Early Detection of Turbofan Failure

Predicting Failure Before it Happens

Data & Scope

- → The data provided for 100 engines consists of the following columns:
  - → 3 settings,
  - → 21 sensors,
  - → Engine cycles w.r.t when it was collected.
- → Out of these columns:
  - → Setting 3 & sensors 1, 5, 9, 10, 14, 16, 18 & 19 did not provide any useful insights.
  - → Engine cycles was used to determine the remaining cycles left.
- → Remaining cycles (RC) is what the model will predict:
  - → Predicting the RC will be robust for your future use case;
  - → The scope is to predict if the engine will fail within the next 15 cycles.

Metric & Evaluation

- → The model will base itself on a metric & attempt to minimize its error through training iterations.
  - → The chosen metric is the Mean Squared Error (MSE) for model training;
  - → This measures the average of the squares of the errors.
  - → A lower MSE interprets to be a better model.
  - → The model has been trained to minimize this error.
  - → For ease of explanation, we will use the Root Mean Squared Error (RMSE), which is the square root of the MSE.
- → As a baseline, we achieved an RMSE of 40.48.
- → The final model achieved an RMSE of 16.76. (58.5% improvement from baseline)
  - → This is based on a 2-layer (Long Short-Term Memory) LSTM model

What Does This Mean?

- → Since the model predicts the remaining cycles left, and a model cannot be 100% accurate;
  - → We propose a buffer of **4 engine cycles** to obtain a **96% confidence** that an engine failure will not fail in less than 15 cycle once the fault is detected.
  - → You may adjust this buffer if the confidence obtained is not acceptable.
  - → To the right is a chart which depicts this proposal.
  - → There is a slight probability that a fault would be detected up to 15 cycles too early,
  - → However, this is a trade-off for the high confidence of 96% that the engine will not fail once failure is detected.