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Deploying Vision AI Assistant for anomaly detection in HMI / SCADA and AVEVA™ Insight

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Visual anomaly detection in HMI/SCADA

Vision AI Assistant applies image processing models to real-time camera feeds automatically identifying and reporting anomalies or inconsistencies from learned image states.

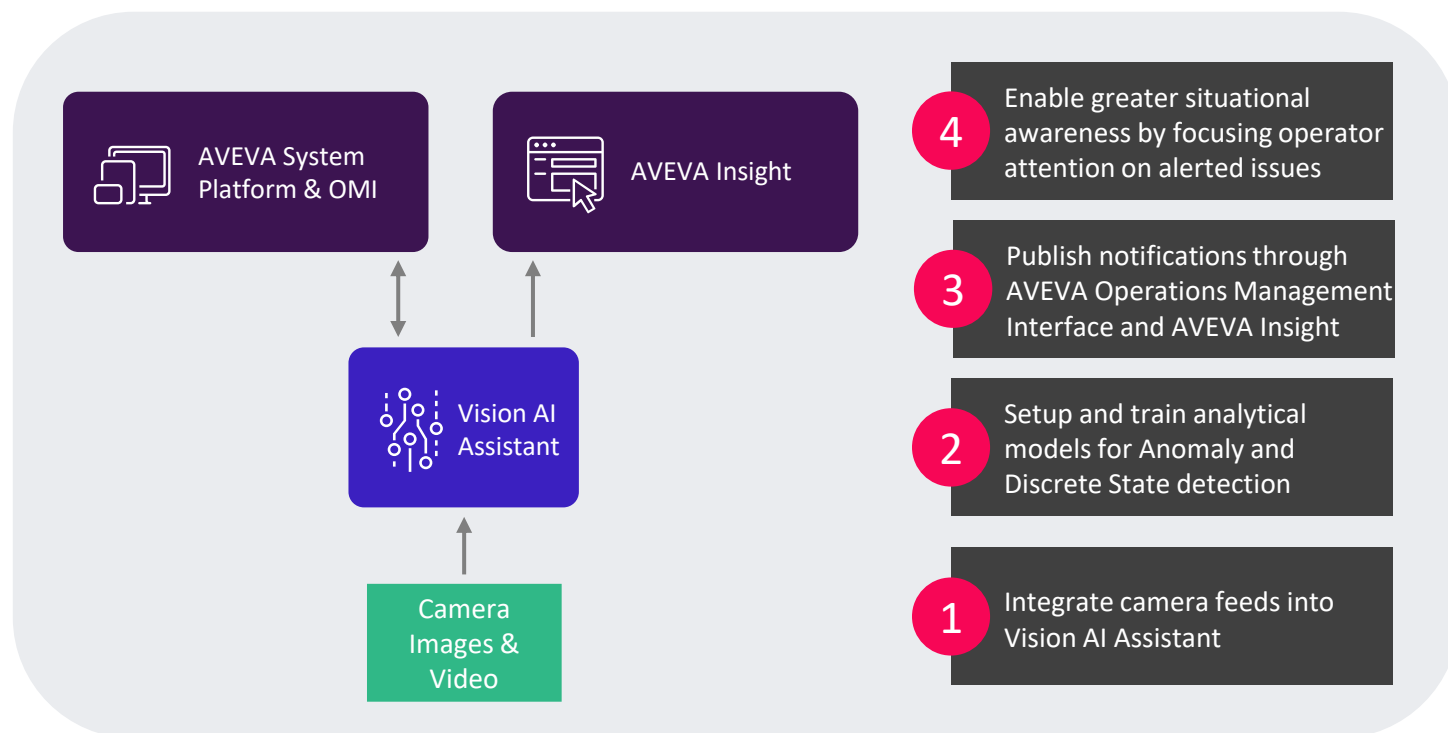| Monitor real-time image streams | Employs deep learning to train and deploy machine learning models | Provides alerts and notifications to operators | Easy-to-use web-based interface | Designed for low latency industrial environments | Helps operators maintain attention on their tasks |

AVEVA

What is Vision AI Assistant?

## Visual Anomaly Detection in HMI/SCADA

Vision AI Assistant applies image processing models to real-time camera feeds automatically identifying and reporting anomalies or inconsistencies from learned image states.

- Monitor real-time image streams

- Employs deep learning to train and deploy machine learning models

- Provides alerts and notifications to operators

- Easy-to-use web-based interface

- Designed to work in low latency industrial environments

- Helps operators maintain attention on their tasks without having to continuously monitor live camera feeds, enhancing their situational awareness

- Integrated with AVEVA System Platform & OMI and AVEVA Insight

AVEVA System Platform & OMI

AVEVA Insight

Vision AI Assistant

Camera Images & Video

4 Enable greater situational awareness by focusing operator attention on alerted issues

3 Publish notifications through AVEVA Operations Management Interface and AVEVA Insight

2 Setup and train analytical models for Anomaly and Discrete State detection

1 Integrate camera feeds into Vision AI Assistant

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Analytic modes – Vision AI Assistant skill types

Use images from existing general-purpose cameras and convert them into image classification-based analytics
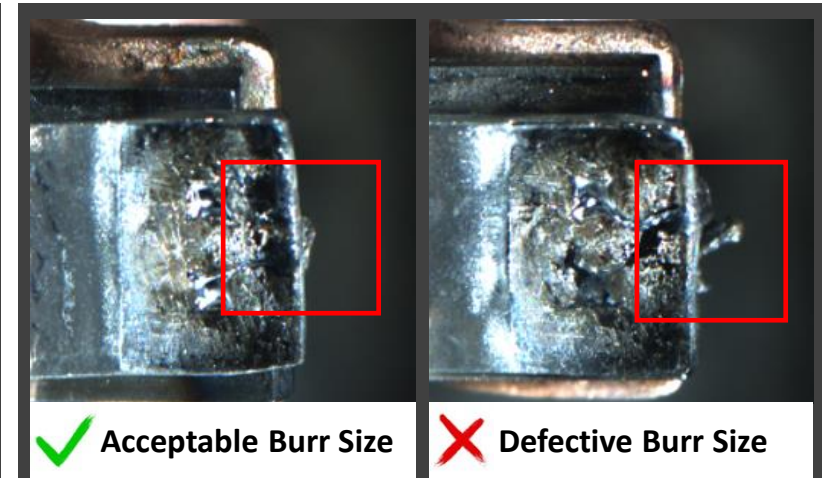

✔ Pass   ✘ Fail
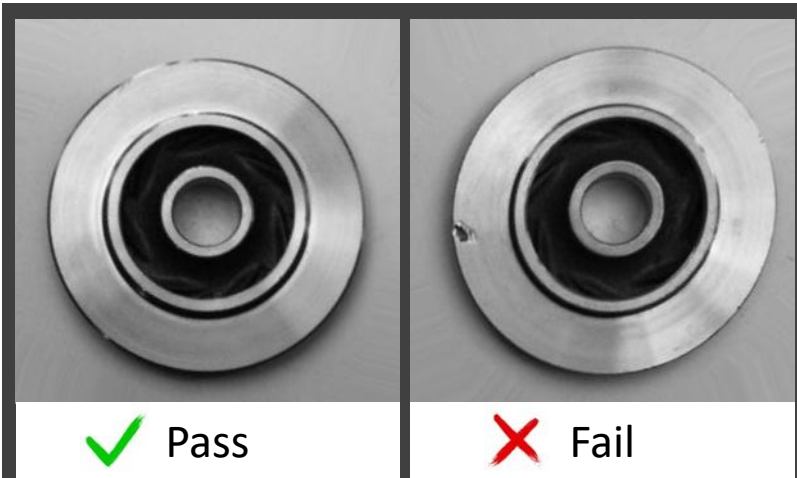
Anomaly Detection Model

Use when there are plenty of images available to represent the 'normal' state, and a vast array of negative states for which images are not readily available.
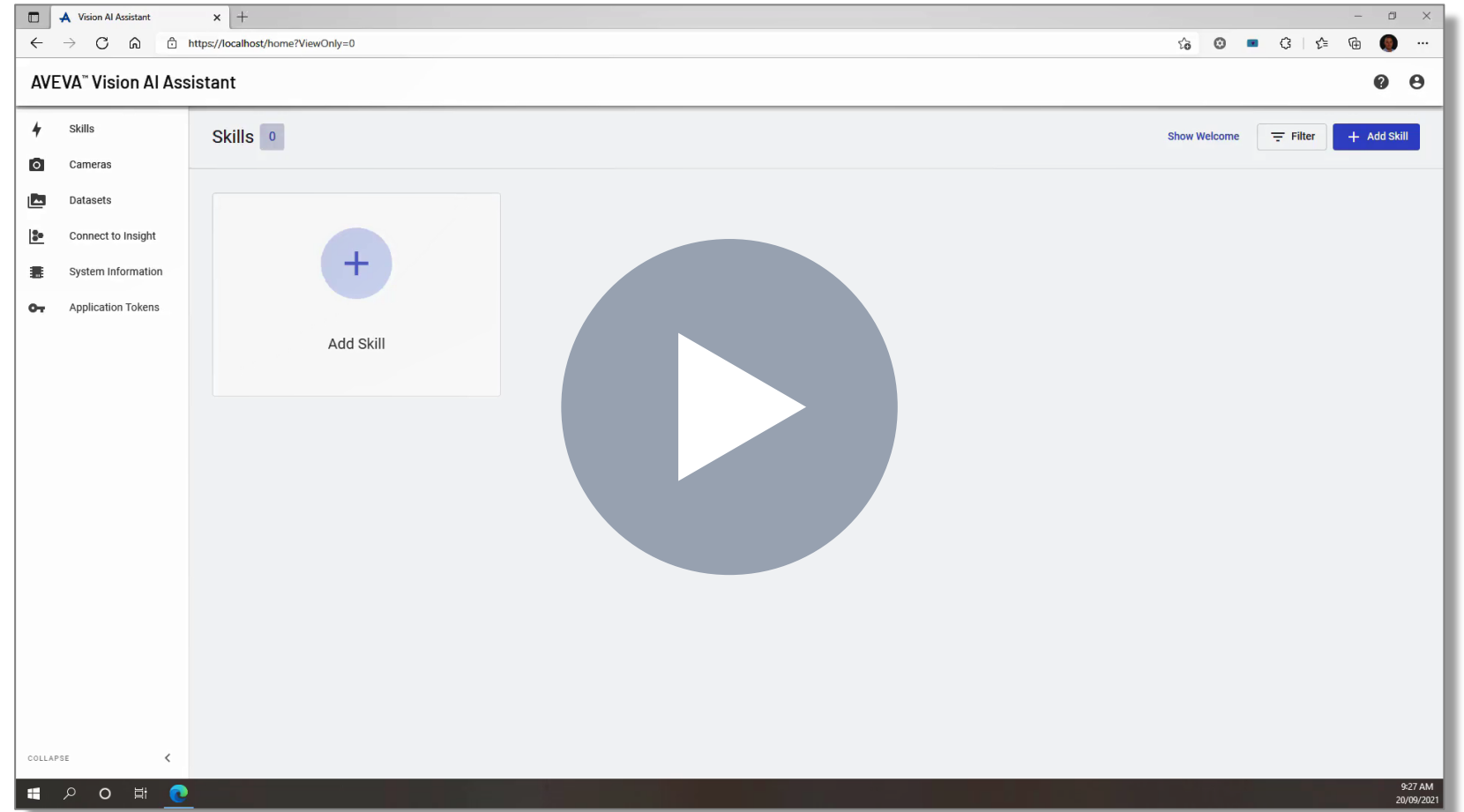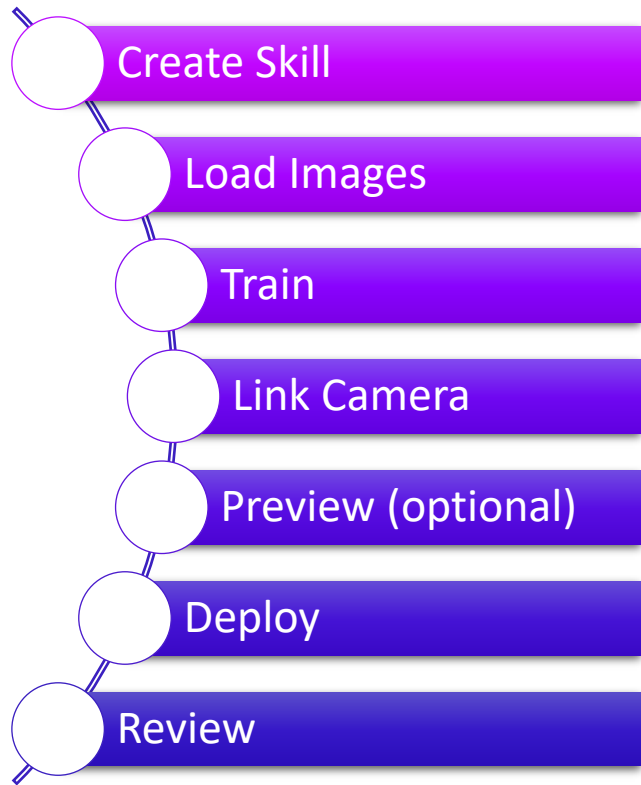
🔴 Red   🔵 Blue
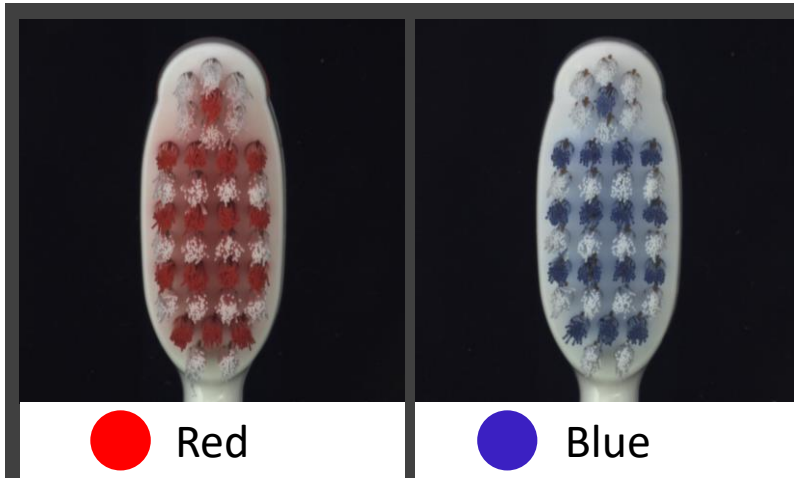
Discrete State Detection Model

Use when two states are known and identifiable to train the learning algorithm.

✔ **Acceptable Burr Size**   ✘ **Defective Burr Size**

User Defined Pipeline

Self-specify a series of automated steps in a chain for pre-processing and transformation of desired images. Powerful for a range of use cases: measuring dimensions, determining color, finding defects, and more.

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Configuration – Skill Workflow

- Create Skill
- Load Images
- Train
- Link Camera
- Preview (optional)
- Deploy
- Review

AVEVA™ Vision AI Assistant

Skills `0`

Show Welcome | Filter | **+ Add Skill**

Add Skill

Deploying Vision AI Assistant within AVEVA System Platform

AVEVA System Platform - Vision AI Assistant OMI App
(On Premise)

- Operational view of anomalies/classifications

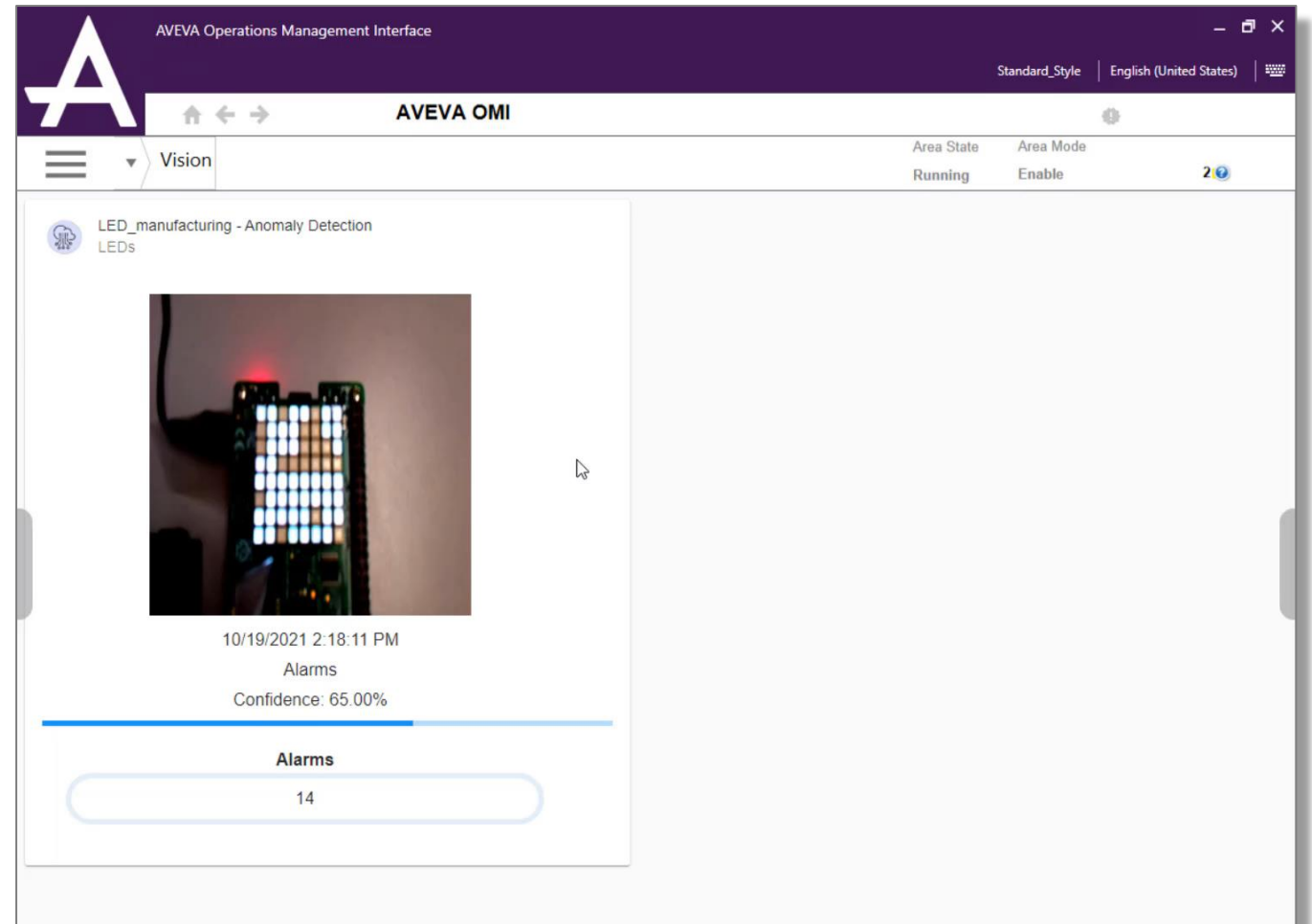- Review image classification results

AVEVA Insight – Vision AI Assistant OMI App
(Cloud)

Operational view with data and visual anomaly results shown in a consolidated list to investigate root cause

Vision AI Assistant Web Client
(On Premise)

- Configure, train, preview, deploy models

- Review image classification results

- Retrain and compare model results

Discrete State Detection

Binary Status Detection and Reporting

Skills

Cameras

Datasets

Connect to Insight

System Information

Application Tokens

New Skill

Choose Skill Type

Create New

Discrete State Detection

Learn More

Skill Info

Create New

Copy Existing

Anomaly Detection

Learn More

Name

User Defined Pipeline

Learn More

Description

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AVEVA™ Vision AI Assistant

Skills
Cameras
Datasets
Connect to Insight
System Information
Application Tokens

Choose Skill Type

Discrete State Detection
Learn More

Anomaly Detection
Learn More

User Defined Pipeline
Learn More

Skill Info

Create New

Name

Description

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Discrete State Detection

This skill uses a Supervised Deep Learning algorithm to distinguish between two known states. This detection model is useful when both states are known and images for both are available to train the learning algorithm.

1. Create and Train the skill
2. Review and Retrain the skill
3. Deploy the skill

COLLAPSE ‹

https://node1:4433/apptokens

Training and Testing Data Sets

Flare OFF Training Video

Flare ON Training Video


Flare OFF Testing Video


Flare ON Testing Video

Use Case

- Detect and report the operational state of the flare used in upstream oil and gas operations.

- Environmental significance:

  - Record and report the amount of time the flare is 'ON' for Environmental Protection Agency (EPA) and internal company goal purposes.

  - Determining if combustion is taking place or if environmentally harmful emissions are being released.

  - Record and report KPIs regarding flare color, height, width, etc. to monitor combustion efficiency and emissions.

AVEVA
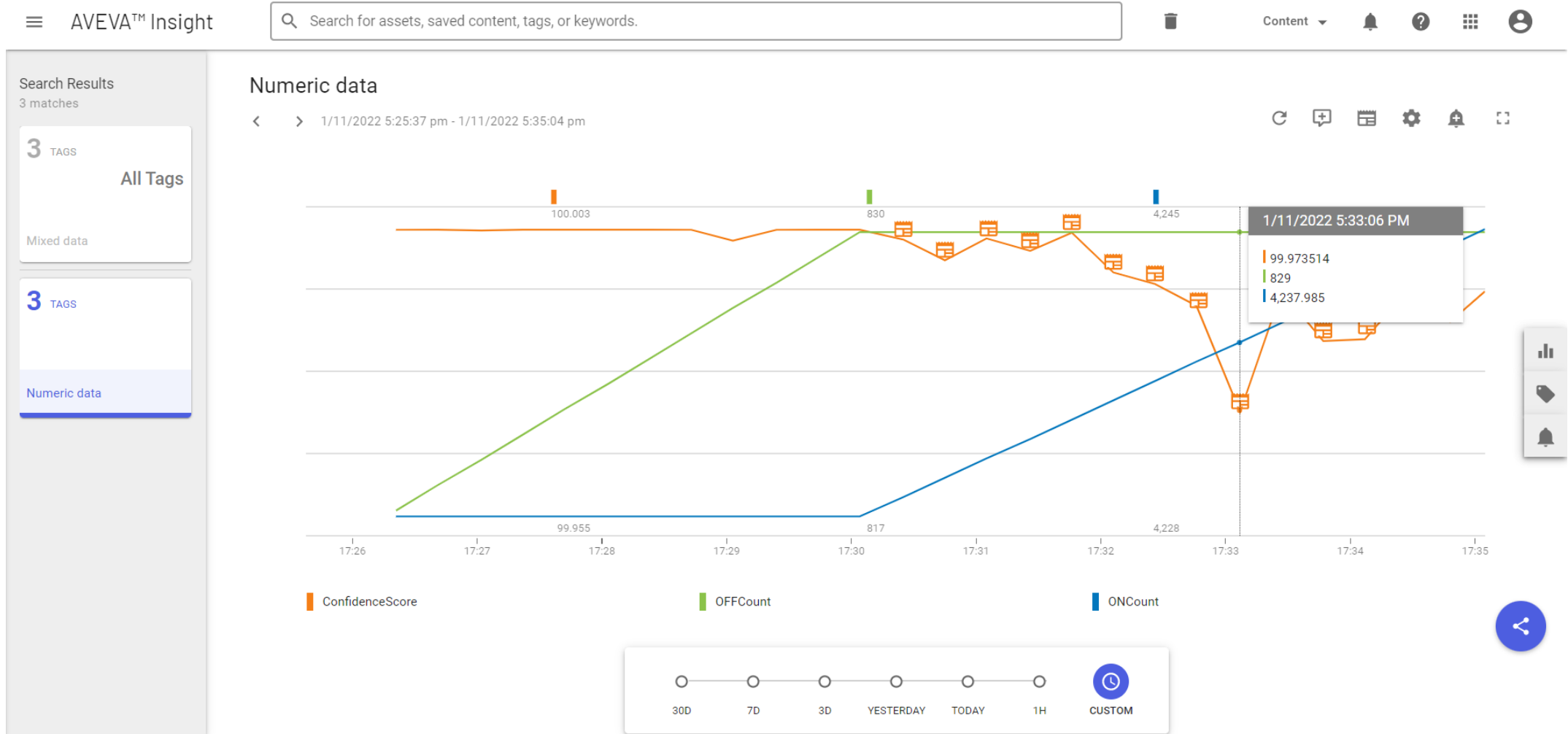
Results in Insight

Results in Insight
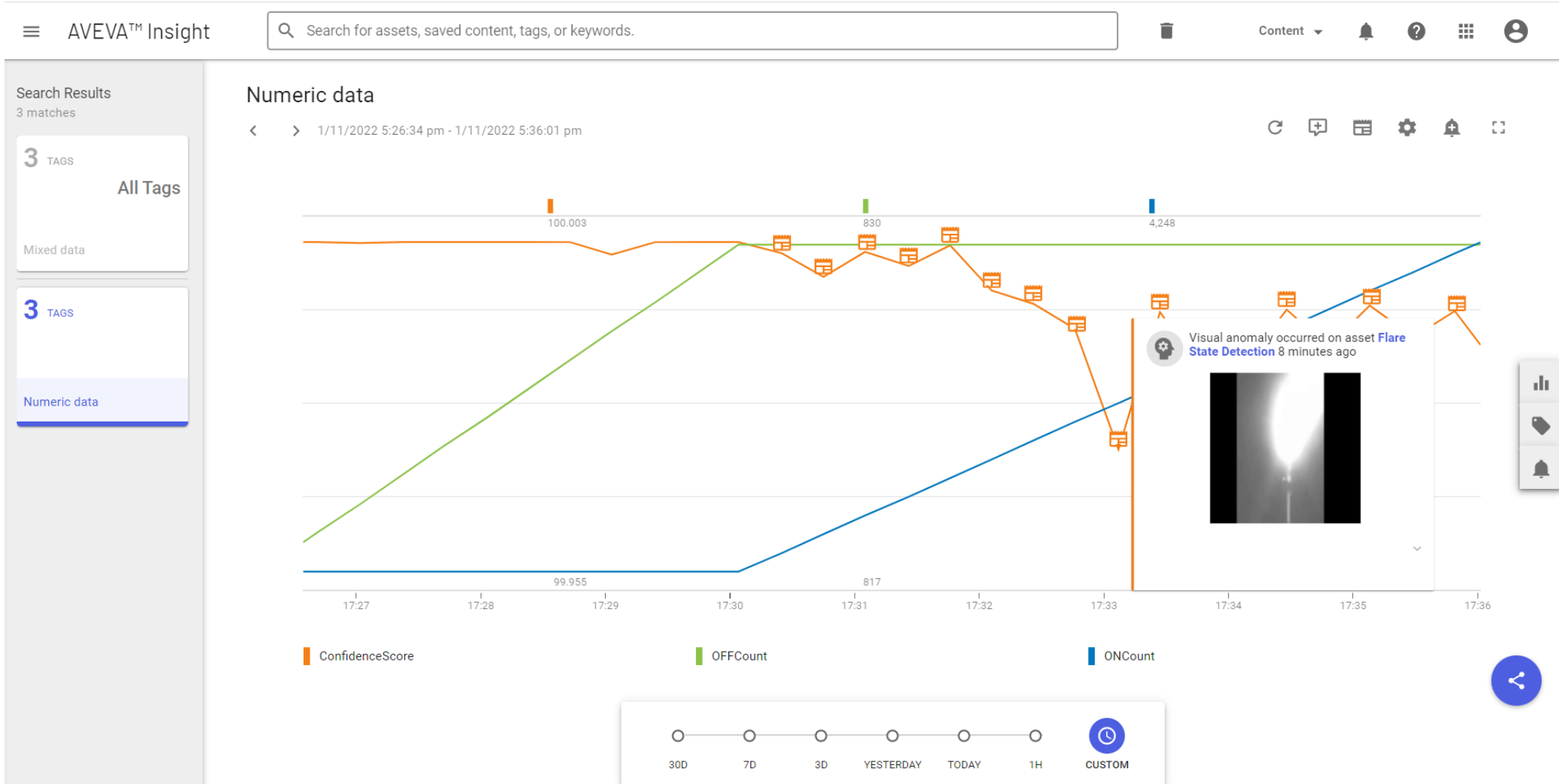
Anomaly Detection

Unsupervised Machine Algorithm to learn what normal is, and then applies a statistical test to determine if a specific data point is an anomaly

Skills

Cameras

Datasets

Connect to Insight

System Information

Application Tokens

New Skill

Choose Skill Type

Create New

Discrete State Detection

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Anomaly Detection

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User Defined Pipeline

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Skill Info

Create New

Copy Existing

Name

Description

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Skills

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System Information

Application Tokens

New Skill

Choose Skill Type

Discrete State Detection
Learn More

Anomaly Detection
Learn More

User Defined Pipeline
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Skill Info

Create New

Name

Description

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Anomaly Detection

This skill is trained to learn what 'normal' is, and then apply a statistical test to determine if the current image represents an anomaly. This is useful when there are plenty of images used to represent the 'normal' state, and a vast array of negative states for which images are not readily available.

1. Create and Train the skill
2. Review and Retrain the skill
3. Deploy the skill

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Example of Overhead Chain/Monorail System
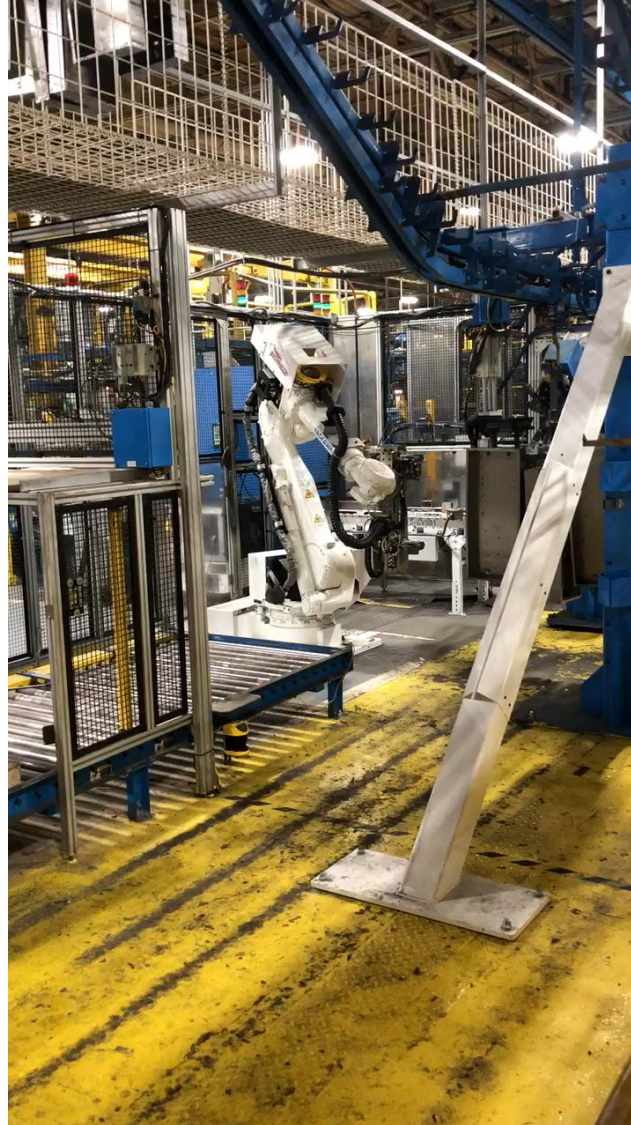
Overhead monorail system used to move parts from one area of the plant to another.

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Chain Breakage Detection

- Preventative Maintenance activity is currently performed on 3rd shift.

- The Main Highway chain takes a little over 22 minutes to complete a revolution.

- Goal is to detect the problem in real time during production and have a higher level of accuracy than a human

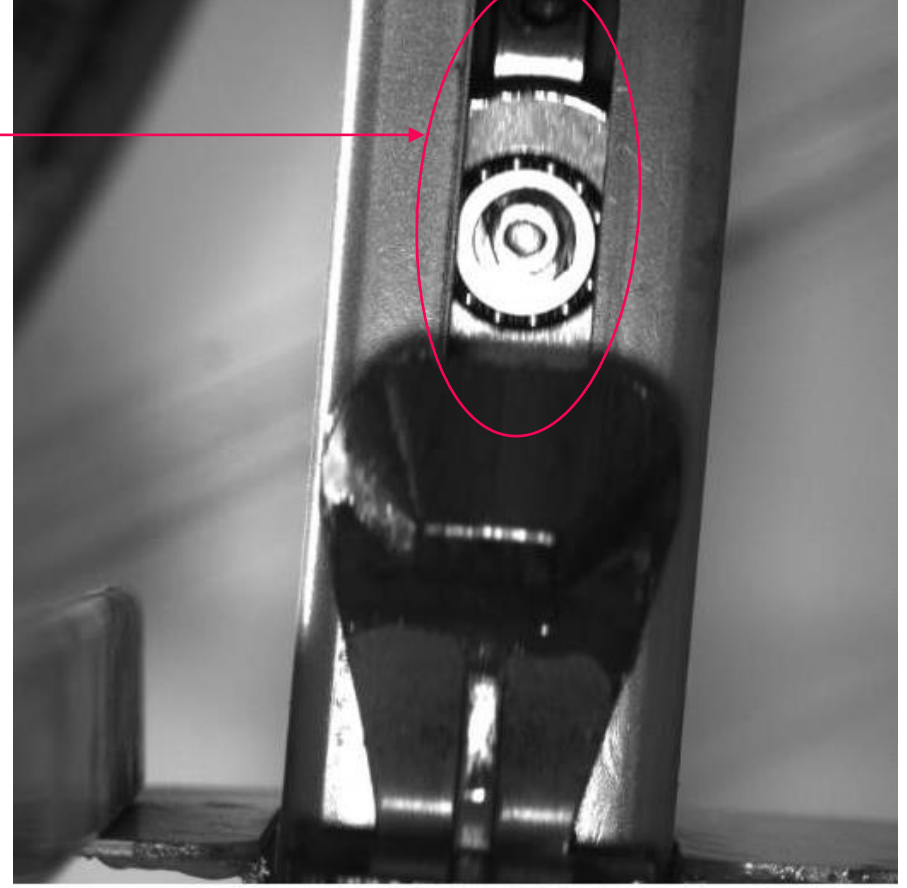 - which could have difficulty due to 'hypnosis'.

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Example Catch #1
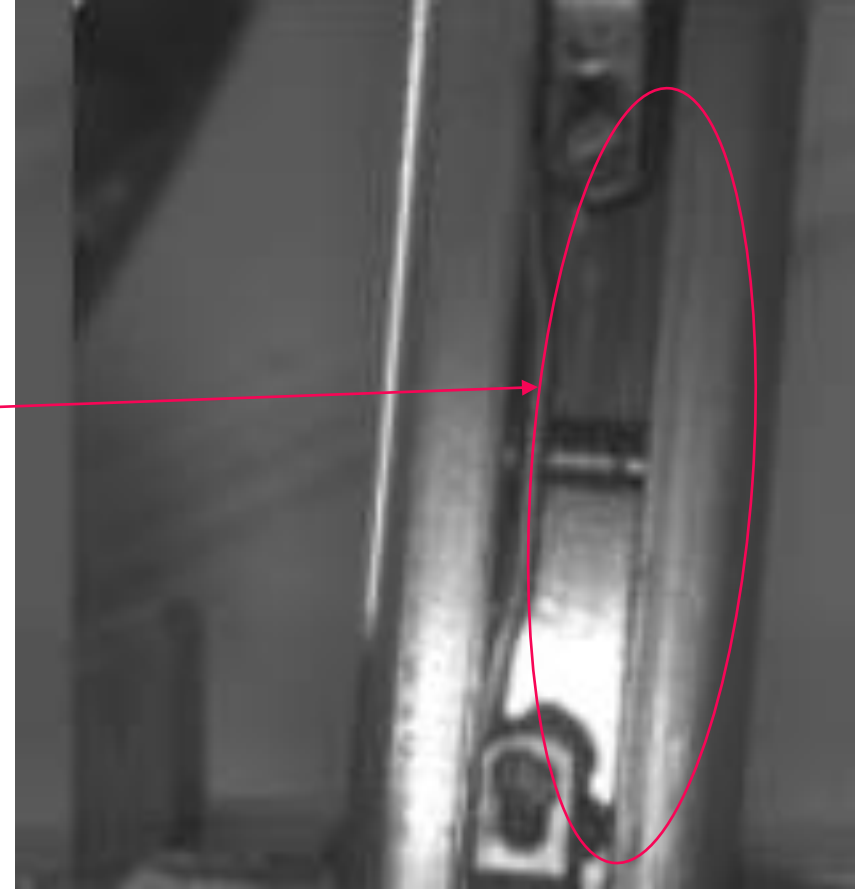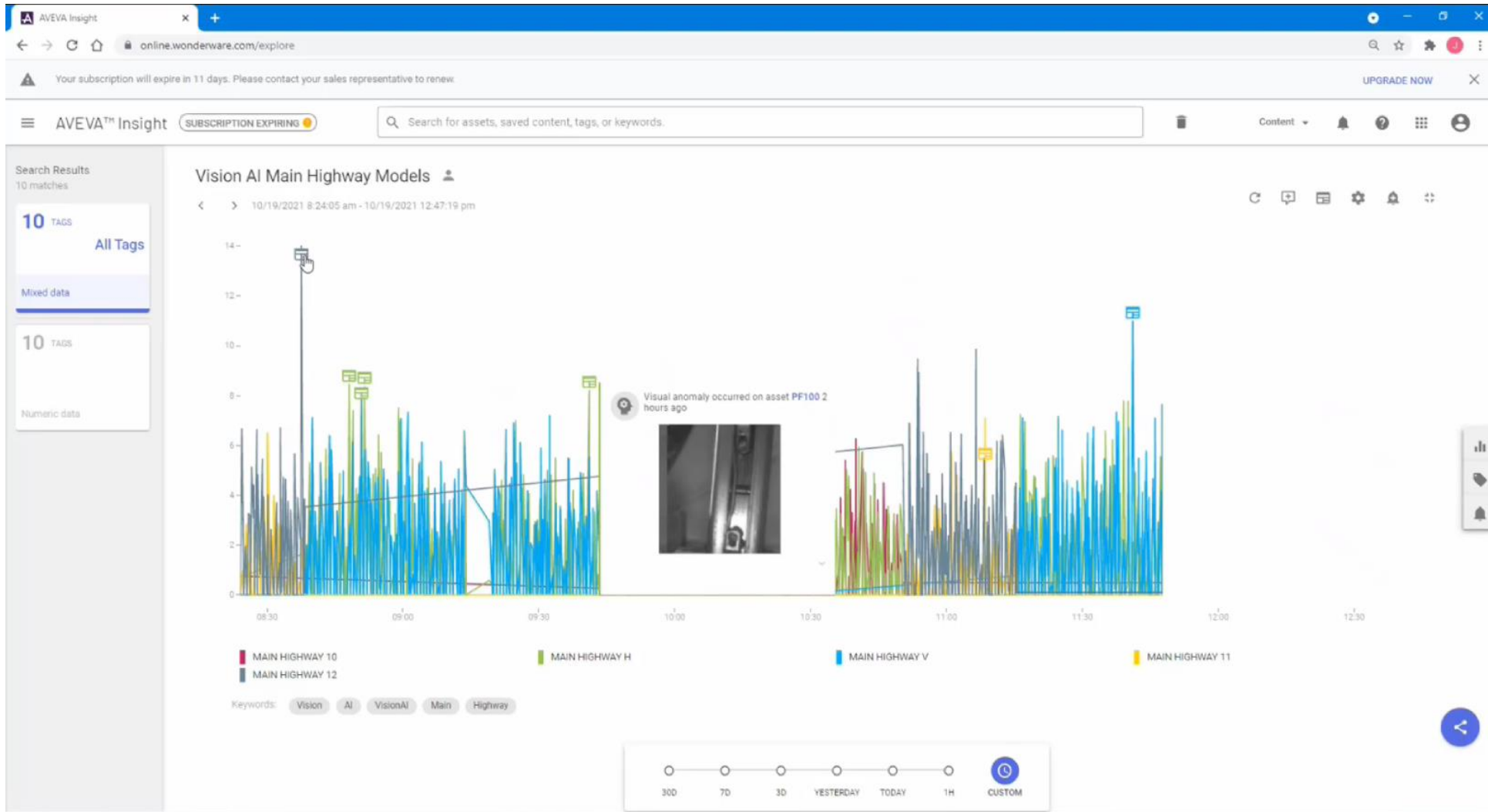
Good/Normal

Bad/Failure

AVEVA
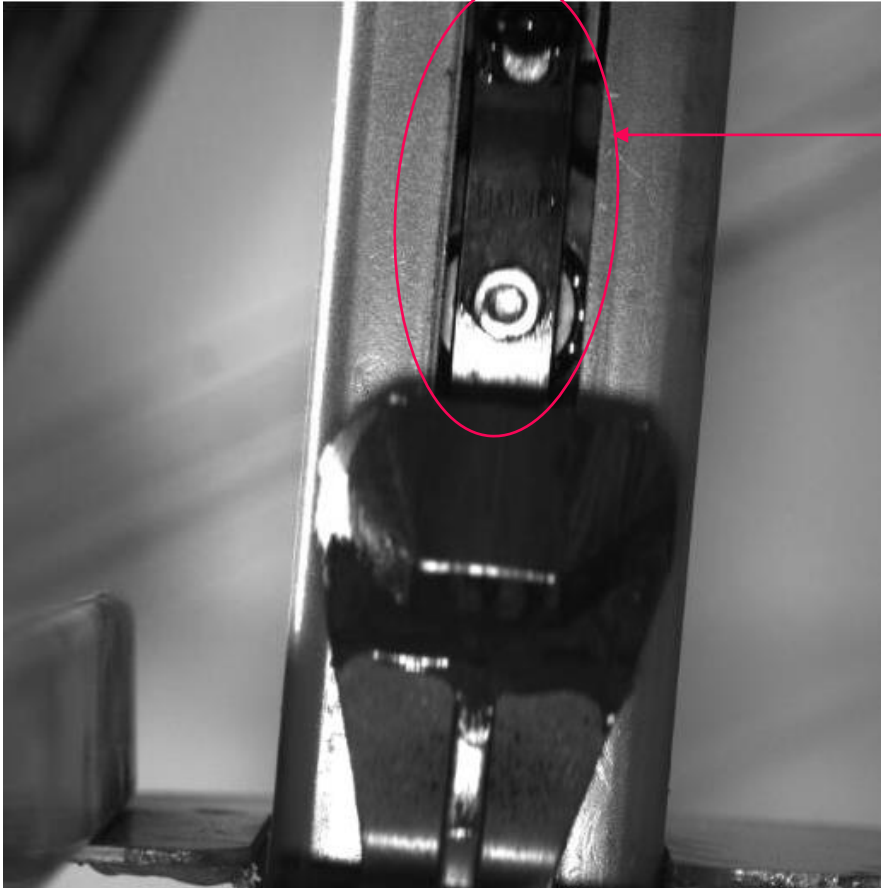
Example Catch #2

Good/Normal

Bad/Failure

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Anomaly Score in Insight

User Defined Pipeline

Create custom, engineered workflows by using out-of-the-box blocks to identify or achieve a specific image related to anomaly detection.

Skills

Cameras

Datasets

Connect to Insight

System Information

Application Tokens

< New Skill

Choose Skill Type

Create New >

Discrete State Detection

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Anomaly Detection

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User Defined Pipeline

Learn More

Skill Info

Create New

Copy Existing

Name

Description

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Skills

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System Information

Application Tokens

New Skill

Choose Skill Type

Discrete State Detection

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Anomaly Detection

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Skill Info

Create New

Name

Description

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User Defined Pipeline

SmartVision enables you to teach your AI new visual skills - such as visual anomaly detection. The AI can let you know when a camera sees something that deviates from what is normal or expected, effectively turning that camera into a visual sensor.

1. Create and Train the skill
2. Review and Retrain the skill
3. Deploy the skill

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User Defined Pipeline - Overview

- A toolbox of image processing objects which can be daisy chained together to create a pipeline.

- Possible tools/objects are:
  - Anomaly Detection and Classifier
  - Region of Interest
  - Align
  - Contrast Threshold
  - Measurement (distance, angle, concavity, etc.)
  - Object Detection (people, equipment, etc.)
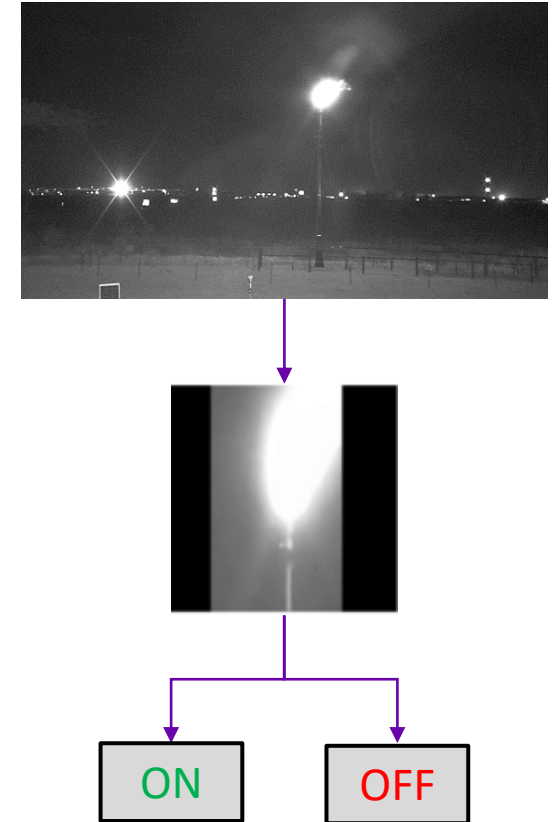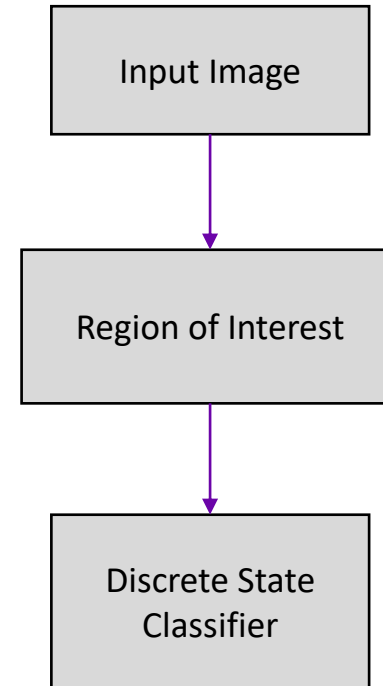
Skills

Cameras

Datasets

Connect to Insight

System Information

Application Tokens

UDP_Slider New

Build Pipeline

Search Block

Pre-Processing

Measurement

Prediction

Action

No Categorization

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Skills

Cameras

Datasets

Connect to Insight

System Information

Application Tokens

Build Pipeline

Search Block

Pre-Processing

Align Image   BETA

Image Thresholding   BETA

Isolate Component   BETA

Isolate Edges   BETA

Refine image   BETA

Select Region of Interest   BETA

Measurement

Prediction

Action

No Categorization

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Skills

Cameras

Datasets

Connect to Insight

System Information

Application Tokens

USER DEFINED PIPELINE
UDP_Slider New

Build Pipeline

Search Block

Pre-Processing

Measurement

Angle   BETA

Bend   BETA

Magnitude of Bend   BETA

Measure Curve   BETA

Measure Length   BETA

Pixel Count   BETA

Prediction

Action

No Categorization

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Skills

Cameras

Datasets

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Build Pipeline

Search Block

Pre-Processing

Measurement

Prediction

Anomaly Classifier   BETA

Discrete Classifier   BETA

Logical AND OR Gates   BETA

SVM prediction   BETA

Statistical Prediction   BETA

Action

No Categorization

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Skills

Cameras

Datasets

Connect to Insight

System Information

Application Tokens

USER DEFINED PIPELINE

UDP_Slider New

Build Pipeline

Search Block

Pre-Processing

Measurement

Prediction

Action

Send to Insight BETA

No Categorization

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Skills

Cameras

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Skills 0

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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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