AI Powered Automation –
Transforming Machine Building and Industrial Efficiency

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Beckhoff Automation

Finland

AI-Powered Automation System

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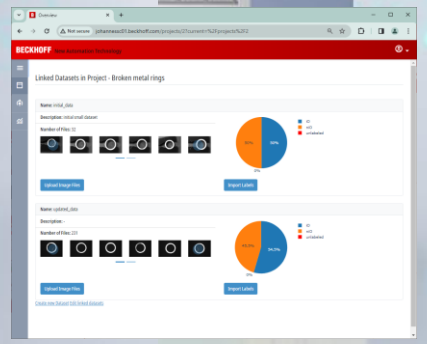
Artificial intelligence seamlessly integrated at **control level**

Automation projects with AI-assisted **engineering**

AI is becoming part of automation

Not separate. Not cloud-only
Built into Control and Engineering



Create ML/AI models easily and automatically

Products and system solutions

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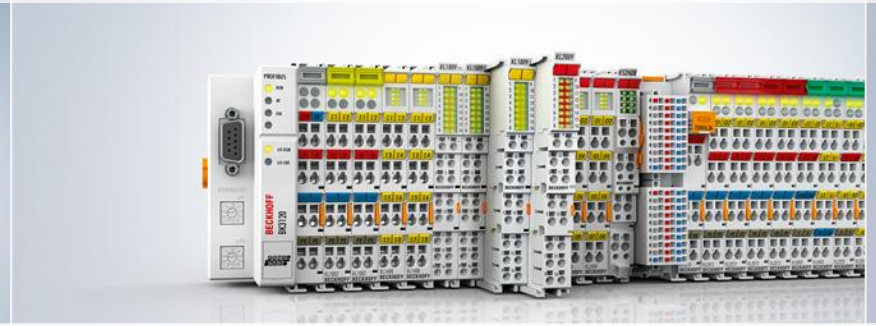
Industrial PC and Embedded PC

EtherCAT

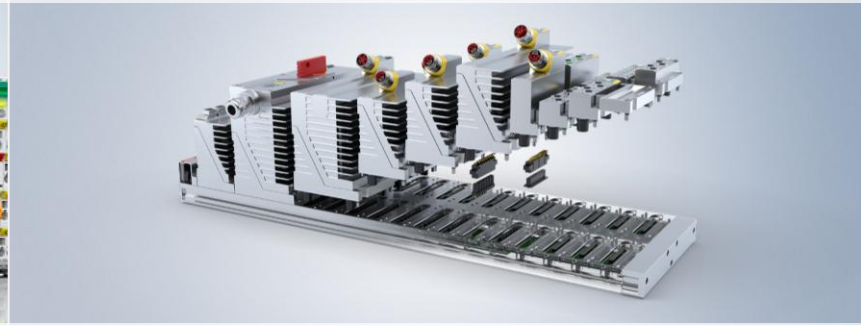
TwinCAT

Infrastructure components

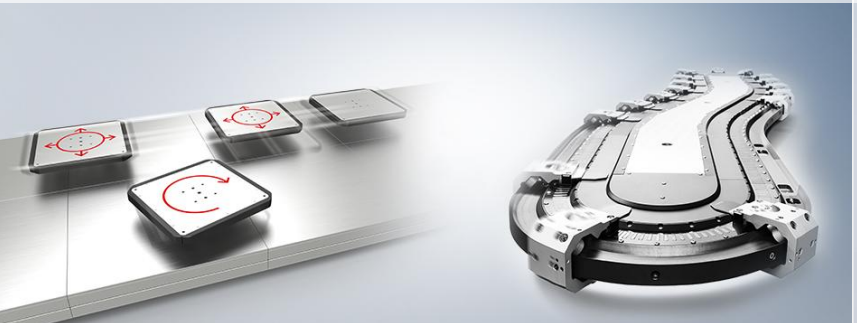
Bus Terminals



MX-System



Transport systems



Drive Technology and robot system

Vision

TwinCAT Machine Learning -
Artificial intelligence seamlessly integrated at control level

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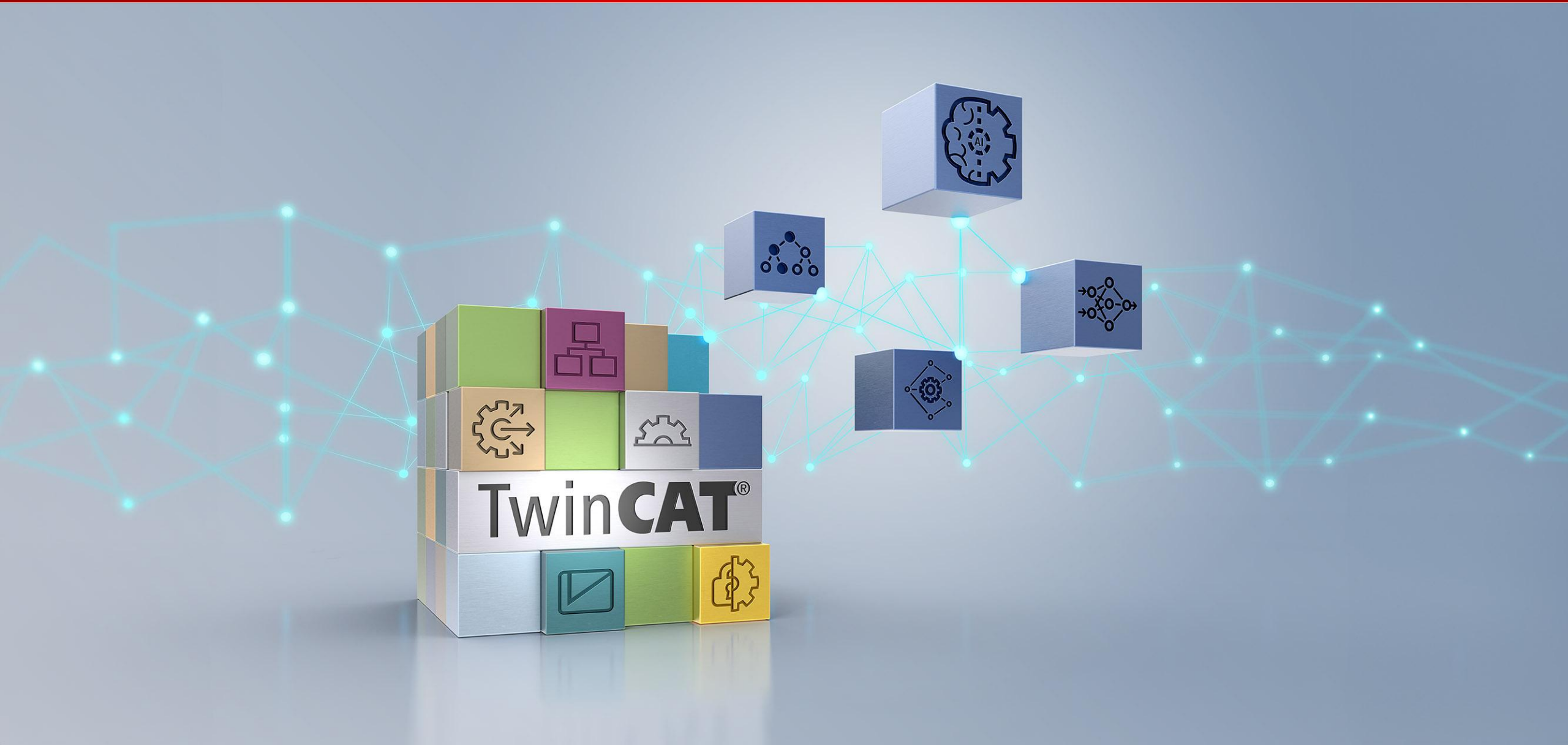

Vision and Machine Learning
Heartwood Orientation in Timber Processing

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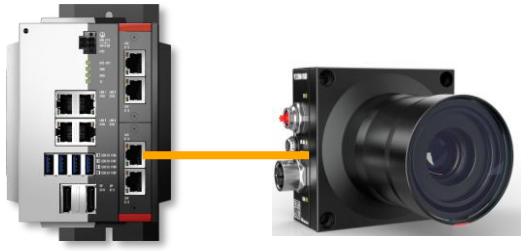
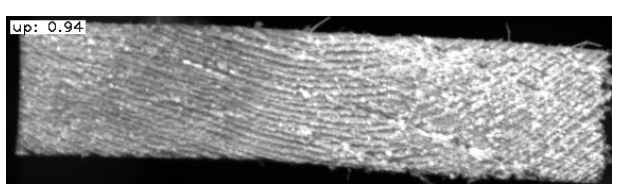
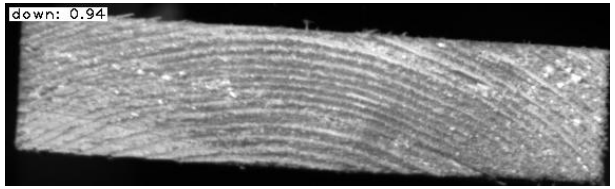
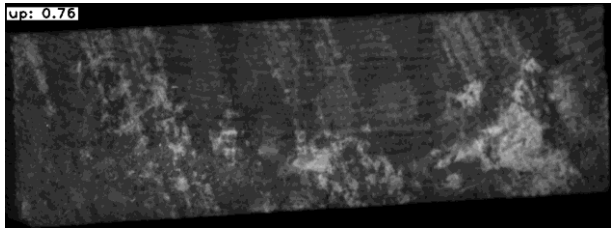
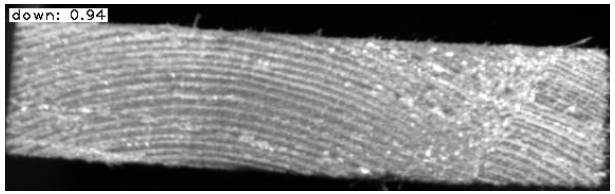
- Detecting whether the heartwood side faces up or down
- Use Cases
  - Flooring & Paneling: Orient boards to reduce warping.
  - Glued Laminated Timber: Align lamellas for better strength and bonding.











High variance of data, e.g. surface damages can have arbitrary shape and appearance

Automation and Data Science

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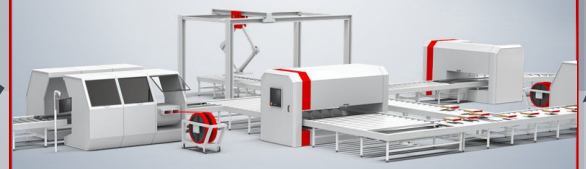
Collect data 1

Train model 2

Use model 3



Automation

Data Science

Automation and Data Science | Deployment of AI models in the shop floor

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Scope

Database Server

Data Agent

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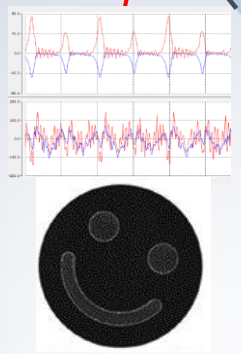
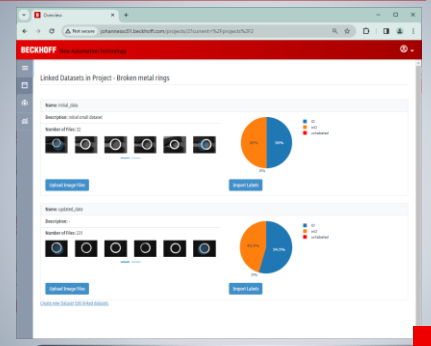
Analytics Logger

Collect data 1



Train model 2

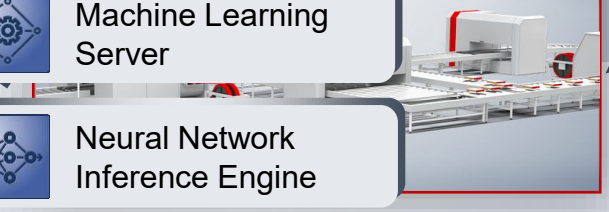


NEW

TwinCAT Machine Learning Creator

ONNX

Use model 3



Automation

Data Science

TwinCAT Vision Neural Networks

Machine Learning Server

Machine Learning Inference Engine

Neural Network Inference Engine

New Tool: TwinCAT Machine Learning Creator
From data to AI model — without AI expertise

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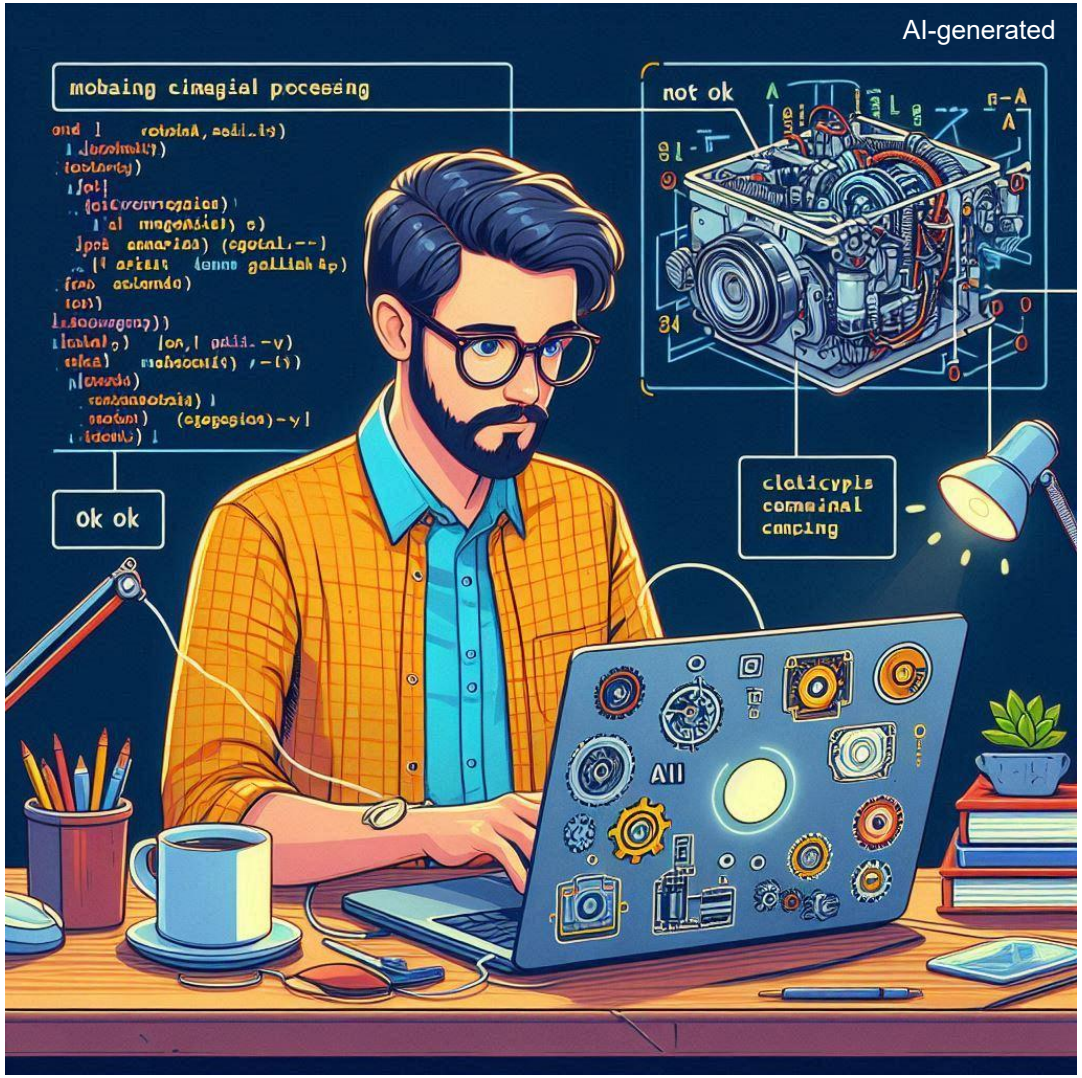
Without TwinCAT Machine Learning Creator



With TwinCAT Machine Learning Creator

TwinCAT Machine Learning Creator
From data to AI model — without AI expertise

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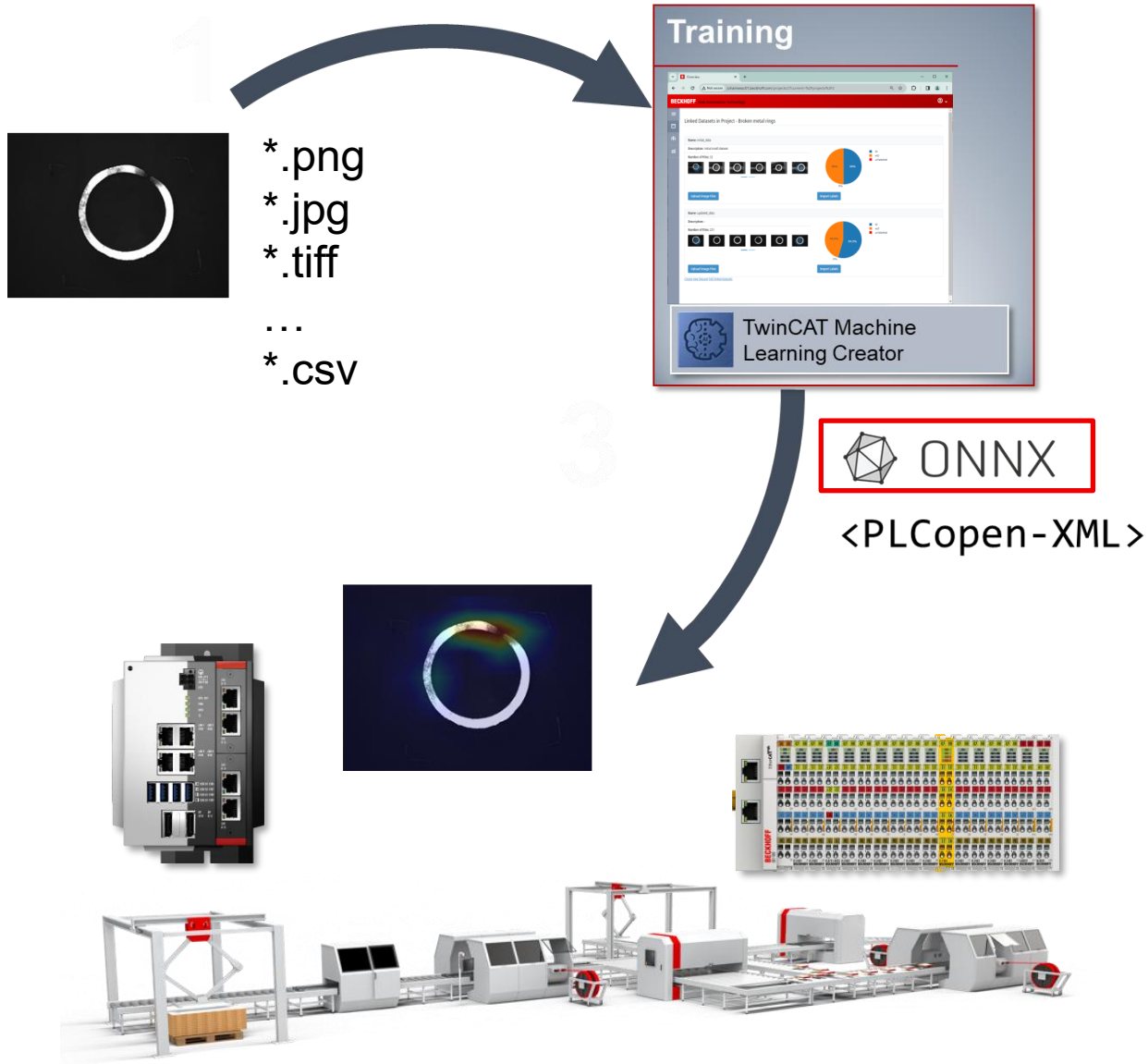
- Empowers automation engineers to create task-specific AI models
- No AI expertise required
- Web-based tool offers calculation power
- Fast model creation and easy evaluation
- Optimized for real-time use (latency & accuracy)
- Export PLC code for easy integration into automation systems



TwinCAT Machine Learning Creator Computer Vision Model Evaluation View

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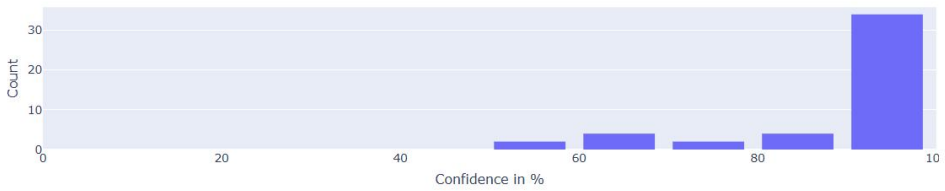
BECKHOFF TwinCAT Machine Learning Creator

Model Statistics:

Test Accuracy:	Test Precision:	Test F1:	Test Recall:
0.936	0.937	0.936	0.936

Confidence Statistic:

Confidence Distribution:



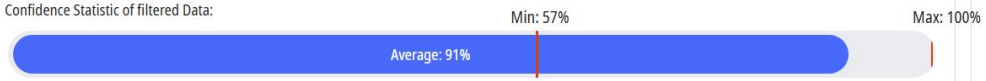
Confusion Matrix Filter

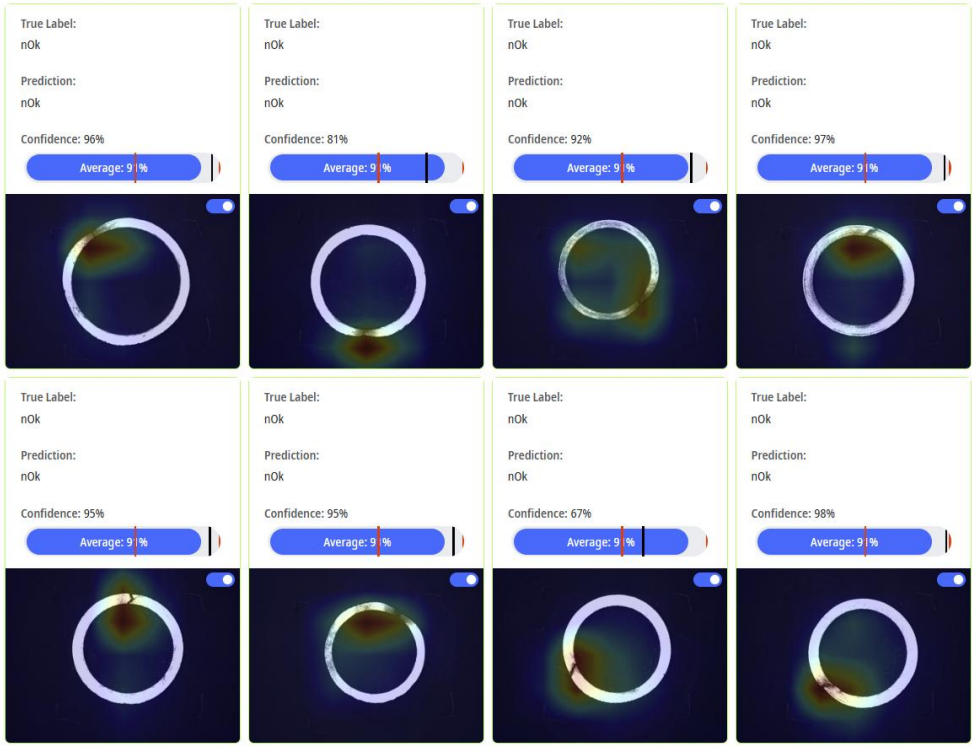
(Model) Prediction Behaviour:

Filter: Predicted Label: nOk | True Label: nOk

Sortby: Confidence

Confidence Statistic of filtered Data:





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TwinCAT CoAgent
AI-Assisted Engineering for Automation

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AI-Assisted Engineering for Automation

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- Addresses key challenges: speed, quality and skills shortage
- Automate routine tasks, focus on complex problems
- Speed up development and troubleshooting
- Use natural language to create and modify automation code
- Support PLC, HMI, I/O and diagnostics

TE1700 | TwinCAT CoAgent for Engineering
Smart agents for automation engineering

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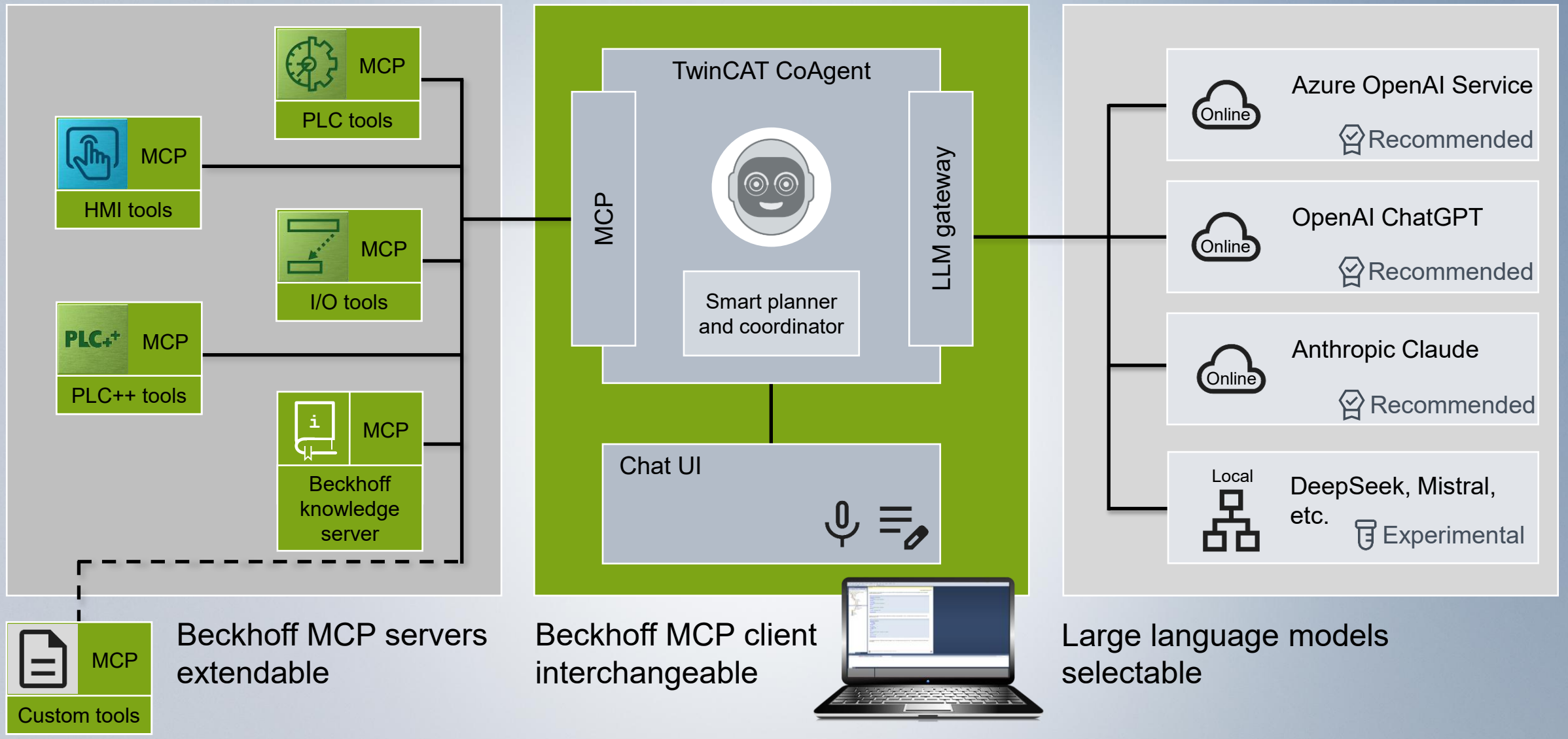

Trusting AI-generated Code in Industrial Automation

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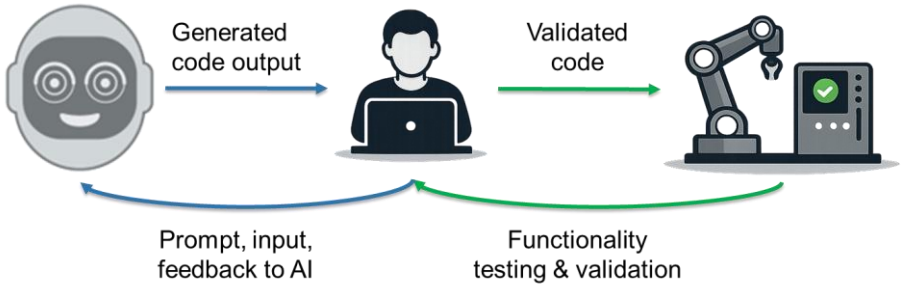
AI proposes — Engineers validate



- Engineers stay in control (human-in-the-loop)
- Treat AI like an external engineer
- Review, test and validate all outputs
- Follow standard engineering processes
- No AI-generated safety logic (yellow ones)

Future: Physical AI
Towards a new approach to interact with machines and robots

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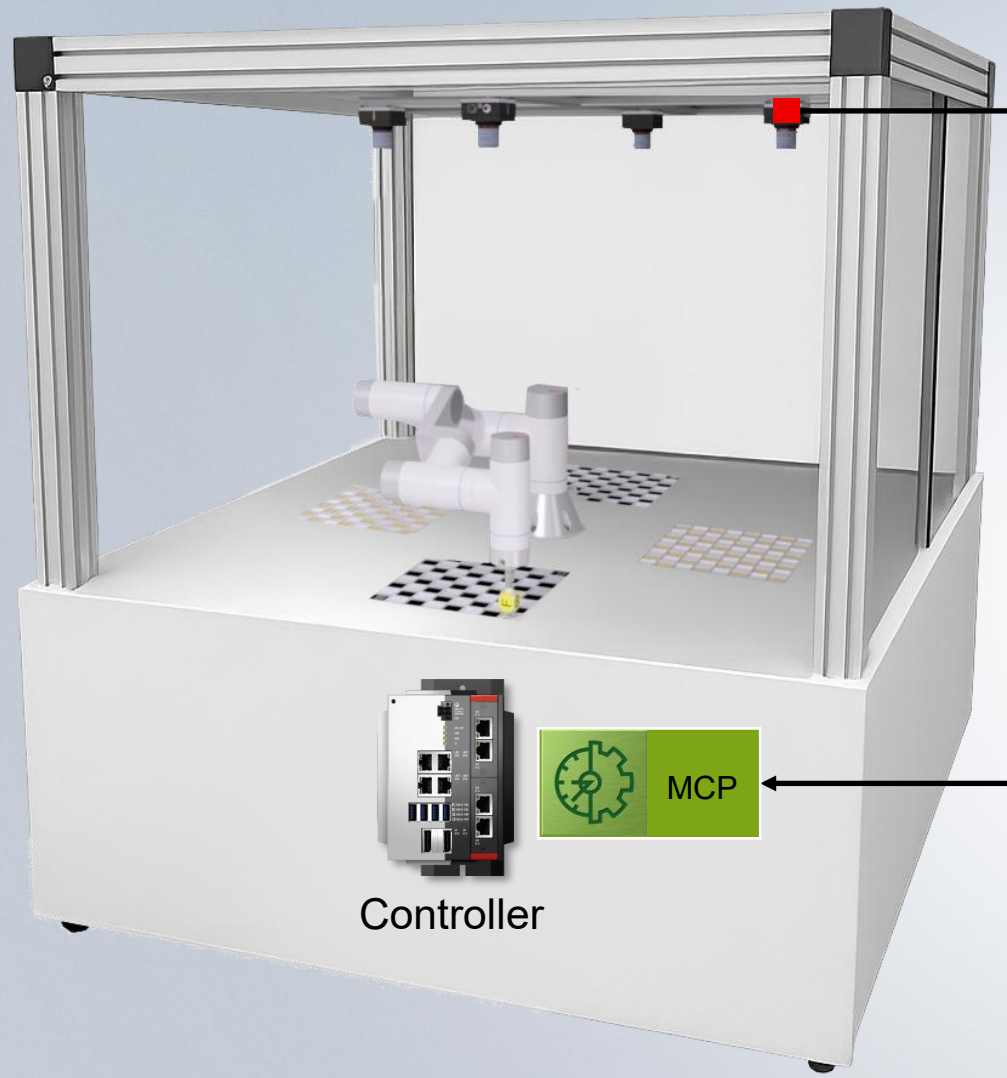

Controller

MCP

{action plan}

Large Language Model

"Let's play chess. Get ready and choose your colour!"

LLM tasks for action planning

- Scene understanding: interpret image, detect objects, derive current state
- Goal analysis: parse the user prompt and define the desired outcome
- Action planning: break down the task into feasible steps
- API mapping: translate steps into valid machine function calls

Operator Station

Key Takeaways – How AI Changes Machine Building?

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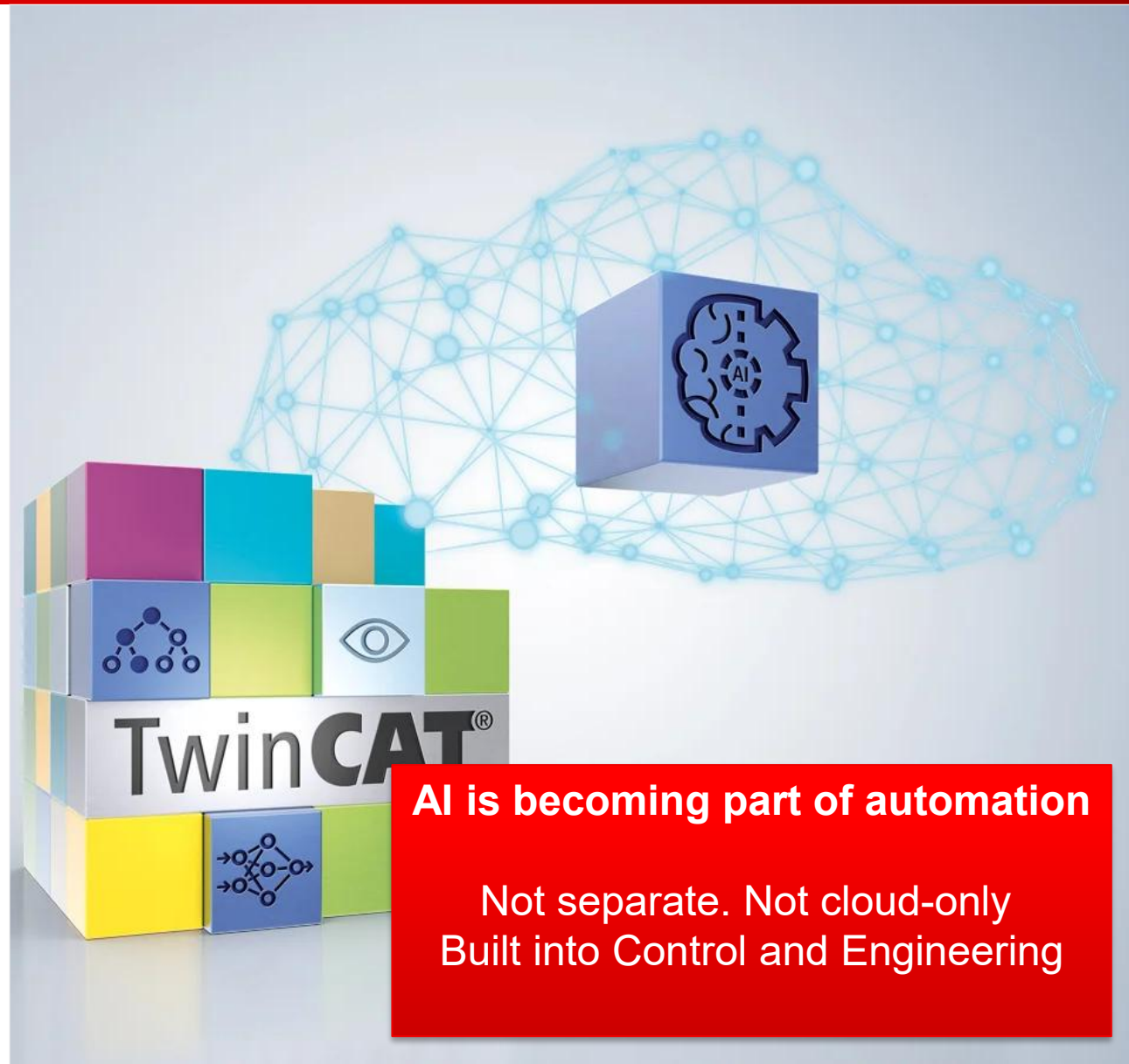
- AI will change how machines are engineered and operated
- Future automation systems combine control, data and AI
- Beckhoff brings AI directly into engineering workflows
- Open and flexible architecture enables freedom of choice
- Trust, validation and data control remain essential



AI is becoming part of automation

Not separate. Not cloud-only
Built into Control and Engineering

More information

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- https://www.beckhoff.com/en-en/company/news/multimedia-ai-technologies-for-industrial-automation.html

- TwinCAT Machine Learning
  - https://www.beckhoff.com/en-en/products/automation/twincat-3-machine-learning/
  - https://www.beckhoff.com/en-en/products/automation/twincat/texxxx-twincat-3-engineering/te3850.html

- TwinCAT CoAgent: AI-based digital assistant for engineering and operation
  - https://www.beckhoff.com/en-en/products/automation/twincat-projects-with-ai-supported-engineering/