[Health Management – Anomaly Detection & Classification]

Use case description

Development of machine learning for detecting and classifying anomalies in equipment

Problem description

Today's Health Management/Condition Monitoring service makes use of Failure Mode analysis of machinery data (looking for known failure patterns in operational data). Significant effort has previously been expended on using Machine Learning to detect anomalies, but the methods used (detecting instantaneous anomalies rather than anomalous trends over time) were incompatible with the needs of equipment condition monitoring.

Additionally, today anomalies detected by Health Management are classified by Product Experts, even when the same anomaly occurs multiple times.

Desired use case output

- Further develop and productionise Machine Learning algorithms to detect anomalous long-term trends (as opposed to instantaneous «point» anomalies)
- Investigate and implement Machine Learning algorithms to classify detected anomalies (based on a first initial classification by a Product Expert)

Value Proposition

Customer

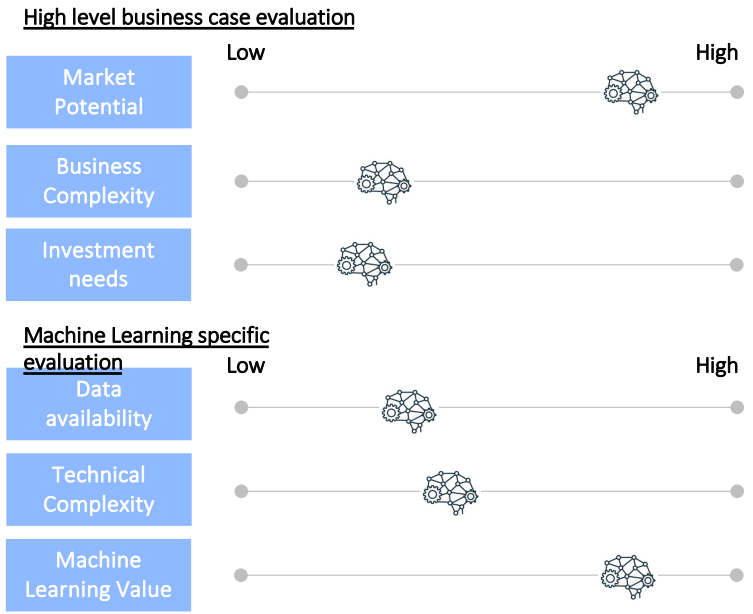
- Early identification of equipment degradation including failure patterns not previously experienced or identified
- Increased responsiveness of Health Management service, with shorter time to equipment issue identification, advice receipt and resolution

KM

- Enhanced Condition Monitoring/Health Management capability covering known and unknown equipment failure modes
- Increased scaleability of service provision, and reduced cost
- Optimised use of KM domain expertise, minimising repetitive work tasks

Overall Evaluation

Evaluation of use case



Oppgave 1 – Anomaly Detection

Further develop and productionise Machine Learning algorithms to detect anomalous long-term trends

INPUT

- Training data: Machinery data for one machinery type (e.g. 4-stroke Engines) for a certain period of time (e.g. 1 year)
- Data labels indicating periods of abnormal operation within Training data
- Test data: Machinery data for one machinery type (e.g. 4-stroke Engines) for a certain period of time (e.g. 1 year)
- Existing ML studies and findings

PROCESS

- Perform research into methods of using Machine Learning to detect deviating long-term trends in provided training dataset
- Develop and train Machine Learning model to detect similar deviations in a given test dataset

OUTPUT

- Developed and trained Machine Learning model able to detect anomalous long-term trends
- Batchelor thesis describing the work done

Oppgave 2 – Anomaly Classification

Investigate and implement Machine Learning algorithms to classify detected anomalies (based on a first initial classification by a Product Expert)

INPUT

- Training data: Machinery data for one machinery type (e.g. 4-stroke Engines) for a certain period of time (e.g. 1 year)
- Data labels indicating periods of abnormal operation within Training data
- Test data: Machinery data for one machinery type (e.g. 4-stroke Engines) for a certain period of time (e.g. 1 year)
- Existing ML studies and findings

PROCESS

- Perform research into methods of using Machine Learning to use previously classified (“labelled”) data anomlaies to classify new and similar data anomalies
- Develop and train Machine Learning model to classify similar deviations in a given test dataset

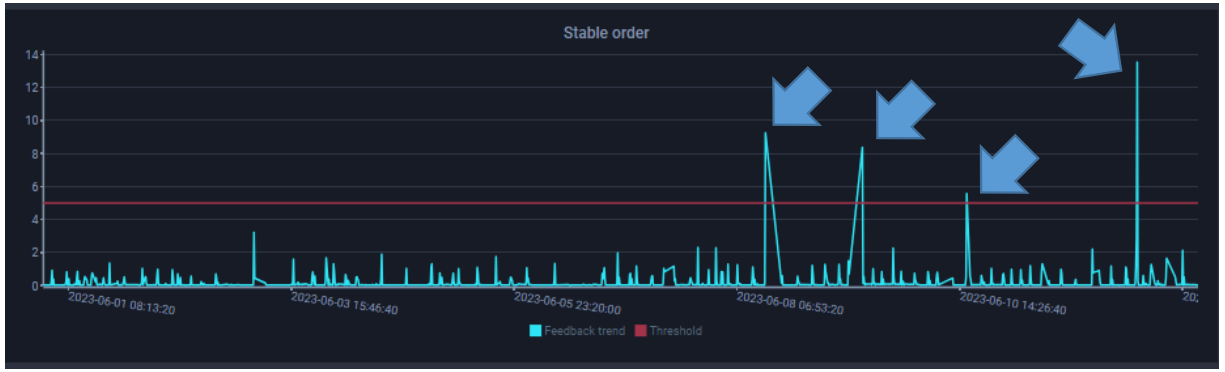
OUTPUT

- Developed and trained Machine Learning model able to classify new anomalies
- Batchelor thesis describing the work done

Point-anomaly vs. Trend-anomaly

POINT-ANOMALY

Short-lived spikes in data that do not affect the overall long-term



TREND-ANOMALY

Trends in data over time (days, weeks months) away from an expected baseline