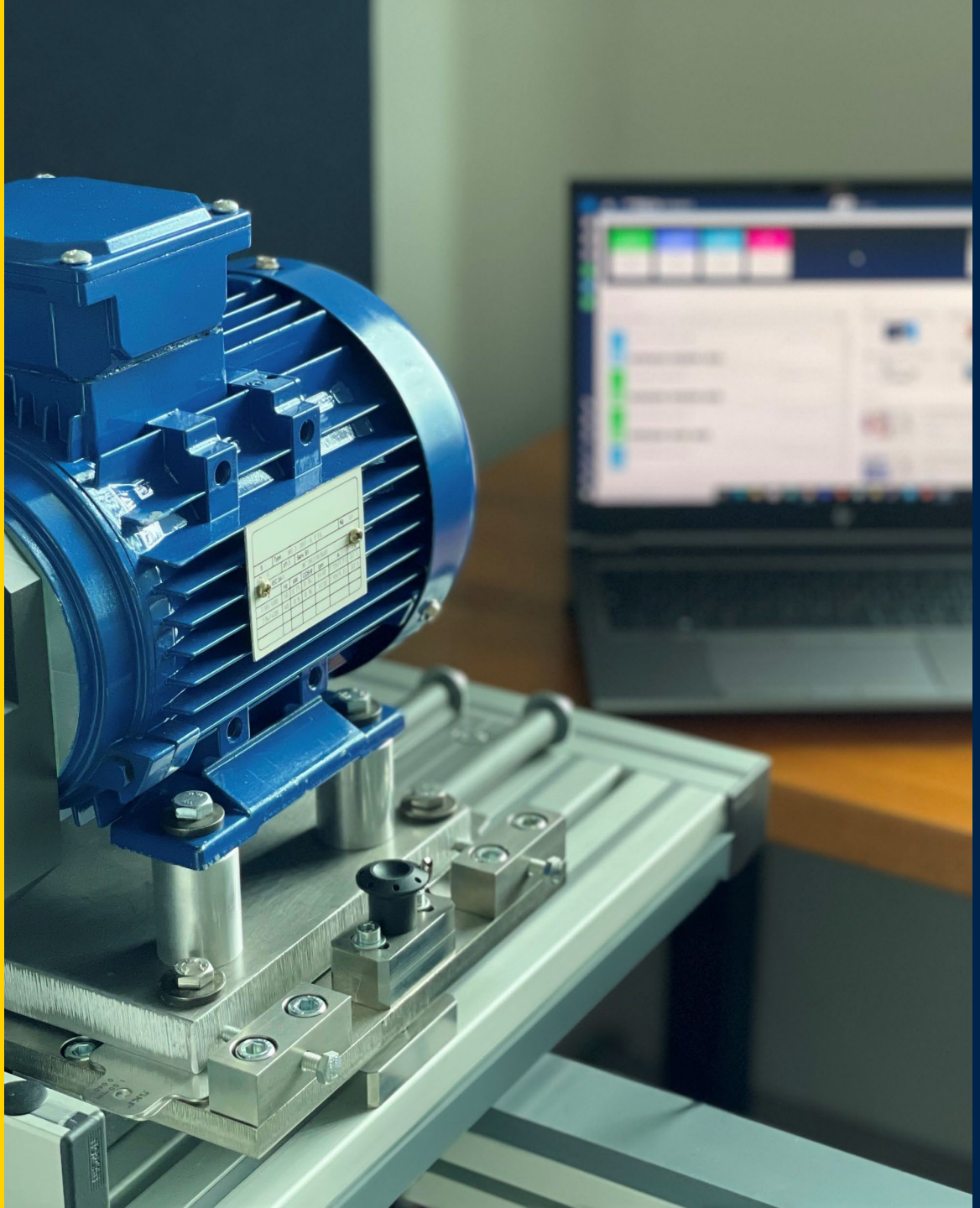


NanoEdge AI Studio

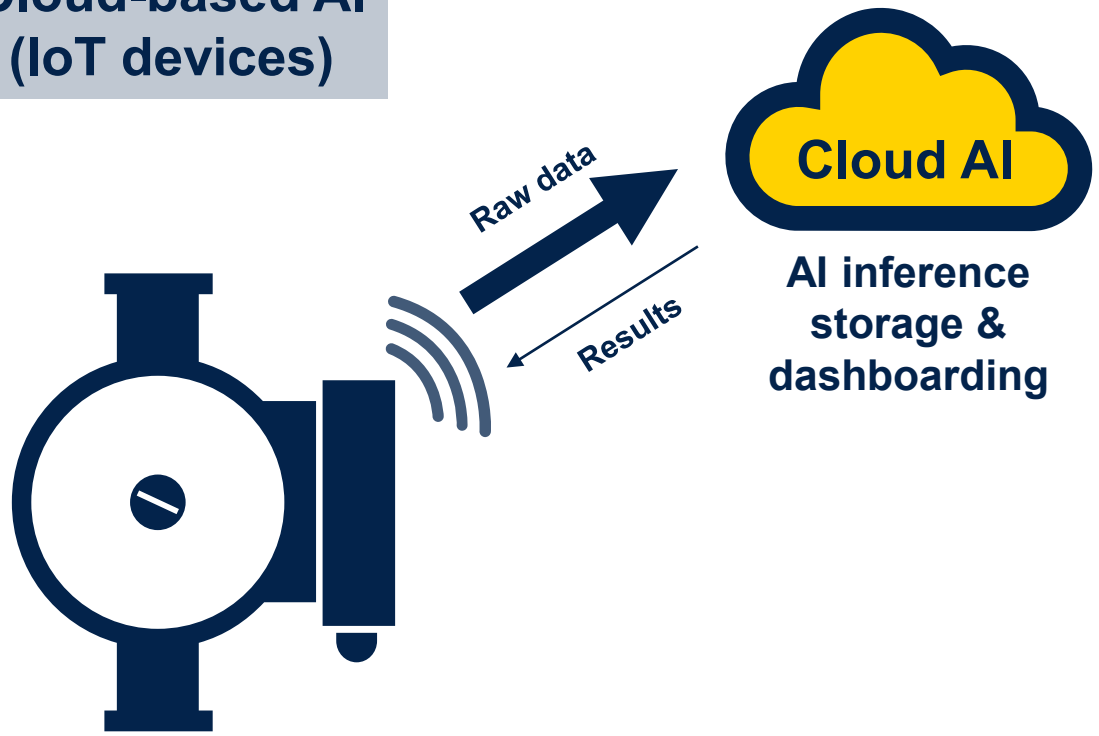
Edge AI AutoML tool for simplified data processing on STM32

NANOEDGE AI STUDIO

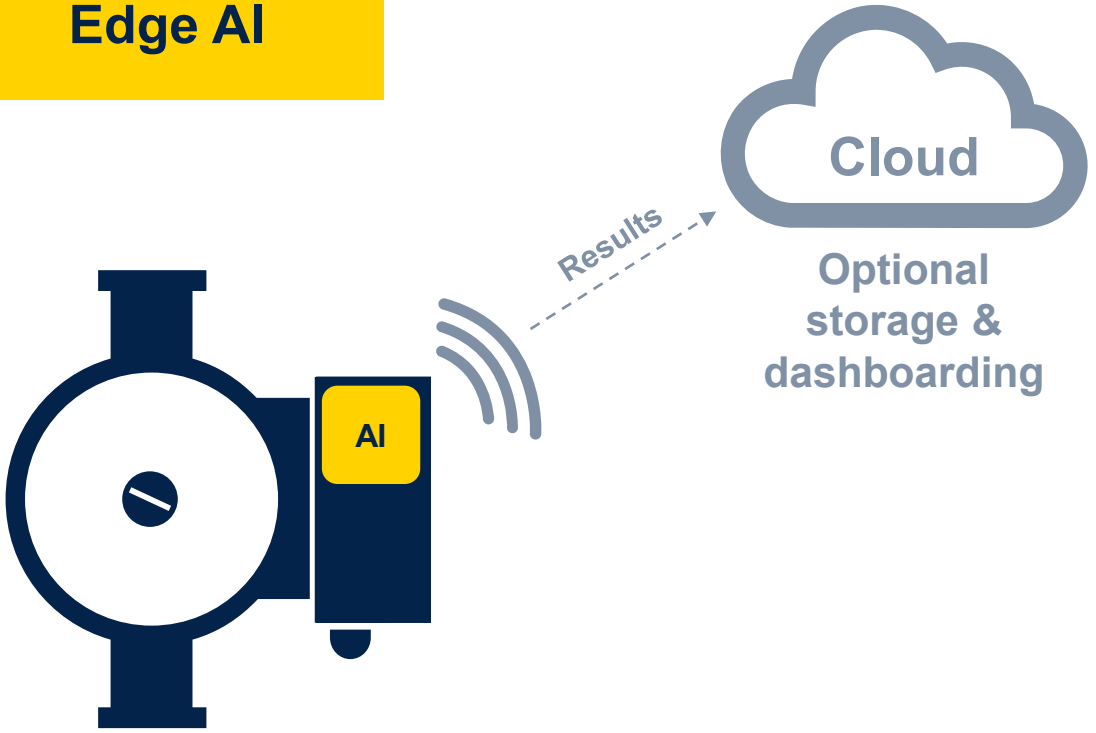
The next leap for intelligent products

Technology is moving beyond simple connectivity to on-device autonomy, where products can infer locally

Cloud-based AI (IoT devices)

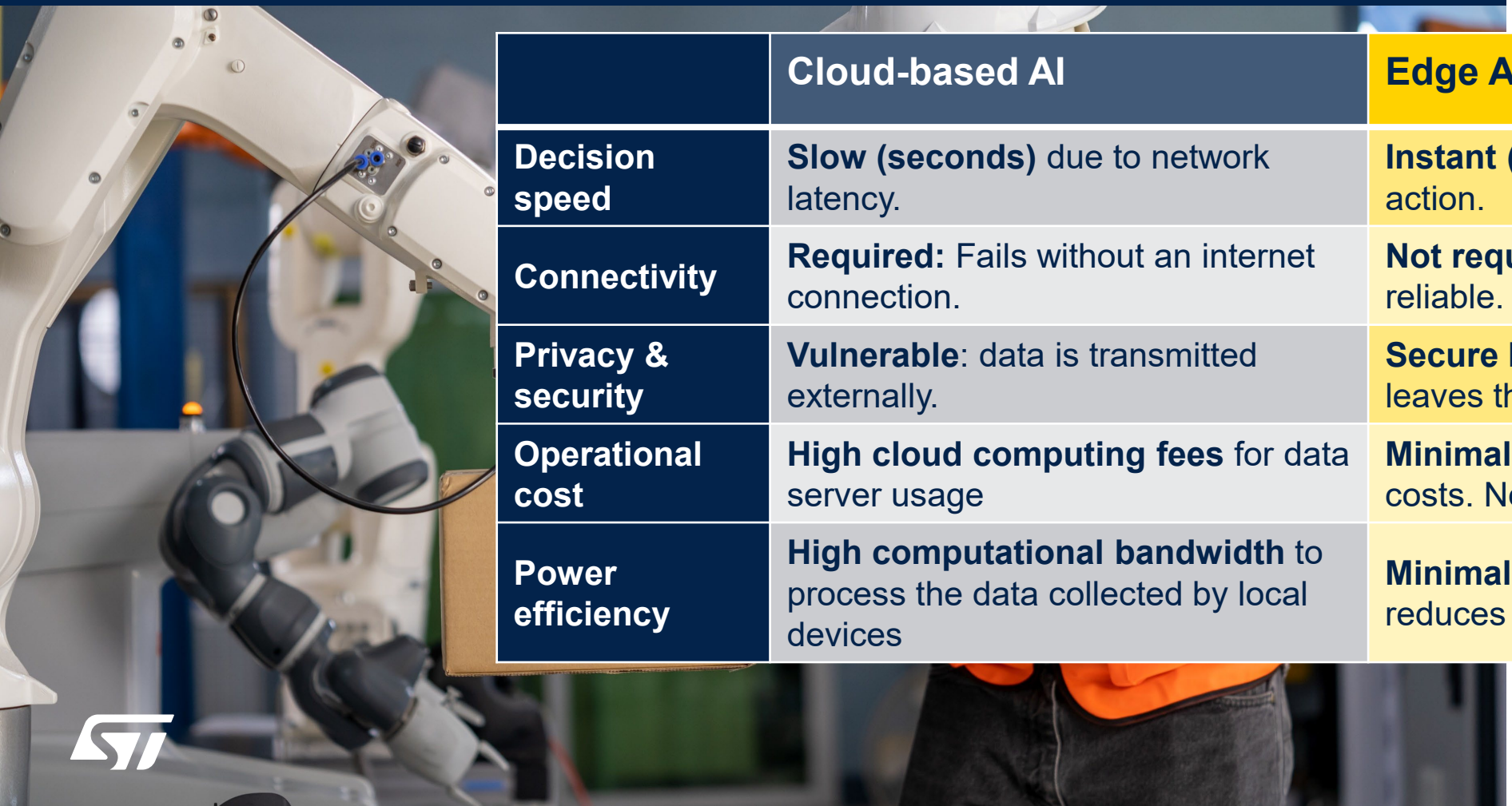


Edge AI



Where should your intelligence live?

For products that need to be reliable, fast, and secure, edge AI is not an option: it's a necessity.



	Cloud-based AI	Edge AI (on-device)
Decision speed	**Slow (seconds)** due to network latency.	**Instant (milliseconds)** for real-time action.
Connectivity	**Required:** Fails without an internet connection.	**Not required:** Fully autonomous and reliable.
Privacy & security	**Vulnerable**: data is transmitted externally.	**Secure by design:** Data never leaves the device.
Operational cost	**High cloud computing fees** for data server usage	**Minimal:** No data transmission costs. No cloud services cost
Power efficiency	**High computational bandwidth** to process the data collected by local devices	**Minimal:** local data processing reduces transmission loads

NanoEdge AI Studio
Your shortcut to on-device intelligence since 2018

A free AutoML tool for STM32 MCUs
that automates the creation of smart edge AI libraries

Available on all STM32 microcontrollers

NANOEDGE AI STUDIO **enables embedded AI on any STM32 MCU**

Wireless MCU	Ultra-low-power MCU	Mainstream MCU	High-performance MCU
Short- and long-range connectivity	32-bit general-purpose microcontrollers: from 75 to 3,360 CoreMark score		





NanoEdge AI Studio is tuned to analyze time-series data

NANOEDGE AI STUDIO

Time-series

Arc Fault Detection

Predictive Maintenance

Battery Management

Simple computer-vision Audio processing

People Detection

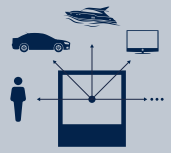
Sound Analysis

Speech Recognition

Advanced computer-vision

Object Classification

Pose Estimation



Object Segmentation

Increasing processing workload

NanoEdge AI Studio is expertly tuned to analyze time-series data

NANOEDGE AI STUDIO

Time-series

Arc Fault Detection

Predictive Maintenance

Battery Management

AutoML for embedded library development

Cost effective

Available on all STM32 MCU portfolio

Low memory usage

Start with a few Kbytes of RAM and flash memory

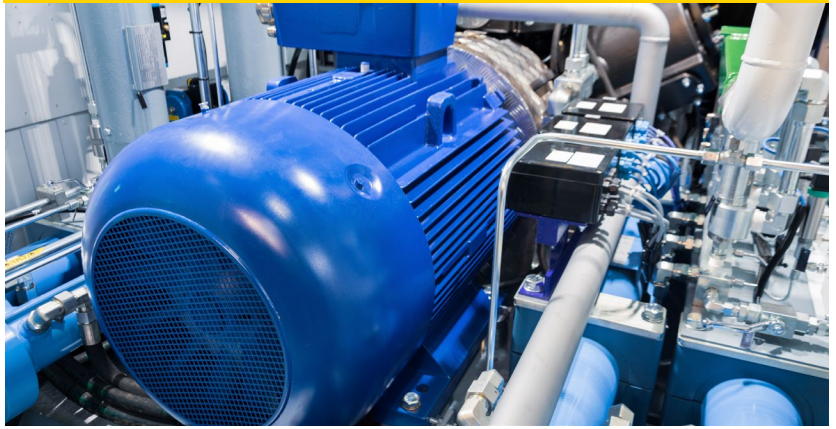
Efficient

Leverage on-device learning capability to increase accuracy

Where do time-series data matter?

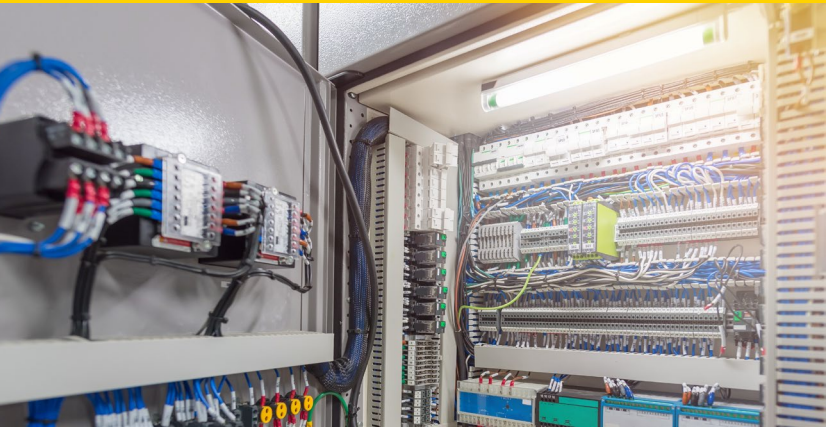
Industrial motors

Industrial pumps



Solar panels

Breakers

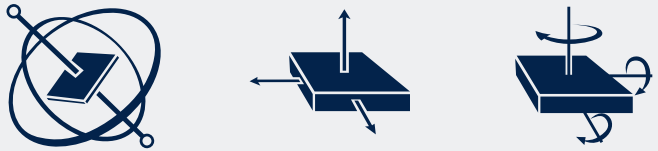


Power tools

White goods

Unlock the hidden value in your sensors

Motion sensors



Vibration analysis, predictive maintenance, appliance monitoring, anomaly detection

Current sensors

Power monitoring, battery management, motor control, arc-fault detection, anomaly detection

Time-of-Flight (ToF) sensors

Distance ranging, multitarget detection, gesture recognition

Temperature sensors

Asset tracking, virtual sensor

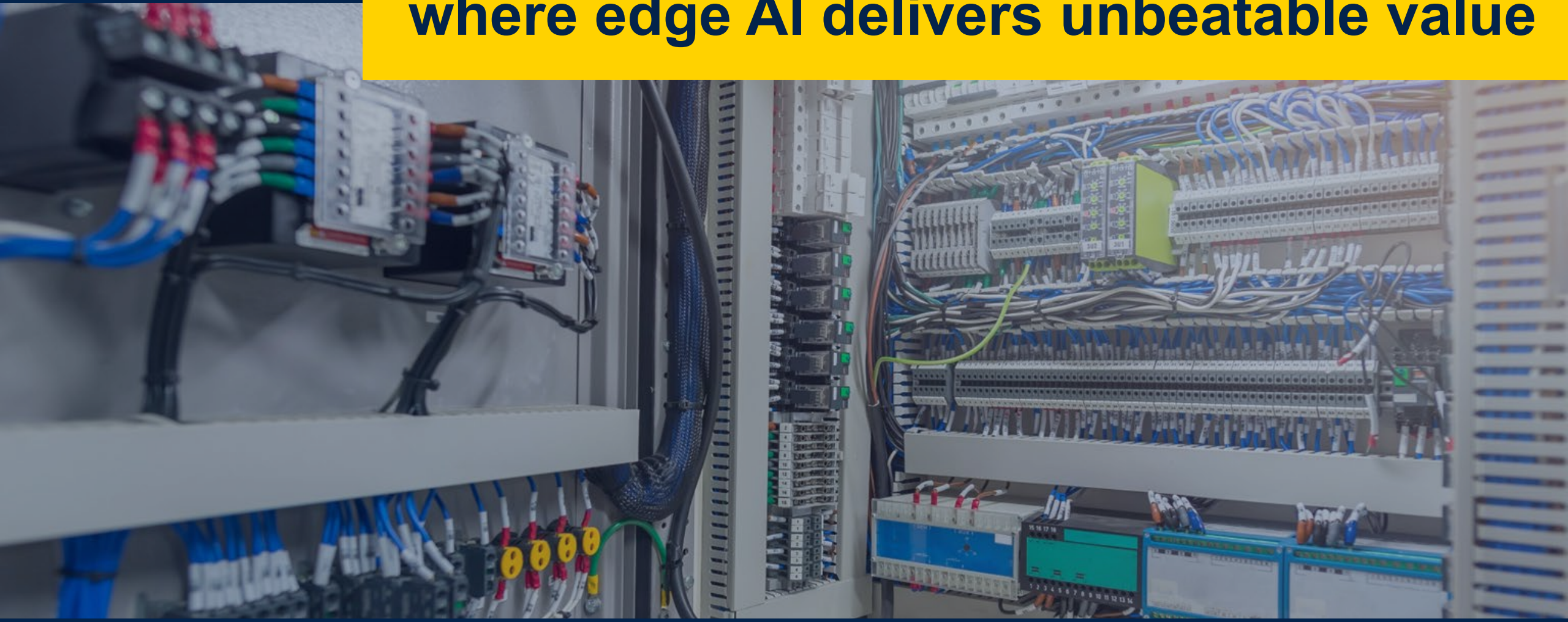
MEMS microphones

Ultrasound analysis

Biosensors

Heart rate, ECG, EEG

Real-life deployment examples, where edge AI delivers unbeatable value



A washing machine uses **advanced motor control algorithms** to weigh clothes and optimize water, detergent, and energy used

~15-40%
Energy saving per washing cycle

Leader in white-goods

Production starting in 2024 for **millions** units

Adding tire pressure detection capability to e-bikes without adding any new hardware

Virtual sensor

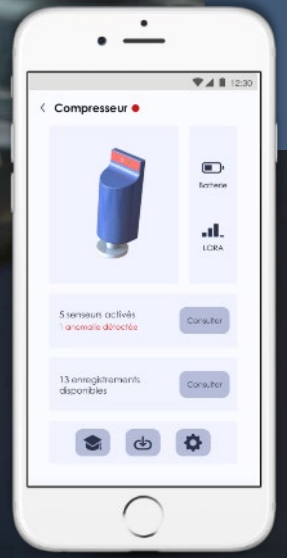
Tire pressure measured through the e-motor current consumption

Panasonic e-bike

Hundreds of thousands of units annually, starting in 2024

Panasonic

After-market predictive maintenance
intelligent sensor with wireless connectivity

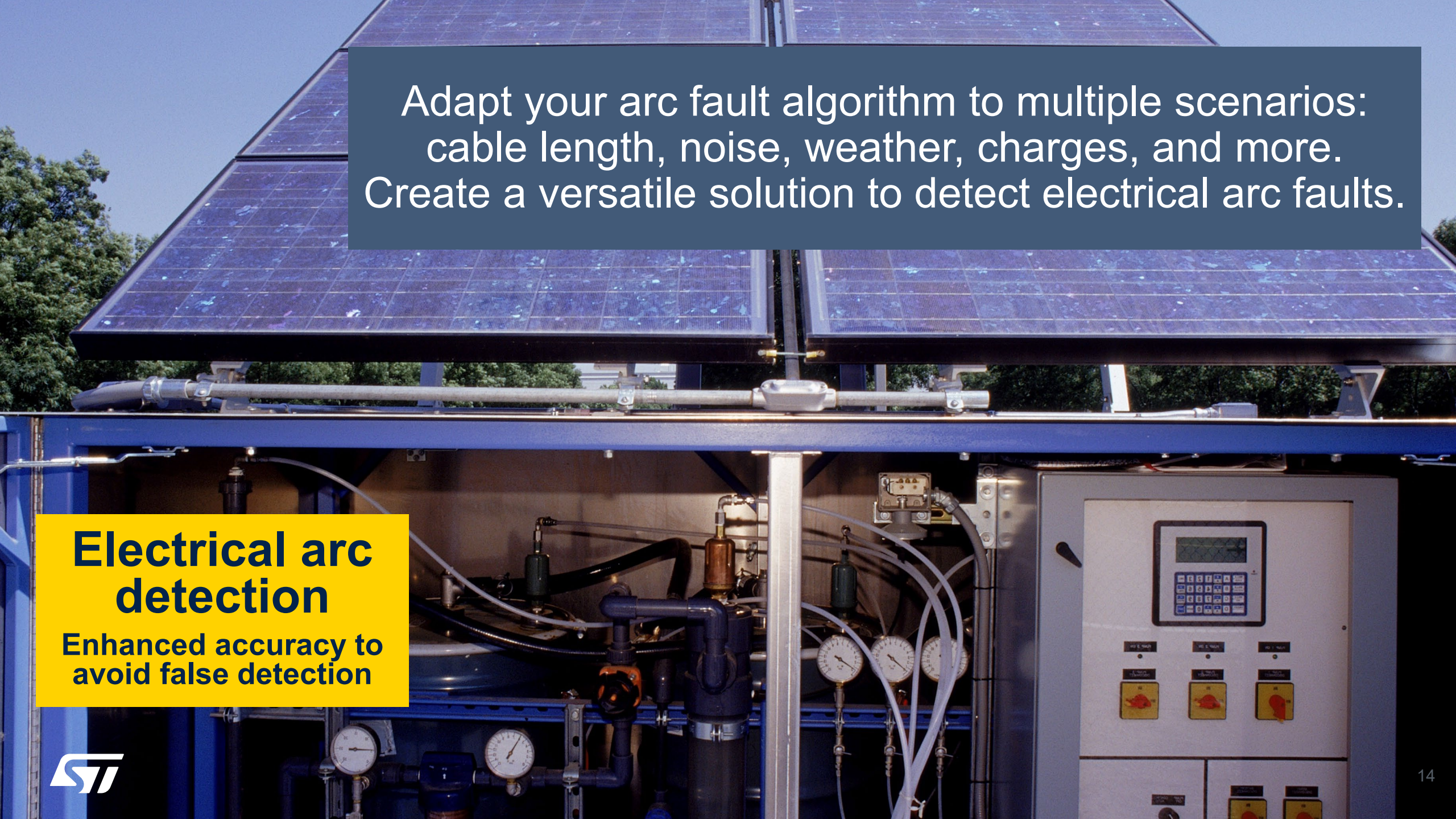


Predictive maintenance
Multisensors and learning on device

EMEA company

Deployed at **Volvo Trucks** manufacturing plant

oXYtronic



Adapt your arc fault algorithm to multiple scenarios: cable length, noise, weather, charges, and more. Create a versatile solution to detect electrical arc faults.

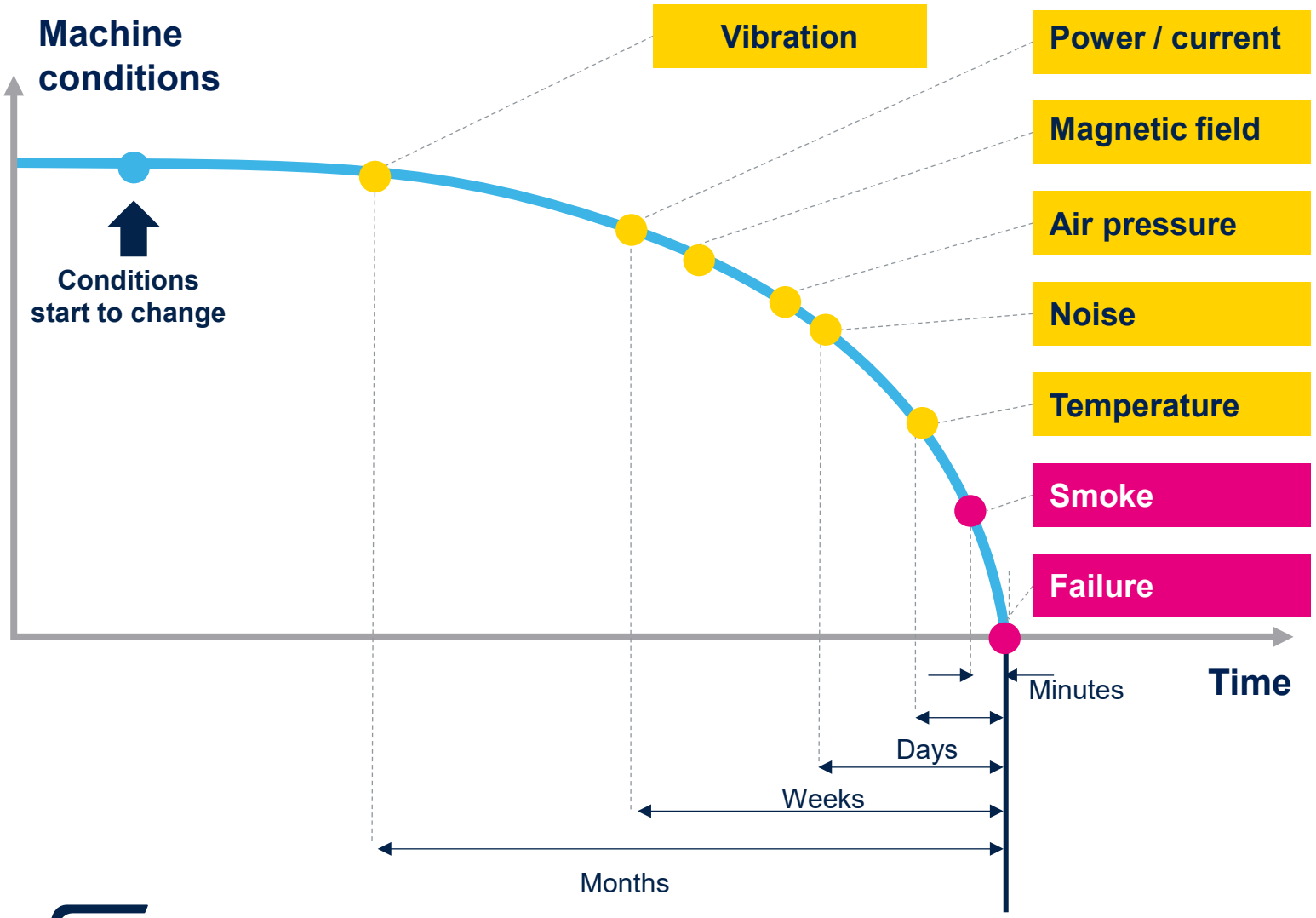
Electrical arc detection

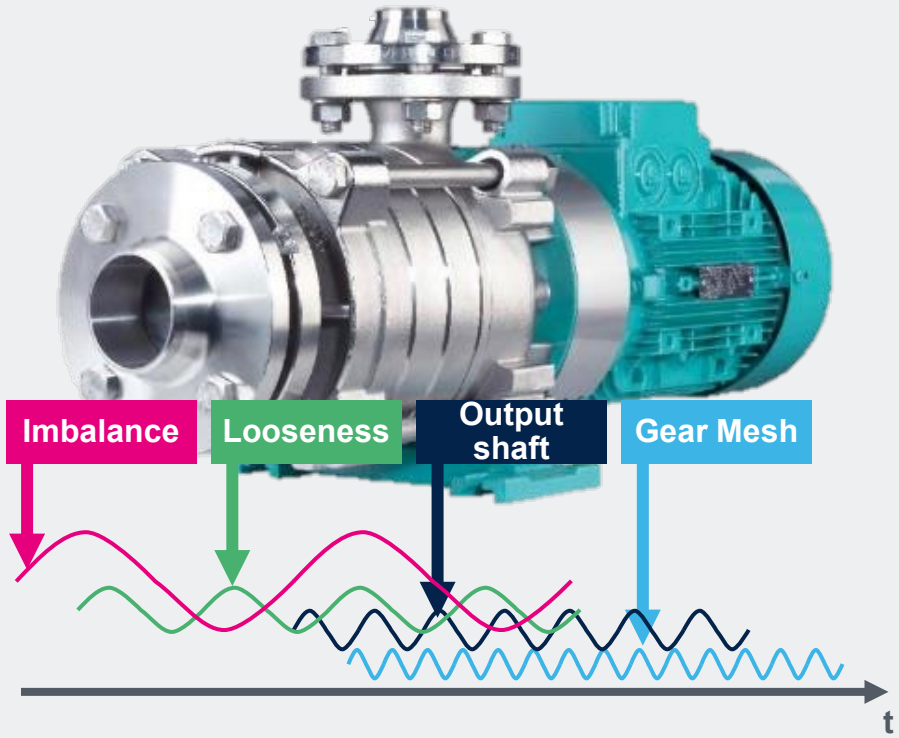
Enhanced accuracy to avoid false detection


Industrial pumps **learn** their own optimal mode of operation and **detect anomalies** by themselves
Predictive maintenance
Simplified large-scale deployment with the device learning feature

Customer success story

Vibration sensors – Condition monitoring

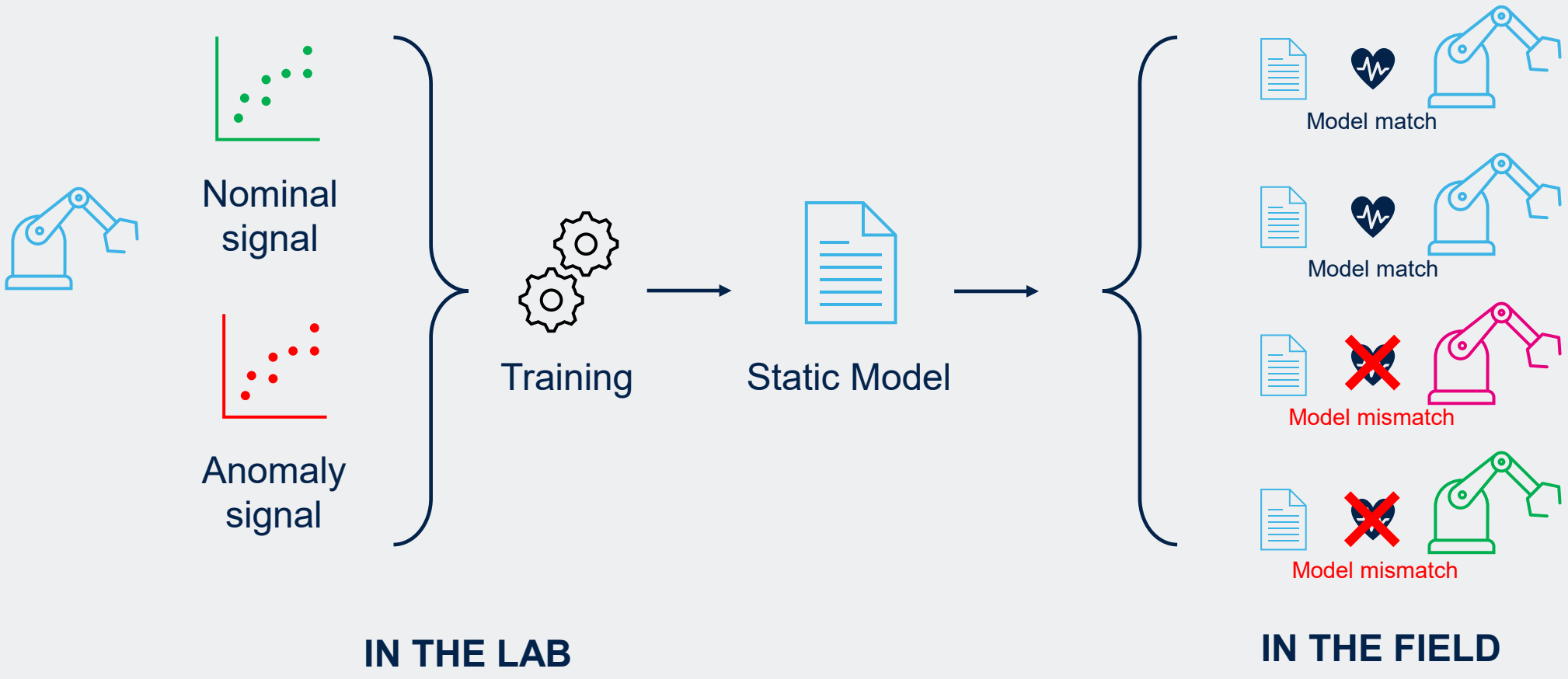




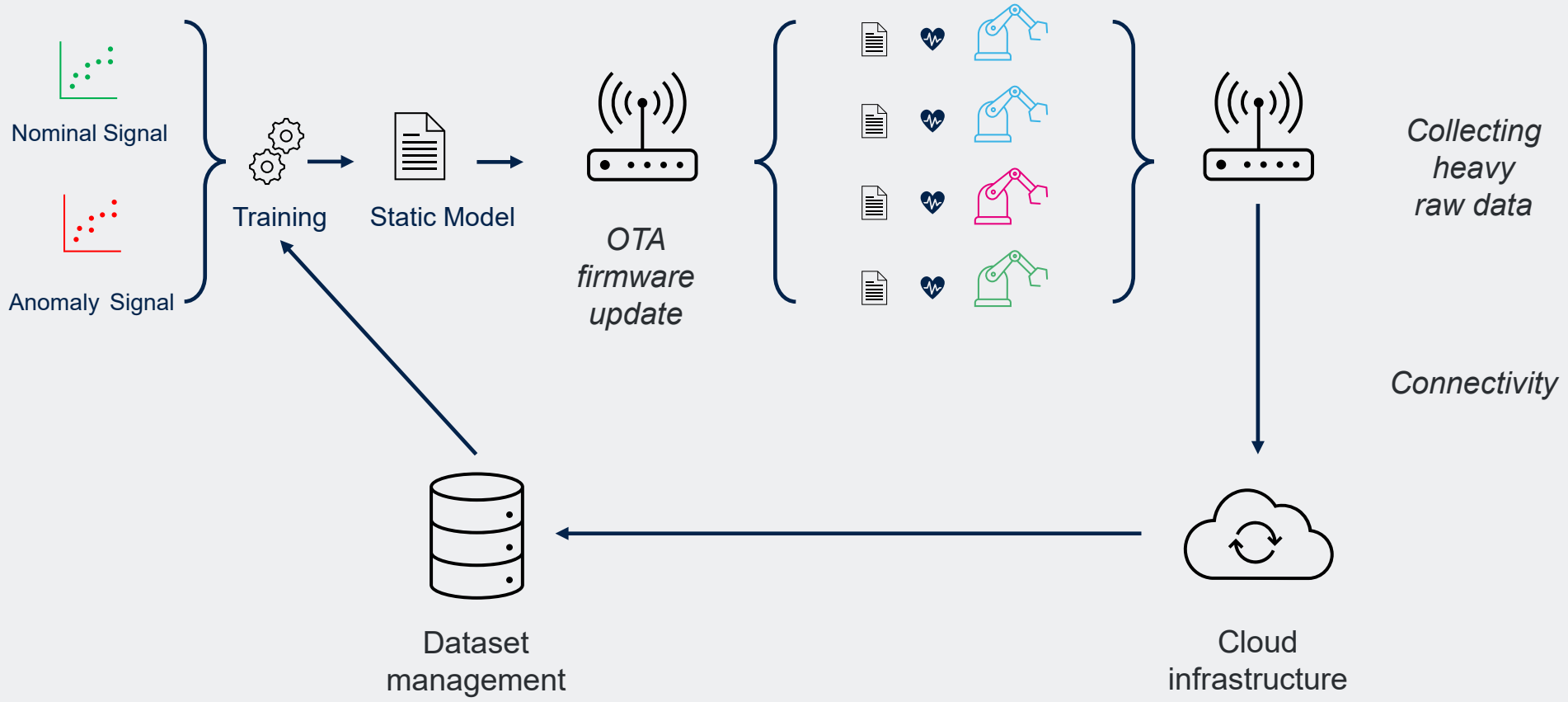
Mechanical vibration

- Displacement
- Speed
- Acceleration
- Angular speed
- Torque
- Acoustic noise

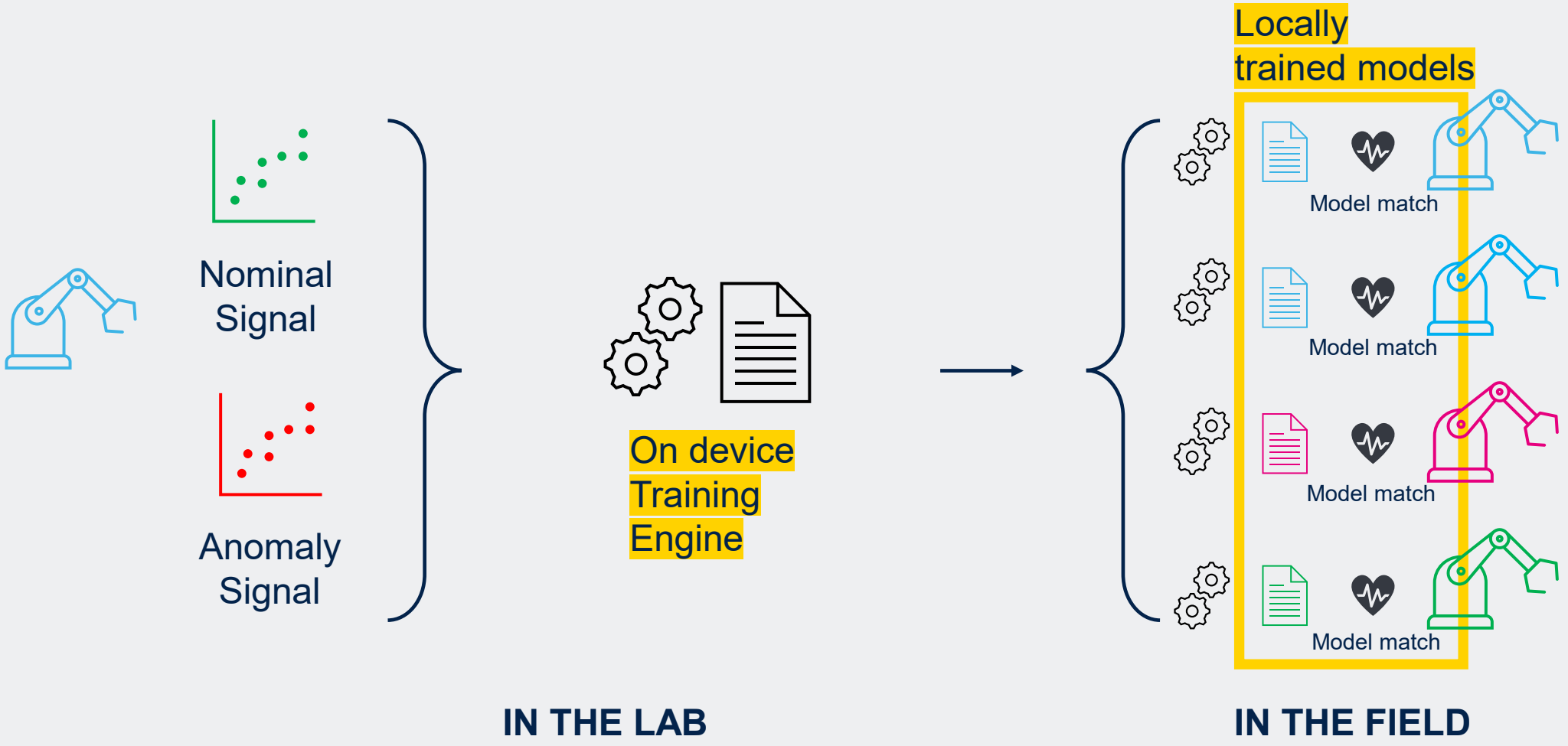
The challenge of « one-size fits all » edge AI for anomaly detection



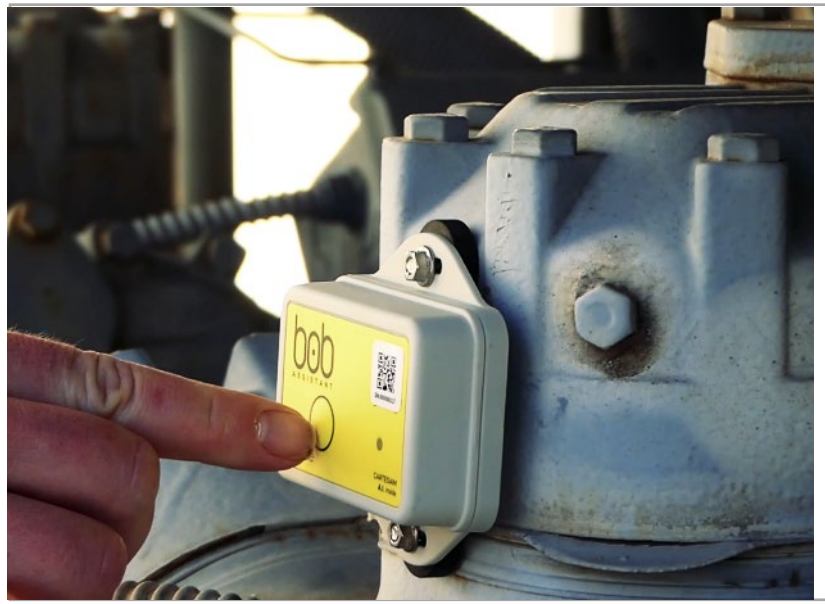
The complex & costly « patch »



A smarter approach



Use cases already deployed



BOB Assistant

Safeguarding industrial machines
using on device AI training since 2018

Le Monde Informatique

Bob assistant, le capteur de maintenance prédictive boosté à l'edge computing

Créé grâce à un partenariat entre l'éditeur IoT Cartesiam et le fournisseur de services et solutions connectées pour l'industrie Eolane, Bob...

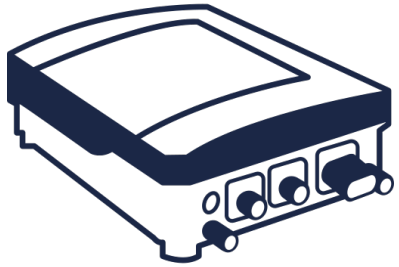
28 mai 2018

Embedded artificial intelligence applied to predictive maintenance

The turnkey solution to monitor your machines 24/7

BoB Assistant is a predictive maintenance and operational assistance technology through continuous monitoring of vibrations and recorded temperatures of isolated systems (pump, air conditioning, chiller unit, fan, etc.).

Form POC to final product in less than a year



Technical features	Application	Pricing
• Arm® Cortex® M-55 • 3-axis accelerometer • Temperature sensor • LoRa • AA 2000 mAh battery	Shock detection	$

Technical features	Application	Pricing
• Arm® Cortex® M-55 • 3-axis accelerometer • Temperature sensor • LoRa® • AA 2000 mAh battery	• Shock detection	$ $ $ $ $
+ Additional development • AI enabled anomaly detection library	• Increase TCO • Reduce/Eliminate down time • Maintenance period prediction • Reduce maintenance costs	

Project kick-off
T0

6 months
Data collection

AI library creation
1 week

6 months
Field test

Start of production
Deployment 1 year after project kick-off

Tool presentation

NANOEDGE AI STUDIO

Best-in-class AutoML solution, for easy and efficient ML deployment

Designed for all embedded developers, regardless of their background in data science.

NANOEDGE AI STUDIO

Largest combination of ML models and preprocessing

Unique on-device learning synthetic data generation for anomaly detection

Bring your own data and generate your ML library easily

More on NanoEdge AI Studio

NANOEDGE AI STUDIO

A simple, guided four-step workflow

1 - Signal

Import labeled dataset

- Define sensor
- Define flash and RAM budget
- Choose target
- Import signals

2 - Benchmark

1 billion+ ML library

- The benchmark will evaluate more than 1B+ combination
- Quality index will reveal the best libraries for the project

3 - Validate

Test and choose your ML library

- Validate performance of best resulting libraries
- Get more details on all library (F1 score, architecture, confusion matrix...)
- Evaluate inference time

4 - Deployment

Compile finale library

- Generate project library

NANOEDGE AI STUDIO

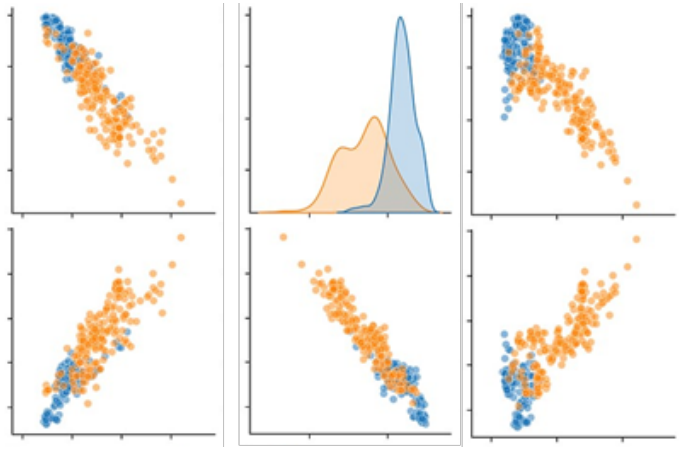
1 - Create the project and import signals

1 - Signal

Import labeled dataset

- Define sensor
- Define flash and RAM budget
- Choose target
- Import signals

Information from NanoEdge AI Studio at that stage



- Multiple representations of the signal
- Time series
- FFT
- Per axe

NANOEDGE AI STUDIO

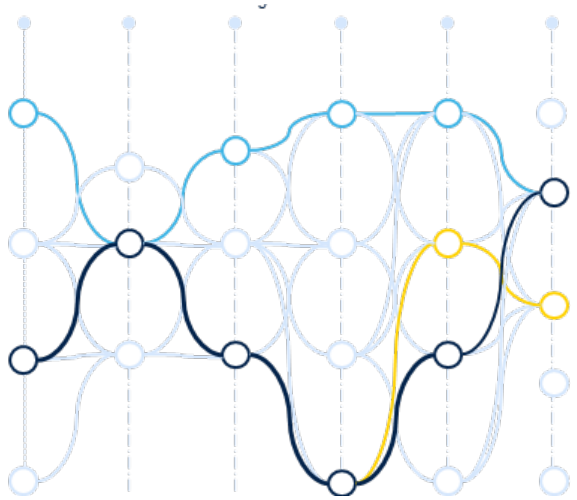
2 - Find the best possible ML libraries

2 - Benchmark

1 billion+ ML library

- List signals to include in the search space

Information from NanoEdge AI Studio at that stage



- The benchmark will automatically evaluate more than 1B+ combination
- Quality index will reveal the best libraries for testing

NANOEDGE AI STUDIO

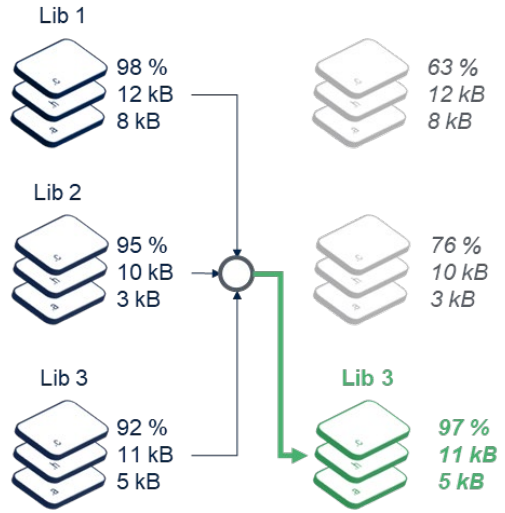
3 - Test and choose your ML Library

3 - Validate

Test and choose your ML library

- Validate performance of best resulting libraries
- Get more details on all library (F1 score, architecture, confusion matrix...)
- Evaluate inference time

Information from NanoEdge AI Studio at that stage



- Results after tests and evaluation based on test signals
- Discriminate between overfitted libraries and good generalization one

NANOEDGE AI STUDIO

4 - Deployment

4 - Deployment

Compile finale library

- Generate project library

Output from NanoEdge AI Studio

- Compiled AI libraries
- Header file
- C file example

NanoEdge AI Studio machine learning algorithms in details

Three machine learning algorithm families to make your product smarter

NanoEdge AI Studio AutoML projects include three types of projects

Anomaly **detection** →

I want to anticipate product failures

Industrial pumps **learn** their own optimal mode of operation **and detect** anomalies **by themselves**

Classification →

I want to identify the activity, the environment, the usage

Smart watches **classify** human activity recognition without using connectivity features

Extrapolation →

I need to predict future states

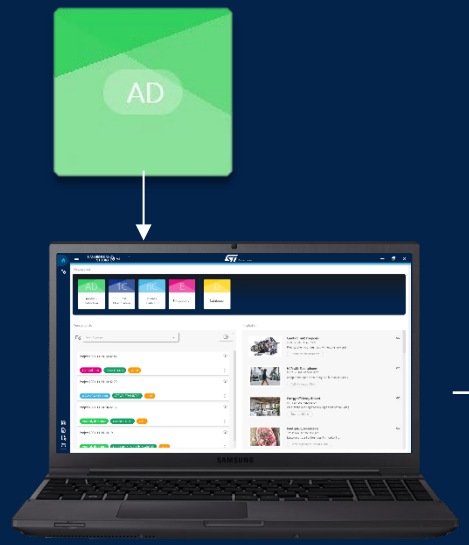
A **virtual sensor** for tire pressure in an eBike estimates pressure based on motor current measurements

NANOEDGE AI STUDIO

Anomaly detection

ON THE PC

1 Creation of an **ANOMALY DETECTION** Machine learning library

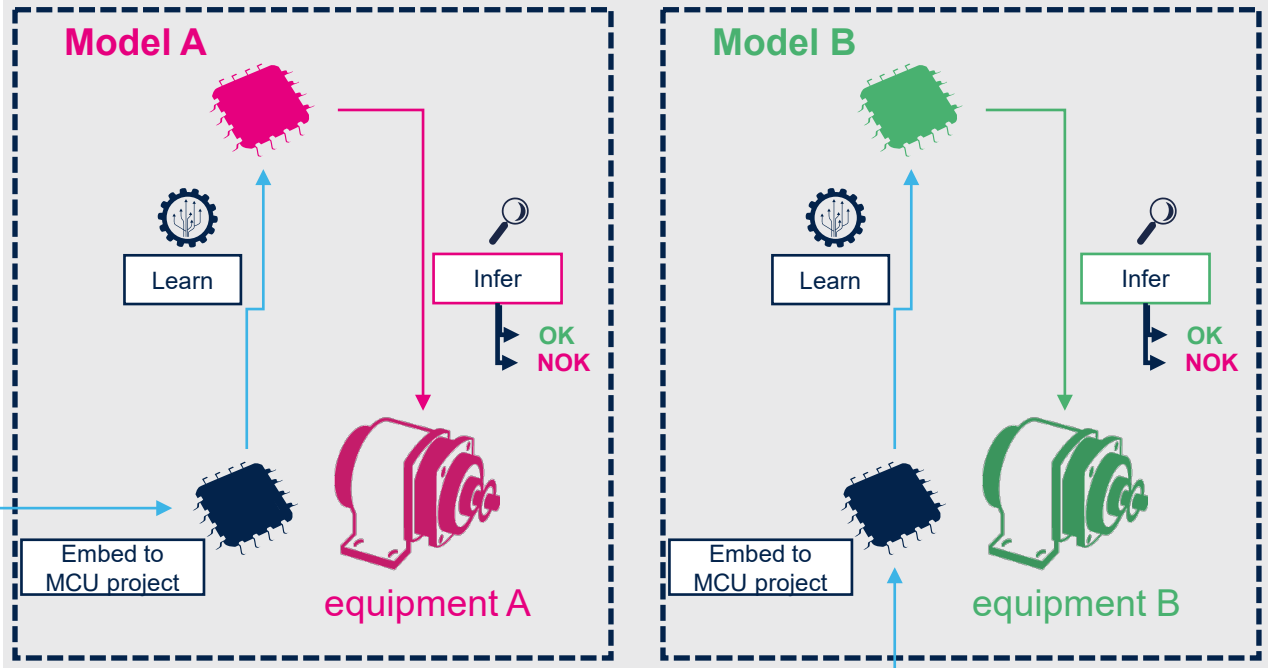


Contextual Signals

ML library

ON THE MCU

2 **On-target learning** for a fine-tuned model

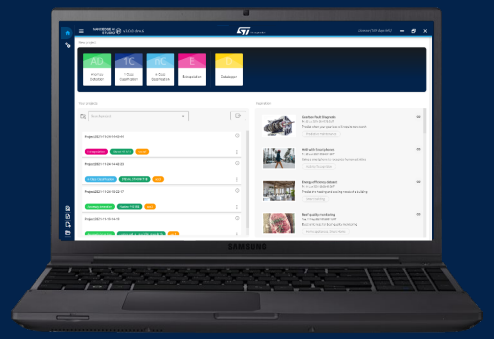


NANOEDGE AI STUDIO

Anomaly detection
Discover the benefits of on-device learning

ON THE PC

1 Creation of an **ANOMALY DETECTION** Machine learning library

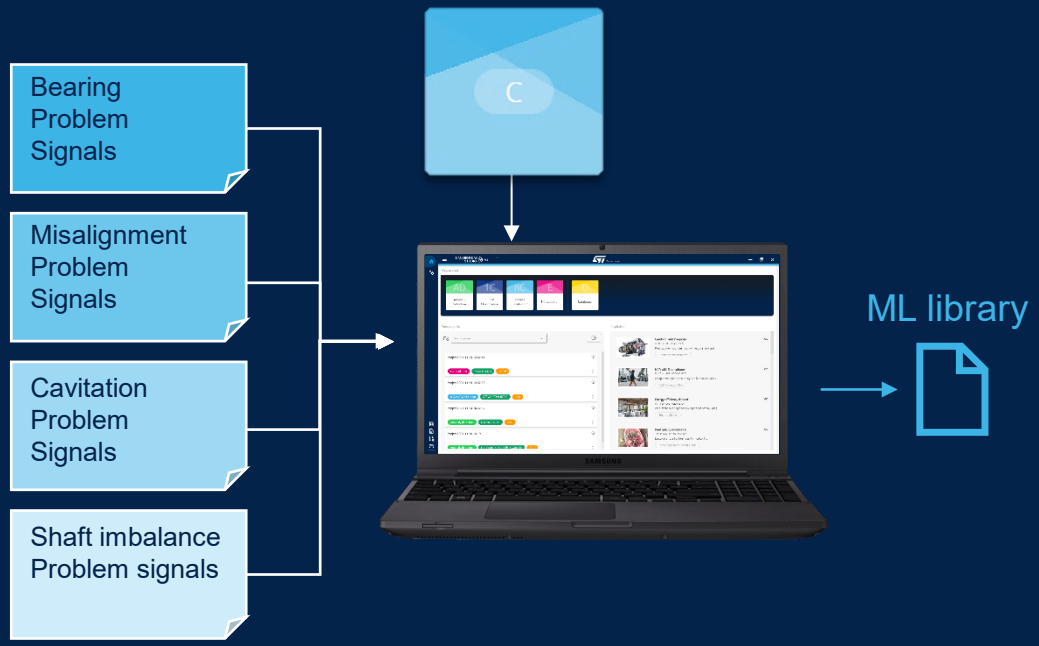


NANOEDGE AI STUDIO

Classification

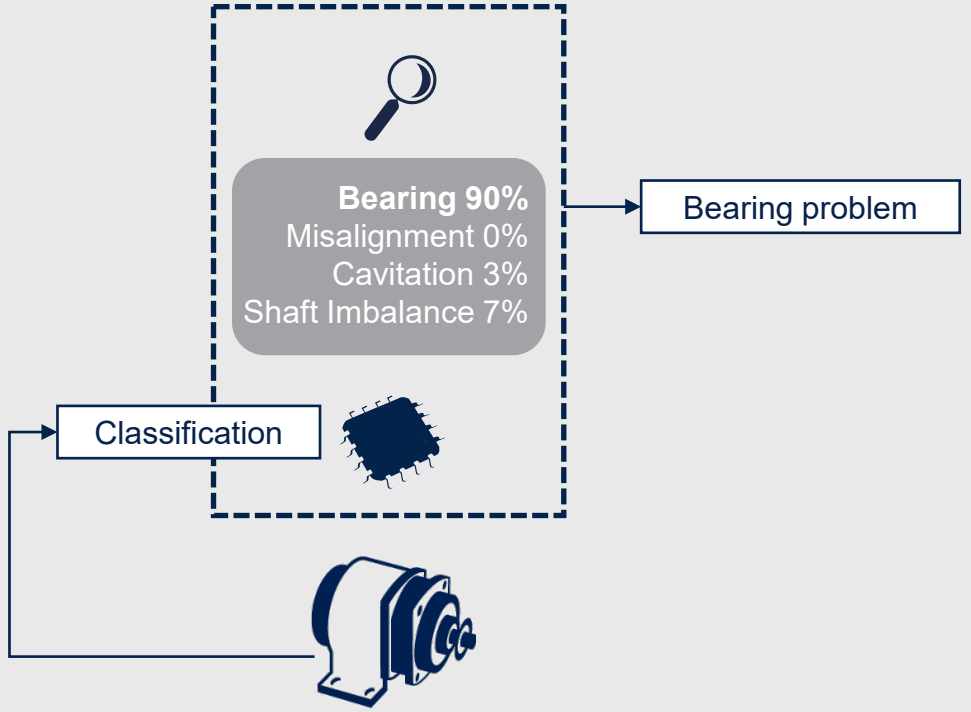
ON THE PC

1 Creation of a **n CLASS CLASSIFICATION** Machine learning library



ON THE MCU

2 Use of an **n CLASS CLASSIFICATION** Machine learning library

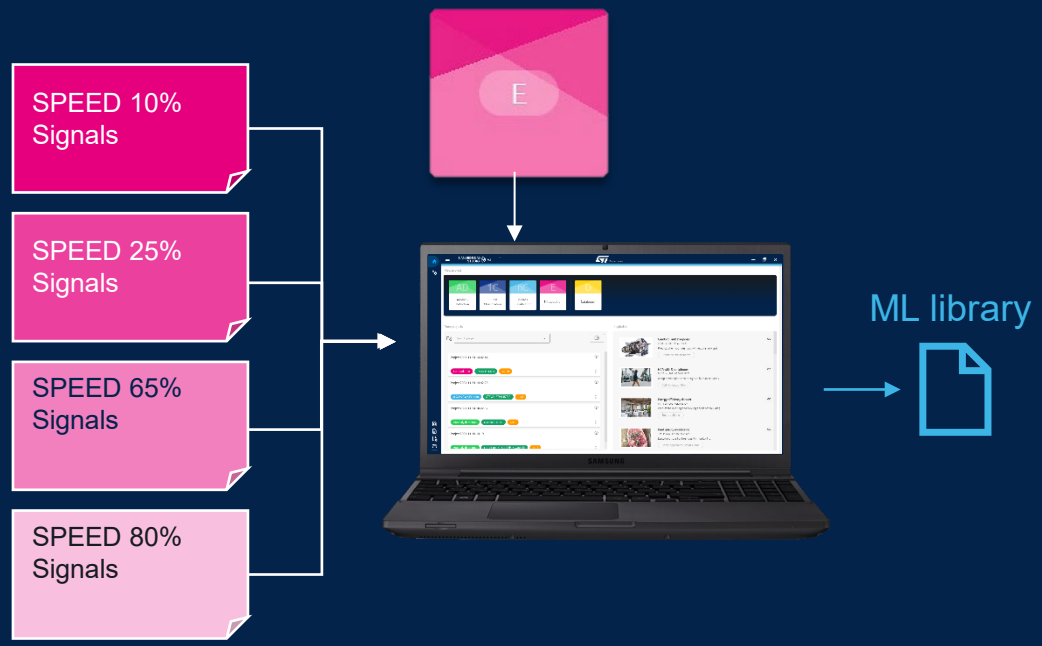


NANOEDGE AI STUDIO

Extrapolation

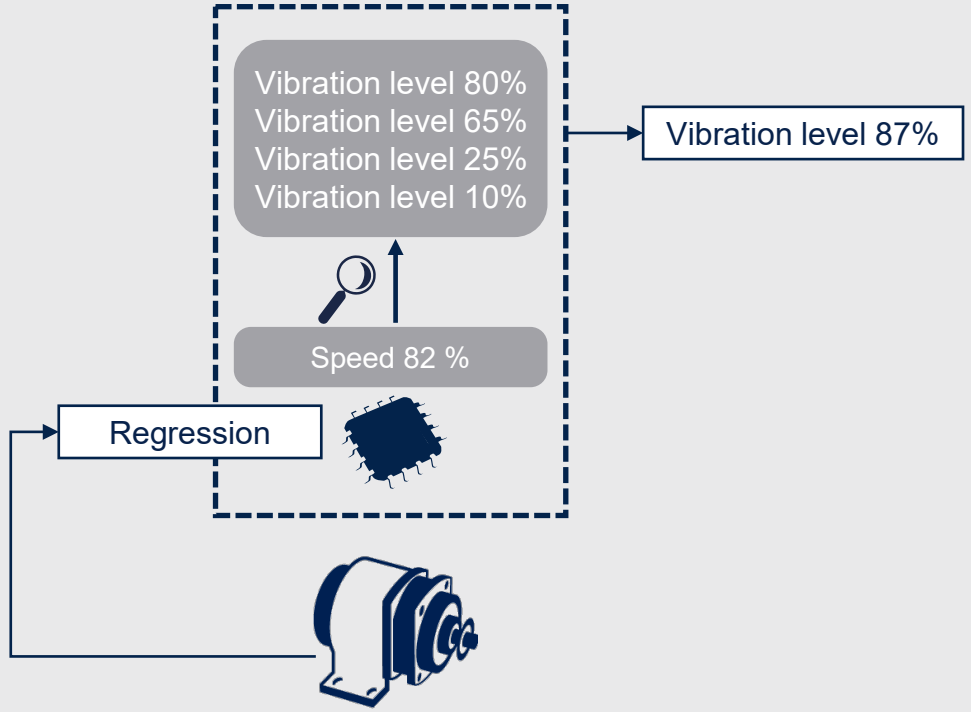
ON THE PC

1 Creation of an **EXTRAPOLATION** Machine learning library

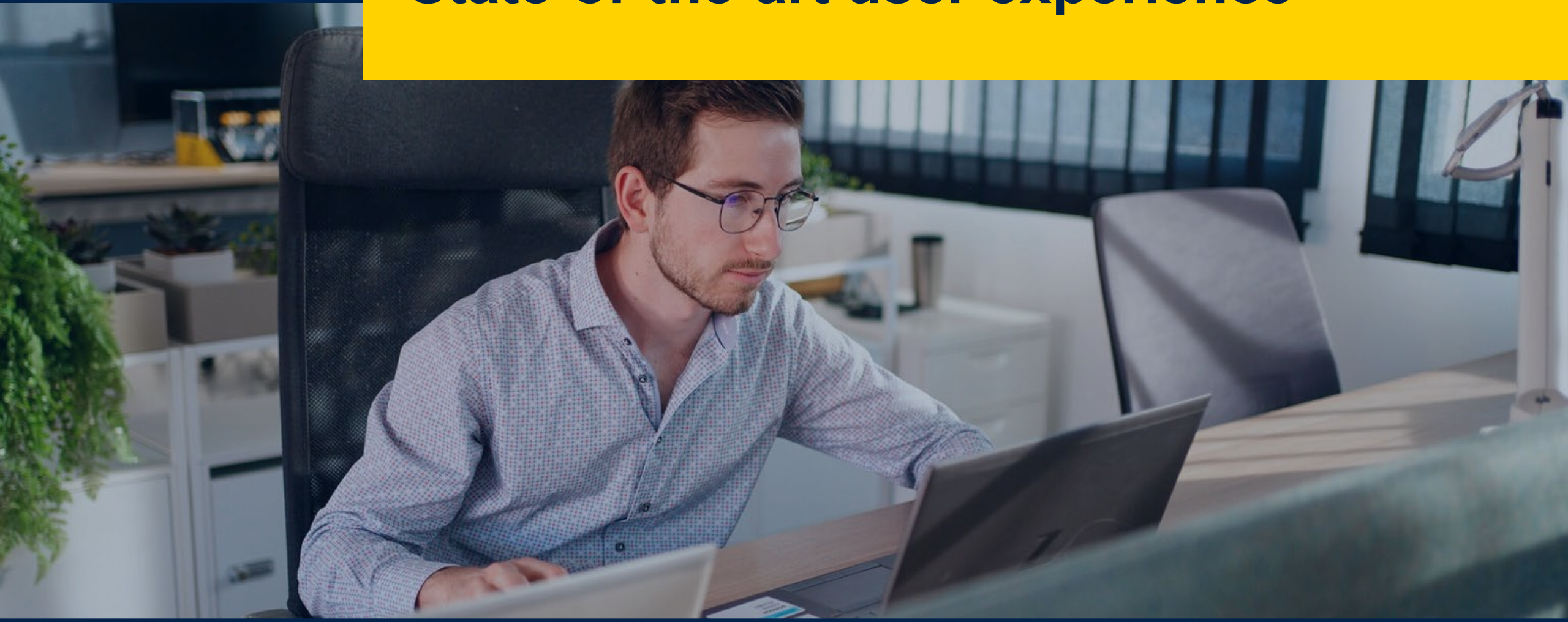


ON THE MCU

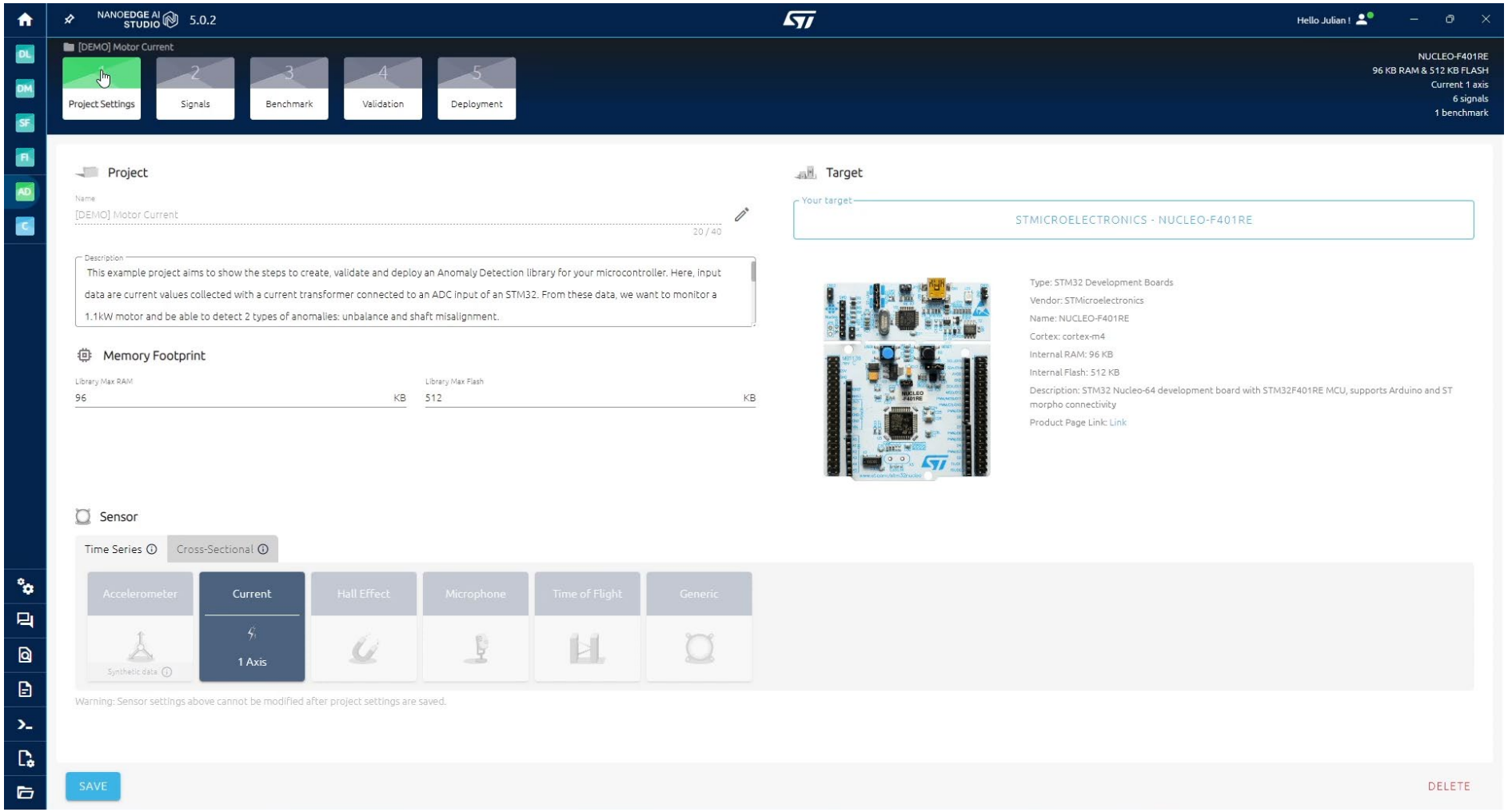
2 Use of an **EXTRAPOLATION** Machine learning library



State-of-the-art user experience



A comprehensive ML algorithm library supported by a reliable workflow



Project settings

Signals

Benchmark against billions of configurations

Validation

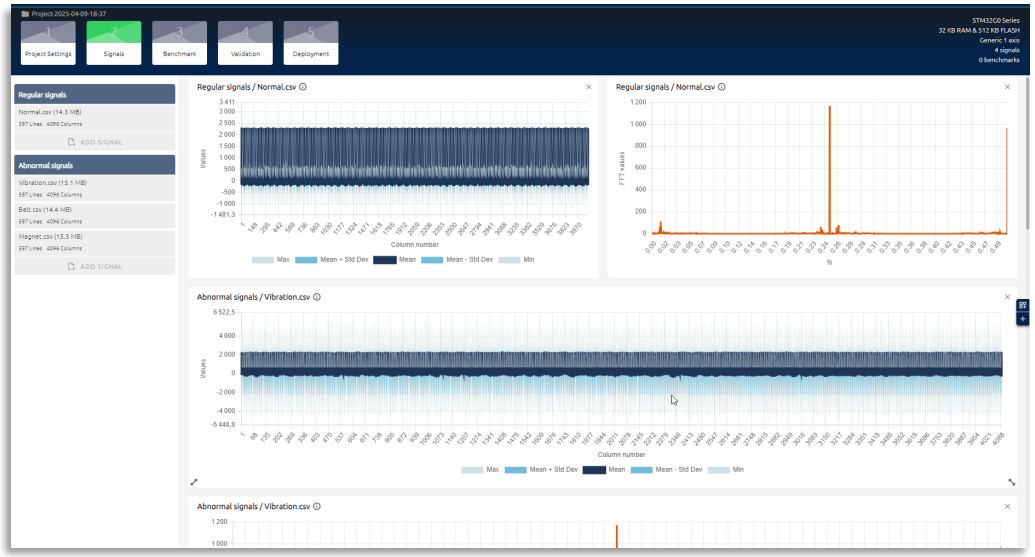
Deployment

NEW

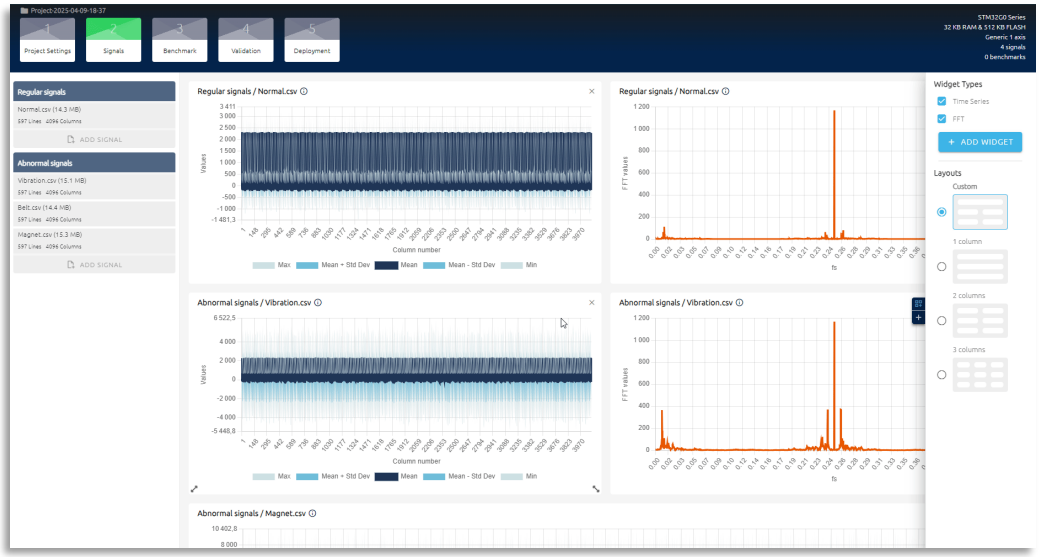
Advanced graphical signal visualization

- New data visualization tools improve model explainability

Visualize easily time and frequency spectrum of the signal for a first view



Customize easily to adapt to the use case



NEW

Synthetic data generation

Focus on the nominal data of your machine to train anomaly detection algorithms

Kick off your anomaly detection project with simple nominal data, easy to data log.

The tool streamlines early-stage development by allowing users to test without extensive real-world data collection.

NEW

Identify the most relevant features of your signal

Feature importance helps you focus on the essential

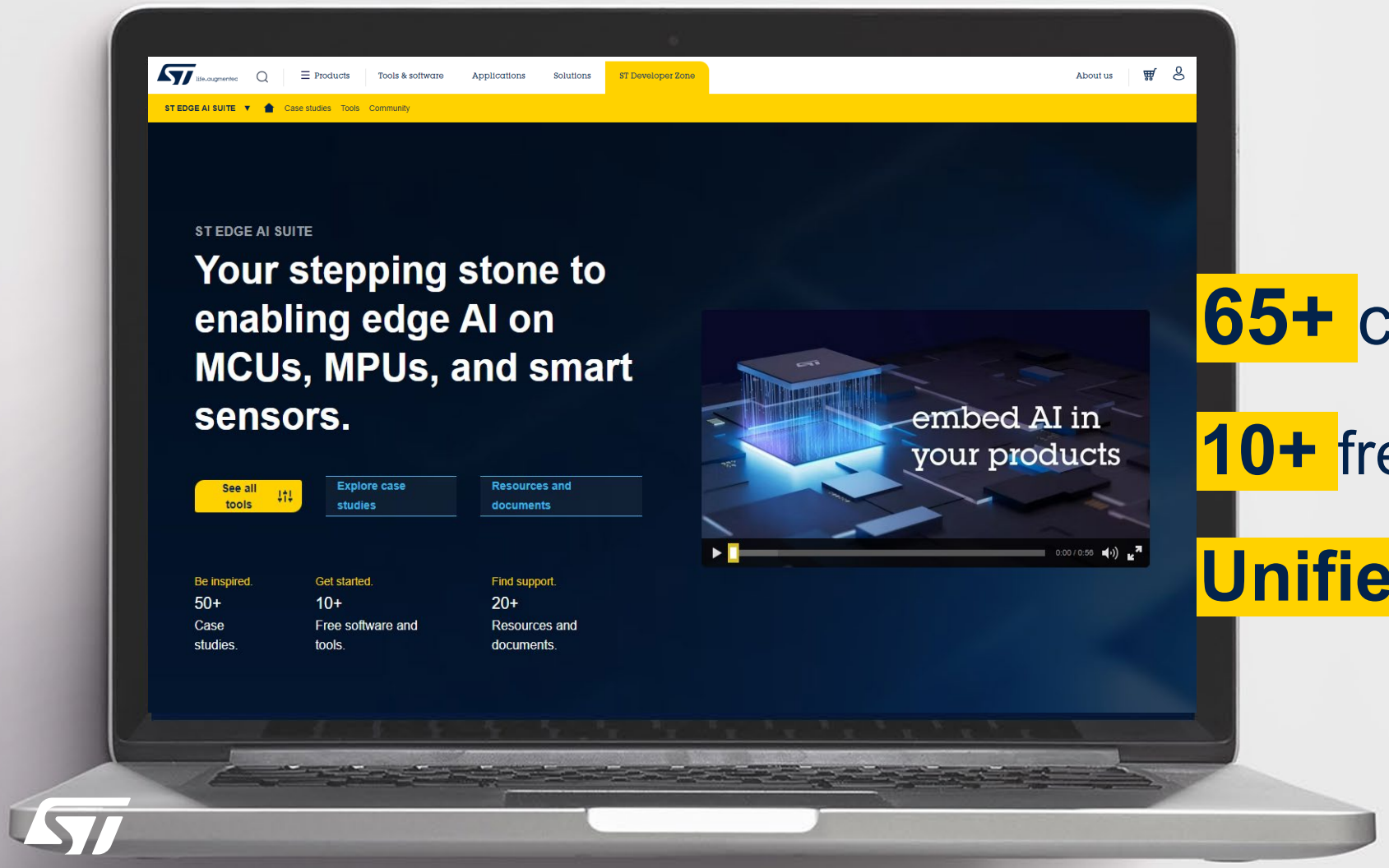
Feature importance shows which sensors matter most.

Helps users refine their dataset for better accuracy and efficiency.

Supports explainability by revealing how the model makes decisions.

NanoEdge AI Studio is integrated in the ST edge AI and STM32Cube ecosystems

NanoEdge AI Studio is part of the ST Edge AI Suite



ST Edge AI Suite

65+ case studies

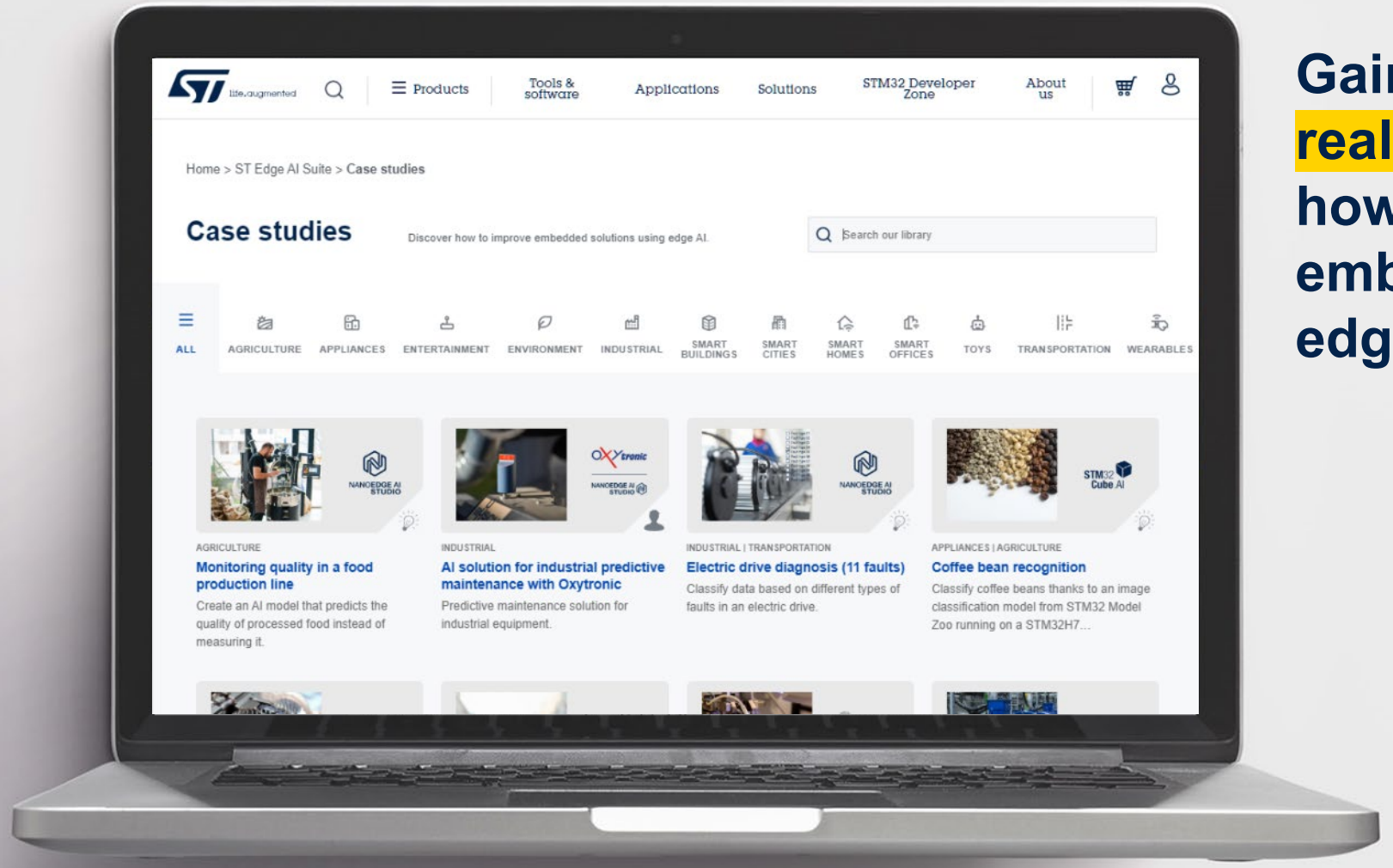
10+ free software tools

Unified AI core technology

ST Edge AI Suite

ST Edge AI Suite

Explore inspiring case studies



Gain valuable insights from real-world case studies on how to improve your embedded solutions using edge AI.

Edge AI case studies

STM32Cube design ecosystem

Helping developers release their creativity

Comprehensive offer helping you accelerate your development

Focus on quality, compatibility, and stability

Documentations, training and worldwide support channels

STM32 MCU and MPU Developer Zone
Everything for STM32 developers in one place

Applicative reference implementations

Extension libraries and AI toolkit

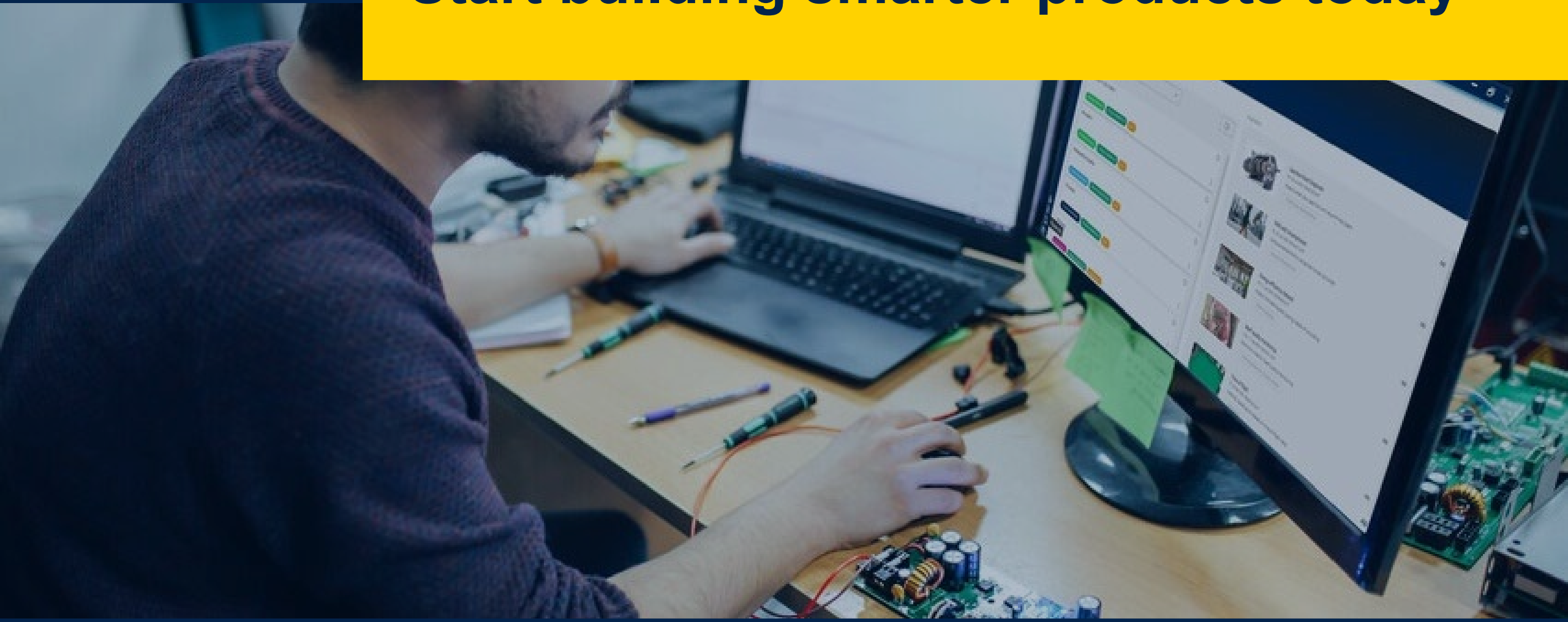
Hardware

Embedded SDK

Development tool kit

Development resources

Start building smarter products today



NANOEDGE AI STUDIO

Your journey to edge AI starts now

Get NanoEdge AI Studio for free on Windows & Linux
stm32ai.st.com/nanoedge-ai/

Browse our library of tutorials and use cases for inspiration

Build your first state-of-the-art, edge AI library in under 30 minutes

Our technology starts with You

Find out more at stm32ai.st.com/nanoedge-ai/