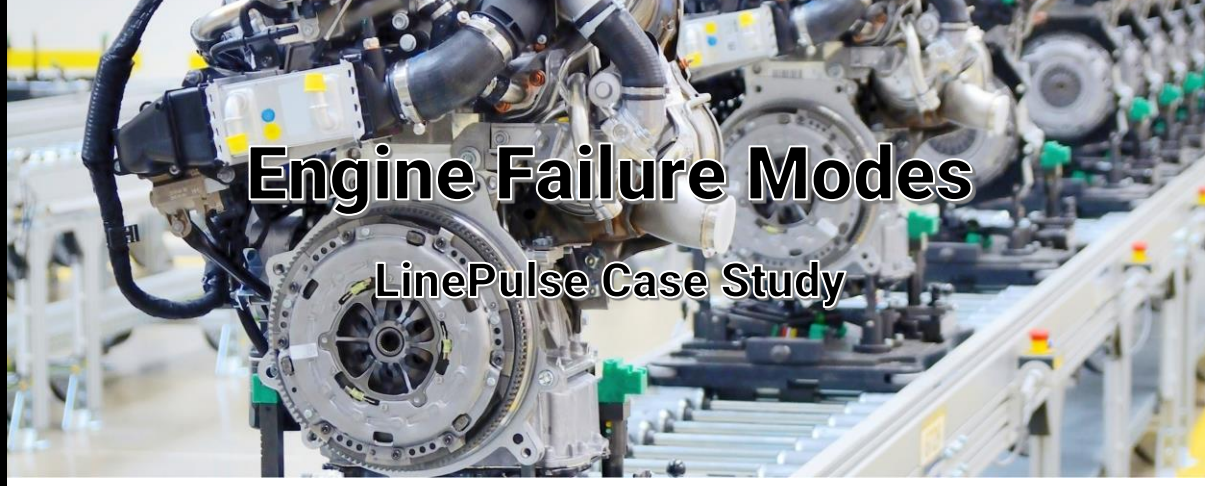


Engine Failure Modes

LinePulse Case Study

Objectives

- Improve vehicle diagnostics by predicting failures in five different engine platforms
- Identify the causes of engine failures using test signal data

Challenges

- Client data collected from four engine platforms, each of which had 4-5 different test profiles
- Model performance required to achieve accuracy of 80% or better for failure prediction
- Dashboard needed to deliver results in near-real time

Results

- Acerta's models achieved 93.3% accuracy for failure prediction
- The models successfully identified the suspect signals and anomalous regions in the vehicle data

Learn more at:
https://acerta.ca

Background

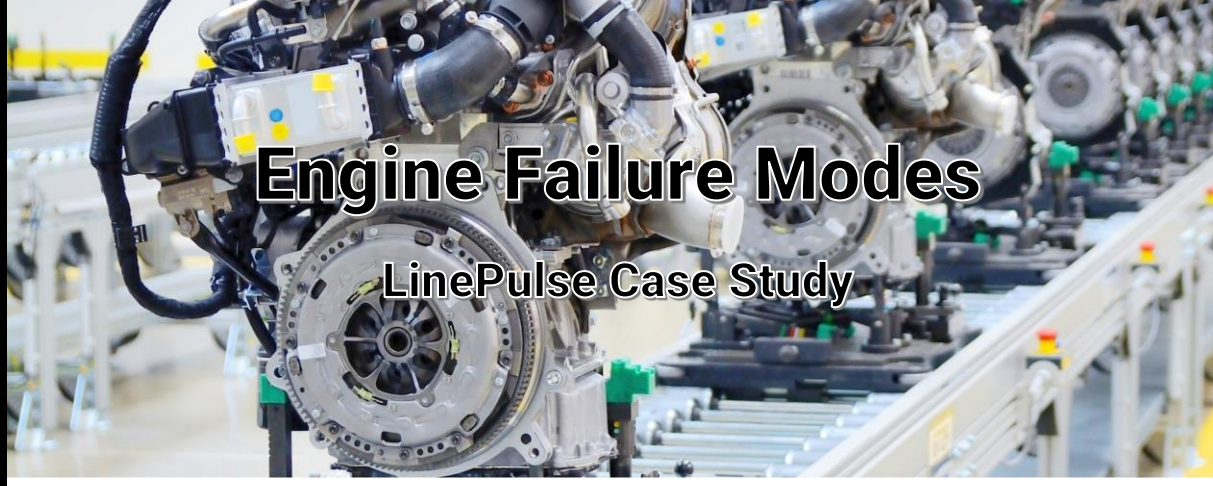
A leading Tier-1 engine supplier based in Japan needed to improve its vehicle servicing and diagnostics to reduce the rate of breakdowns and accelerate maintenance and repairs. The company had been relying on aggregated diagnostic trouble codes (DTCs) collected via the OBD port to indicate when vehicles needed to be serviced, but its existing diagnostic tools were unable to capture four distinct engine failure modes. Moreover, investigating the source of these failures was difficult and time-consuming.

The Problem

The client requested a solution that could predict failures for five different engine platforms. The signal data from each engine was generated through 4-5 different test profiles. The client required Acerta's models to predict engine failures with an accuracy rate of at least 80%. Moreover, because the client's goal was to improve its diagnostic tools, Acerta's engineers needed to build a dashboard for the client to upload data and validate our results, which had to be delivered in minutes.

Solution Process

Acerta's team began by exploring the client's sample data—analyzing the signals and evaluating the viability of various machine learning model types for this application. A fundamental question faced by our data scientists was whether to use one model for all four engine platforms or one model per platform. In the end, we elected to use different models for different platforms, as well as for different stages in testing. The client's two goals also required two different approaches (i.e., classification vs anomaly detection).



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Solution Process (cont.)

This led to Acerta's data engineers building a nested data pipeline for the classification and anomaly region results. Because the client required a dashboard, our engineers needed to take that into account in setting up the data storage and organization. Ultimately, the dashboard displayed the engine ID, the name of the data trace, whether the unit was passing or failing, an abnormality score and highlights of any anomalous regions in the signal data.

Results

Acerta created and deployed an end-to-end solution and integrated it into the client's diagnostic tools. Our models exceeded the client's requirements for accuracy in predicting engine failures at a rate of 93.3%. Furthermore, Acerta's data scientists successfully identified suspect signals and anomalous regions within the engine test signal data, enabling technicians to catch more failures and reduce the time it takes to investigate them.

This demonstrated Acerta's proficiency with automotive data, as our data scientists were able to use feature engineering to exclude certain results which they knew to be erroneous based on their domain knowledge.