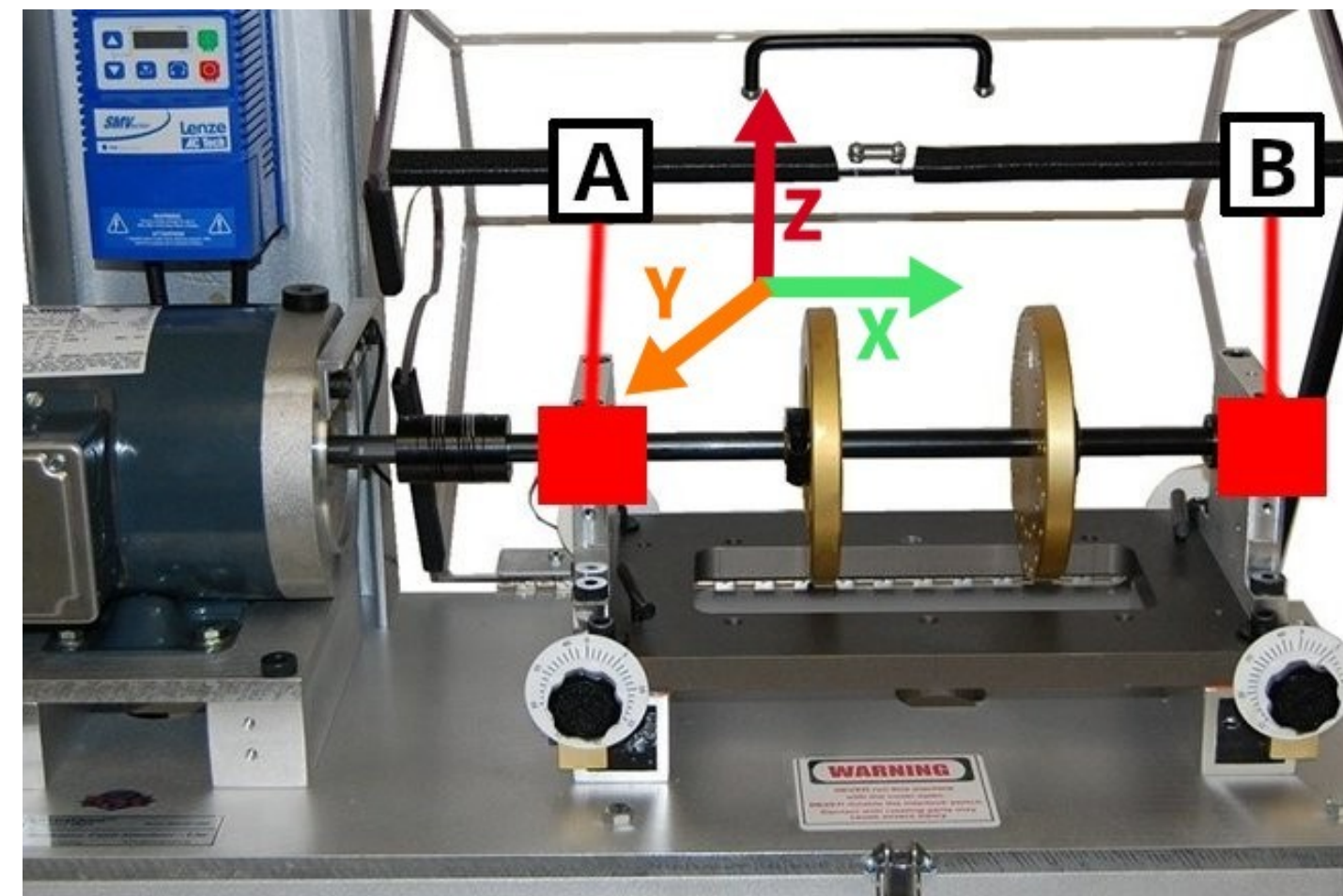
Fault Classification of Rotating Machinery using Limited Set of Features and k-NN

Bc. Miroslav Hájek

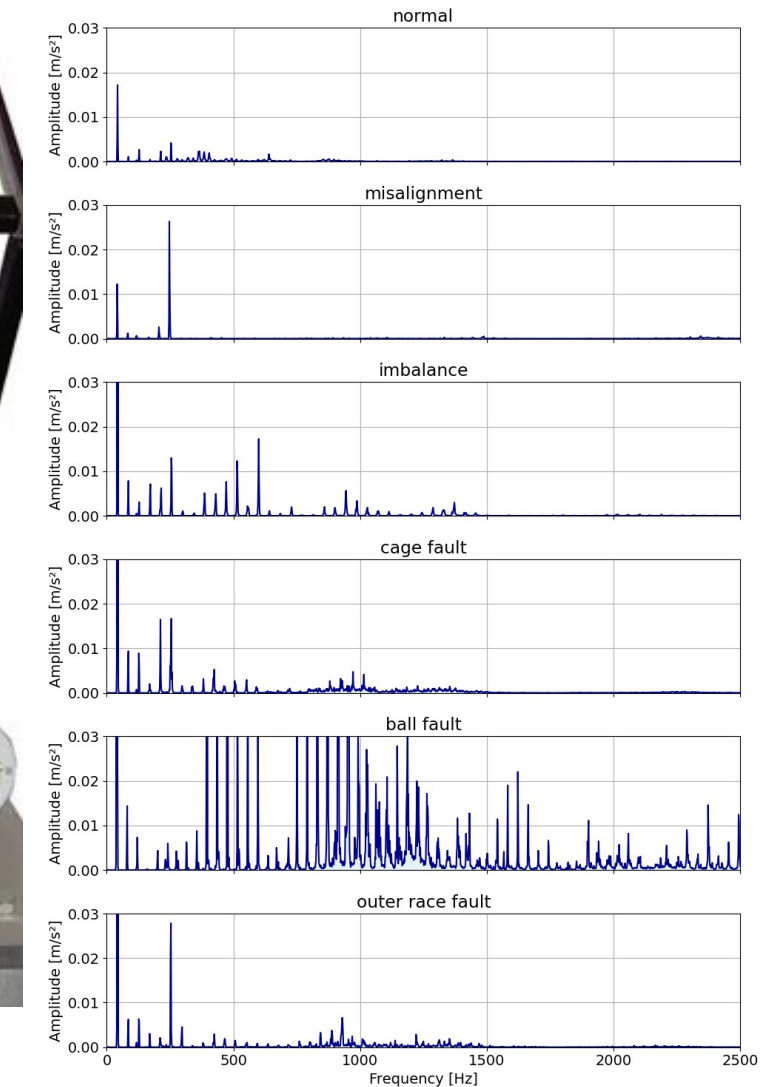
Ing. Marcel Baláž, PhD.

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



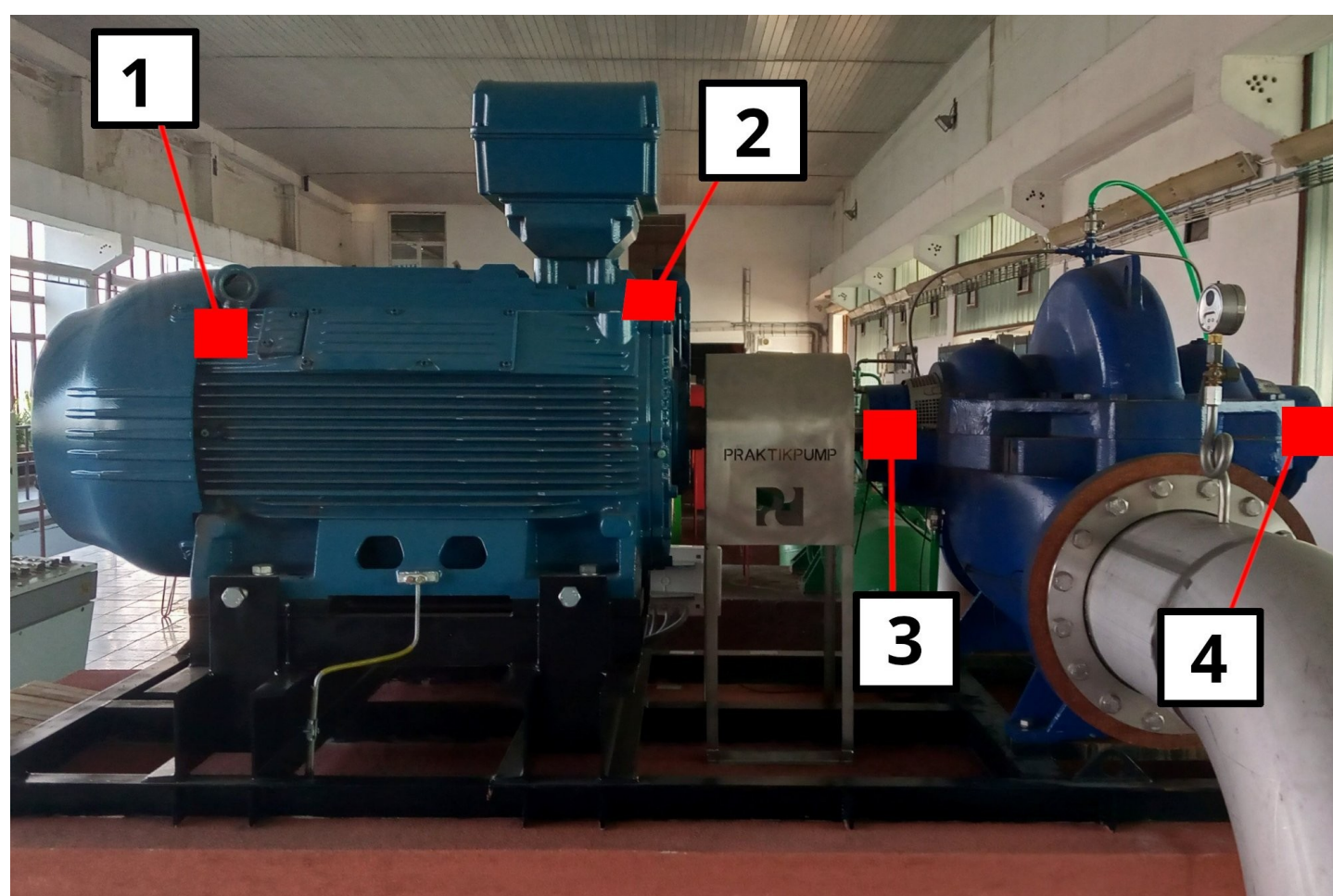
SpectraQuest Machinery Fault Simulator



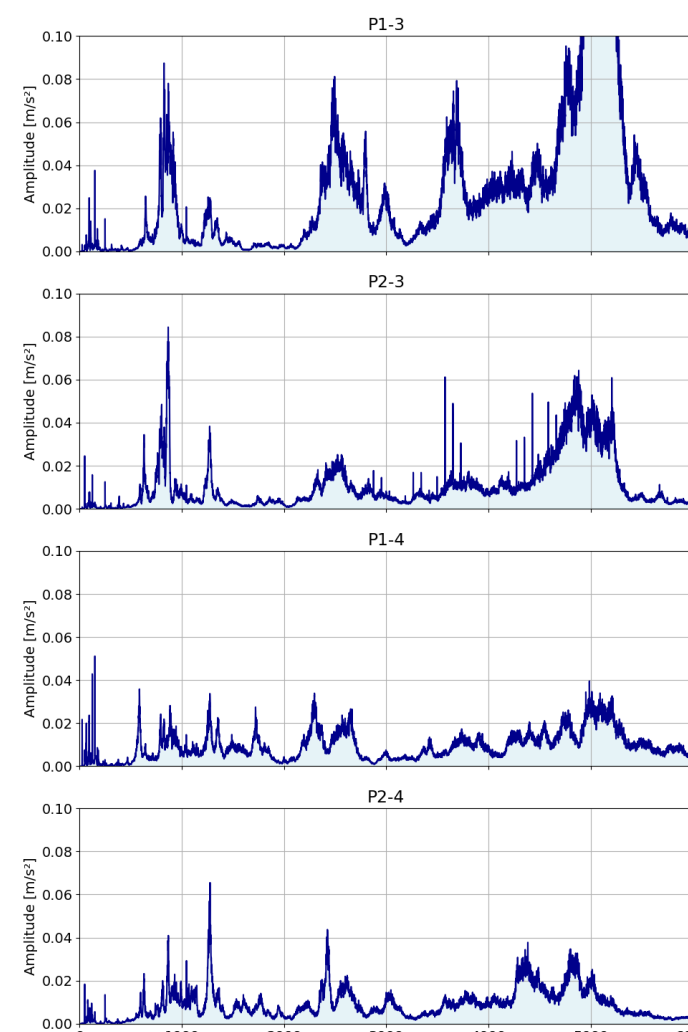
Labels in MaFaulDa

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



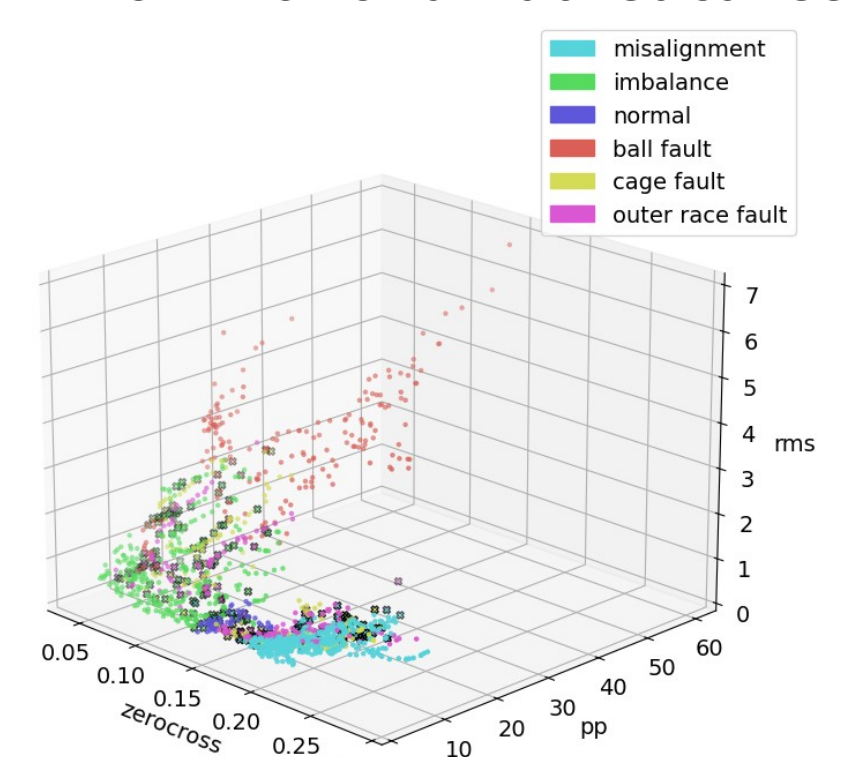
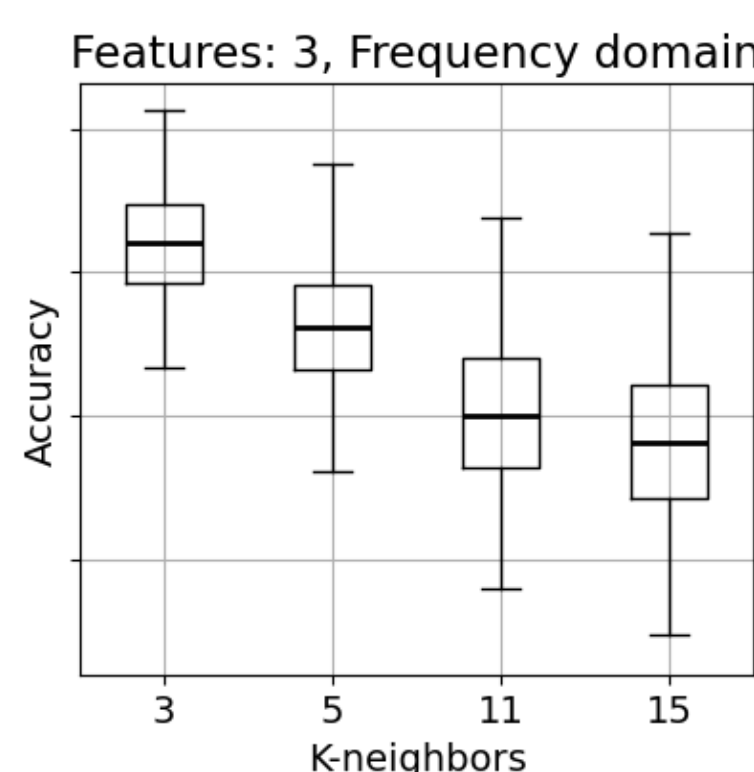
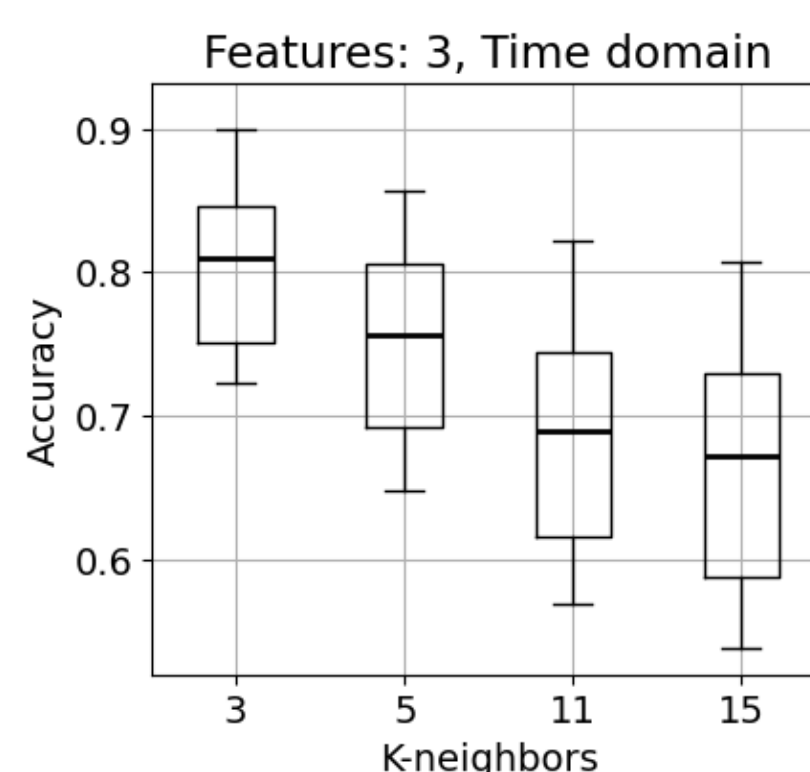
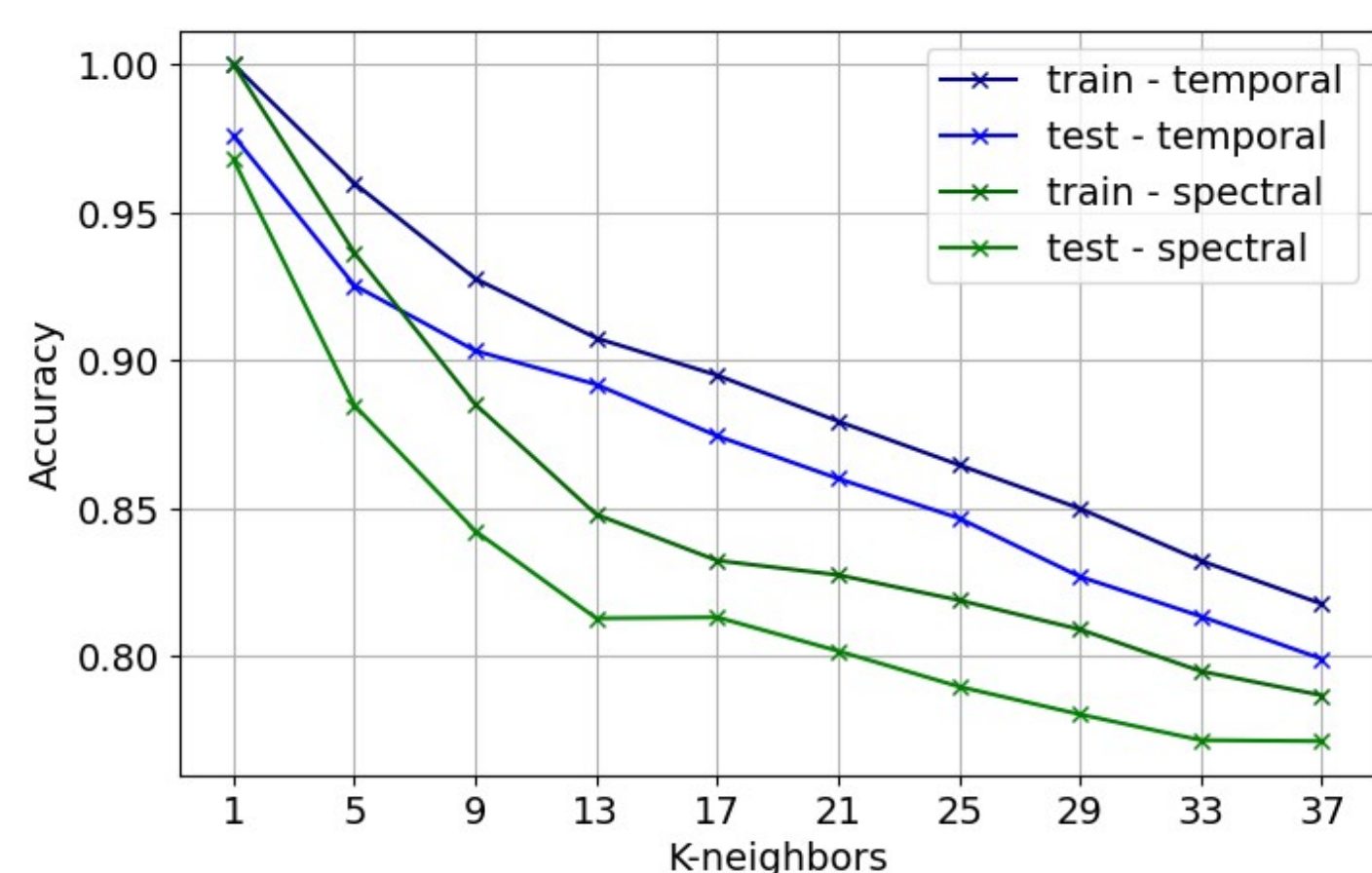
Pump KSB Omega and WEG W50 motor



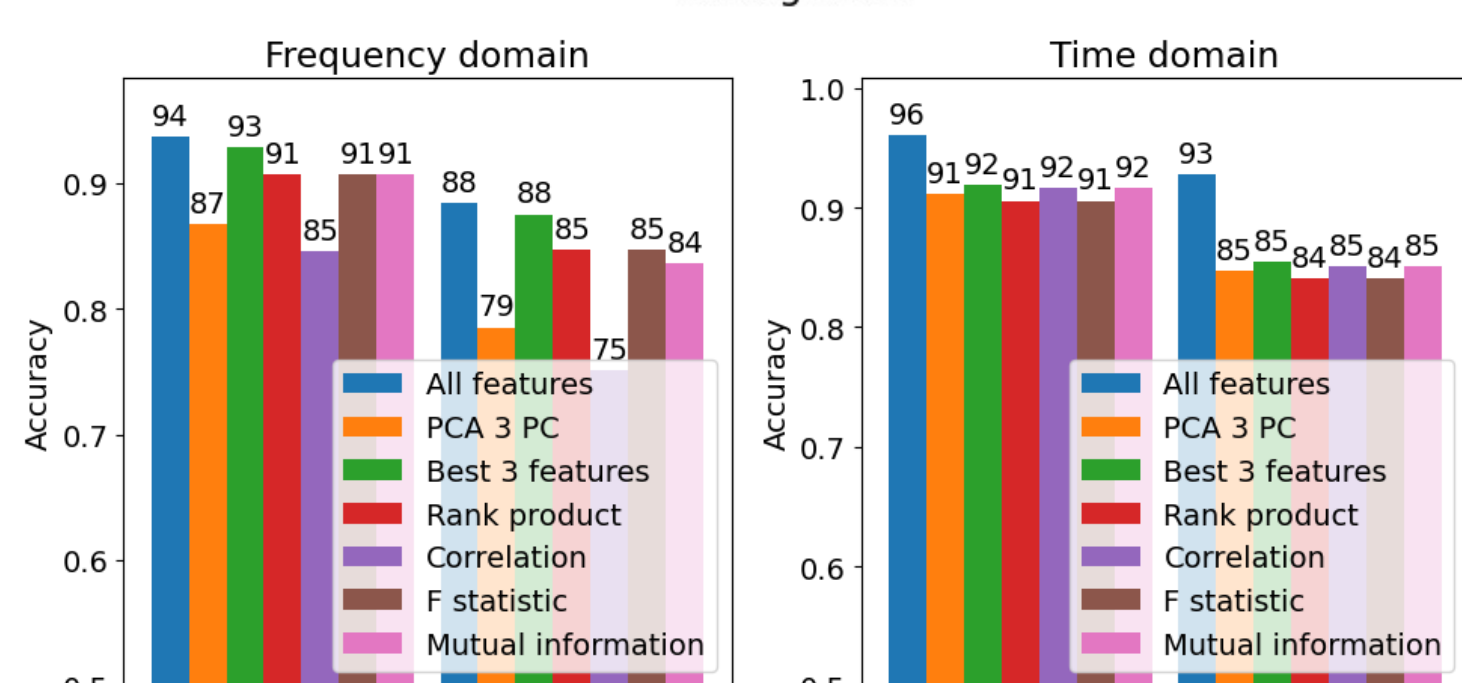
Spectrum of pumps

Results

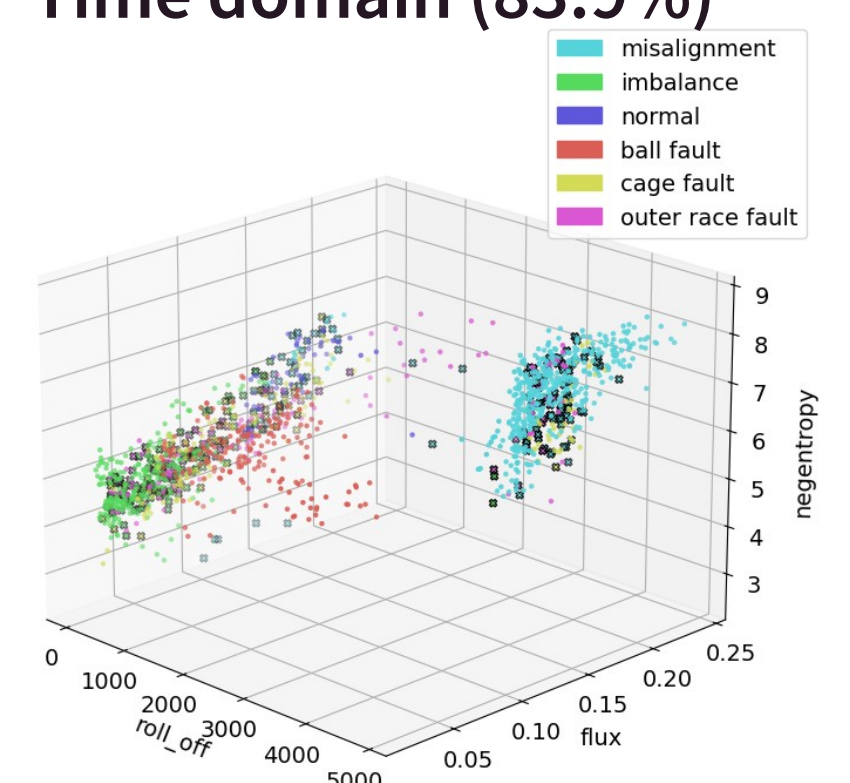
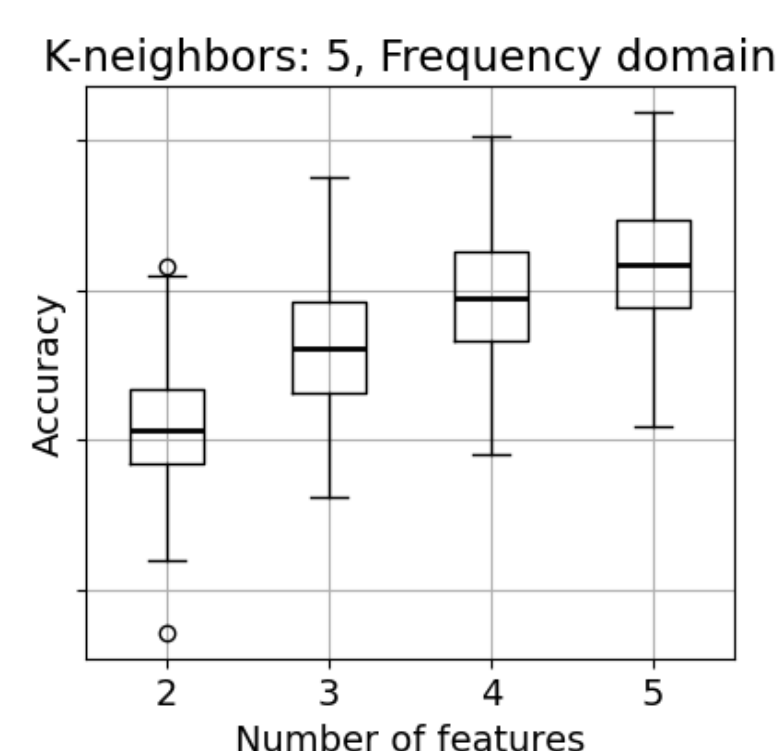
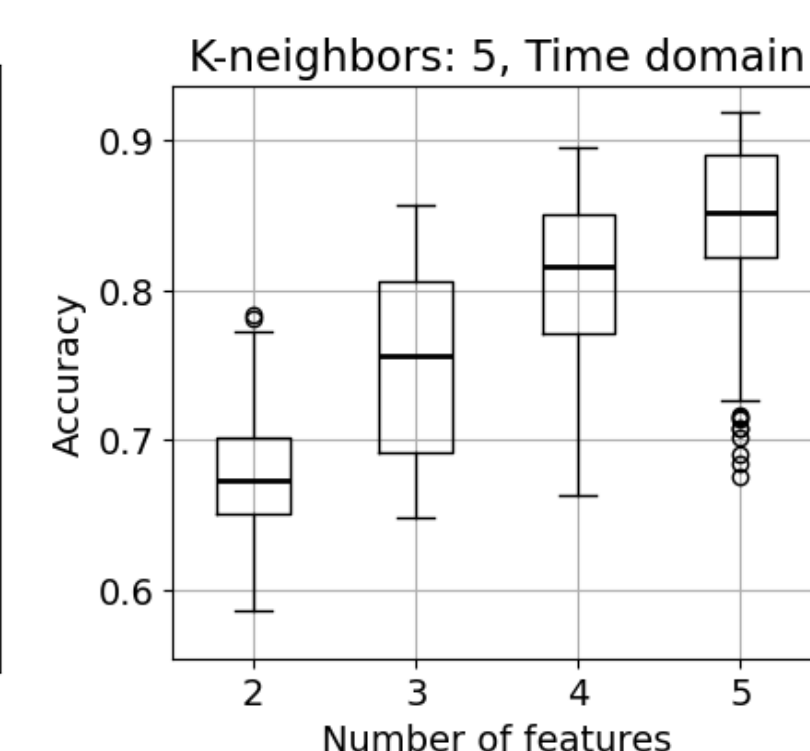
Graphs are for Bearing A using Euclidean norm of triaxial features



Time domain (83.9%)



k neighbors = 5, number of features = 3



Frequency domain (79.1%)