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Connecting intelligence

How infrastructure can take your data to the next level

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AVEVA



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Agenda

- Why AI-driven analytics?
- The right tool for the right job
- Getting started with AI-driven analytics

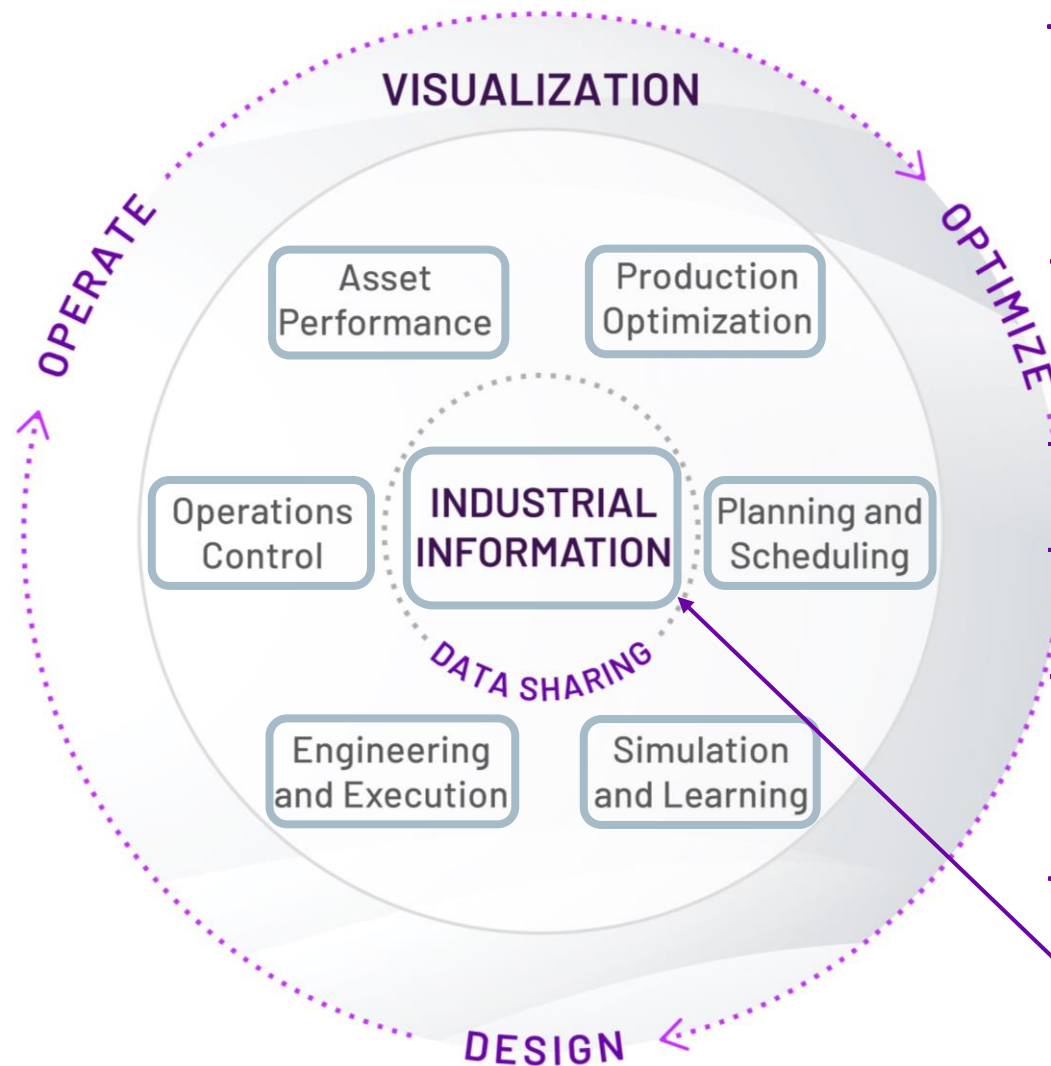
Why AI-driven analytics?

Artificial intelligence infused

Across AVEVA's broad product portfolio

Predictive
Performance
Prescriptive
Prognostic
Perceptive

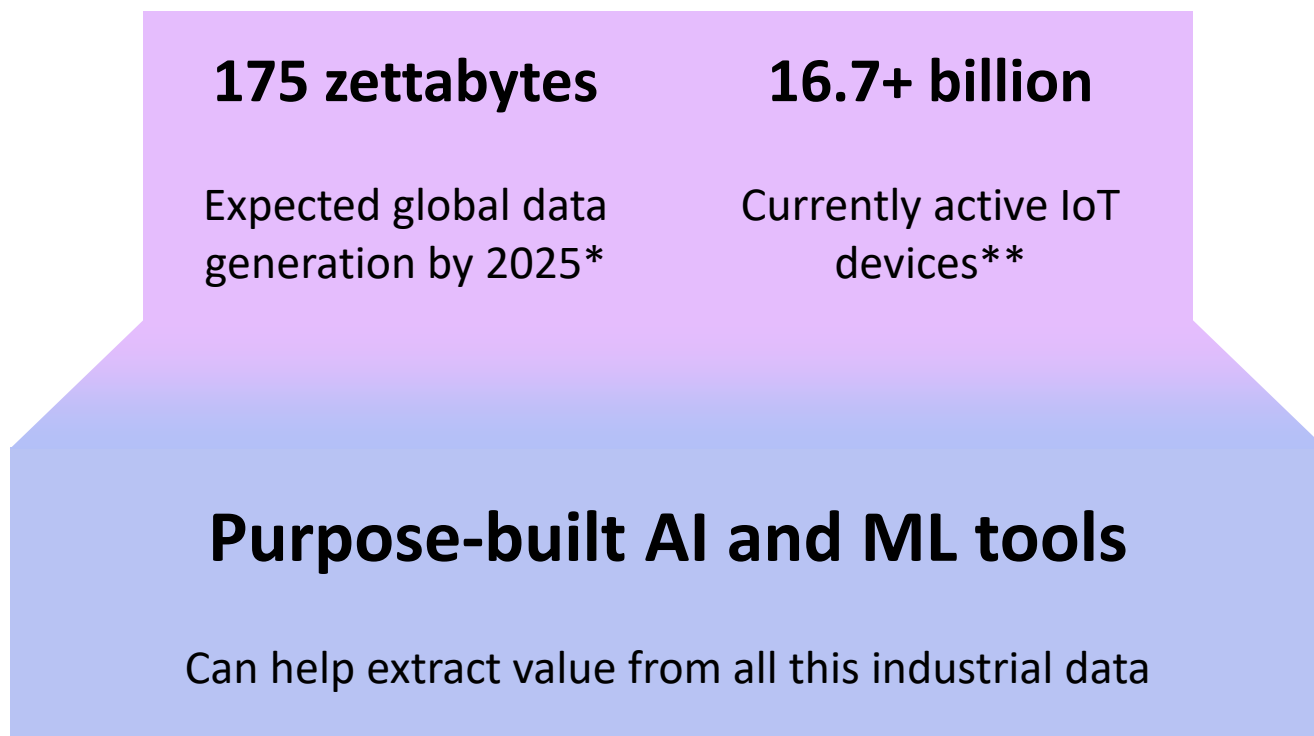
17 commercially released AI products



- Automated analytics
- Guided analytics
- Predictive analytics/maintenance
- Asset prescriptive analytics
- Process optimization
- Predictive quality/throughput (batch)
- Remaining Useful Life Estimation (RULE)
- Predictive asset optimization (PAO)
- Schedule AI Assistant
- Real-Time Crude
- AI-infused process simulation
- AI-infused Dynamic Simulation
- E3D Whitespace Optimizer
- E3D suggestive design framework
- Point Cloud Manager
- Advanced process control (APC)
- InSight OMI app (native integration with system platform SCADA)
- AI inferencing
- Vision AI Assistant
- Knowledge linking

Rapidly increasing data collection

The need for artificial intelligence and machine learning



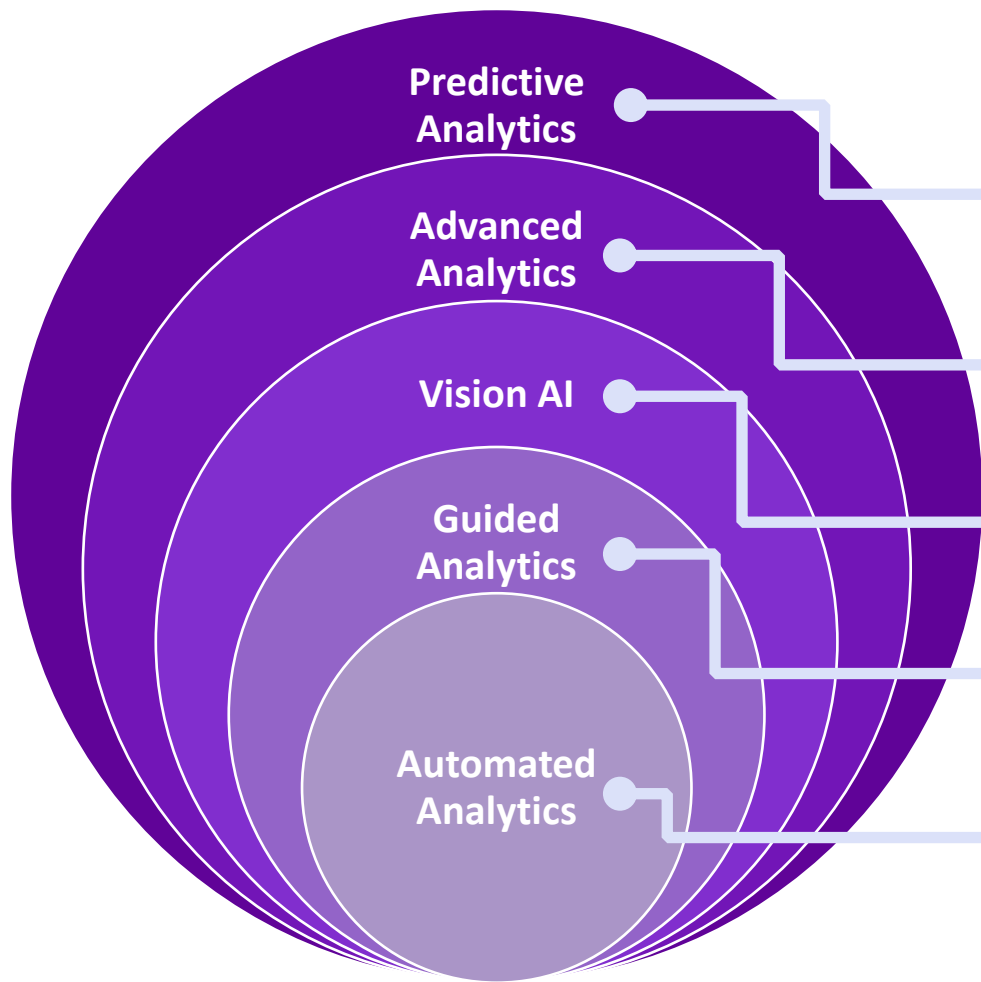
Infrastructure use cases for AI	
Asset targets	Strategies
<ul style="list-style-type: none">• Pumps• Motors• Chillers• Heaters• Fans• Heat exchangers• Power supplies• Engines• +++	<ul style="list-style-type: none">• Anomaly Detection• Equipment Reliability• Energy efficiency• Quality Optimization• Computer vision• +++

* Source: forbes.com, IDC

** Source: iot-analytics.com

Purpose-built, AI-driven analytics

Choosing the right tool to get started



Purpose	Primary Data Sources	AI Resides	Data Maturity
Detailed anomaly detection, alert/case management, fault diagnostics, and forecasting	AVEVA™ PI System™ and other historians	On-Prem	↑
In-depth models for quality optimization, energy efficiency, and throughput	AVEVA™ Data Hub	Cloud	
Analyzes images for anomalies, classification, and other skills	Cameras	On-Prem	
Fast-to-create anomaly detection models	AVEVA™ Insight	Cloud	
Unsupervised, automatic data analysis	AVEVA™ Insight	Cloud	

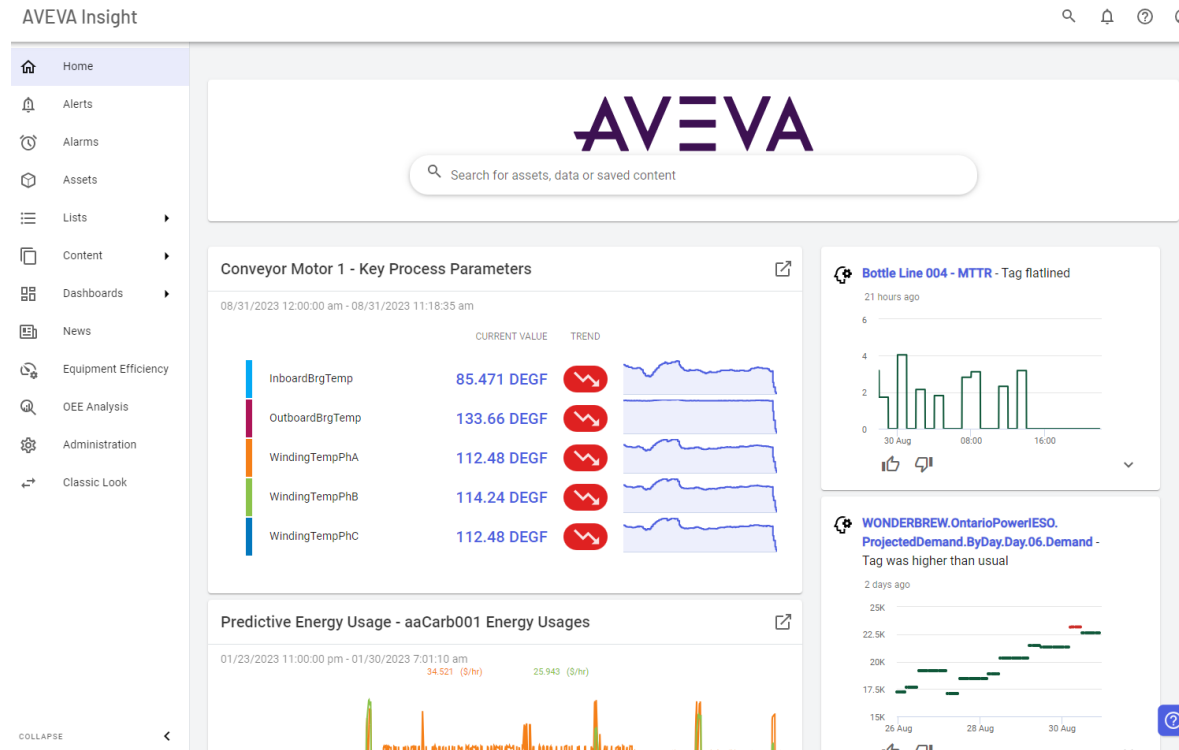
The right tool for the right job

AVEVA

Automated Analytics

What is it & how does it work?

- Automated Analytics is an unsupervised machine learning application designed to detect changes in behavior of all tags in AVEVA Insight
- It automatically analyzes data for the following changes:
 - Value High / Value Low
 - Data Source Flatline / Tag Flatline
 - Variation High / Low
 - Cycle Time High / Low
 - Tags relate differently
- After publishing data to AVEVA Insight, it takes ~1-2 weeks to learn typical behavior and updates on a rolling basis
 - Differences compared to this recent history are displayed in Insight Newsfeed



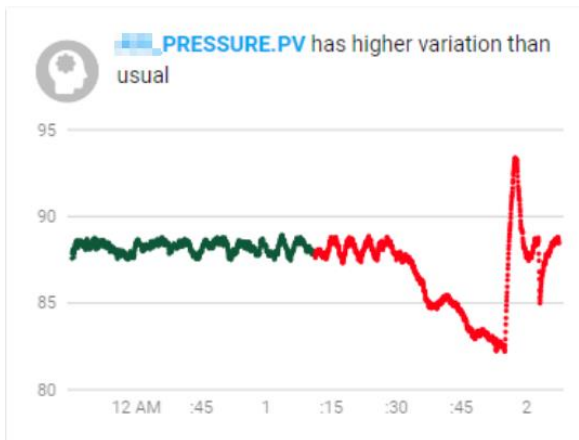
Time to deploy your first model:
Immediate – automatically starts analyzing new data in Insight

Automated Analytics

When to use it

- When you have simple, lightly-instrumented equipment or processes (not enough data for other solutions)
- Light-touch monitoring is all that is required
- Supplements condition-based rules in AVEVA Insight

Air compressor pressure regulation issue:



Decreasing product scale weight:



Heater outlet temperature above normal:



Guided Analytics

What is it & how does it work?

- Guided Analytics provides multivariate anomaly detection in AVEVA Insight
- Easy-to-use wizard guides you through the model creation process
- Two algorithms are available: process anomaly detection and asset anomaly detection
 - Both work by analyzing the behavior/relationships of all the tags in the model during a specified training period
 - If the current relationship differs from this, it'll be flagged as an anomaly
 - It's important to choose a training date range of predominately 'normal' behavior to avoid bad/abnormal conditions from being learned as good
- The model outputs an Anomaly Score tag to AVEVA Insight, and new anomalies will appear in the Insight Newsfeed
 - The larger the difference, the higher the anomaly score

Asset Anomaly Detection Guided Model Details

Model Name *
Motor Reliability
Unique name excluding *, ; , <, >, &, [] 17 / 50

Algorithm Type
AVEVA Predictive Analytics Anomaly Detection

Asset
/theGalaxy/WonderbrewCorp/NewYorkPlant/Roasting/Conveyor/Motor1

Tags *
Choose one or more tags to use in your model

- InboardBrgTemp
- OutboardBrgTemp
- Power
- OutboardVibX
- CurrentPhA
- CurrentPhB
- OutboardVibY
- CurrentAvg

10 tag(s) added out of 30

Configure Filter
Optional condition to indicate the asset or process is not running.

Filter Tag
GuidedAnalytics_Roaster.Conveyor Motor GA 1.Power

Filter Operator
LessThan

Cancel Save

Time to deploy your first model:

Minutes – the wizard-based approaches guides you through a few basic steps

Guided Analytics

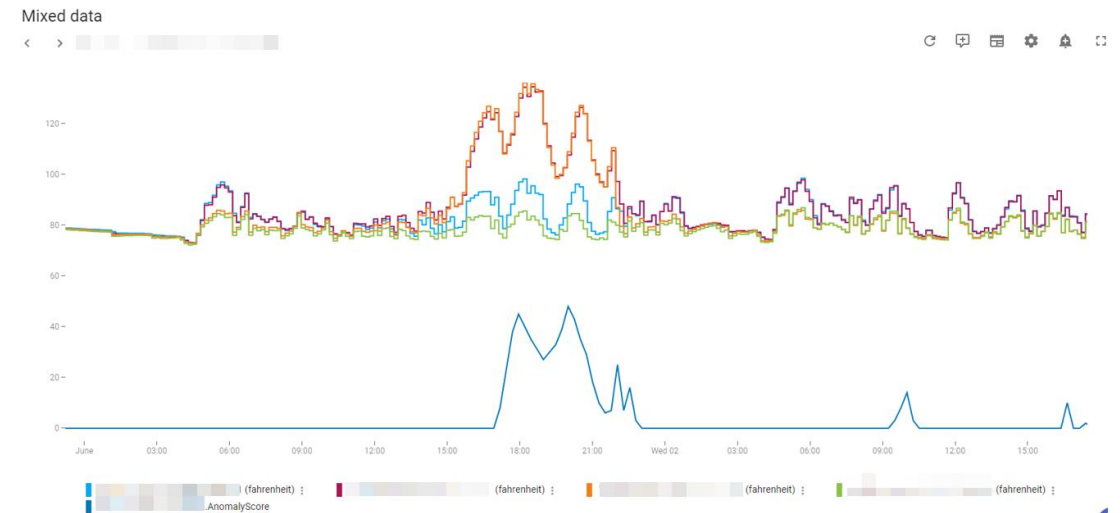
When to use it

- When you have moderately instrumented assets or processes that would benefit from anomaly detection
- Light-touch monitoring is all that is required

Increasing pump vibrations, traced to excessive cavitation during startup:



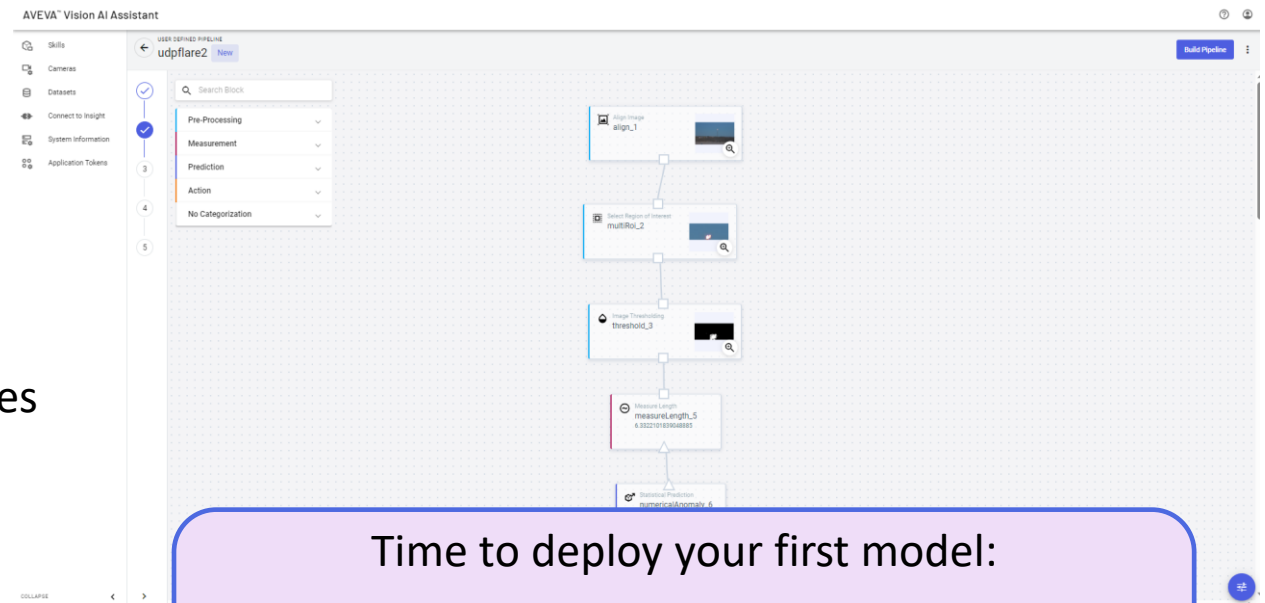
Cooling water supply issue to high-current welding cables leading to high temperatures:



Vision AI Assistant

What is it & how does it work?

- Vision AI Assistant analyzes images instead of time-series sensor data, in one of three ways
- All model training is done through the point-and-click interface
- Model results can be viewed in the Vision AI Assistant standalone app, AVEVA Insight, or the System Platform OMI app



Anomaly detection

- You supply a series of known-good training images
- Model flags an anomaly when a new images differs from that in any way

Classification

- You supply labeled training images of two different states
- Model identifies new images as one state or the other

User-defined pipeline

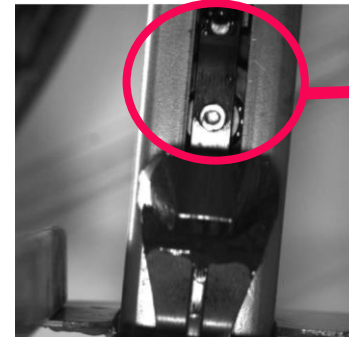
- You define a series of image processing steps to produce a desired output
- Example: Align on object; select region of interest; detect edges; measure horizontal edge in pixels; convert to inches

Vision AI Assistant

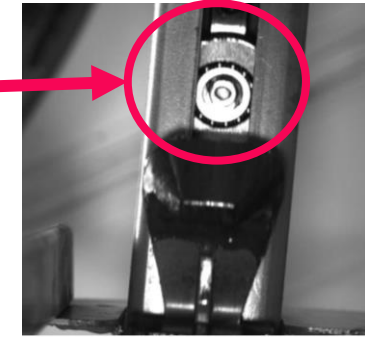
When to use it

- When you have cameras pointed at a process or other area of interest, uses include:
 - Flagging of anomalous conditions (unexpected change of normally 'consistent' conditions)
 - Distinguishing between two states (object present/not present, device on/off, etc.)
 - Measurement applications (length, width, angles of deformation, etc.)

Good image



Bad image (missing linkage arm)



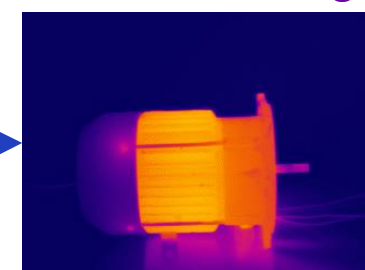
Object with defect
(metal burr)



Measure size of defect
beyond right edge



Detect abnormal hotspots with thermal images



Advanced Analytics

What is it & how does it work?

- Advanced Analytics provides model types targeted to specific problems, including:
 - Predictive Quality
 - Predictive Throughput
 - Predictive Energy Efficiency
- Wizard-based approach to setting up digital twins and models
 - Digital twins define the context of a machine or process, including sensors and operating states
 - Models target a specific parameter to optimize and learn based on historical data which process conditions come closest to that goal
 - Models then look at real-time process data to recommend adjustments to current values
 - Advanced configurations and model types available for data science users
- Connects directly to AVEVA™ Data Hub as a data source



Predictive Quality

- Run CpK
- First pass Quality



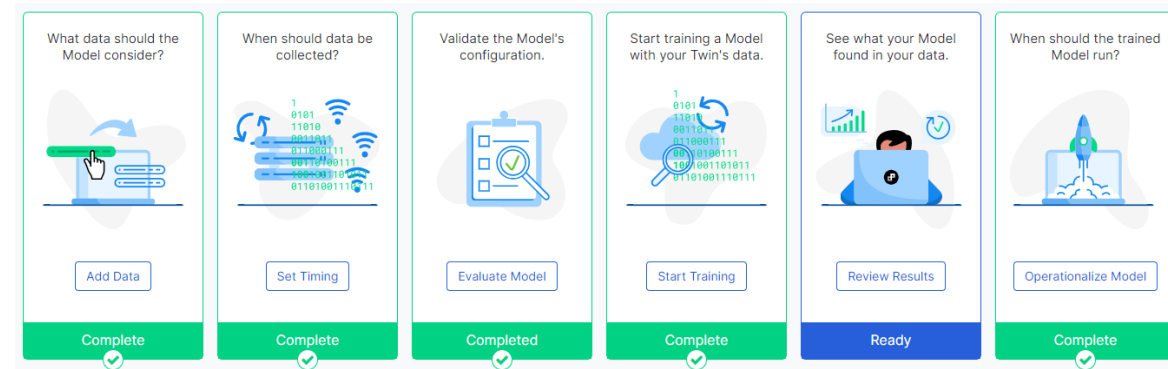
Predictive Throughput

- Improve Production rate, run length, cycle time
- Reduce Material cost per unit production



Predictive Energy Efficiency

- Energy Cost
- Unit Production



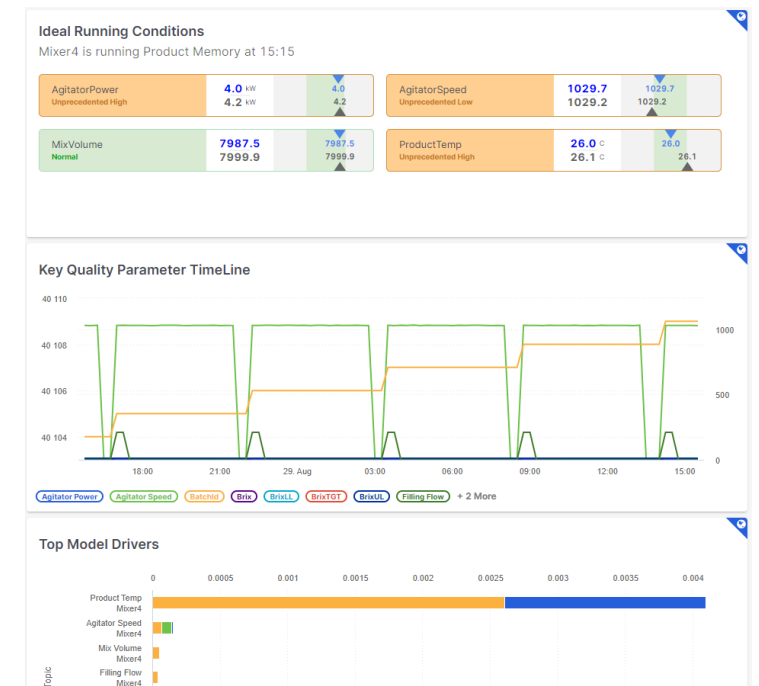
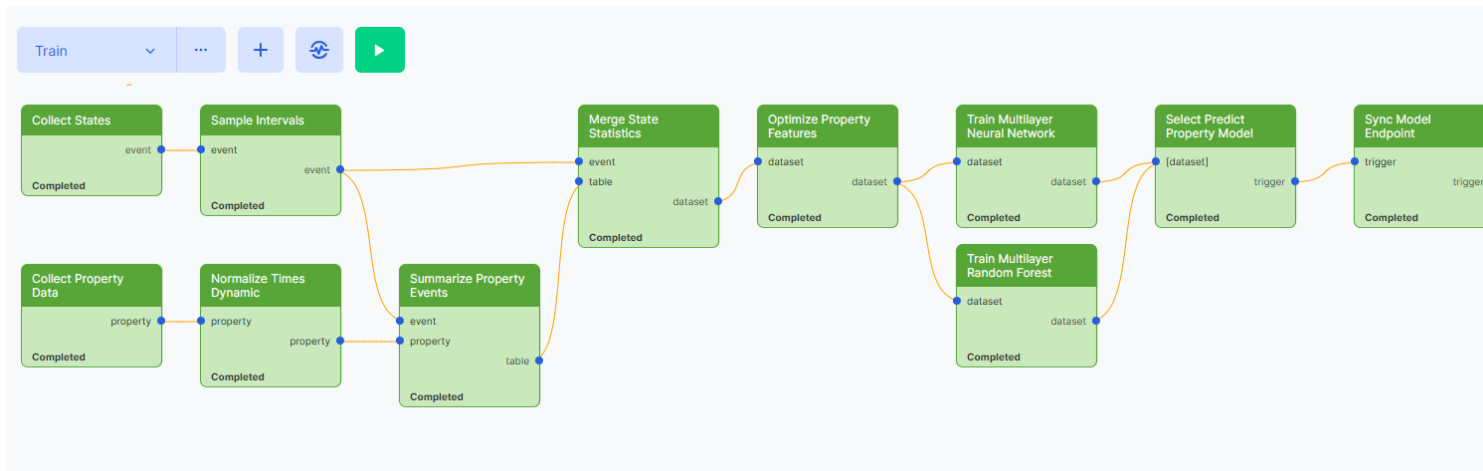
Time to deploy your first model:

Less than hour after first connecting
to AVEVA Data Hub

Advanced Analytics

When to use it

- When you want deep insight into your process, full control over model configuration and dashboard creation for viewing model results and recommendations
- Requires a reasonably well-instrumented equipment/process, including historical data for a target parameter to optimize, such as energy consumption



Advanced Analytics

Data center management

- Provided an asset management solution to extend UPS (Uninterruptable Power Supply) battery life and reliability
- Combined subject matter experts with digital twins created in Advanced Analytics
- The solution was scaled to encompass:
 - 450 sites
 - 650,000 digital twins
 - 20mm Sensors
 - 12mm Digital threads
 - 750,000 Predictive models



Scaled to cover 450 sites



750,000 models created

Advanced Analytics

Furnace monitoring

- Created models to increase furnace life and energy efficiency
 - Identified performance degradation over time
 - Increased furnace life and optimized replacement cycles
 - Identified root causes of inefficiencies
- A Virtual Center of Excellence was established to monitor these models and provide expertise to diagnose the issues
- This has resulted in:
 - 10% improvement in asset efficiency
 - \$1M reduction in costs
 - New units can be added in one day



10% improvement in asset efficiency



+\$1M reduction in capital costs

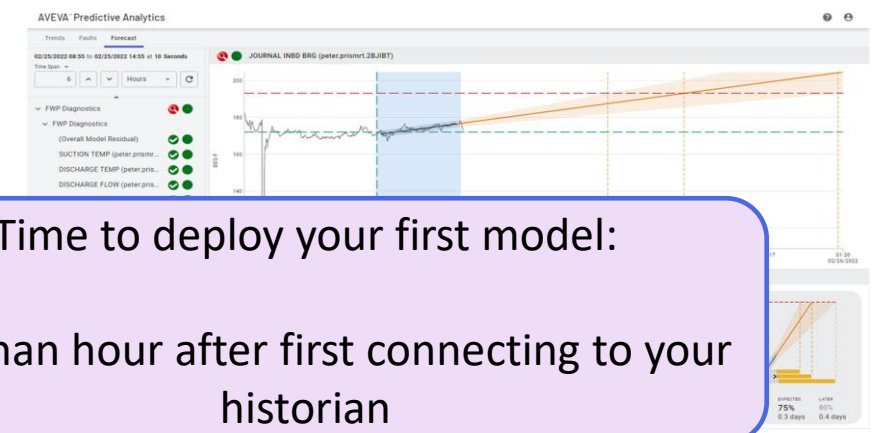
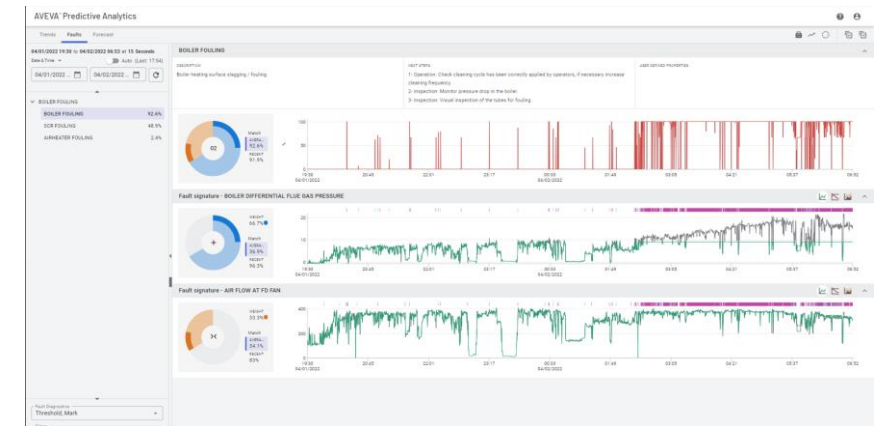


Solution deployed in less than 6 weeks

AVEVA™ Predictive Analytics

What is it & how does it work

- AVEVA Predictive Analytics provides advanced multivariate anomaly detection capabilities to find early warning of failure
- Models are derived from templates, but are trained on historical data specific to each machine
 - 1 year of data is a common standard
 - Models learn how all the sensors typically behave *together* across various operating conditions
- If the current conditions begin to deviate from the historical normal, the model will create an alert
 - An analyst will review the associated trends, fault diagnostics, and forecasting projections
 - The analyst can change the alert state and open a case if needed
- Connects to virtually any historian, and is also integrated with PI Asset Framework for faster model deployment



Time to deploy your first model:
Less than hour after first connecting to your historian

AVEVA™ Predictive Analytics

When to use it

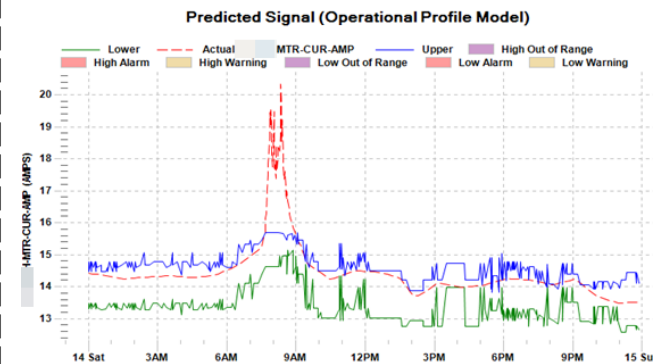
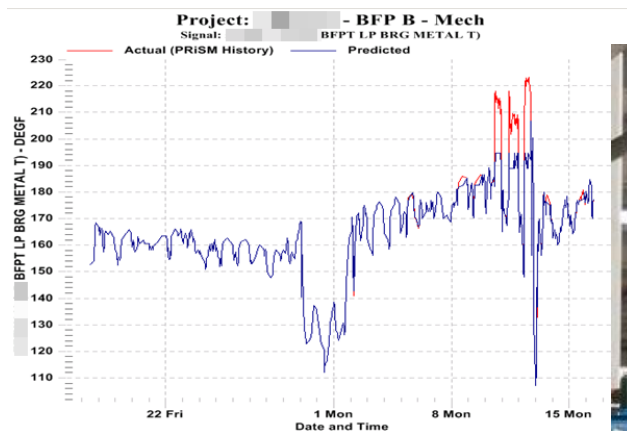
- When you want deep insight into your equipment reliability, ability to have full control over model configurations, and support for a full monitoring process including alert + case management and forecasting
 - Requires a reasonably well-instrumented equipment/process

Observation: High bearing temps on a pump relative to normal operation

Cause: Oil reservoir found to be half filled with water due to valving issue

Observation: Increased motor current for a given load

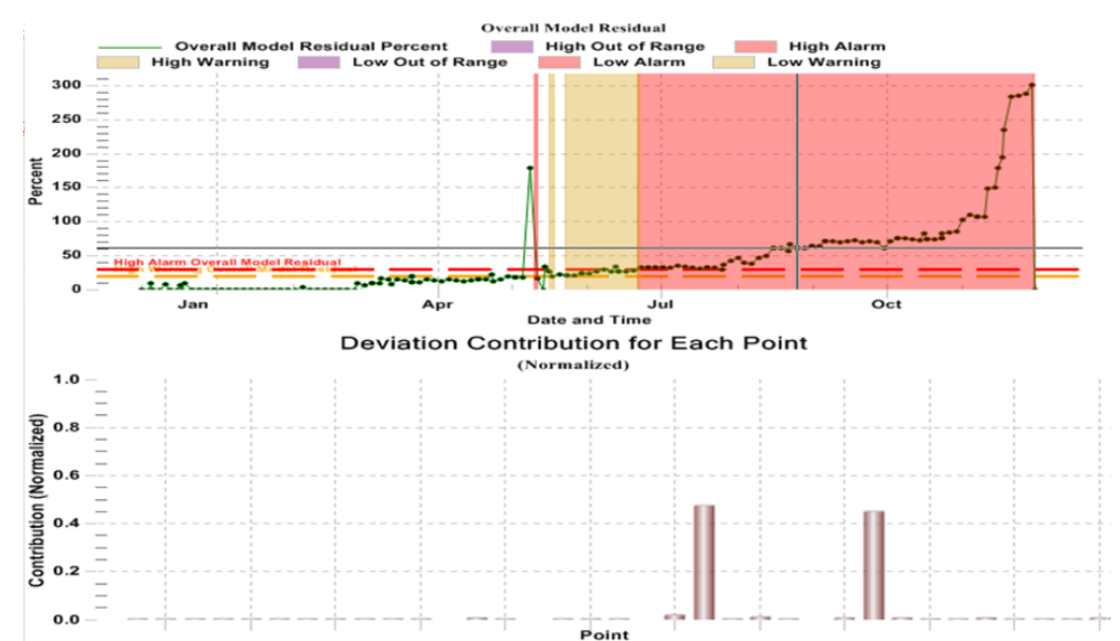
Cause: Leak found from ceiling that saturated the motor insulation, causing expansion issues



AVEVA™ Predictive Analytics

Cracked air compressor impeller

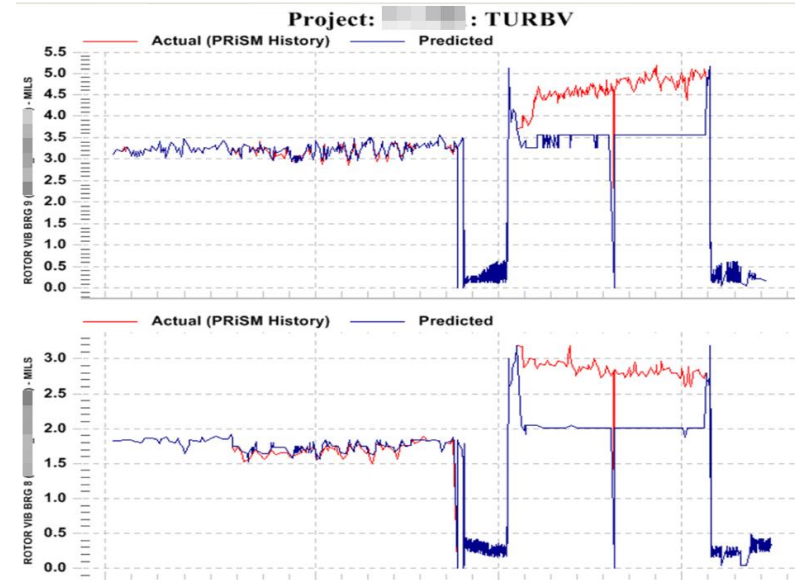
- Early warning with clear indicators of anomaly on the 2nd stage of the compressor ~3 months before operators noticed it
- A crack was found to be developing on the compressor's rotor
- Early detection allowed for \$500k savings on:
 - Planned vs. unplanned maintenance (no emergency maintenance)
 - Production savings (avoiding secondary interruptions)



AVEVA™ Predictive Analytics

Damaged steam turbine blades

- Following a routine outage, a step change on steam turbine bearing vibrations was detected (values still well below plant alarm levels)
- The unit was shut down for inspection
- Bolts on the lower half of the flow sleeve had broken, which then contacted the L-0 blades
- Although some damage to the LP blades occurred, early detection prevented additional damage from occurring on the other stages of blades, packing, and diaphragms
- Estimated early detection savings of **\$4.1 million**

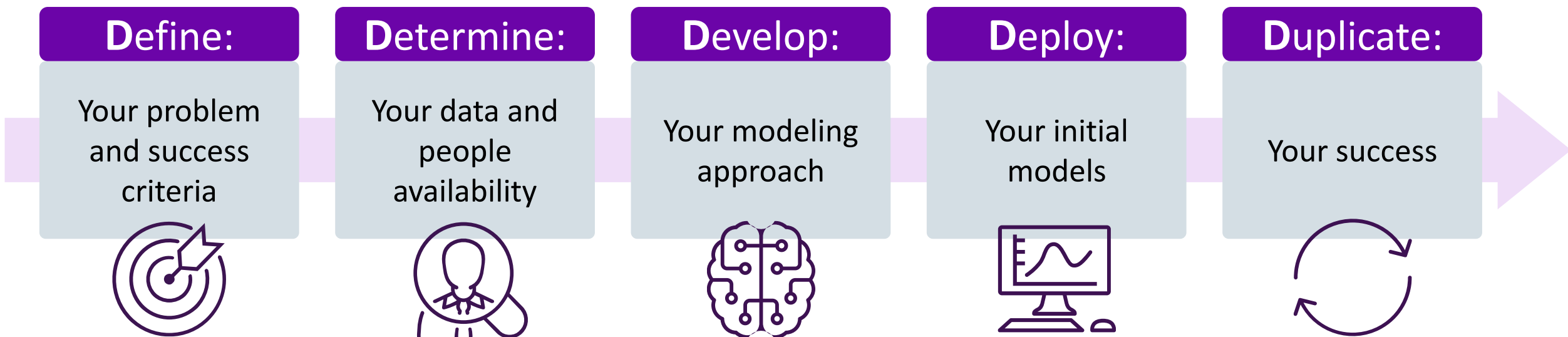


Getting started with AI-driven analytics



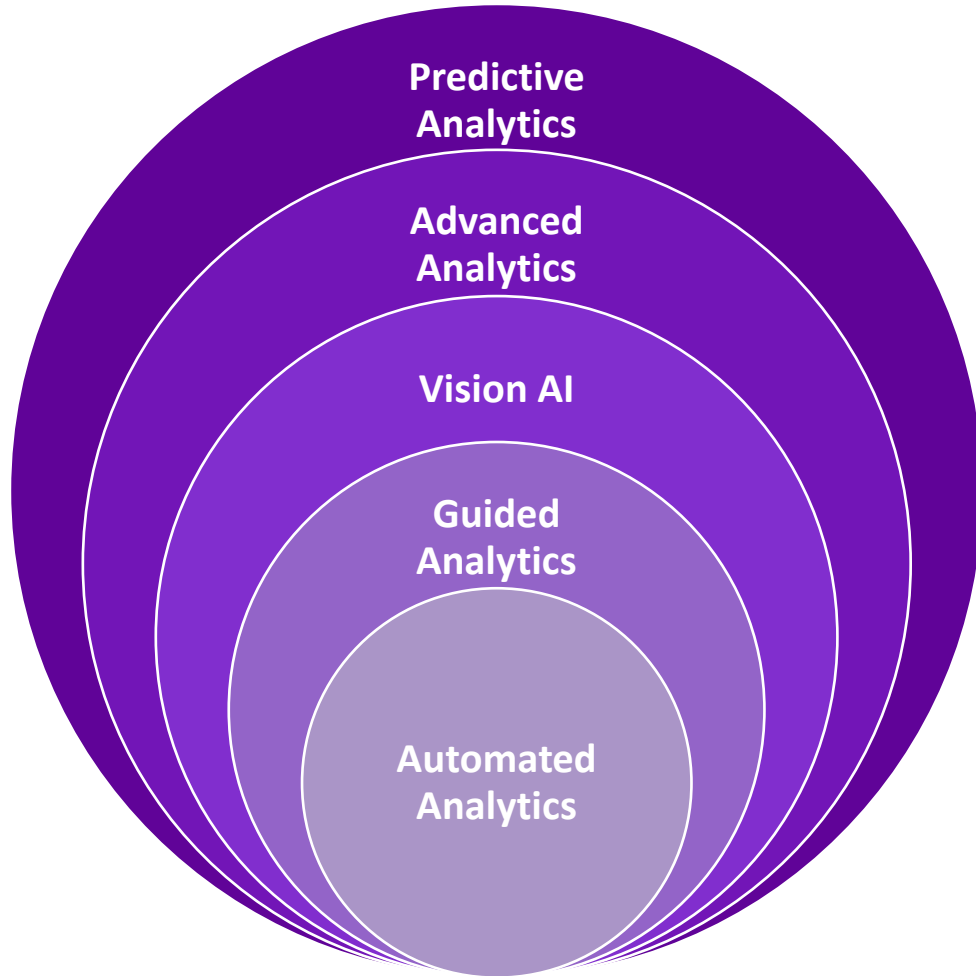
Path to success with AI

5 key stages to succeeding with AI tools



Starting your AI journey

How to solve real problems with AI



Infrastructure use cases for AI

- Anomaly Detection
- Equipment Reliability
- Energy Efficiency
- Quality Optimization
- Computer Vision
- +++
- Pumps
- Motors
- Chillers
- Heaters
- Heat Exchangers
- Power Supplies
- Engines
- Object Detection
- +++

Questions?

Please wait for the microphone.
State your name and company.



Please remember to...

Navigate to this session in the mobile app to complete the survey.



Thank you!

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AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

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