

Compute Time-Variant Statistical Features & Health Indicator

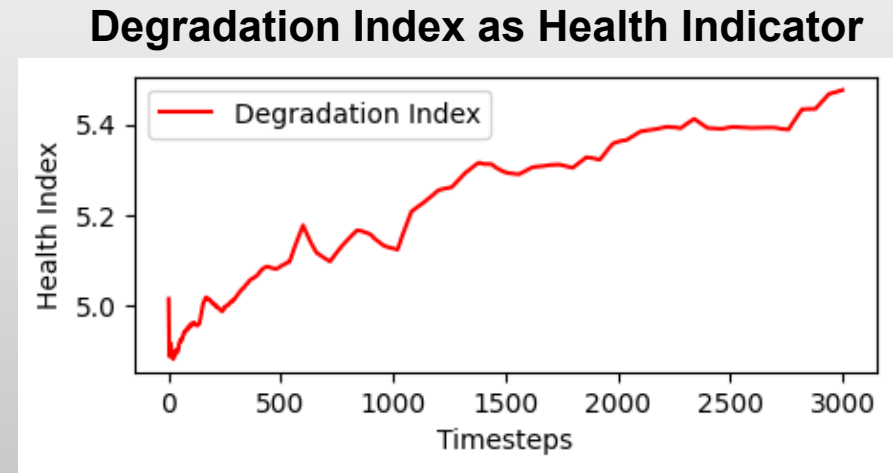
$$\text{Kurtosis}^{(j)} = \frac{\sum_{i=1}^P (x_i - X_{mean})^4}{(\sum_{i=1}^P (x_i - X_{mean})^2)^2}$$

$$\text{Mean}^{(j)} = \frac{1}{P} \sum_{i=1}^P x_i$$

$$\text{Std. Dev}^{(j)} = \sqrt{\frac{\sum_{i=1}^P (x_i - X_{mean})^2}{P - 1}}$$

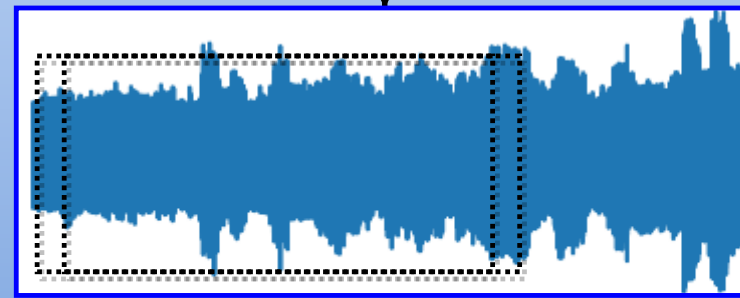
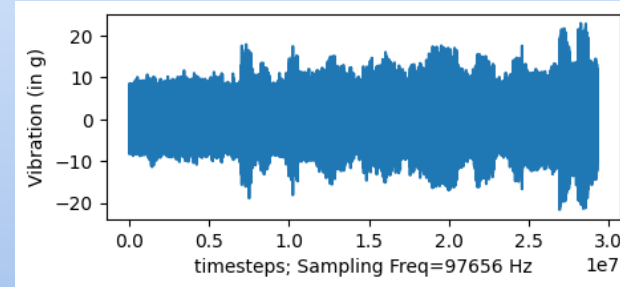
$$\text{Impulse Factor}^{(j)} = \frac{\max(x_1, x_2, \dots, x_P)}{\frac{1}{P} \sum_{i=1}^P |x_i|}$$

$$\text{Skewness}^{(j)} = \frac{\sum_{i=1}^P (x_i - X_{mean})^3}{(P - 1) \times \sigma(j)^3}$$



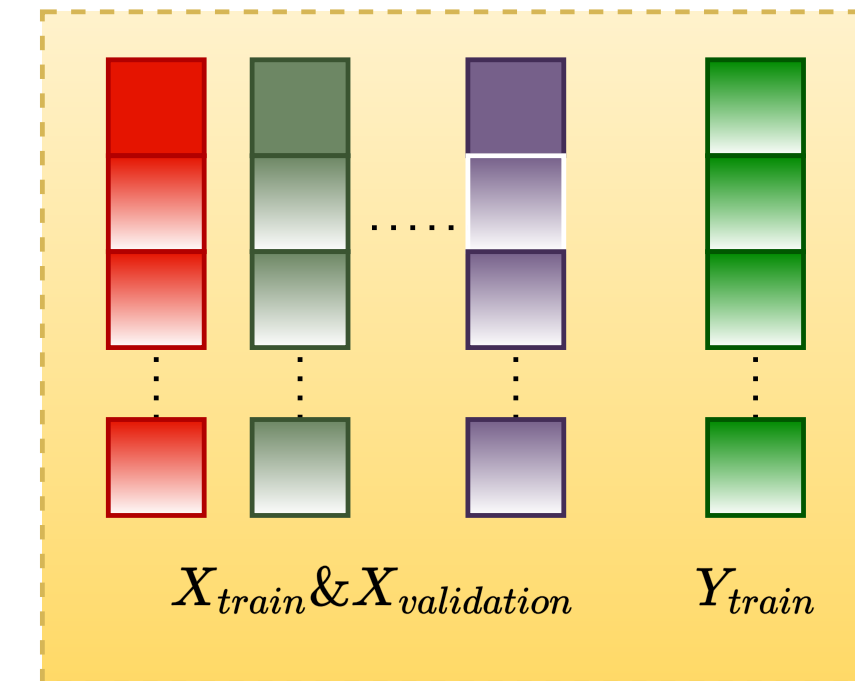
$$HI^j = \mu^j + \alpha \sigma^j,$$

Acquire vibration signature for High Speed Bearing

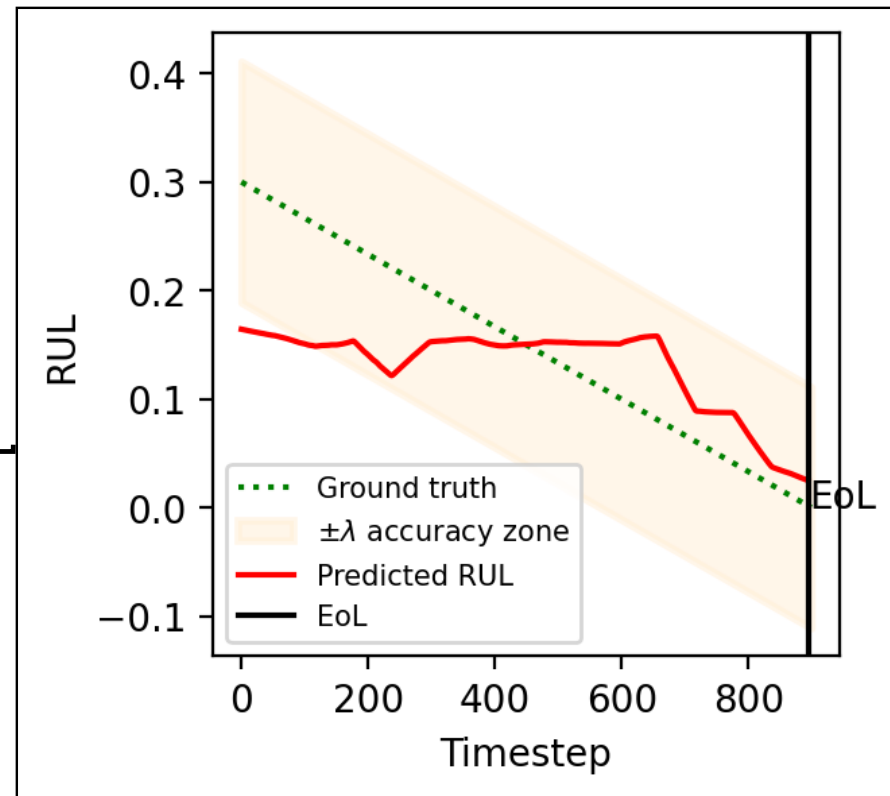
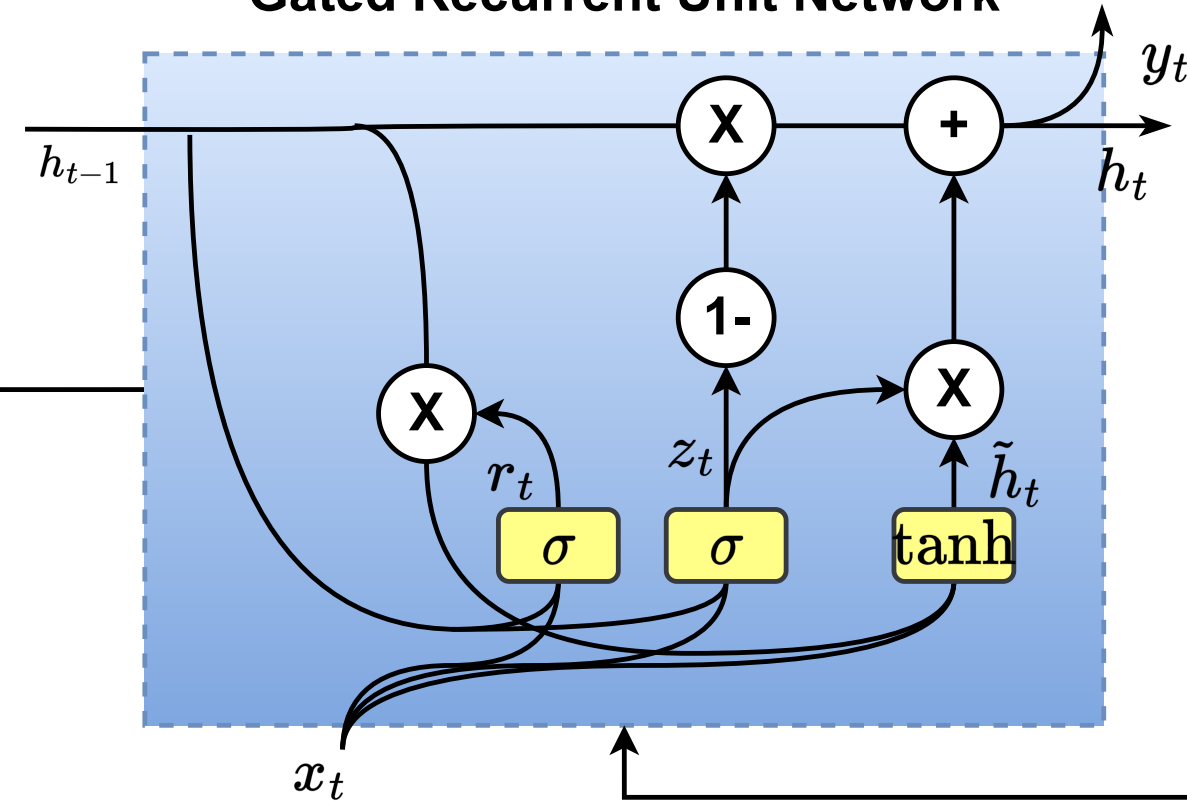


Sliding Window Adaptive Threshold

Prepare input for GRU cell



Gated Recurrent Unit Network



Is RUL close to critical value?

Yes

No

Check RUL again

Decision Making based on RUL estimates

