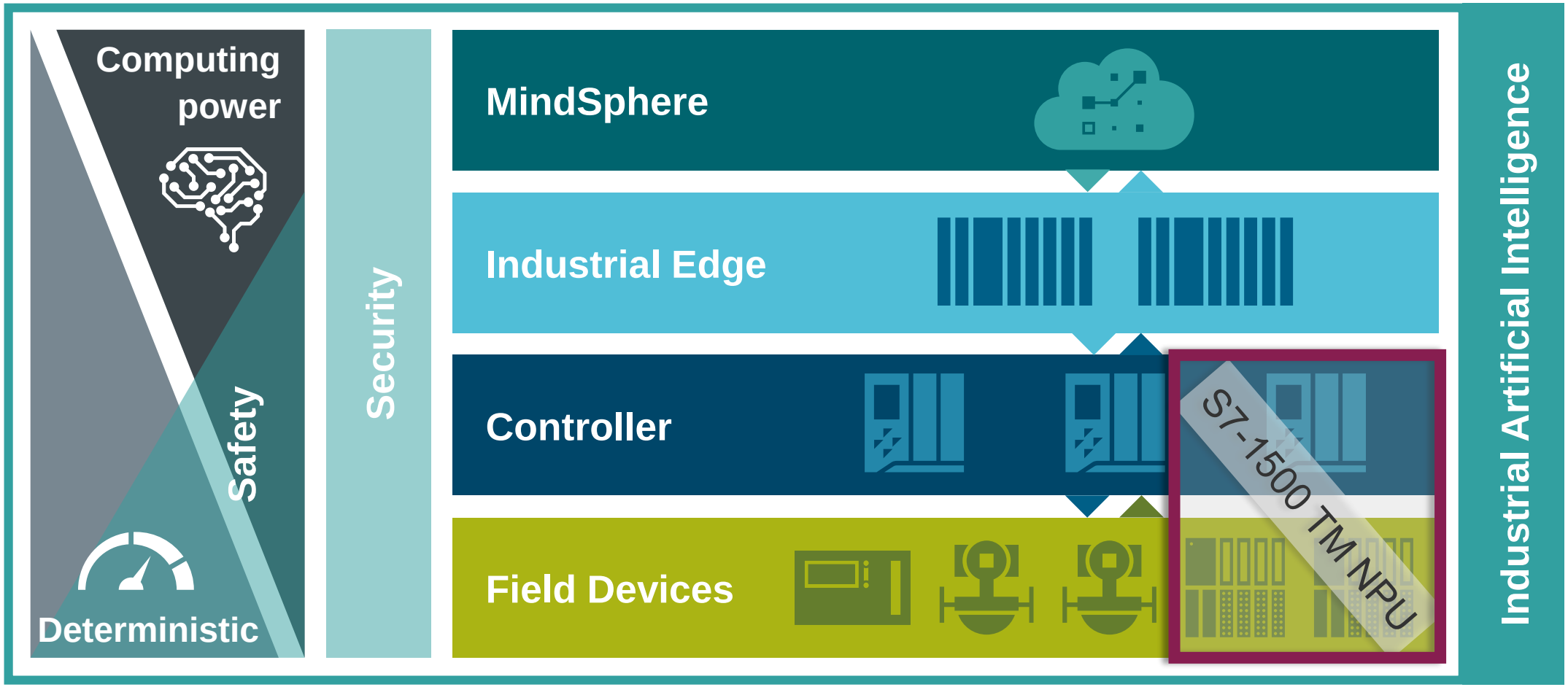


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Artificial Intelligence

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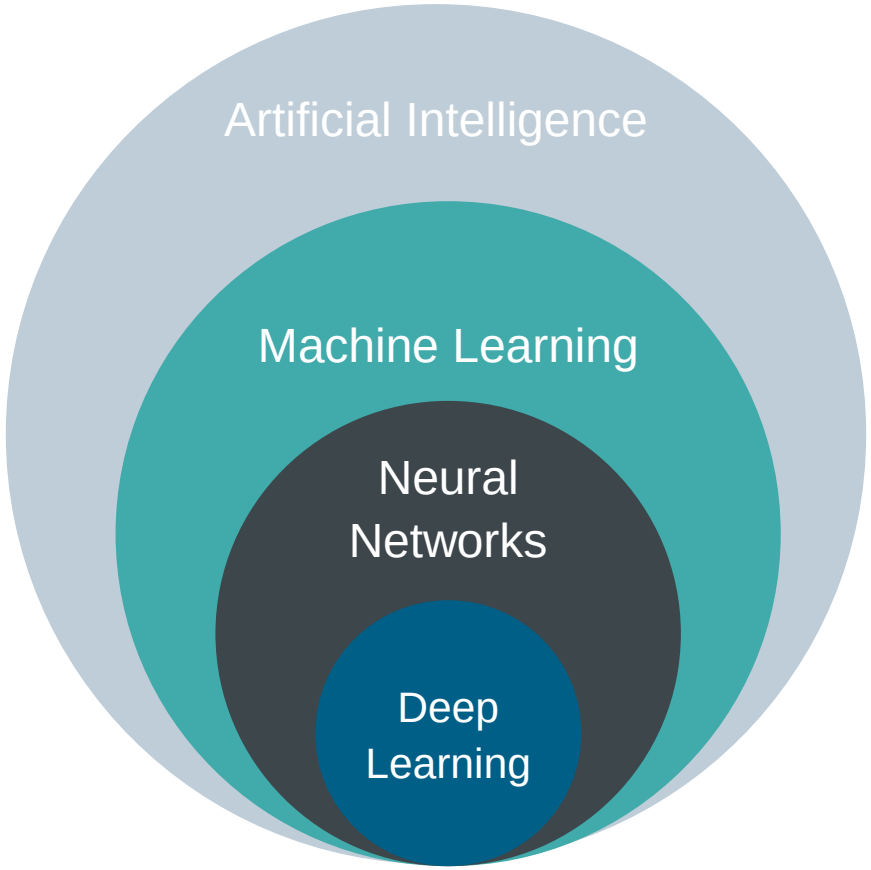
Our future portfolio will enable AI across all levels of Totally Integrated Automation - Best fit to customers needs



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Demystifying Artificial Intelligence

Basic Definitions for common Buzzwords



Artificial Intelligence (AI)

Ability to interpret external data + learn from them + use those learnings for a goal.

Machine learning (ML)

Learn making decisions without being explicitly programmed.

Neural Network (NN)

Learn to perform tasks by considering examples.

Deep Learning (DL)

Cascade of multiple layers of nonlinear processing units.

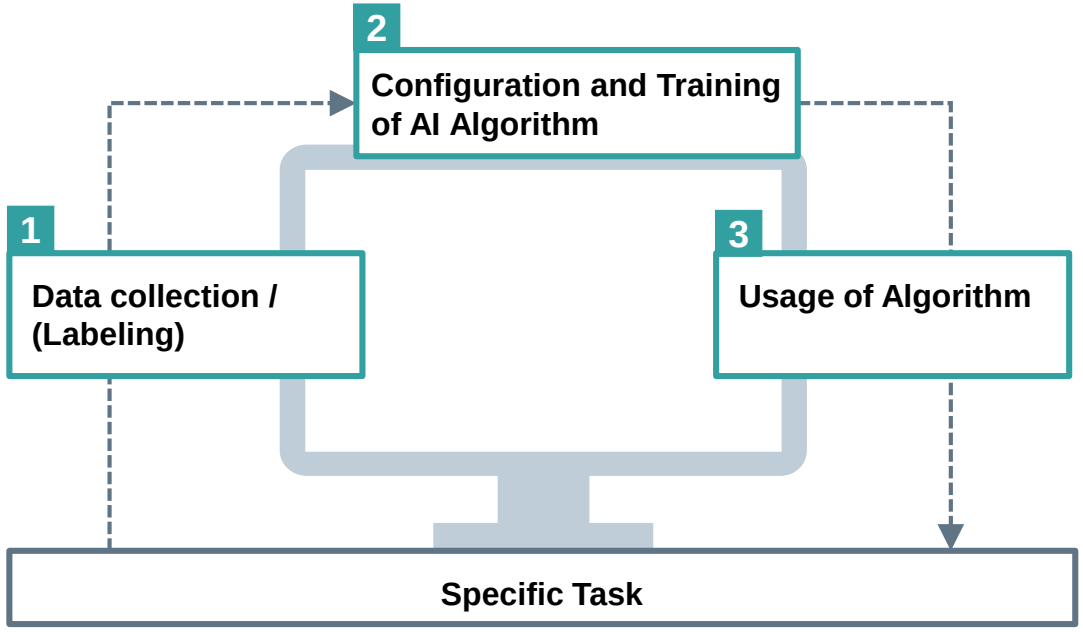
Sources: Wikipedia

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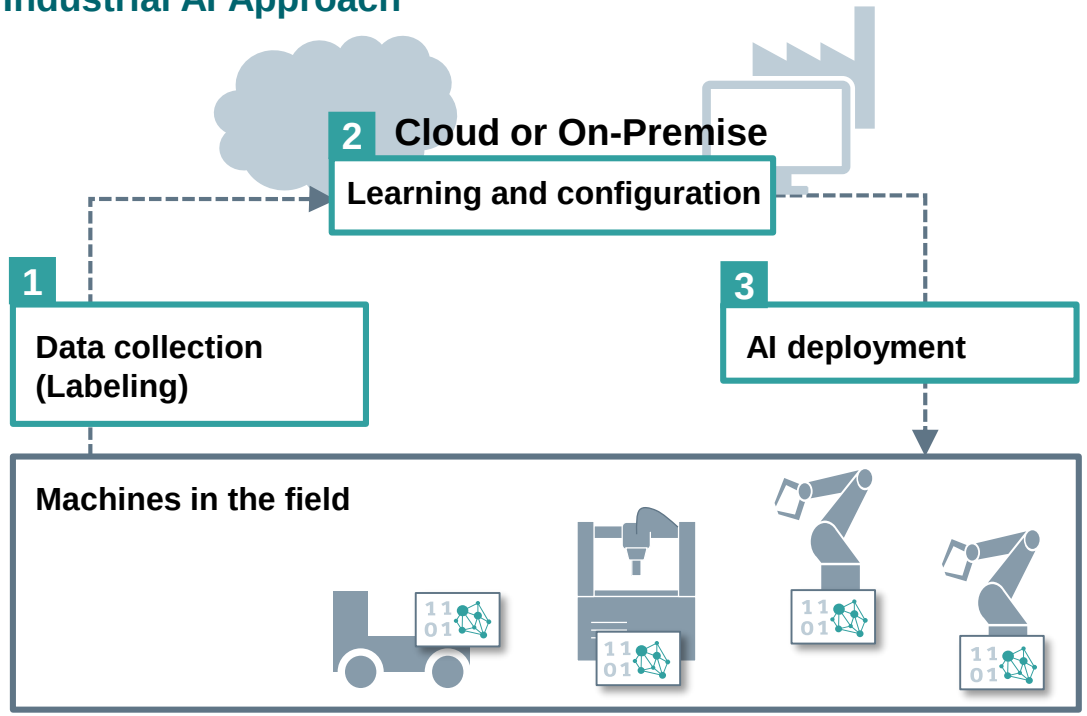
Artificial Intelligence in Industry

The way to an Industrial AI Approach

General AI Approach



Industrial AI Approach



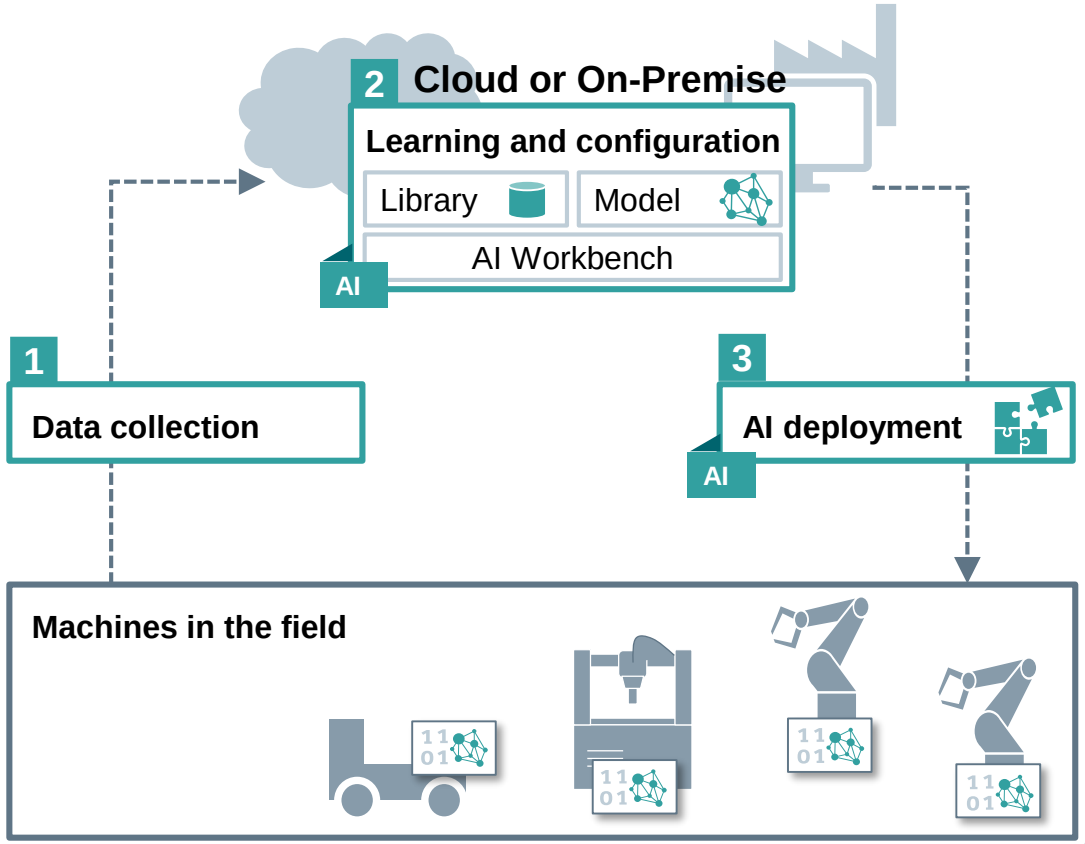
Computer as central system for AI Applications

Focus on Industry – other surrounding, new challenges

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Artificial Intelligence in Industry
Vision for Industrial AI Approach

Industrial AI Approach



→ **Requirements:**

1. **Data Collection:**
   Data directly from machines
   branch and process knowledge needed
   labeling of data
2. **Learning and configuration of AI Algorithm:**
   Algorithm and training knowledge needed
   Cloud or on-Premise
3. **Deployment of AI:**
   Industrial-suited Hardware required

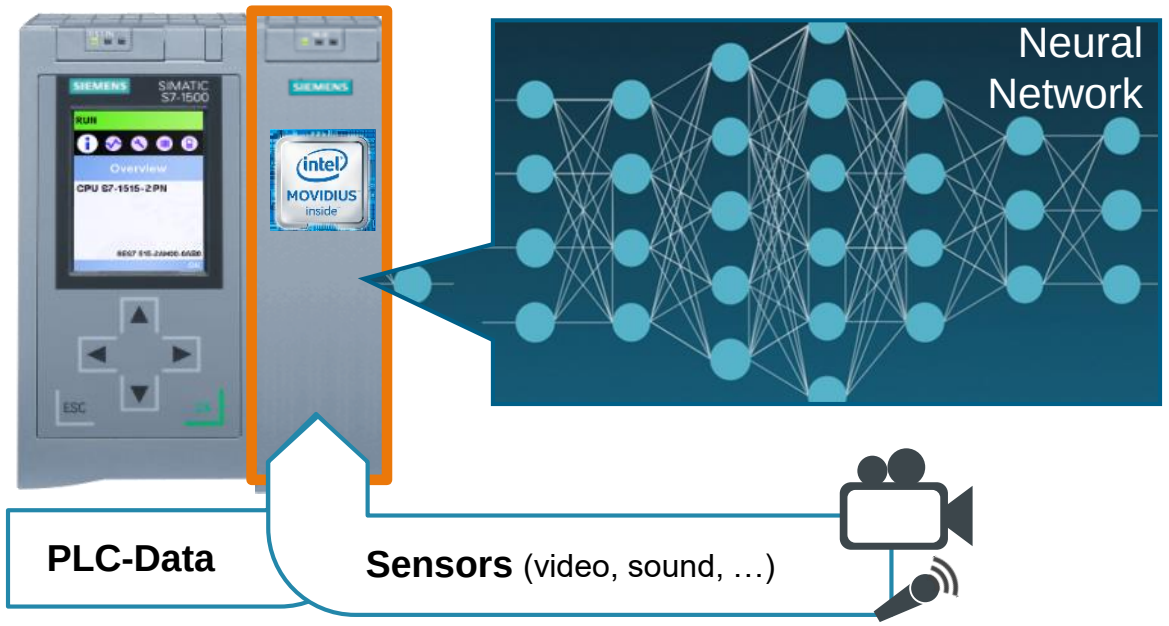
→ **Objective:**
Automized Usage of AI Algorithms in an industrial environment

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Artificial Intelligence in the SIMATIC world
Introduction to the TM NPU

A new module for the S7-1500 / ET 200MP:

S7-1500 TM **NPU**
(**N**eural **P**rocessing **U**nit)



“(Artificial) neural networks are computing systems vaguely inspired by the biological neural networks that constitute (animal) brains.

Such systems "**learn**" to perform tasks by considering examples, generally without being programmed with any task-specific rules.”*

Transfer of human expertise to the machine through training

*source: Wikipedia

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References:
Siemens Manufacturing

PCB cutting machine

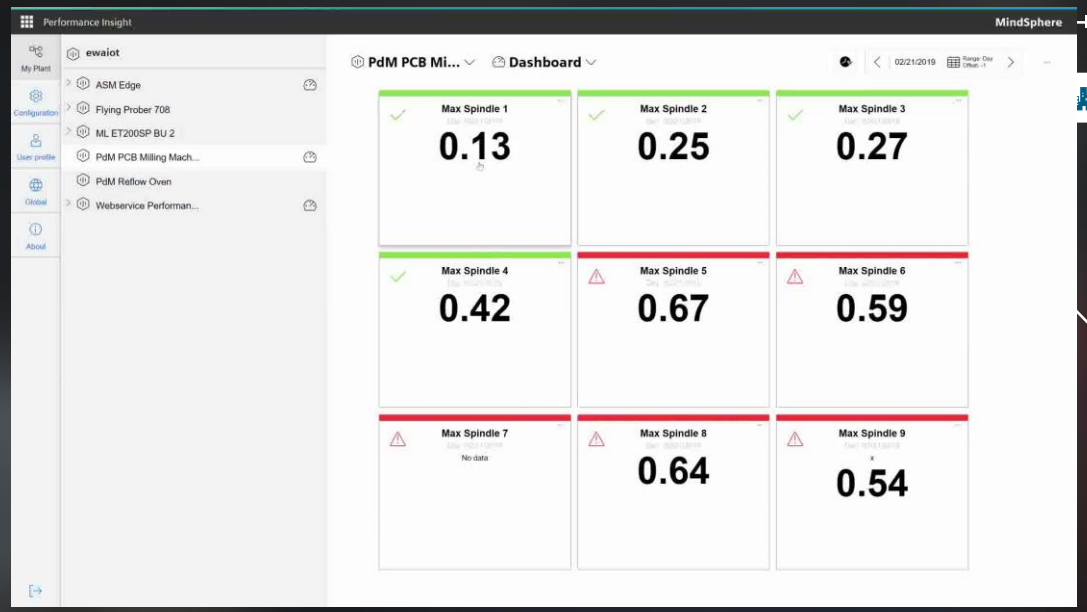
Siemens Electronics Factory
Amberg, Germany

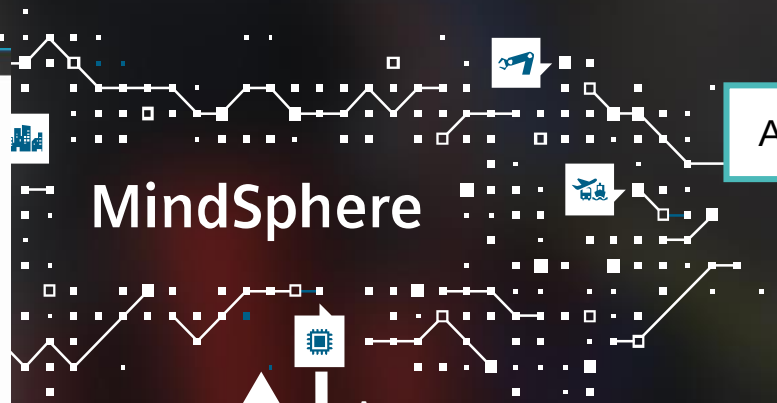
The challenge



Aggressive milling dust causes drive bearing to get stuck

Non production critical level





AI

Training
of Algorithm

Smart Data
Transfer

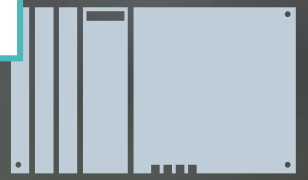
App
Deployment/
Update

Proxy

Production critical level

Anomaly detection
for Predictive maintenance

AI



Edge Device

Machine data



PCB cutting machine

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AI predicts spindle maintenance for PCB cutting machine up to

2 days
in advance

Reducing preliminary spindle failures of this type by

100%

Total calculated savings for 18 machines

200k€
p.a.



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X-ray-based PCB quality assurance

Siemens Electronics Factory Amberg, Germany

Challenge

Production output of SMT line limited by time consuming X-ray Quality tests

Every further X-ray machine requires additional invest of €500,000

Non Production Critical Level

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AI
Training of Algorithm

MindSphere

App Deployment/Update

Continuous data storage

Proxy

Production Critical Level

Captured Data

Real time capturing of >40,000 production parameters

Peak volume of 10 MB/s

AI
PCB Quality Prediction Algorithm

Edge Device

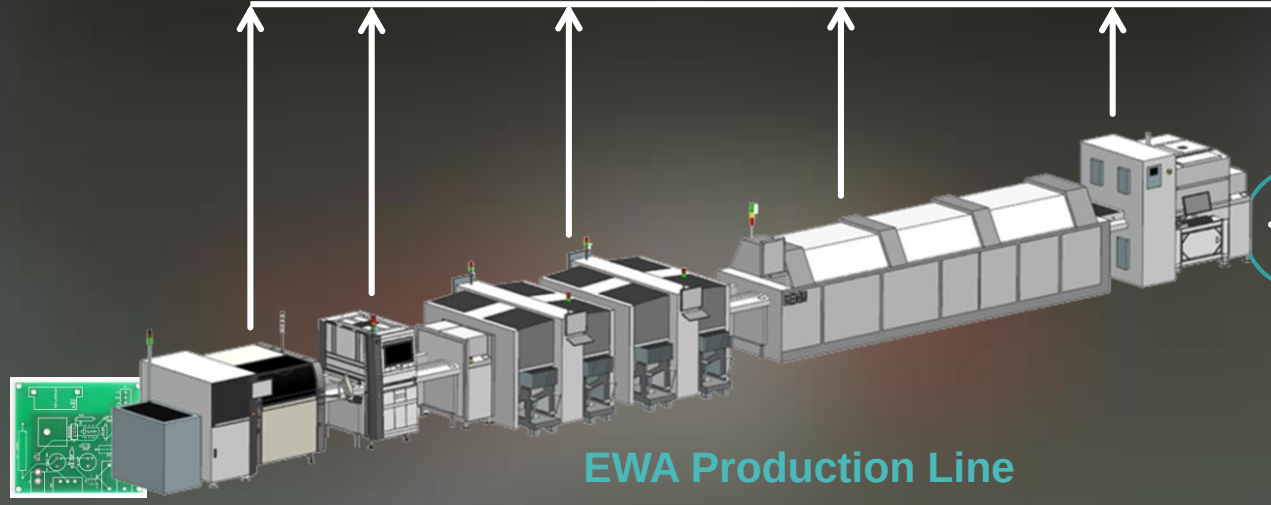
X-RAY Testing necessary?
YES or NO

X-RAY

No X-Ray

Assembly line

Manufacturing Execution System



EWA Production Line

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Minimization of necessary X-ray tests by up to

30%

Quality rate of

100%

Reduced capital invest for further X-ray machines of

€500,000