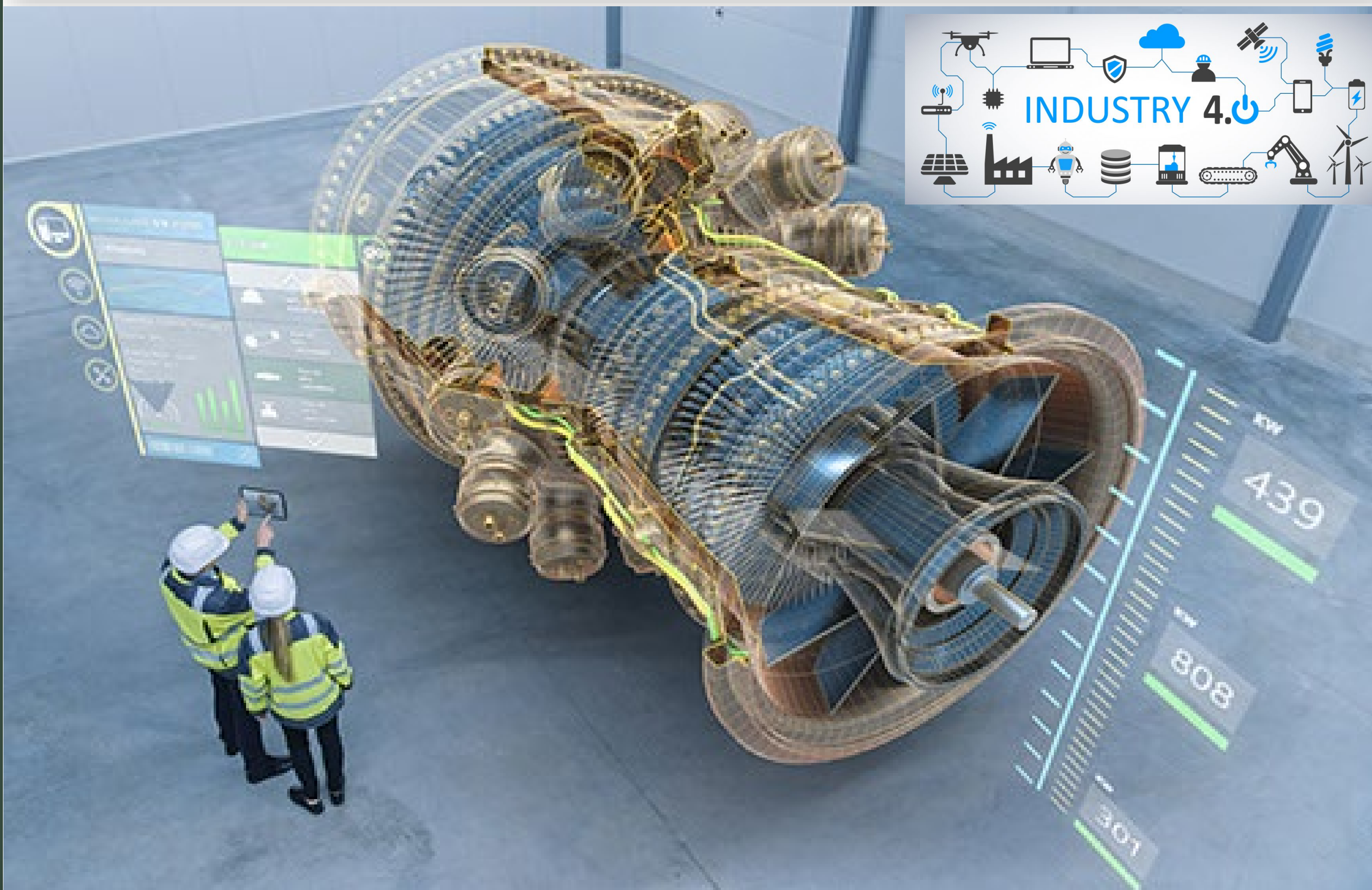


# Fault Detection, Diagnosis and Prognosis

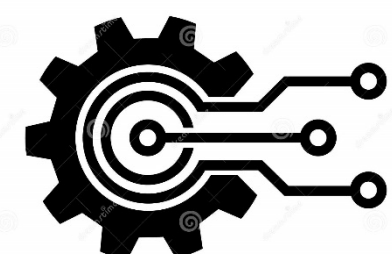
Centre for Mechatronics and Hybrid Technology  
 Mechanical Engineering McMaster University  
 Christian Bangmi

EECOMOBILITY (ORF) &  
 HEVPD&D CREATE

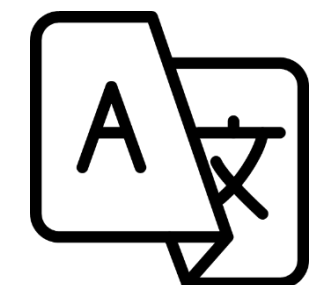
## Background



## Manufacturing imperatives



<b>Increased</b> Reliability Quality	<b>Decreased</b> Production Cost Maintenance
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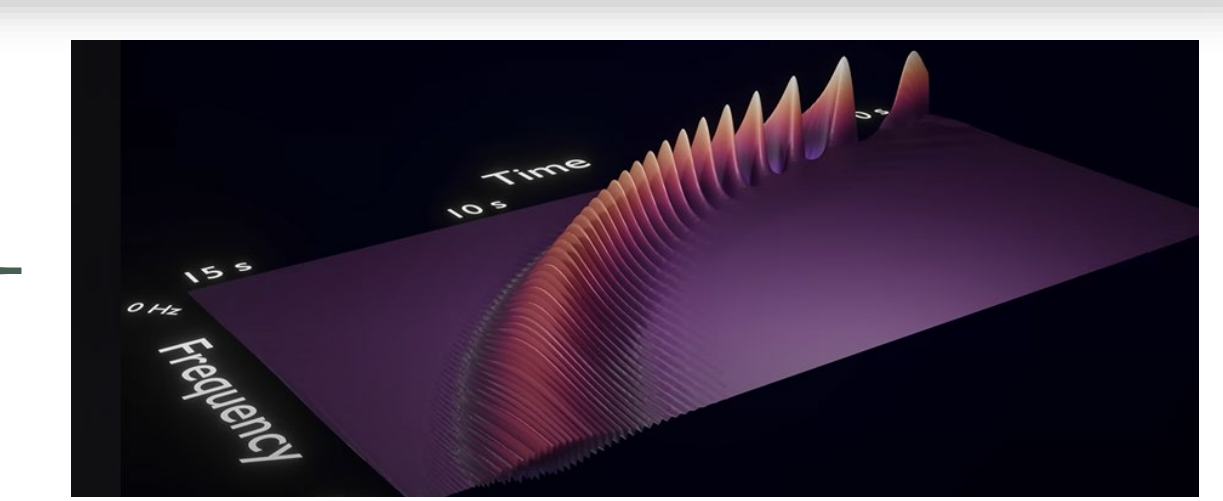
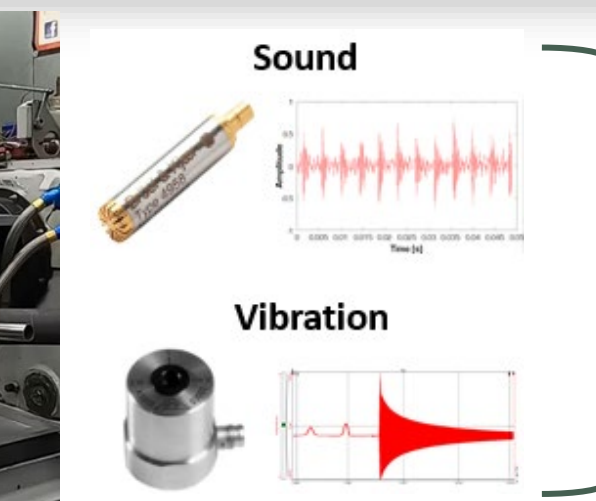
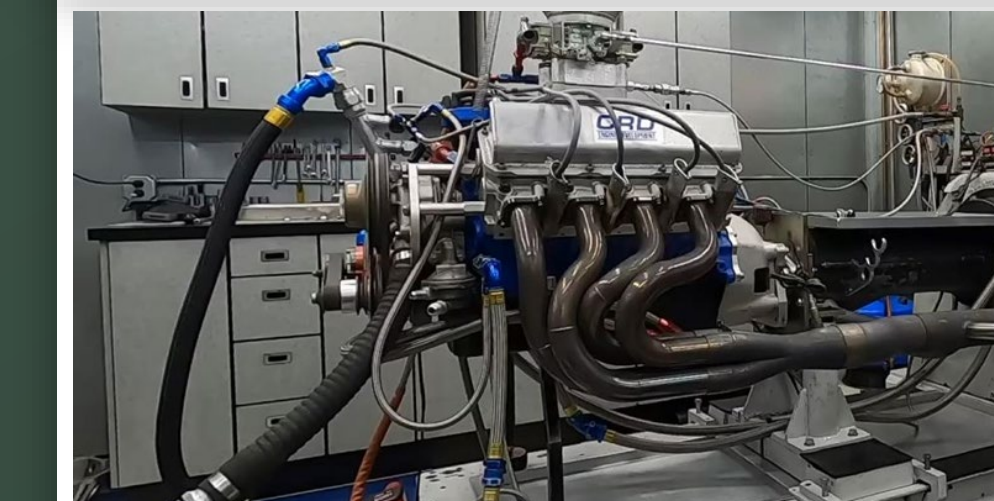
Has a fault occurred?	→ Fault Detection
Where did it occur and how large?	→ Fault Diagnosis
How will it progress in the future?	→ Fault Prognosis

## Research Outcome

Engine durability test time reduction is at the corner

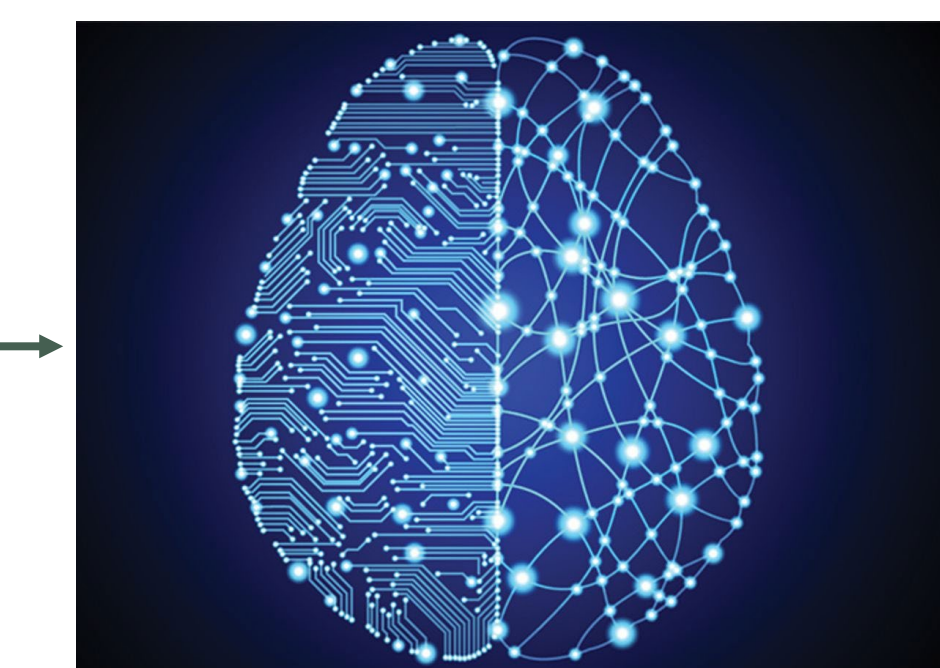
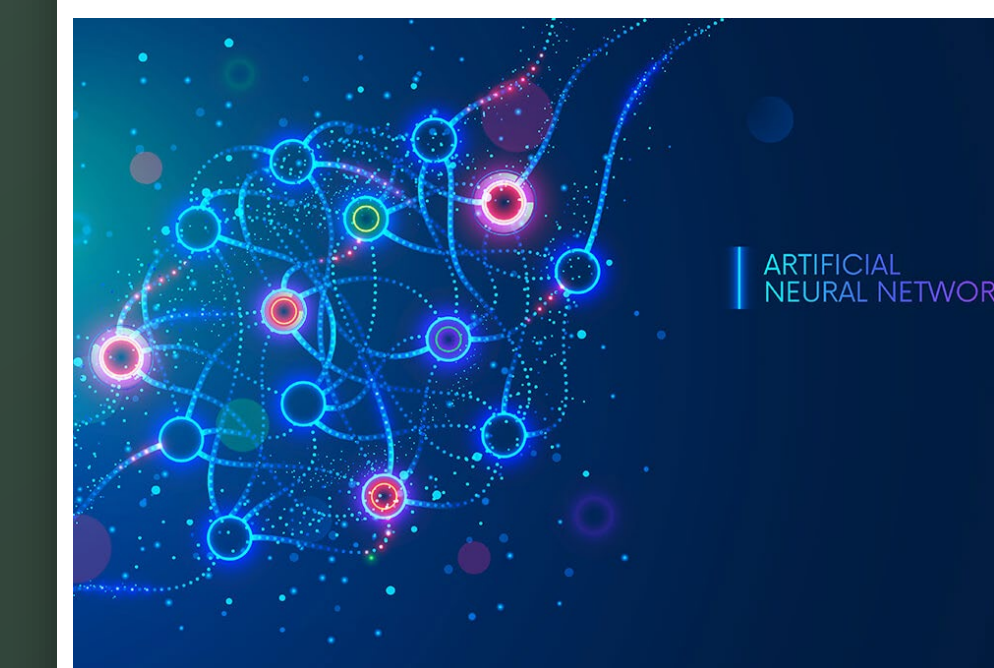


## Approach



**Data Recording:** Vibro-Acoustic signals are a good indicator of rotary machineries' operating conditions. A fault in the machinery will generate different vibration and sound signatures

**Signal Processing:** Vibro-Acoustic decomposition in time and frequency domains via the use of Wavelets



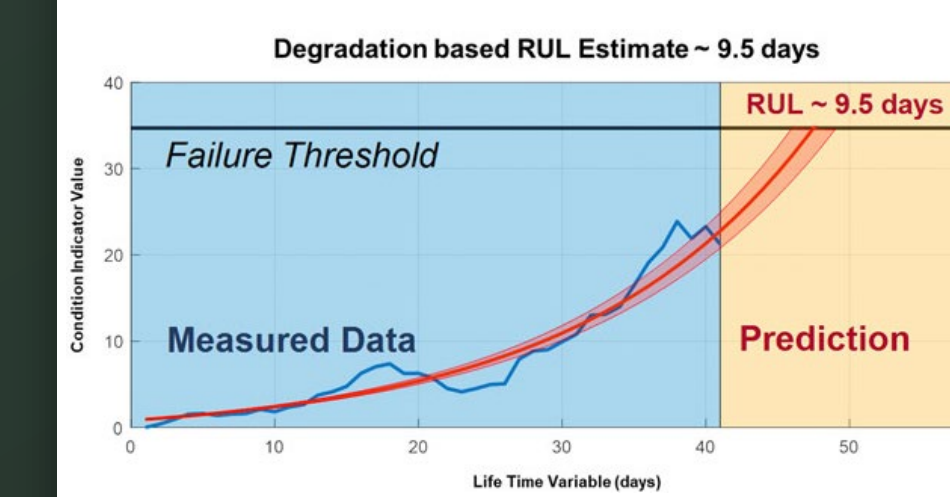
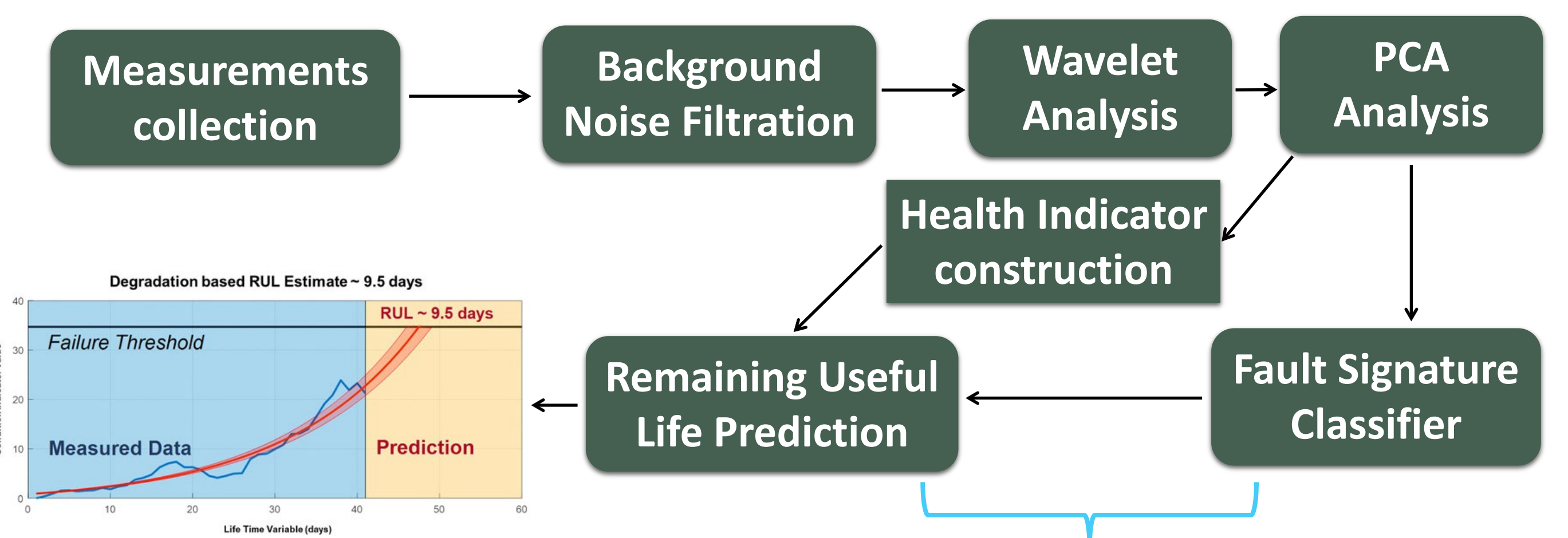
**Artificial Neural Networks:** Computing systems consisting of layers of interconnected nodes, or neurons, that process information and make predictions based on patterns in the input data.

## Framework

**Background noise filtration** is an important step to eliminate any confusion in the results.

**Wavelet analysis** is able to analyze the measurements both in time and frequency domains.

**PCA** is able to detect any changes in the time and frequency domains produced by wavelet analysis



Results

**Health Indicator:** measure or metric that is able to track and evaluate the health status

**AI Model:** Uses Artificial Neural Networks first to determine what type of fault is present in addition to severity, and second to predict how much time is left before failure in that faulty (or degradation) state