mix

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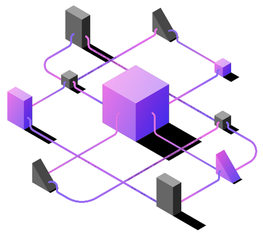
Predictive Maintenance on Cross Industry Collaboration Network

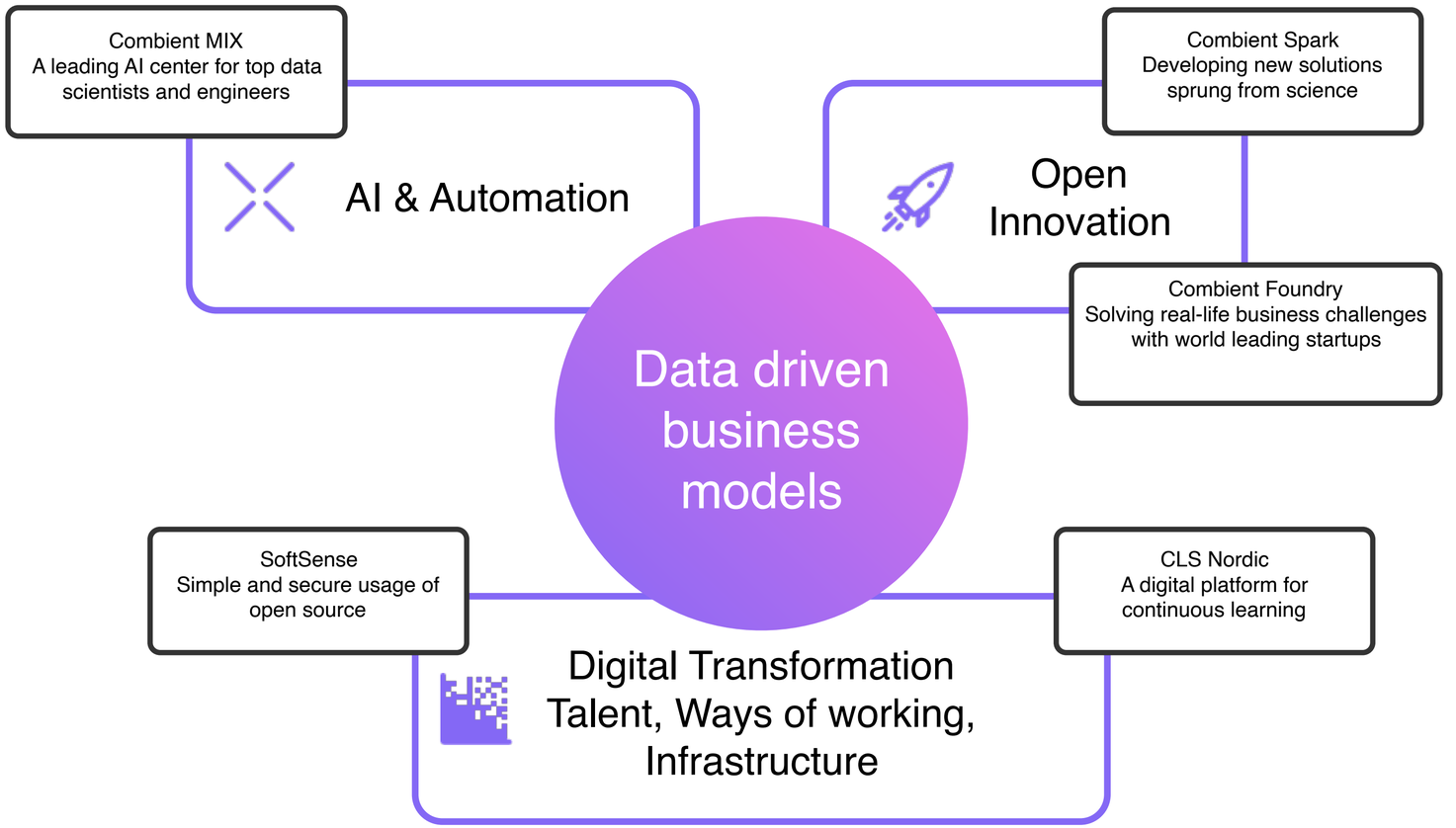
Anssi Collin
Combient Mix

Combient Network

- 30 non-competing Finnish & Swedish enterprises
- Width & depth of relationships
- A place for networking, knowledge sharing, collaboration and co-creation
- 1000 contacts, several major events annually as well as quarterly specialist forums

Seasoned business, new thinking.





Aleris · Atlas Copco · Electrolux · Epiroc · Ericsson · FAM · Fazer · fortum · Husqvarna Group · Höganäs · Investor · K · KONE · Konecranes · LKAB · Munters · Mölnlycke · permobil · Perstorp · SAAB · SAS · Scania · SEB · Sigma · SKF · Stora Enso · Södra · Wärtsilä

COMBIENT

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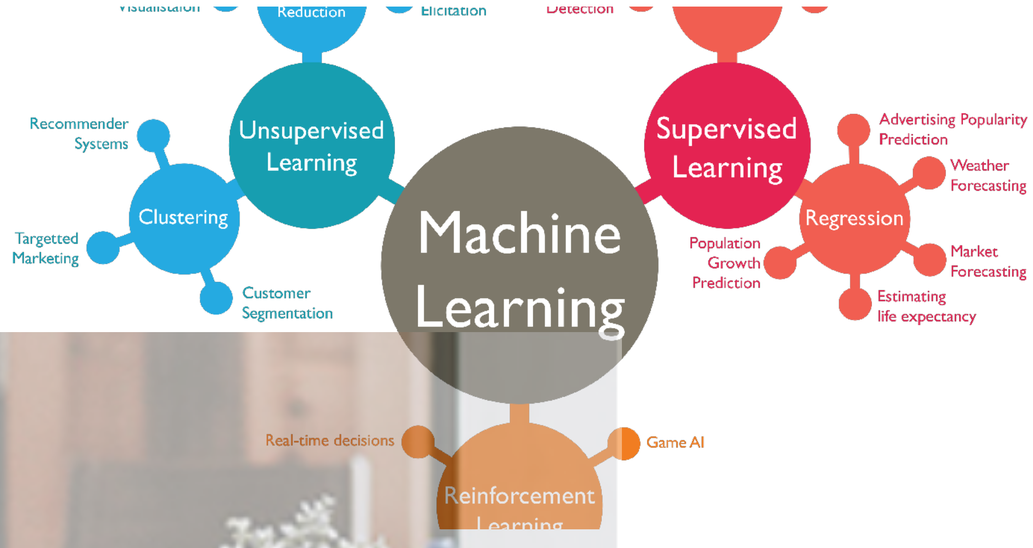
The AI that makes difference

Applied Machine Learning and AI
Data and Analytics solutions
AI Operating Models
Educational Packages



Our Strength

Part of Combient family

80% with PHDs or higher

10 nationalities

9 different disciplines

People who can make a difference

Established partnerships and Competence centres in universities

At the forefront of technology

Predictive Maintenance

- Build models that learn from machine performance history and can predict future faults
- Sensors are cheap, etc.
- One of our member’s have decreased maintenance costs with ~70% in one of their plants

Offline vibration analysis

Rotating systems contain bearings and vibrate during operation

Portable vibration data collection

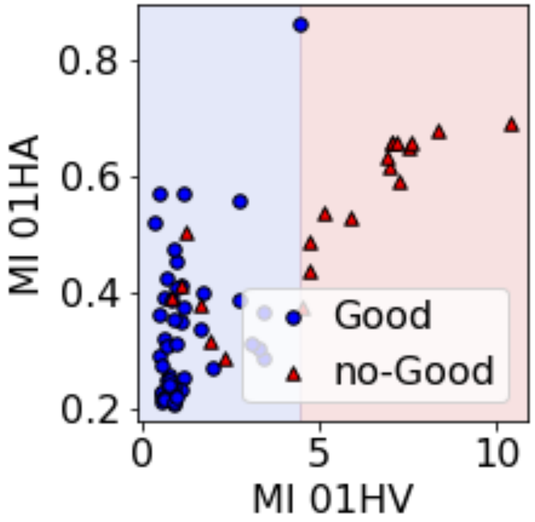
Determining health of rotating machines from vibration measurements

Data collection

Data storage

Analysis, fault detection/prediction, recommendation

Peak-to-peak vibration signals



~1000 people in SKF (x10 including customers using SKF CoMo solutions)

Image classification on rail images

Goal

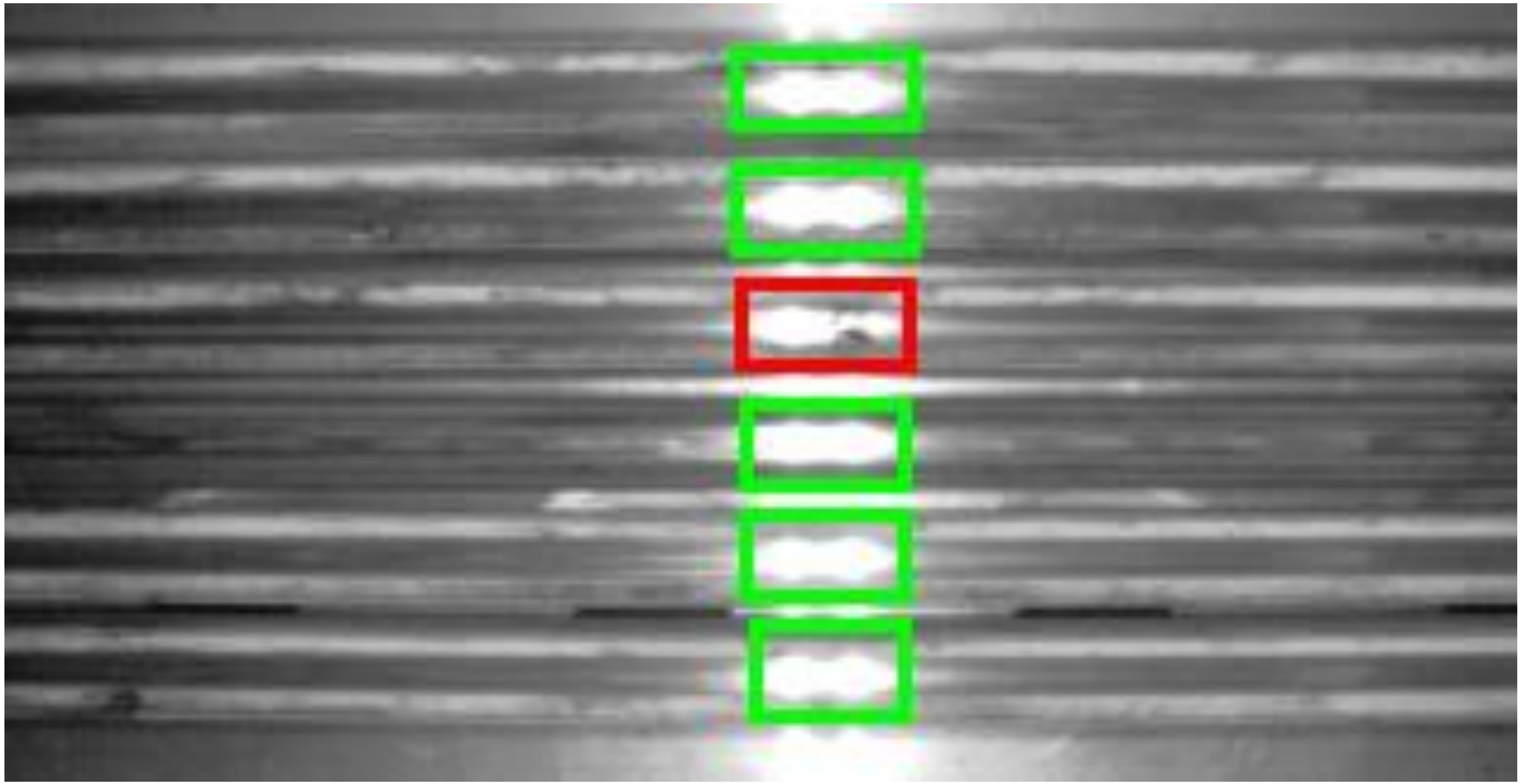
Identify defects on conductor rails in real time

Solution

- Condition monitoring is collecting acceleration data in real time
- High resolution camera is taking photos continuously

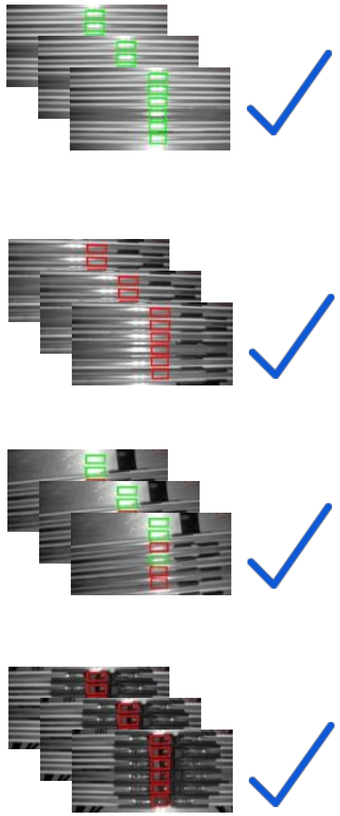
Source: artstudio_pro.fotolia.com

What are we searching for?

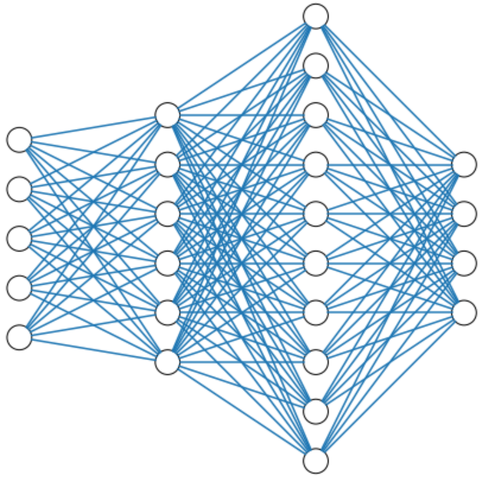


Efficient labeling

Manual label images



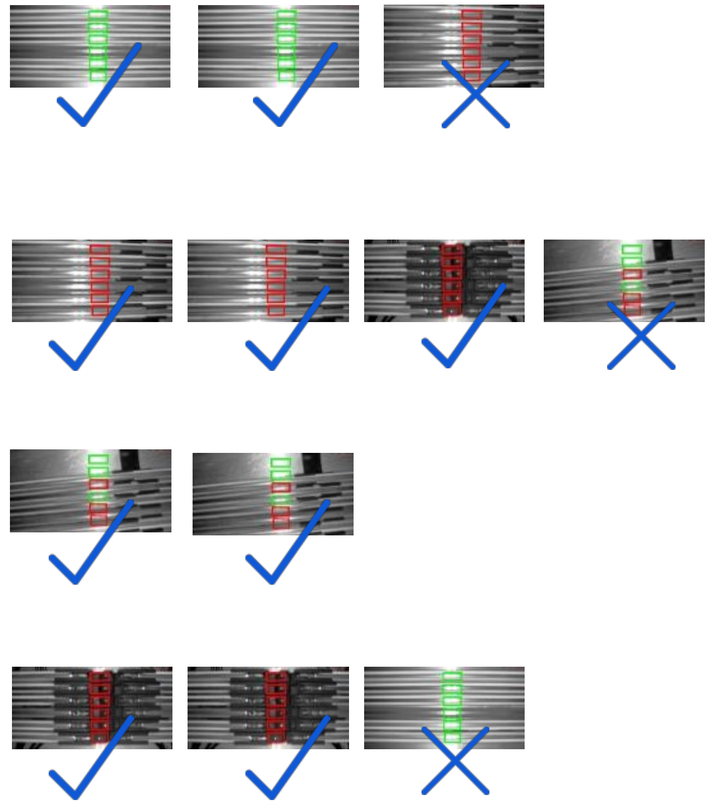
Deep Learner



Amazon EC2

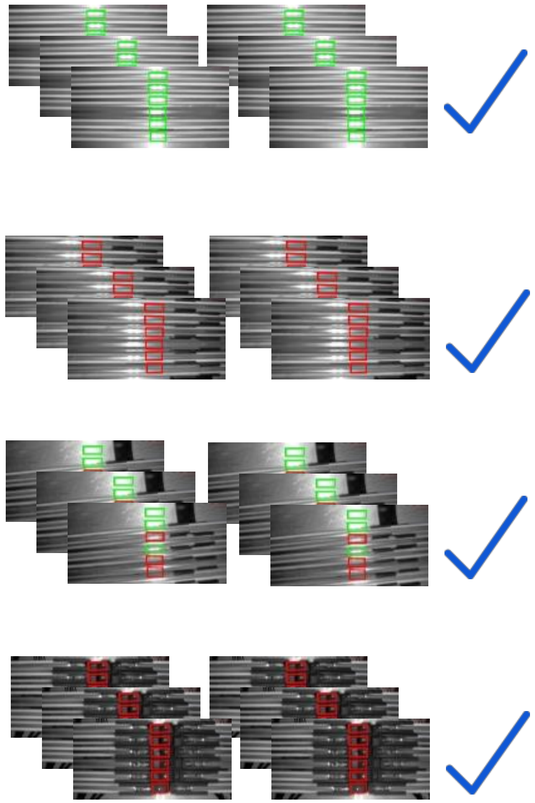
mxnet

Automated labeled images

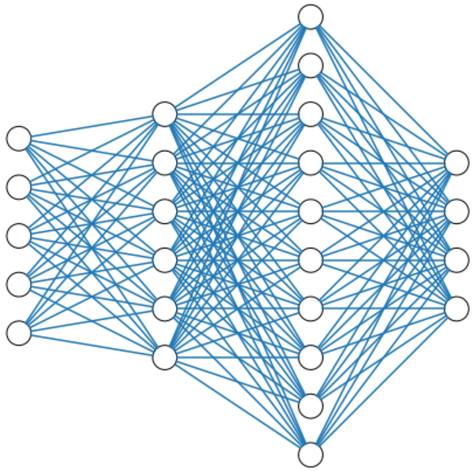


Classifier model

Automated & manual approved labeled images



Deep Learner



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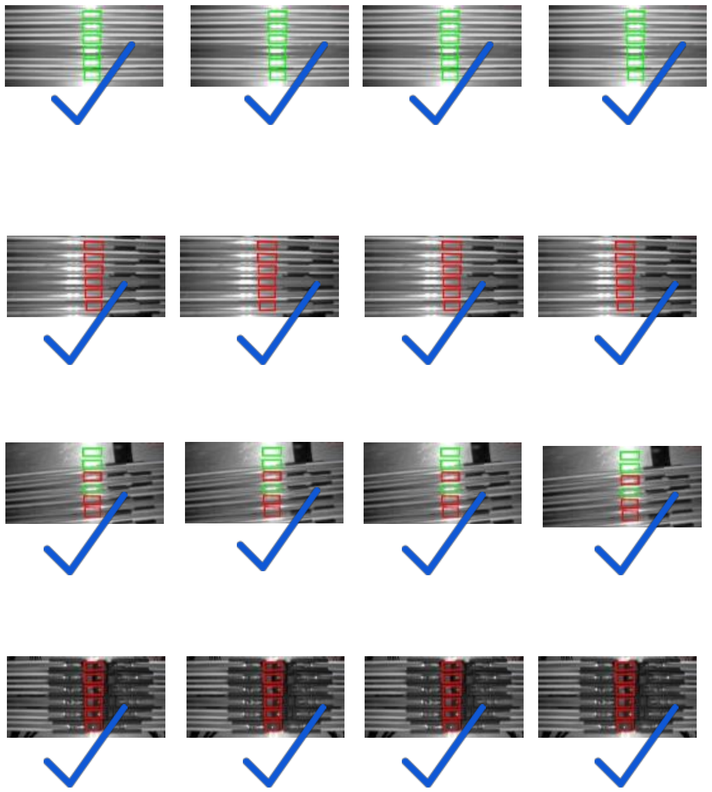
Classifier Model 99.9% accuracy



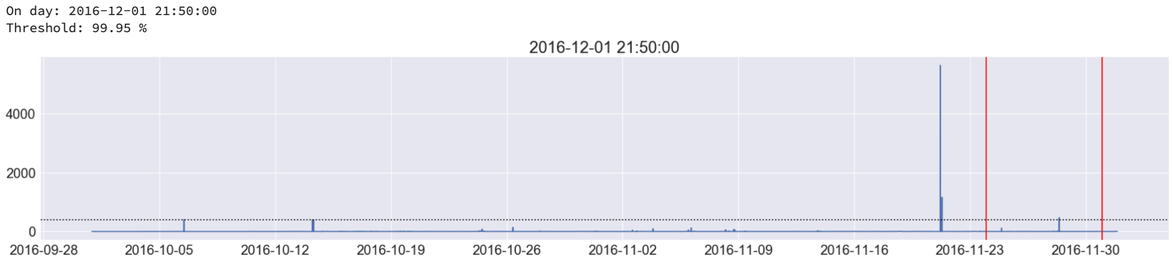
Anomaly detection on fan measurements

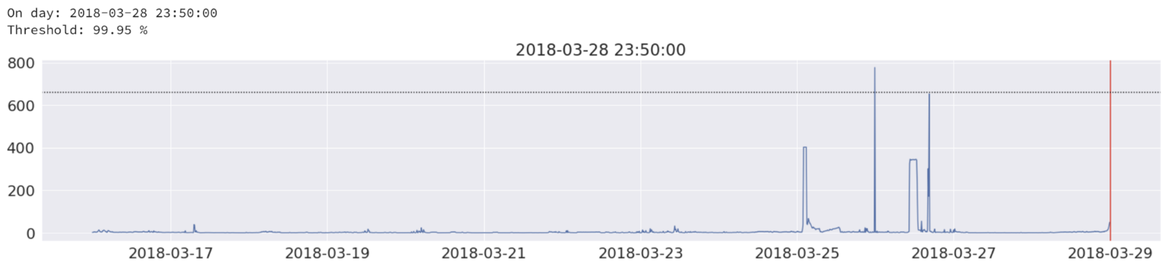
Problem overview

- The facility contains two fans, critical for operation. Each fan has about 50 measurements including vibrations, temperatures, power consumption, pressures etc.
- Only 2 registered failures happened in the given time period (about a year).
- Neither clear definition of operational states nor list of possible failures were provided
- Ultimate goal: “predict when and why the next breakdown will occur”, goal of the project: anomaly detection of fan measurements.

Methods and Results

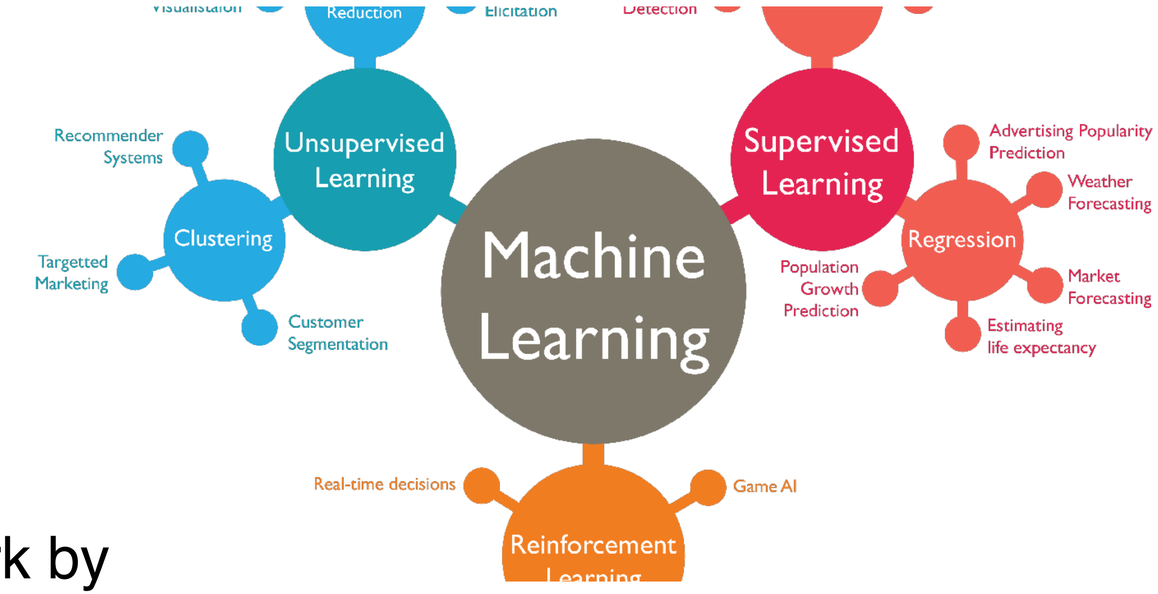
- Reverse engineering using clustering in order to identify hidden operational states. It allowed us to define what behaviour can be considered to be normal.
- Using Robust Principle Component Analysis set an anomaly score. Based on the definition of normal, anomaly score gives the indication of abnormality.
- Recommend top three sensors to investigate based on their contribution in the total anomaly score.
- Validation of anomalies presented in the data (based on actual failures).





Summary

- Associated companies have developed the predictive maintenance capabilities with Combient Mix team
- The value potential has been proven and majority of the projects continue one way or another
- Next steps: gain more value from the network by deeper joint projects, data sharing platform, developing tools together etc.



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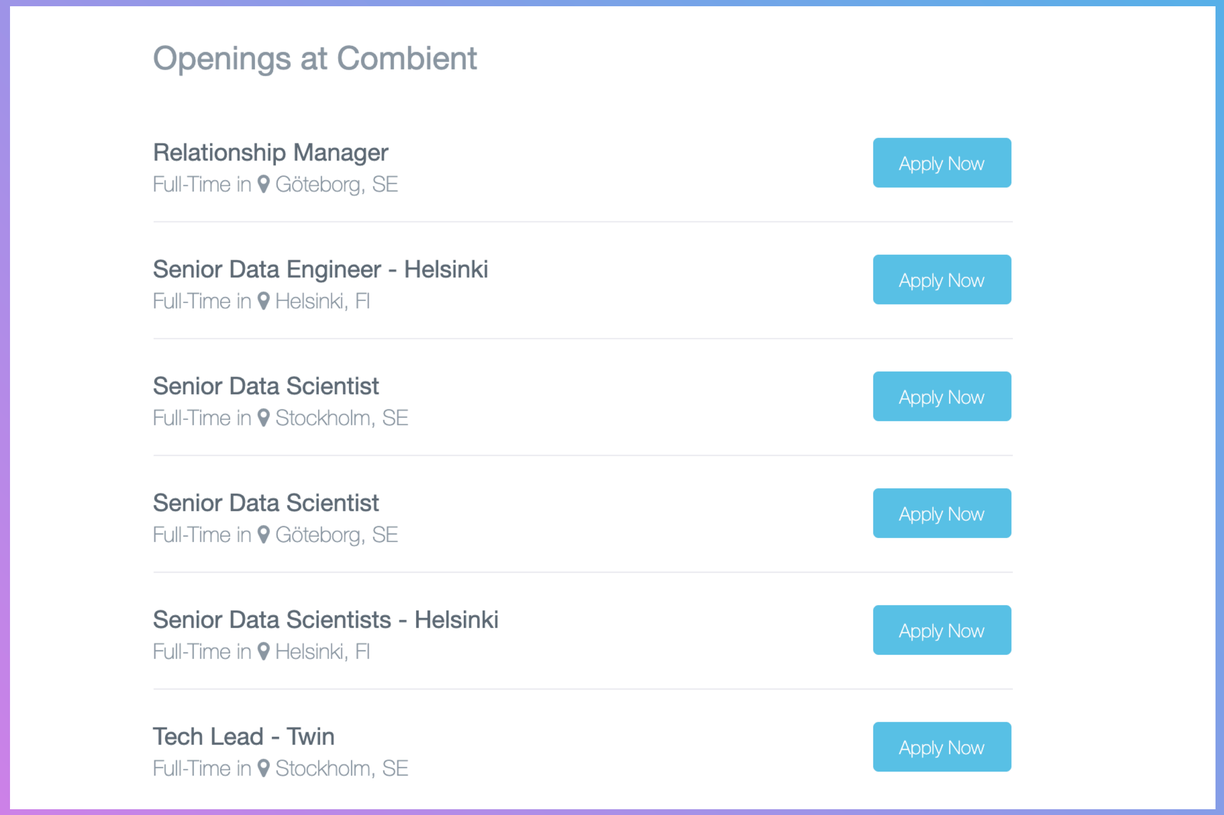
We are hiring!



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Thank you!