Insight
Centre for Data Analytics

Predicting equipment failure on aircraft instrumentation

CURTISS – WRIGHT

Curtiss-Wright and Insight use machine learning to support the process of identifying malfunctioning sensors in aircraft

Executive Summary

Challenges

Curtiss-Wright Avionics designs data acquisition equipment for prototype aircraft. A key goal here is the early identification of equipment and sensor failure to allow preventative maintenance. This requires:

- Handling large volumes of streaming sensor data from multiple sensors

- Early identification of anomalies in real time from noisy signals

- Correctly classifying different types of errors

What Insight Delivered

Insight delivered a two-stage project that used state-of-the-art machine learning techniques to:

- Efficiently analyse streaming sensor data from a variety of inputs to detect potential faults

- Accurately classify faults into distinct error categories

Measurable Impacts

This project provided Curtiss-Wright Avionics with a proof-of-concept for an algorithmic approach for selecting equipment that needs preventative maintenance. This system can:

- Reduce the requirement for human monitoring of sensor data

- Improve turnaround time for equipment inspection

- Prevent abnormal event occurrences in aircraft

- Establish Curtiss-Wright as a pioneer of machine learning in the aviation industry

Over the past century, aviation systems have grown increasingly complex. Curtiss-Wright Avionics designs and manufactures tools that allow aircraft manufacturers to more accurately monitor these systems. Strain gauge modules, for example, inform flight test engineers when parts of a plane are under excess stress and need to be relieved. However, malfunctioning sensor apparatus can compromise such test systems. It often renders the aircraft nonoperational until the device can be repaired. Fortunately, equipment faults can be identified prior to this stage by thorough inspections of their output data. Currently, sensor data must be manually reviewed by domain experts to detect potential equipment failures. This requires a substantial amount of human effort, even for a single aircraft. Therefore, equipment inspection is a significant financial burden for modern airlines. Curtiss-Wright Avionics believes that machine learning tools can significantly reduce the human effort required in this process, by intelligently monitoring multiple sensor data streams to quickly identify problems in real-time.

Solution and Outcome

The Insight Centre for Data Analytics has developed a research programme focusing on anomaly detection and fault classification for avionic sensor equipment. Initially, Insight focused on detecting errors in strain gauge modules. Prototype algorithms were developed which used limited historic data to emulate expert judgment. These prototype systems were then refined using an iterative evaluation process, until they could rapidly and reliably detect errors. In the second stage of the project Insight developed more advanced machine learning techniques to identify diverse anomalous events from sensor data. The system learned the expected output of operational equipment and then monitored the actual output data for significant deviations from this baseline. Curtiss-Wright has a century long tradition of innovation. By introducing machine learning as a core part of their business strategy, they can establish themselves as a pioneer in the aviation industry. By embedding these technologies in the aircraft inspection process, Curtiss-Wright will further improve the safety of air travel.

For further details see:

Curtiss-Wright
https://www.curtisswrightds.com/avionics/

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"Curtiss-Wright was delighted to partner with Insight for this project. The insight team were the key to delivering this project. They provided vital expertise in machine learning, were always available, worked extremely well with the development team and were crucial to meeting our project goals. It was a pleasure to work with Insight on this project."

Alan Cooke, Principal Software Architect

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