yazzoom
creating value from data

PROCESS AUTOMATION SOLUTIONS

AI als hefboom voor onderhoud en service teams

Dr. Jan Verhasselt, Managing Director
Yazzoom, a PA-ATS company

2024

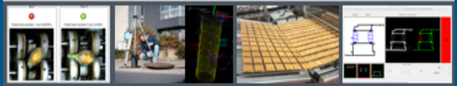


Yazzoom offer: our 4 activities to create value from data

DISCOVERING VALUE WORKSHOPS

HOW CAN AI CREATE VALUE FOR YOU?

INSPIRATION + ROI CALCULATION + PRIORITIZATION



Machine Vision

Quality Control

Visual Inspection

Assembly Check

Automatic Sorting

Measurements & Metrology

Colour & Shape Control

Custom AI Solutions for Industry 4.0

Decision support

What-if analysis

Automated Optimization

Planning Recommenders

Diagnostic analytics

YANOMALY

AI-Powered Analytics for Industrial Data Platforms

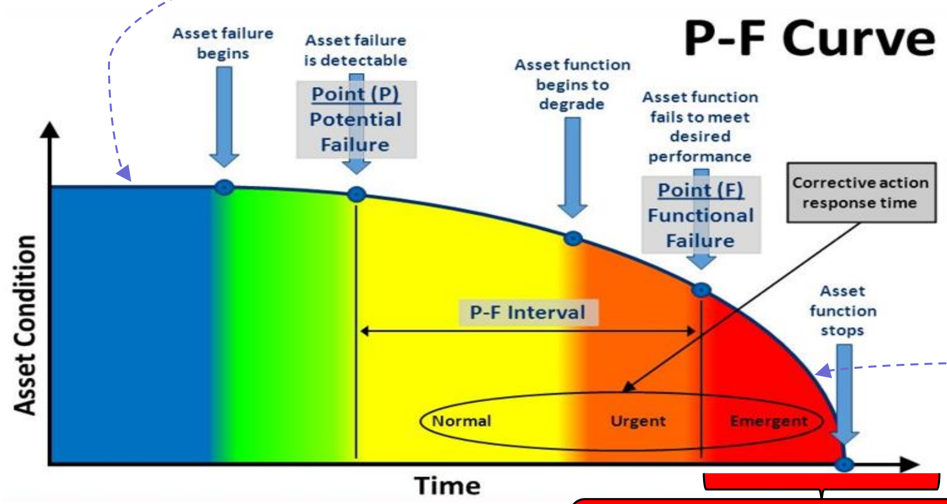
Corporate Structure

- Yazzoom is daughter company of Process Automation Solutions (https://pa-ats.com/)
  - About 1600 people
  - Offers for Industrial Production companies:
    - Consulting
    - Automation
    - Digital solutions
- Process Automation Solutions is daughter of ATS Corporation (https://atsautomation.com/)
  - About 7000 people
  - HQ Cambridge, Ontario, Canada
  - Listed on Toronto and New York Stock Exchange
- Locations: 60 manufacturing facilities and over 80 offices in North America, Europe, SE Asia and China

AI for data-driven maintenance

What if you could detect asset health issues in existing machine/process data?

Preventive maintenance attempts to fix something before it is broken, based on usage time, but it may be too early or too late



Reactive maintenance: fix when functional failure is noticed. Unplanned stop time depends on stock level

Data-driven maintenance: measures regularly, identifies conditions and anomalies in data to detect early, to predict and prevent failures

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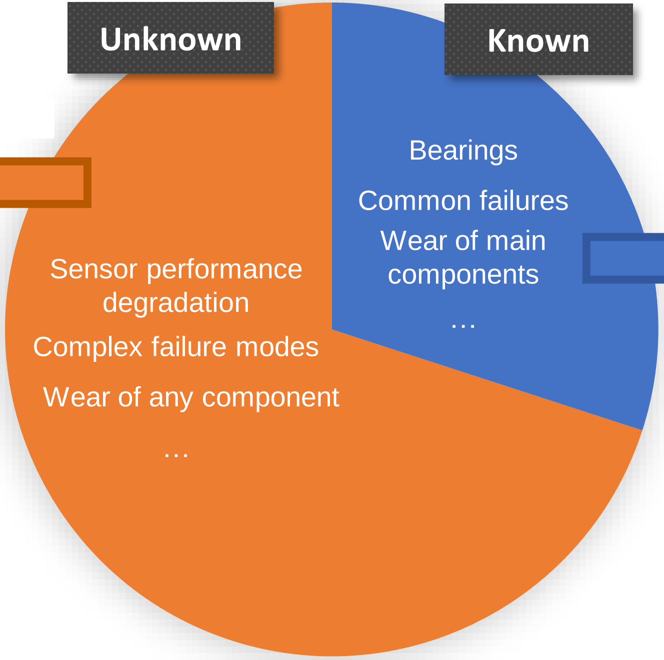
Data-drive maintenance techniques

Failure Types



Traditional approaches:

Statistical Process Control

Comparison against “white-box” asset model

as in Process Data Reconciliation

AI-based approach:

Existing and/or new sensors +

Unsupervised Machine Learning:

models normal operation and detects

any deviation from it

=

AI-powered Anomaly Detection

Traditional approach:

Dedicated sensors

(Vibration, Oil quality…)

+

Hand-written rules or algorithms

= (Online) Condition Monitoring

AI-based approach:

Existing and/or new sensors +

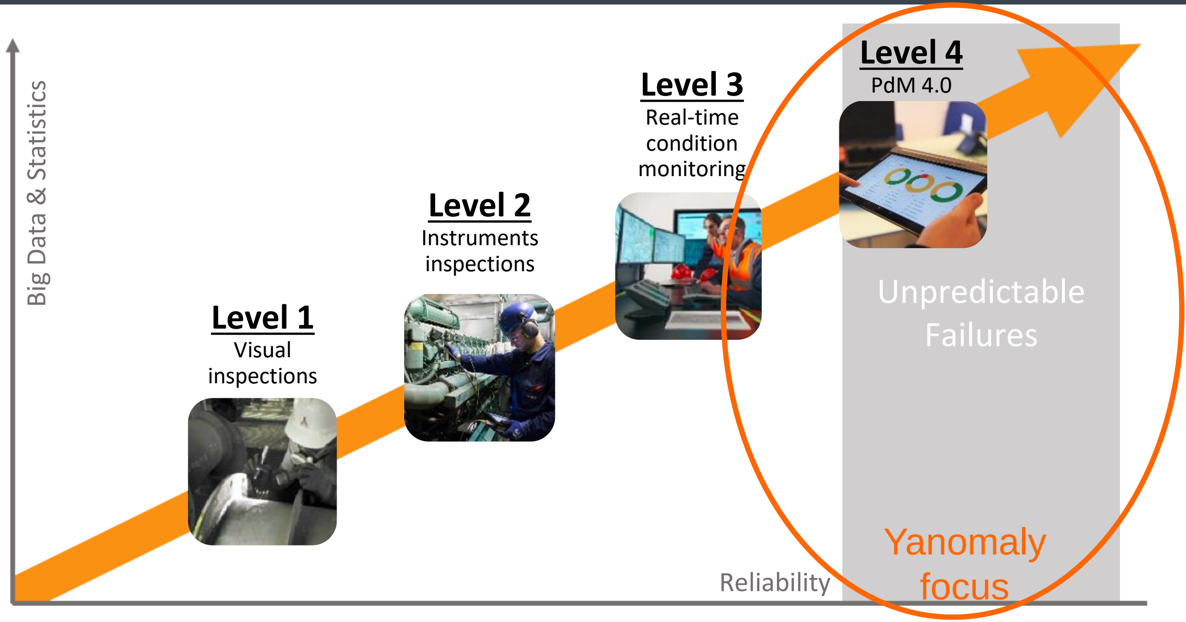
Supervised Machine Learning:

models specific problems/failures

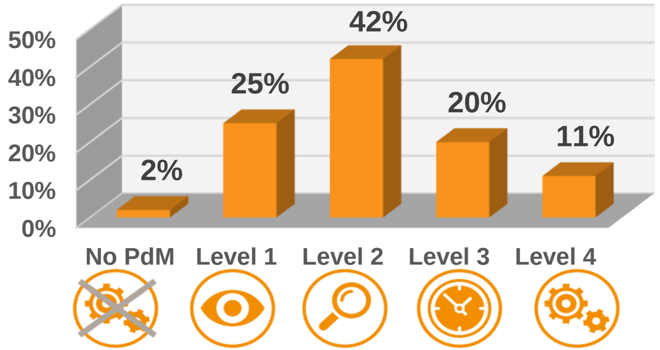
=

AI-powered predictive models,

What is your Predictive Maintenance Maturity?



Current PdM maturity level - EU Industries (2018)

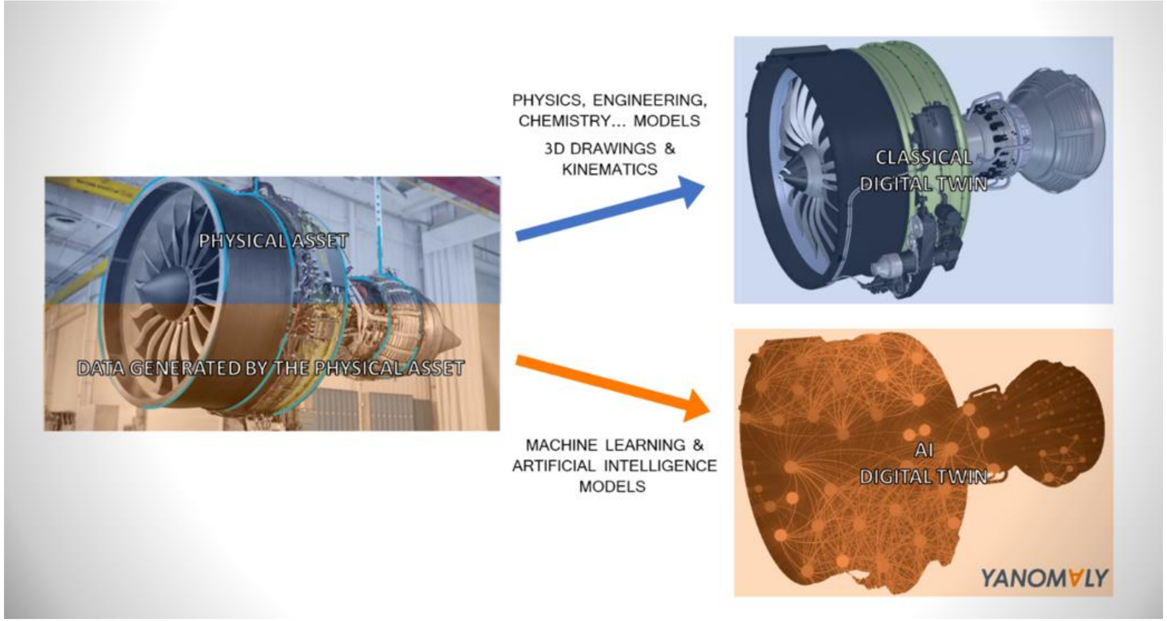


- **Visual inspections:** periodic physical inspections; conclusions based solely on inspector's expertise
- **Instrument inspections:** periodic inspections; conlusions based on a combination of inspector's experise and instrument read-outs
- **Real-time condition monitoring:** continuous real-time monitoring of assets, with alerts given based on pre-established rules & critical levels
- **Predictive maintenance with big data analytics:** continuous real-time monitoring of assets with alerts sent based on AI techniques such as anomaly detection and regression.

Source : PwC – Beyond the hype - 2018

HOW IS AI-BASED ANOMALY DETECTION DONE?

AI-based anomaly detection is done by letting computer algorithms learn mathematical models (digital twins) of normal operation/data of a machine or system, and then report deviations from normal operation as anomalies



- **Abnormal values**
- **Abnormal dynamics**
- **Abnormal patterns**
- **Abnormal statistics**
- **Abnormal settings**
- **Abnormal changes**
- **Abnormal relations**
- **…**

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YANOMALY: OWN SOFTWARE PRODUCT FOR ANOMALY DETECTION...AND MORE

YANOMALY

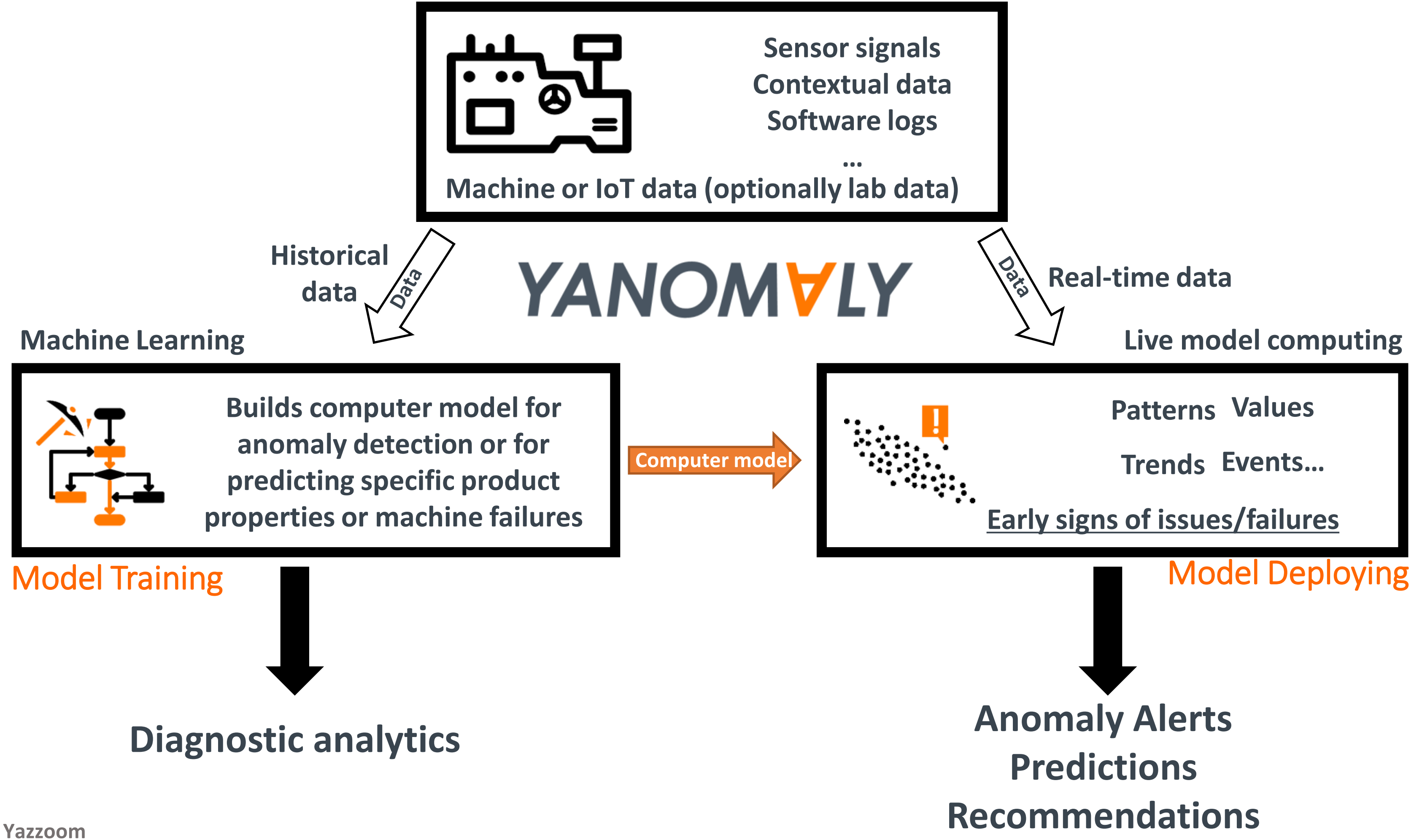
Scalable software product for adding AI-based monitoring & analytics to Machines, Production Lines and IoT devices

Included functionalities:

1. **Sensor data quality validation**
2. **Anomaly detection**
3. **"Golden" production run advisor**
4. **Predictive models for virtual sensing**
5. **Micro-stop detection**

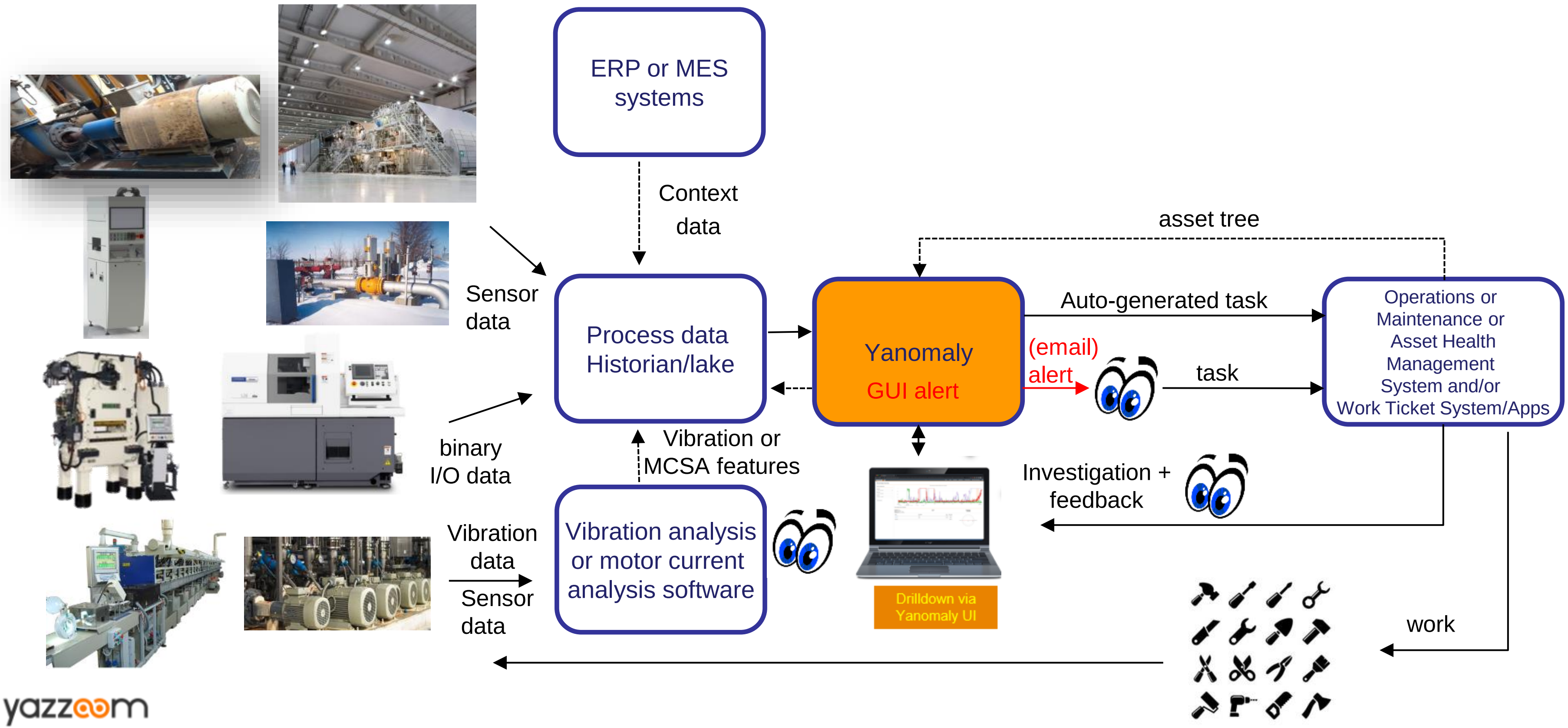
Used for:

1. **Production process improvements**
2. **Data-driven maintenance**
3. **Product quality improvements**



Yanomaly provides a no-code DIY environment for model training, deployment, alert management etc.

Example integration in existing IT/OT technology for anomaly detection, with optional vibration/MC analysis



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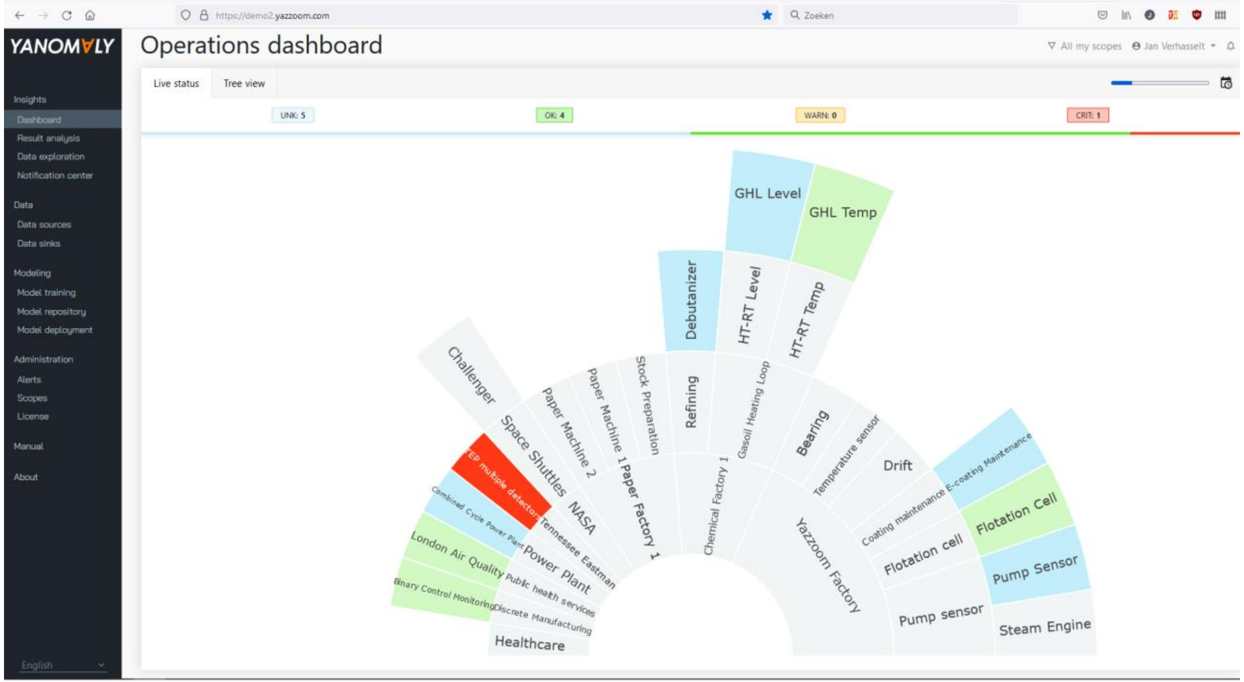
Live Status Dashboard / Overview Report showing location of biggest issues + allow drill-down



Example of levels: Plant, Line, Machine, Subsection, Control Loops

5 different ways AI-based anomaly detection complements traditional condition monitoring

1. Combine traditional predictive maintenance technology ("condition monitoring") with process data and context data to make an **even earlier or more reliable (less false alarm) detection of specific failures**. Thanks to making the decision to alarm or not on more information about the concrete circumstances.
   - *Example: combining vibration + context + process data in pump monitoring*
2. **Detect and remedy issues in the production process that over time would lead to asset degradation.** This is before the P-point of that failure. Avoid avoidable asset health degradation by detecting process anomalies.
   - *Example: detect oscillation of control loop caused by bad PID parameters: avoid faster wear of control valve*
3. **Detect asset health issues for which there is no condition monitoring technique.** Because it is a quite unique installation for which there are not enough examples of failures to build a dedicated sensor and algorithm to detect that failure.
   - *Example: detecting issues in a floatation cell based on multivariate anomaly detection in the sensor data.*
4. **Detecting asset health issues for which adding available condition monitoring techniques is too expensive.** Instead use existing process data for anomaly detection on many assets. Better than no health monitoring.
   - *Example: Stora-Enso and other large-scale anomaly detection customers.*
5. **Detecting asset health issues for which there is no gradual degradation of the health, but a sudden one.** In that case the idea of predicting the failure is impossible.
   - *Example: detect mistake made during planned maintenance on pump. Avoid functional failure.*

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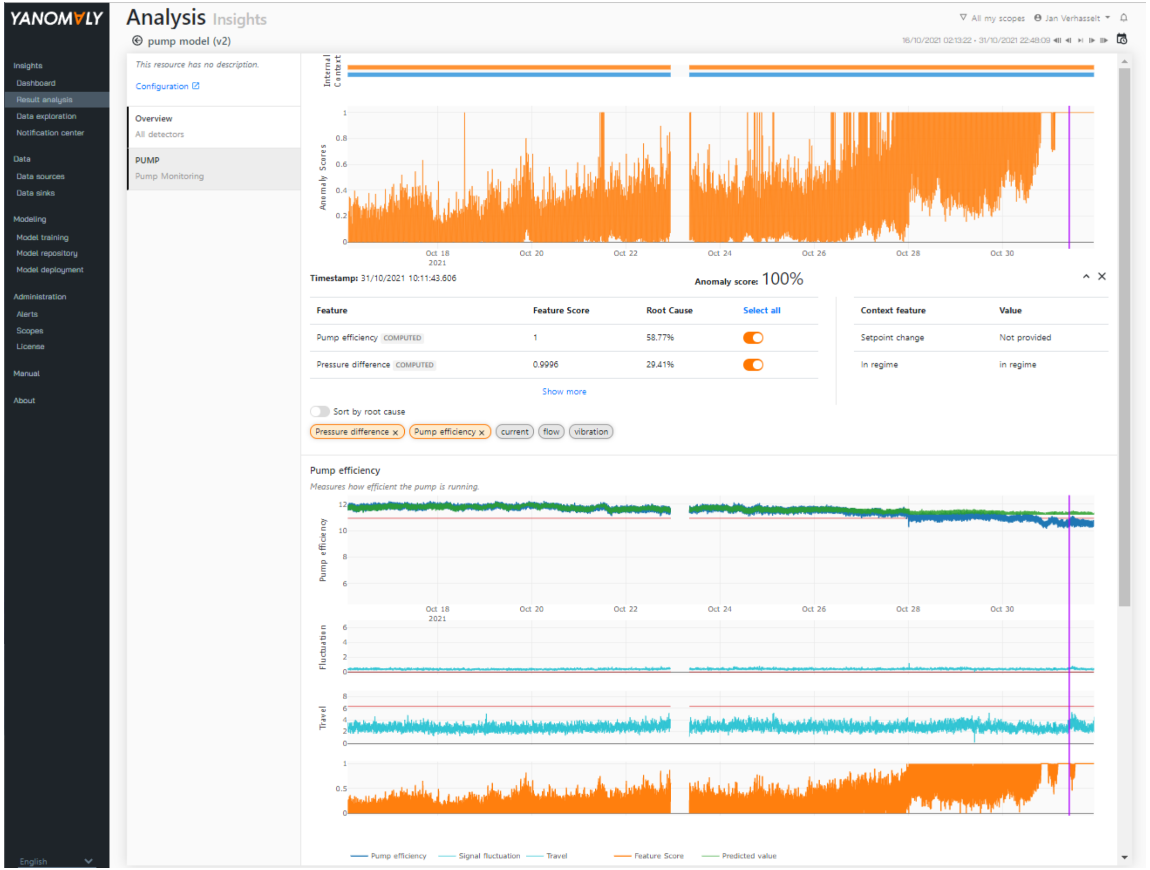
Specific hybrid AI anomaly detector for monitoring pumps: Pump monitoring detector:

Example from sugar producing company



Benefits:

- **Reduce unplanned stops**
- **Save energy**
- **Avoid bigger damage to pump**

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Example use-case from food industry
Control Performance Degradation Detection

Oscillations detected preceding control valve breakage

- <u>Cause</u> : Ceramic valve of level controller broken
- <u>Risk</u> : No control on level
- <u>Action</u> : Maintenance on the valve during planned stop
- <u>Added value</u> : WinCC is not able to detect oscillations. Yanomaly detected issue 8 days before failure

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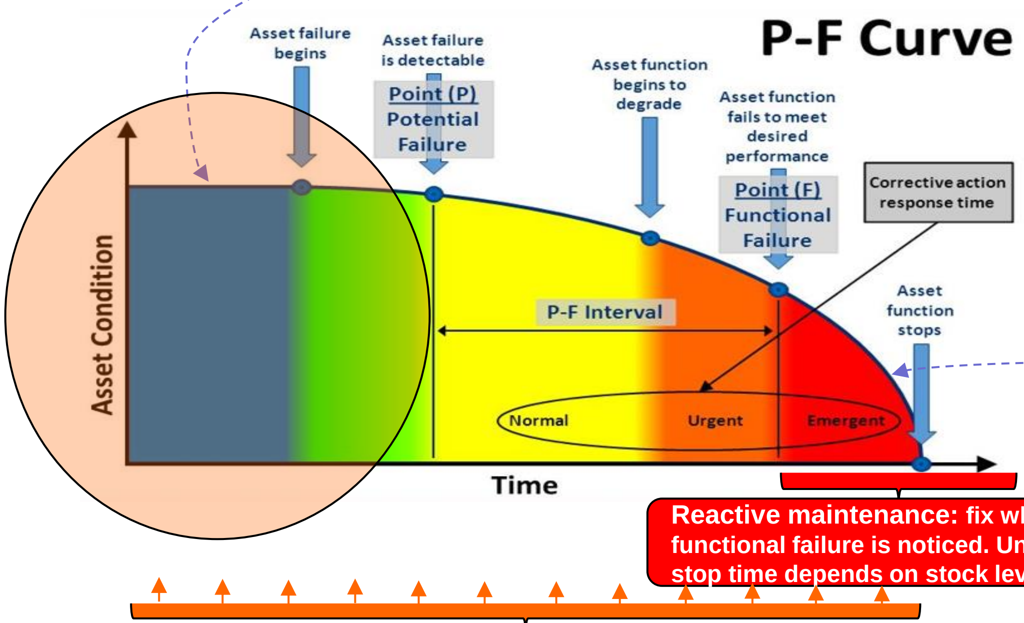

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Evaluation by users @ paper mill with 500 anomaly detecting models on motors, controllers,…

- All (email) notifications by Yanomaly are investigated and classified:
  - False alarm
  - Justified alarm, but not useful
  - Justified alarm and useful
- Actions are coupled to the useful notifications, examples:
  - “Pump doesn’t work without manual intervention, must be replaced”
  - “Re-tune PID controller”
  - “Limit control valve to 20%”
- No vibration sensors used
- Summary statistics after 6 months:

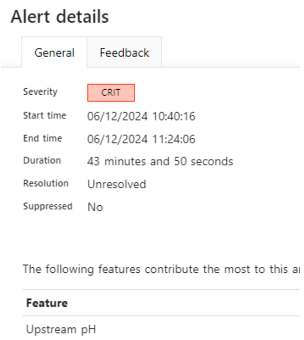
Categories	count	%
False alarm	24	12.12%
Justified alarm but not useful	40	20.20%
Justified alarm & useful	134	67.68%
Total	**198**	**100.00%**

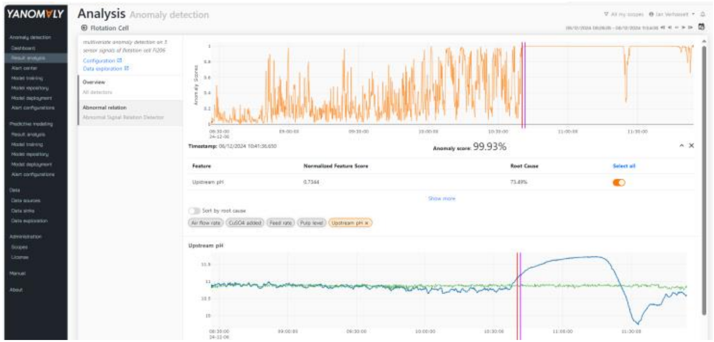
Alert List

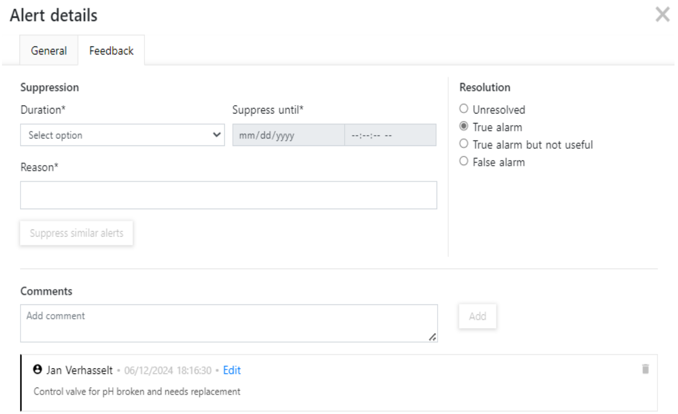
Useful for operators/engineers to see most recent alerts, investigate them, and give feedback

●	06/12/2024 10:40:16	43m 50s	Flotation Cell	Abnormal relation	Upstream pH	CRIT
●	06/12/2024 10:40:06	10s	Flotation Cell	Abnormal relation	Upstream pH	WARN
●	06/12/2024 10:39:56	10s	Flotation Cell	Abnormal relation	Upstream pH	CRIT

1) Select alerts from list of recent alerts







2) Investigate

3) Give feedback

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Boon Edam case Lifeline security gates PoC

- Status: Currently preparing data collection including normal functioning and failures
- Next: figure out which anomaly detection algorithms applied to which data is best suited for data-driven maintenance

BEDANKT VOOR JE AANDACHT!

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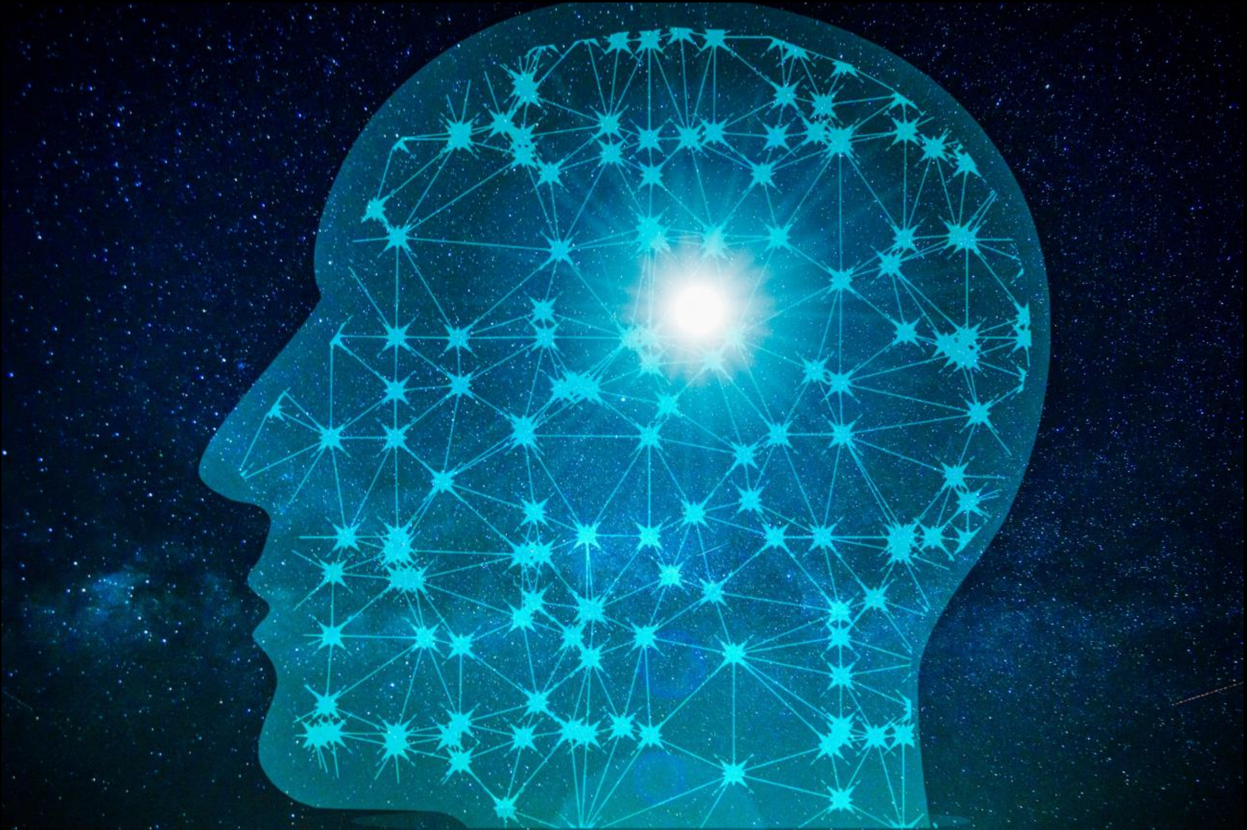
FME AI FOR INDUSTRY JAAREVENT



Bedankt voor je aandacht!

FME POWERED BY DUTCH TECHNOLOGY