



Solid, rapid and efficient adoption of Data, AI & Robotics applications in production

## **SolidAIR Training programme Phase 2: AI Fundamentals**

### **AI Fundamentals for Industrial Manufacturing**



**Funded by  
the European Union**

- **After this workshop you will:**
  - Understand basic AI technologies
    - Get an overview of the key AI technologies and concepts
  - Learn how machine learning works
    - Understand the principles and steps behind machine learning
  - Explore industrial AI applications
    - See real-world examples of AI in manufacturing and industry.
  - Understand the role of data in AI systems
    - Learn why data is essential and how it powers AI solutions.

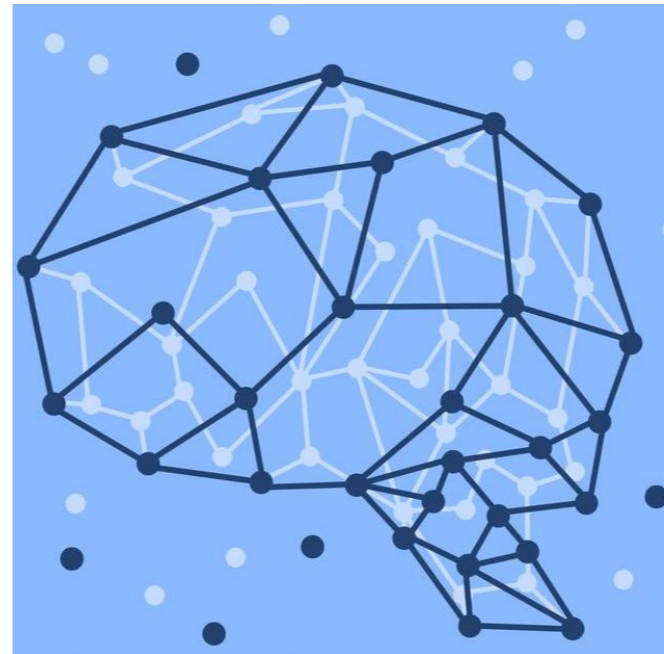


## Artificial Intelligence (AI) means:

Computers that can learn, recognize patterns, and make decisions – similar to humans.

## What AI can do:

- Recognize patterns
  - e.g. detecting defects in production
- Analyze large amounts of data
  - Faster than any human
- Support decision-making
  - Suggesting optimal actions
- Detect anomalies
  - Spotting problems before they happen



## Artificial Intelligence

*[,äɪ-tə-'fi-ʃəl in-'te-lə-jən(t)s]*

The simulation of human intelligence by software-coded heuristics.

Most AI systems are based on Machine Learning

→ They improve automatically by learning from data

## Key AI technologies include:



### Machine Learning (ML)

Systems that learn from data and improve over time



### Computer Vision

AI that interprets and analyzes images or video



### Natural Language Processing (NLP)

Understanding and generating human language



### Robotics & Automation

Intelligent systems that automate physical tasks



## Most common AI technologies in industry

In modern manufacturing environments, widely used technologies are:

✓ Machine Learning

✓ Computer Vision

### because they enable:

- ✓ predictive maintenance
- ✓ automated quality inspection
- ✓ process optimization
- ✓ real-time monitoring





Machine Learning allows computers to **learn patterns from data**.



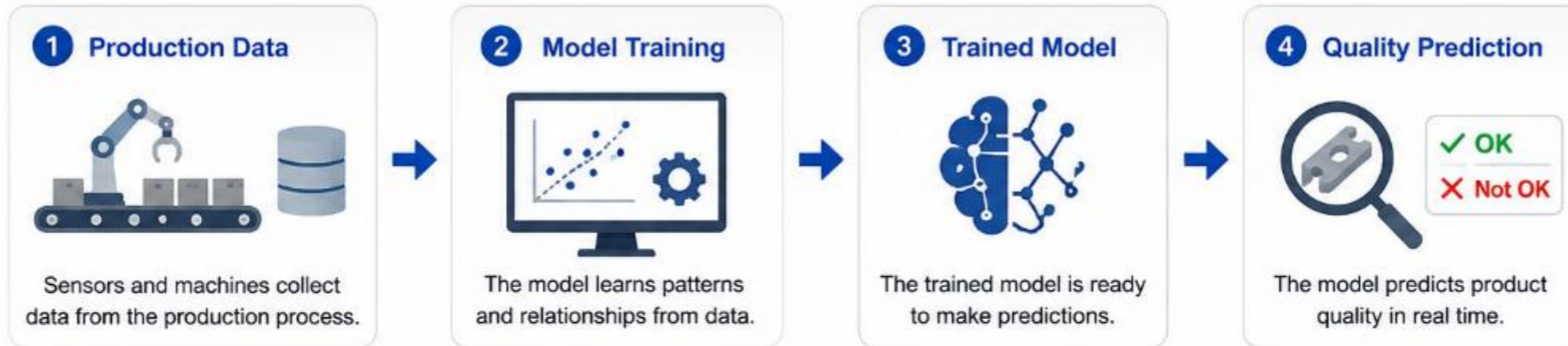
Instead of programming rules manually, **models learn from examples**.



Machine Learning helps systems make **better predictions** and decisions.

## Example:

Production data → Model training → Quality prediction



## Key Idea:

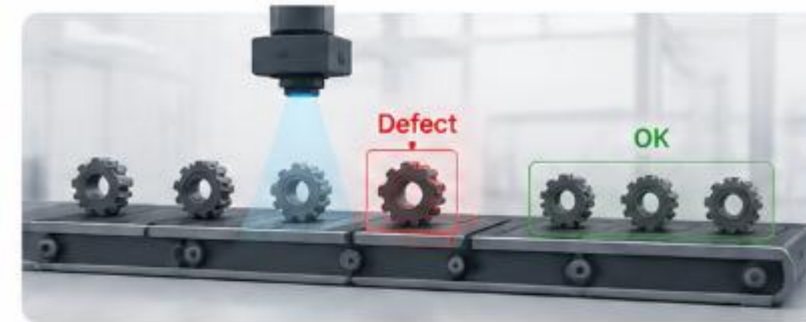
Instead of following fixed rules, the system **learns from data** and improves over time.



## 1 Supervised Learning

- Models learn from labelled data.
- Used for prediction and classification tasks.

**Example:** Detecting defective products.



## 2 Unsupervised Learning

- Models identify patterns without labelled data.
- Used for clustering or anomaly detection.

**Example:** Anomaly detection in production data.



## 3 Reinforcement Learning

- Systems learn by interacting with an environment.
- Actions are rewarded or penalized over time.

**Example:** Robot control optimisation.



**Key Takeaway:** Different ML types solve different problems – choose the right approach for your use case.



Computer Vision allows machines to **interpret images and videos**.

Typical industrial applications:



**Defect Detection**



Automatically detect defects in products or components.



**Quality Inspection**



Ensure product quality and consistency in real time.



**Object Recognition**



Identify and classify objects in images or video streams.



**Robot Guidance**



Guide robots to pick, place or assemble with precision.



## AI enables robots to:

- Recognise objects
- Interact safely with humans
- Adapt to changing environments



## Applications:

- Collaborative robots (cobots)
- Automated assembly
- Material handling



### Collaborative Robots (Cobots)



AI helps robots work safely alongside people and adjust to their actions.



### Automated Assembly



AI improves precision and quality by adapting to variations in real time.



### Material Handling



AI enables robots to navigate and handle materials efficiently.



**Key Benefit:** AI makes robots smarter, safer and more flexible – increasing productivity and reducing downtime.



AI systems require large amounts of data.



Typical industrial data sources:

- Sensors
- Production machines
- Cameras
- Manufacturing execution systems



Data quality is crucial for reliable AI models.



Sensors



Collect real-time data such as temperature, vibration, pressure, and more.



Production Machines



Provide operational data including performance, cycles, alarms, and downtime.



Cameras



Capture images and videos for inspection, monitoring and process control.



Manufacturing Execution Systems (MES)

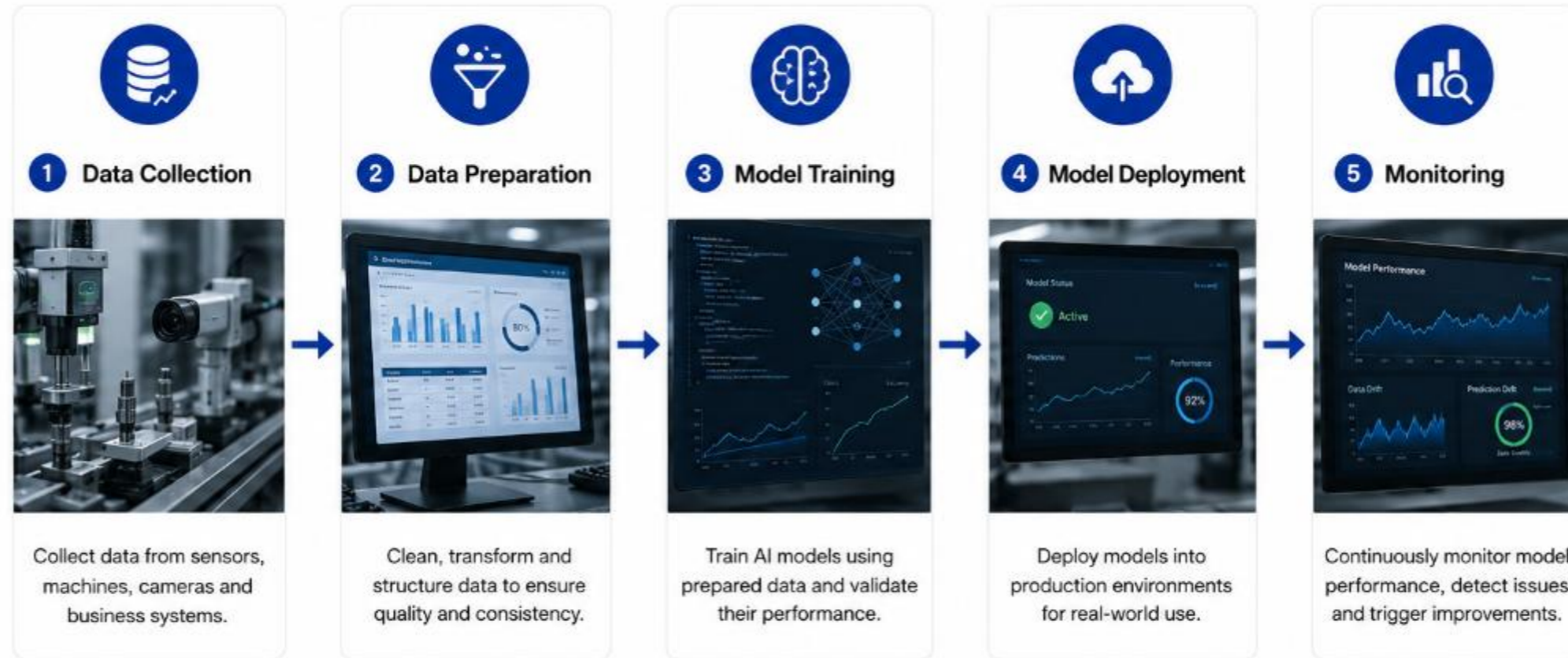


Provide production orders, quality records, traceability and process information.



**Key Takeaway:** High-quality, well-integrated data is the foundation for accurate predictions and smarter decisions.

## Typical AI pipeline:



**Key Takeaway:** AI systems require continuous data flow, model updates, and monitoring to stay effective.

## Predictive Maintenance



Sensor data from machines is **analysed** using **machine learning models**.



The system predicts potential failures **before** they occur.

### Benefits:

- Reduced downtime
- Lower maintenance costs

### 1 Data Collection



Sensors collect real-time data such as vibration, temperature, pressure and more.

### 2 Data Analysis with AI/ML



Machine learning models analyse patterns and detect unusual behavior.

### 3 AI Prediction



The system predicts potential failures before they occur.

### 4 Preventive Action



Maintenance teams take action in advance and prevent unplanned downtime.



### Reduced Downtime

Identify issues early and avoid unexpected machine breakdowns.



### Lower Maintenance Costs

Plan maintenance proactively and reduce unnecessary repairs.



### Improved Reliability

Increase equipment uptime and extend asset lifespan.

AI systems depend on:

1  **Data Availability**



AI requires sufficient and accessible data.

2  **Data Quality**



Poor-quality data leads to unreliable AI results.

3  **System Integration**



AI must integrate with existing production systems.

4  **Employee Acceptance**



Successful adoption depends on trust and acceptance.



**Key Takeaway:**



**Successful AI adoption requires both technical and organisational readiness.**

Important aspects include:

 <h3>Transparency of AI Systems</h3>  <p>AI decisions should be explainable and understandable to build trust and enable accountability.</p>	 <h3>Reliability of Predictions</h3>  <p>AI systems must produce accurate and consistent predictions that can be validated and monitored.</p>	 <h3>Safe Human-AI Interaction</h3>  <p>AI systems should be designed to support humans, ensure safety, and prevent harm in all operating conditions.</p>	 <h3>Data Protection</h3>  <p>Data privacy and security must be ensured throughout the AI lifecycle to protect sensitive information and comply with regulations.</p>
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 <h3>Key Takeaway:</h3>	 <p>Ethical and safe AI builds <b>trust, protects people and data, and ensures responsible innovation.</b></p>
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Which AI technologies could be useful in your production environment?

What types of data are currently collected?

What challenges might occur when implementing AI?

## 1. What is the main goal of Machine Learning?

- A) To manually program every rule
- B) To learn patterns from data
- C) To replace all factory workers

## 2. Which AI technology is mainly used for image inspection?

- A) Computer Vision
- B) Natural Language Processing
- C) Cloud Computing

## 3. What is an important requirement for successful AI systems?

- A) Random decision-making
- B) Large amounts of high-quality data
- C) No employee interaction

Next training phase:

## Phase 3 – Practical Experience

Participants will:



Work with AI Tools



Gain hands-on experience using modern AI tools and platforms.



Analyse Production Data



Learn to analyse and interpret production data to generate insights.



Explore Industrial AI Use Cases



Discover real-world AI applications that improve efficiency and quality.



Key Takeaway:



Hands-on experience helps transform AI knowledge into practical skills.

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Thank you for your attention!

