



7TH Edition



19-20-21 March 2025

ศูนย์ประชุมและแสดงสินค้านานาชาติตลิ่งชันมหาวิทยาลัย, ชลบุรี

www.automation-expo.asia

AI for Quality Control

Using AI to Improve Manufacturing Process

My Profile

- Tapanan Yeophantong (A. Tap)
- Full-time Lecturer at the Department of Design and Digital Innovation (DDI), Martin de Tours School of Management and Economics, Assumption University
- Co-founder & Research Director at Baksters
- Managing Director at Praram Nine Technology
- 20+ years experience in AI research



Topics

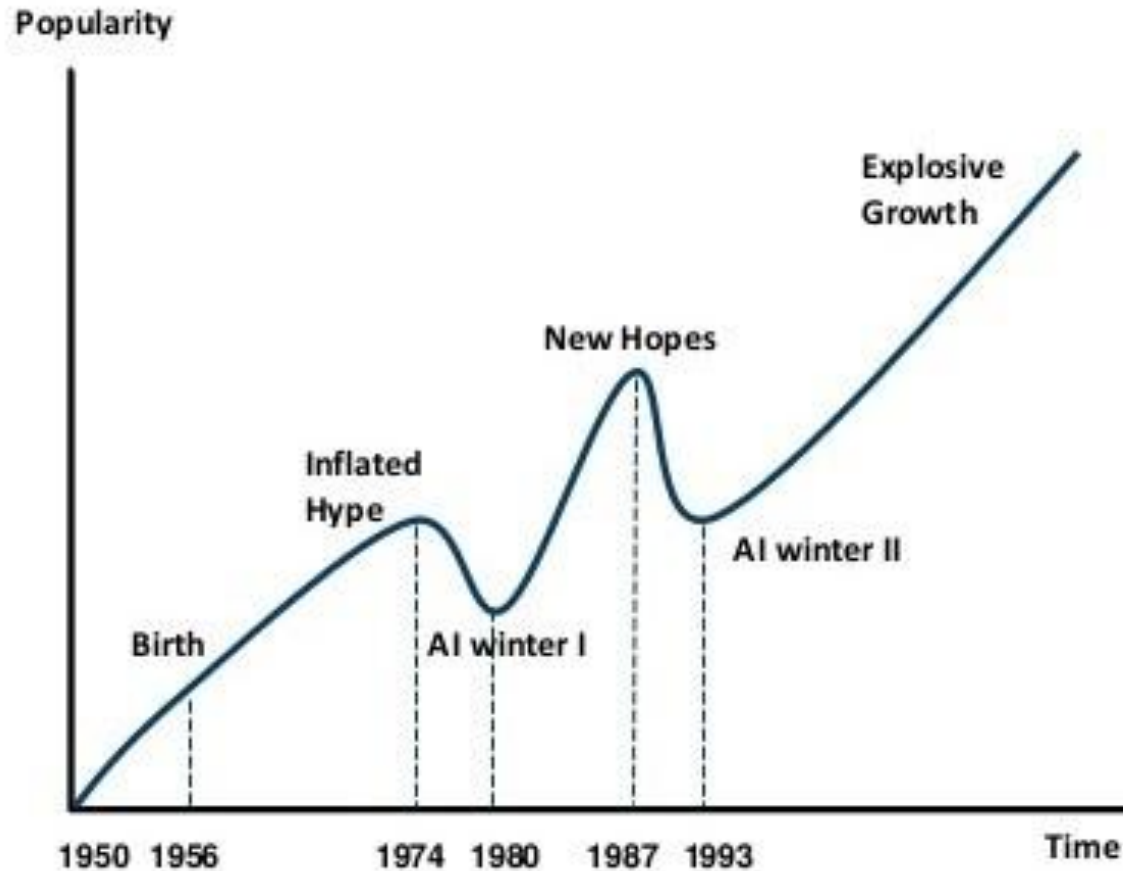
- A Correct Understanding of AI
- AI Transformation in Manufacturing
- Key Technologies for AI in Quality Control

A Brief History of AI

How has AI come to be?



AI HAS A LONG HISTORY OF BEING “THE NEXT BIG THING” ...

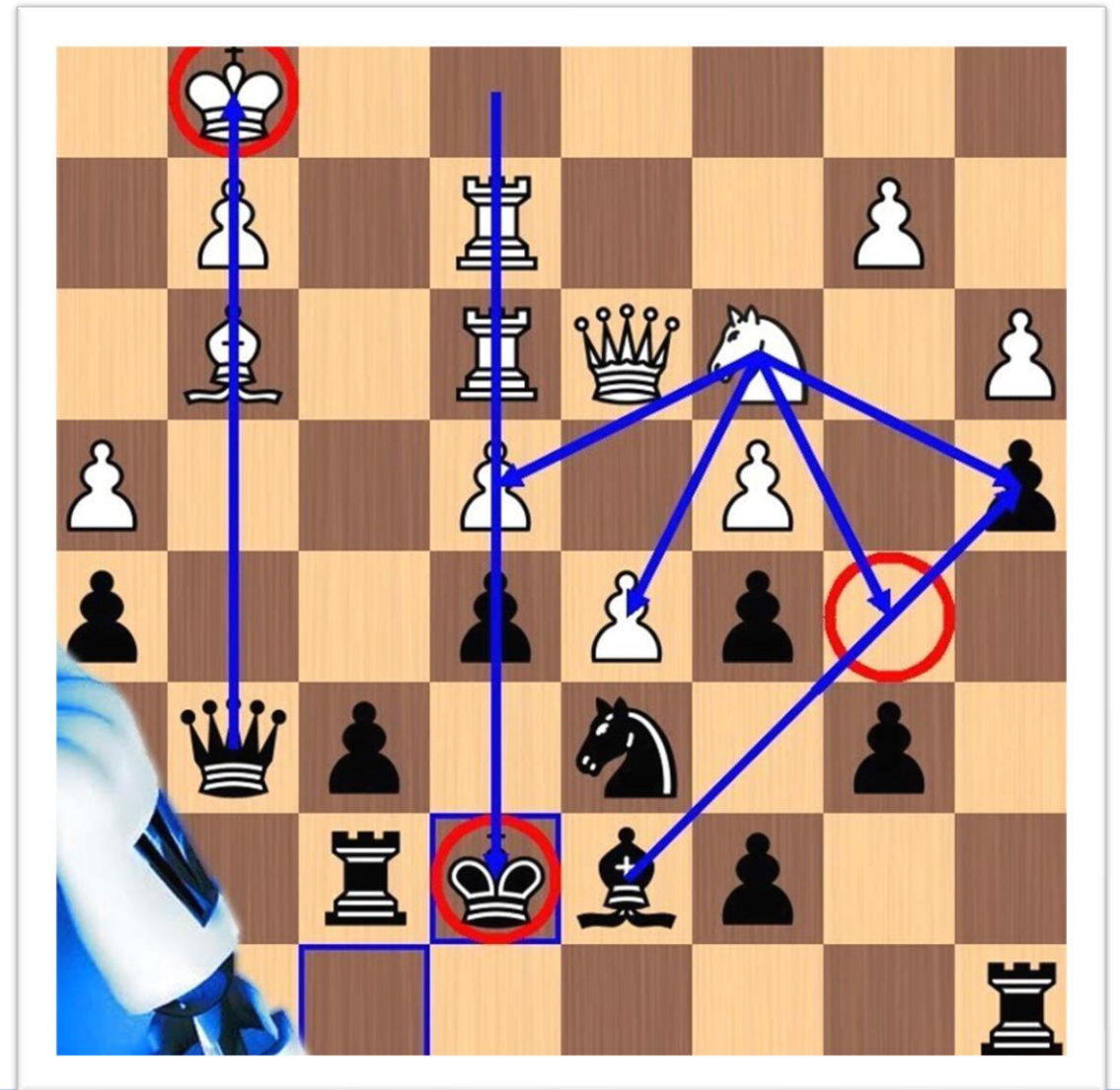


Timeline of AI Development

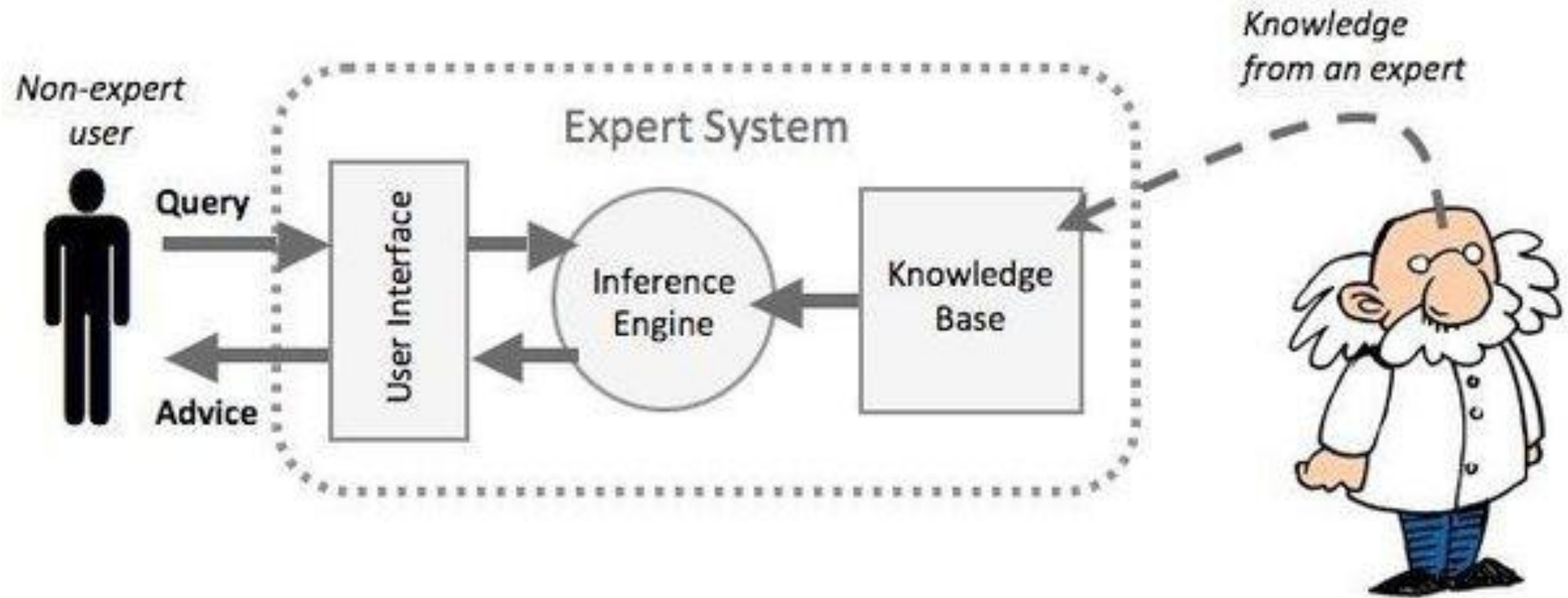
- **1950s-1960s:** First AI boom - the age of reasoning, prototype AI developed
- **1970s:** AI winter I
- **1980s-1990s:** Second AI boom: the age of Knowledge representation (appearance of expert systems capable of reproducing human decision-making)
- **1990s:** AI winter II
- **1997:** Deep Blue beats Gary Kasparov
- **2006:** University of Toronto develops Deep Learning
- **2011:** IBM's Watson won Jeopardy
- **2016:** Go software based on Deep Learning beats world's champions

Rule-based AI

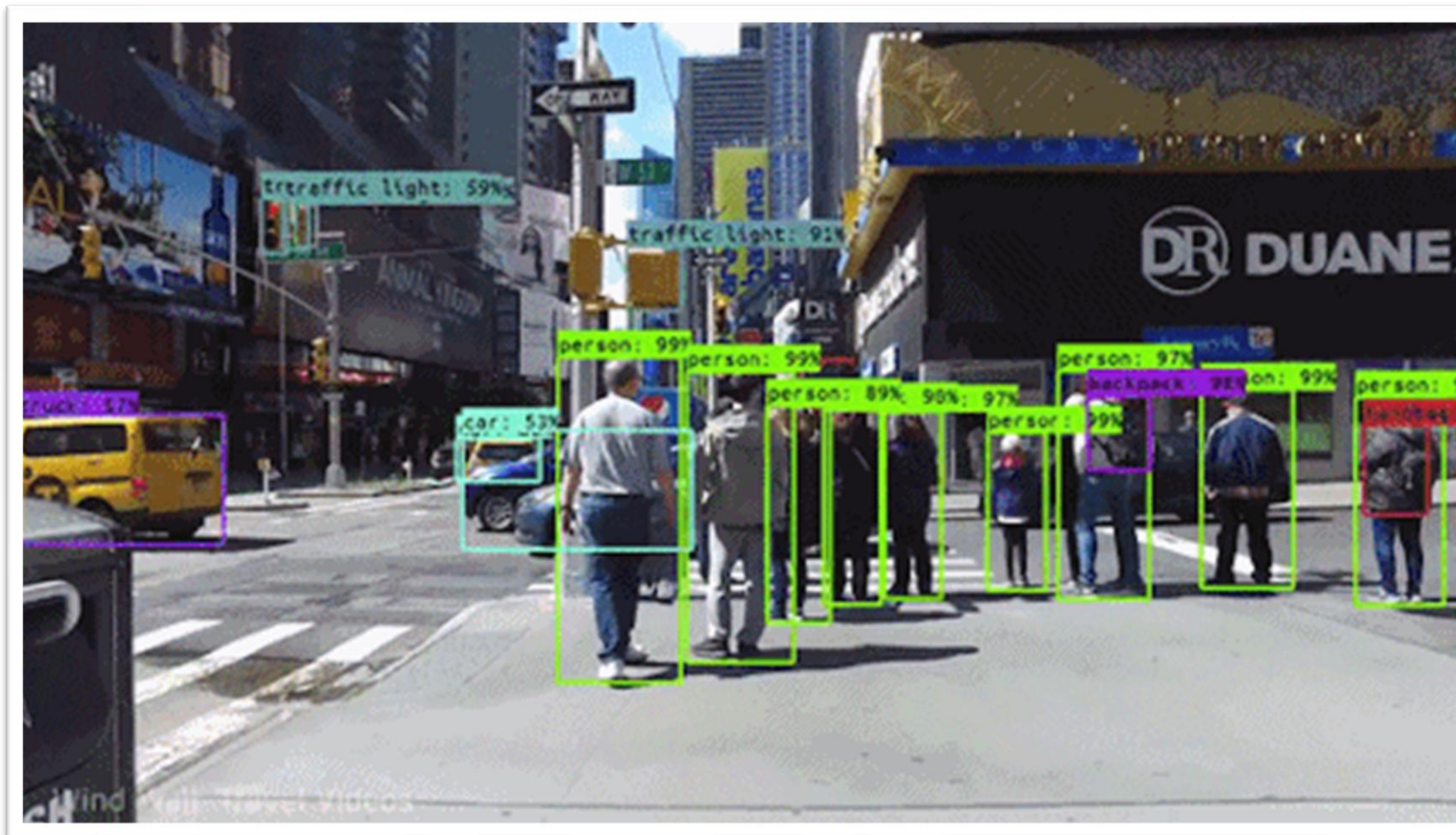
- AI systems were then based on IF-THEN rules hard-coded into the program.
- Key domains:
 - Chatbot
 - Games
 - Machine Translation



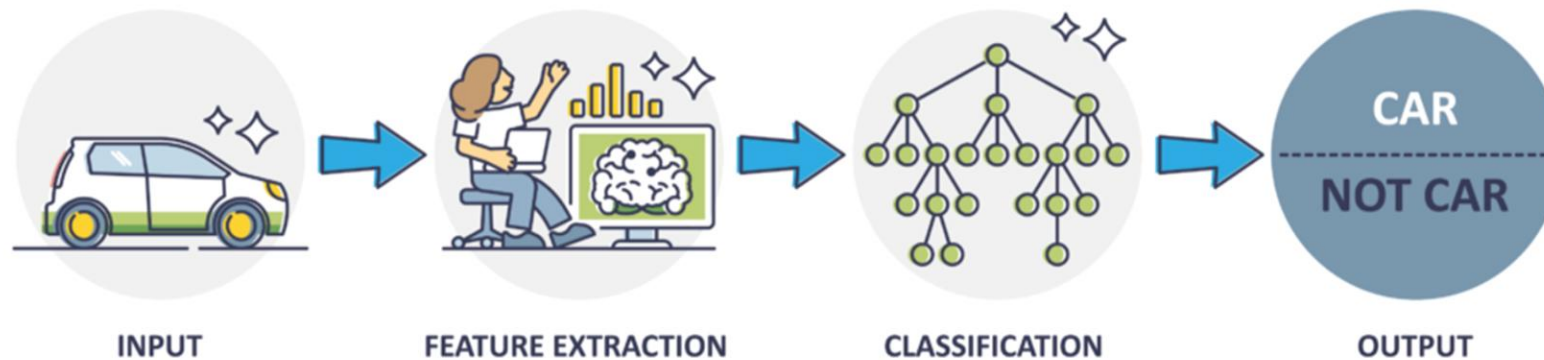
Expert Systems



Machine/Deep Learning



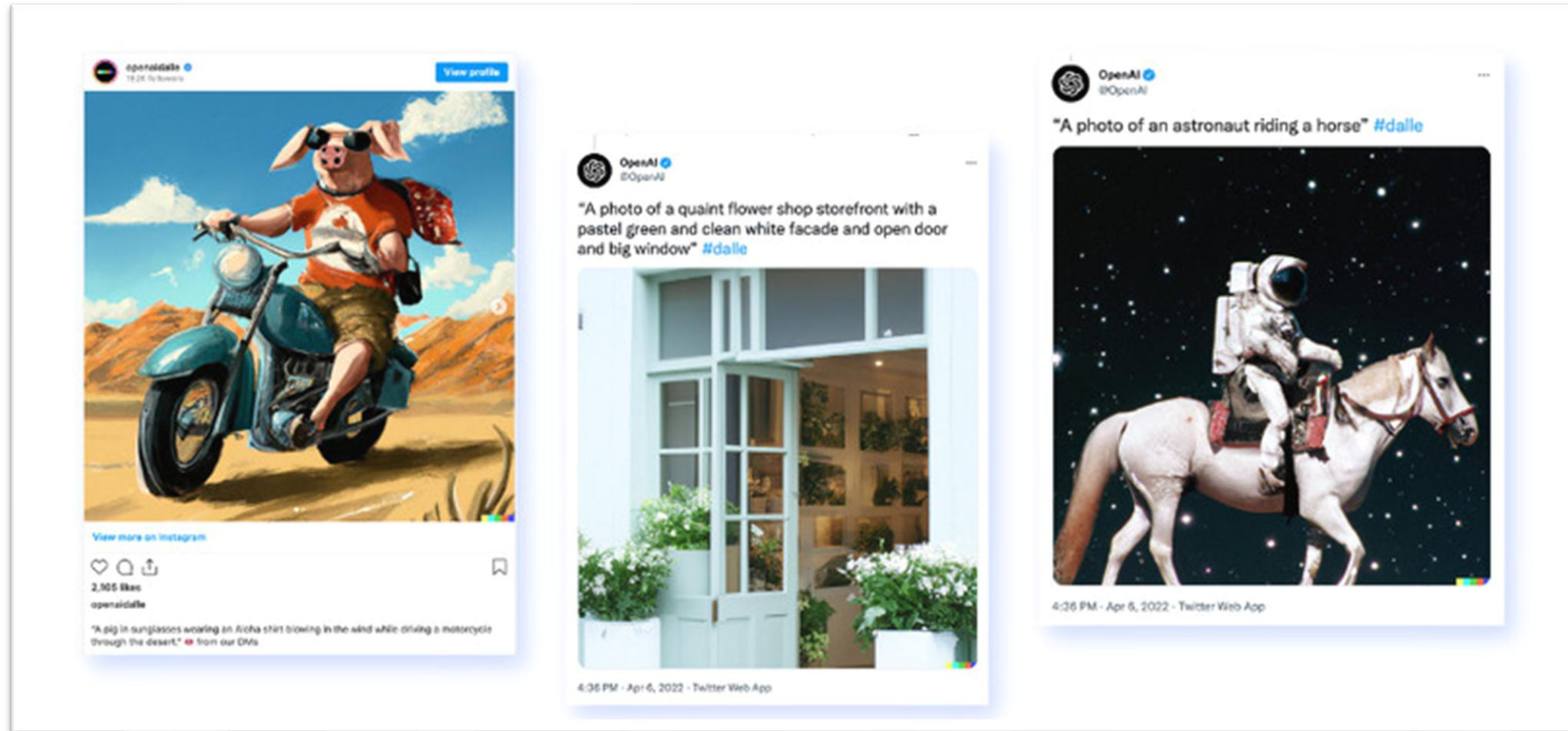
MACHINE LEARNING



DEEP LEARNING

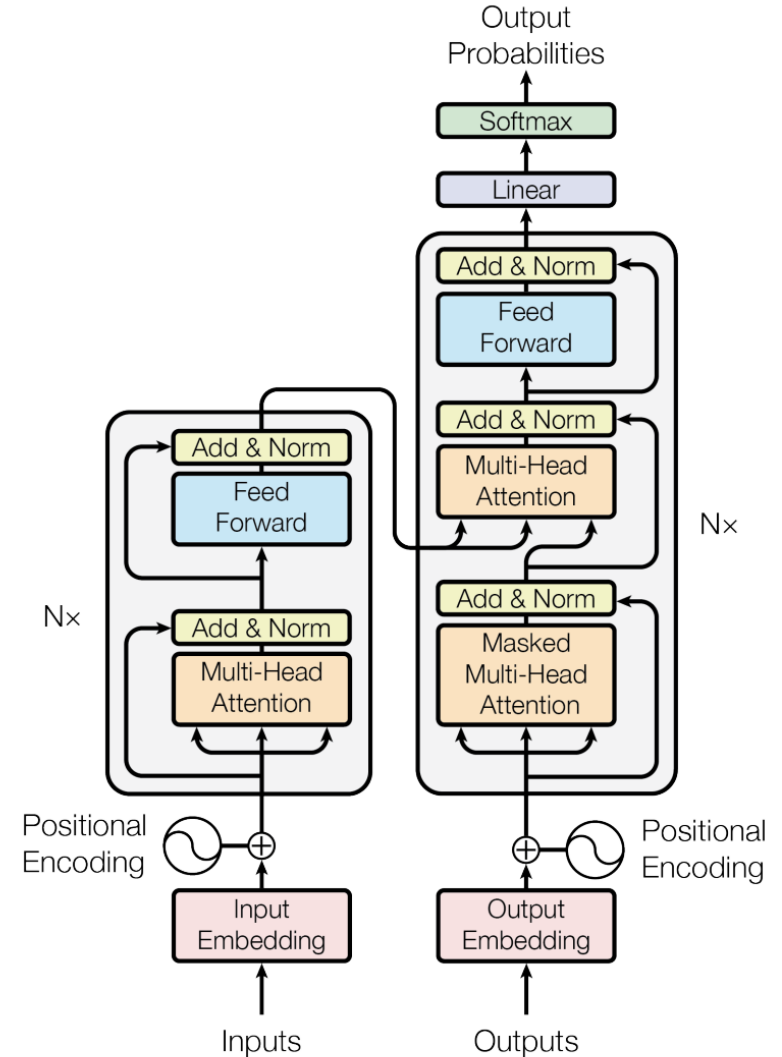


Generative AI



What about LLMs?

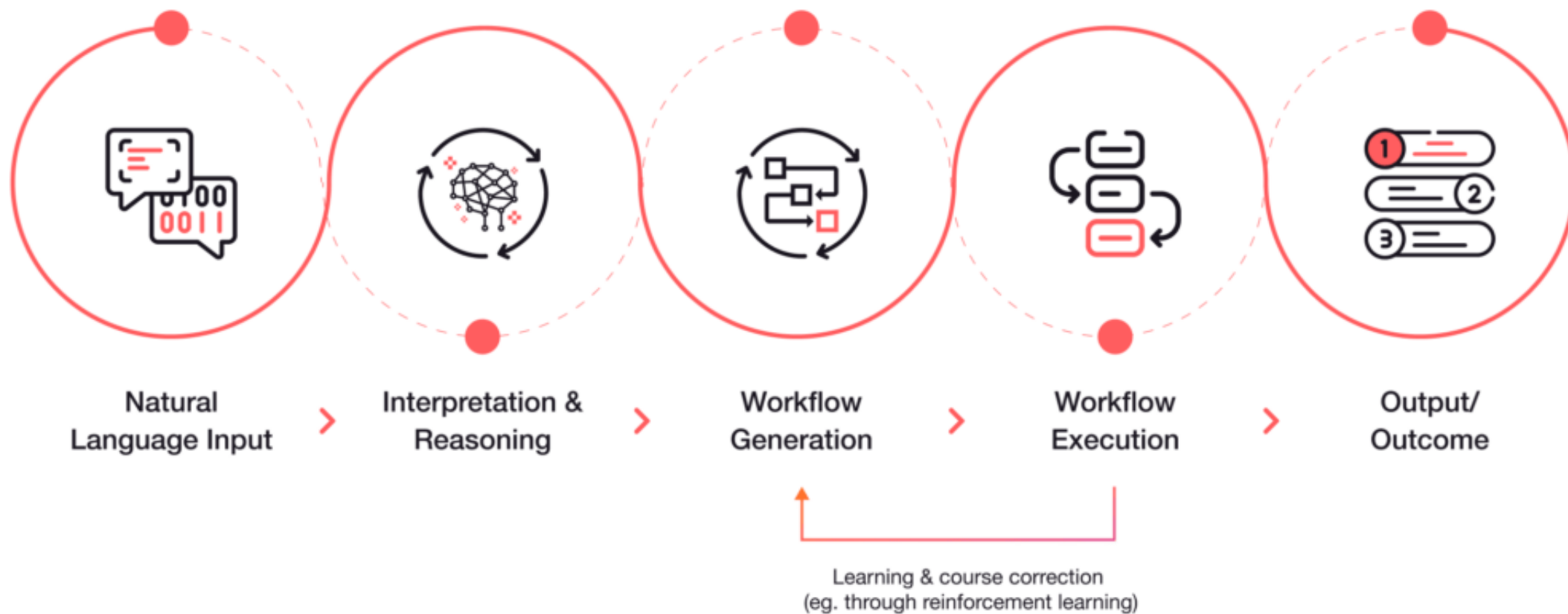
- LLMs, like other generative models, are built on advanced neural network architectures.
- However, they are specifically designed to process and generate natural language more efficiently.
- Common models:
 - Transformers (e.g. BERT, GPT)
 - Retrieval-Augmented Models (e.g. RAG)
 - Recurrent-Augmented Models (e.g. BigBird)



Summary of LLM Architectures

Architectures	Models	Use Cases
Transformers	GPT, BERT, RoBERTa	General-purpose NLP
Decoder-only Transformers	GPT, BLOOM, LLaMa	Text generation, chatbot
Encoder-only Transformers	BERT, RoBERTa, ALBERT	Text classification, retrieval
Encoder-decoder Transformers	T5, BART, Pegasus	Translation, summarization
Mixture of Experts	Switch Transformer, GLaM	Scaling of diverse tasks
Retrieval-Augmented Models	RAG, RETRO, GPT-4 w/ plugins	Domain-enhanced generation
Recurrent-Augmented Models	Longformer, BigBird	Long text understanding
Hybrid Architectures	ChatGPT, Claude	Chatbot

Agentic AI



Artificial Intelligence

AI involves techniques that equip computers to emulate human behavior, enabling them to learn, make decisions, recognize patterns, and solve complex problems in a manner akin to human intelligence.

Machine Learning

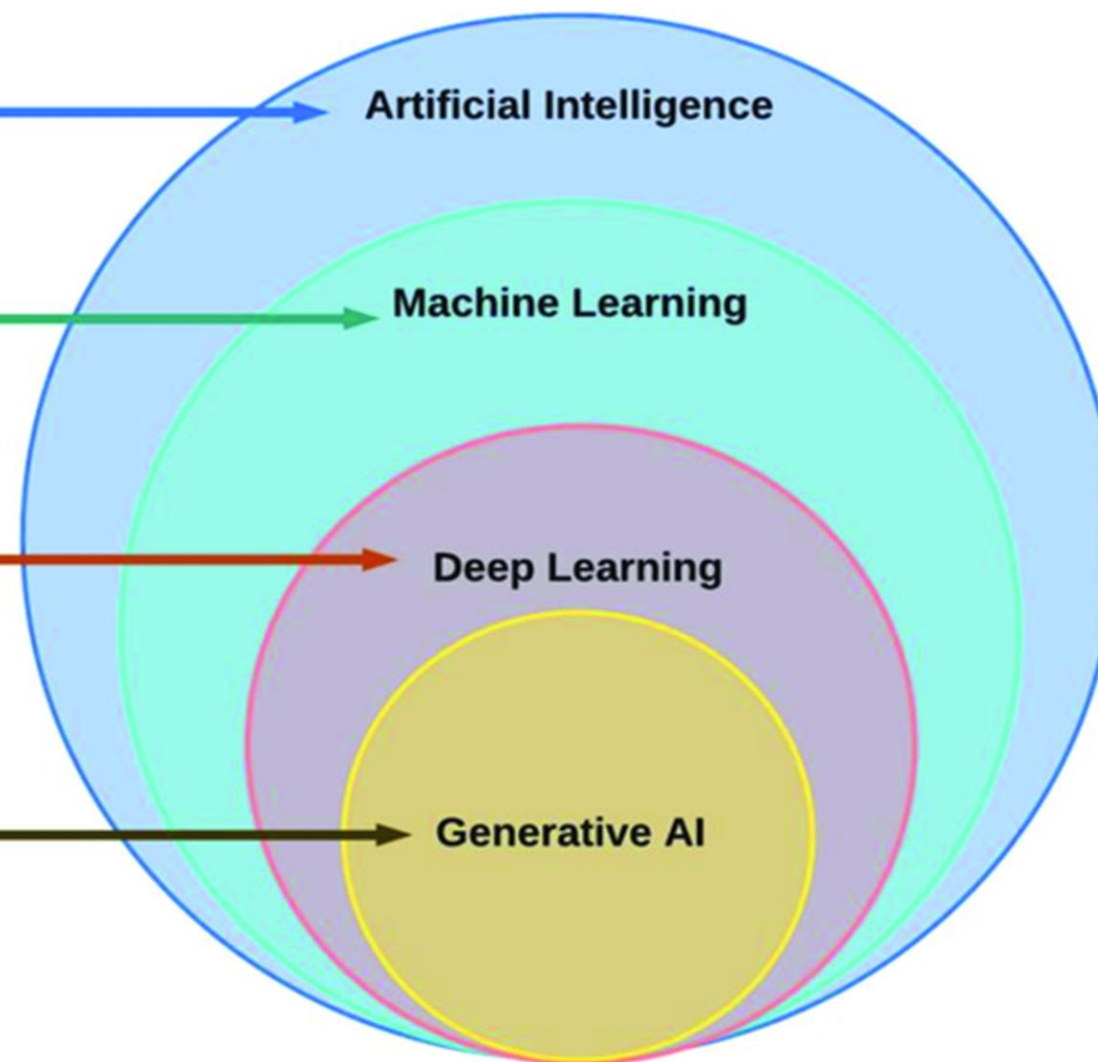
ML is a subset of AI, uses advanced algorithms to detect patterns in large data sets, allowing machines to learn and adapt. ML algorithms use supervised or unsupervised learning methods.

Deep Learning

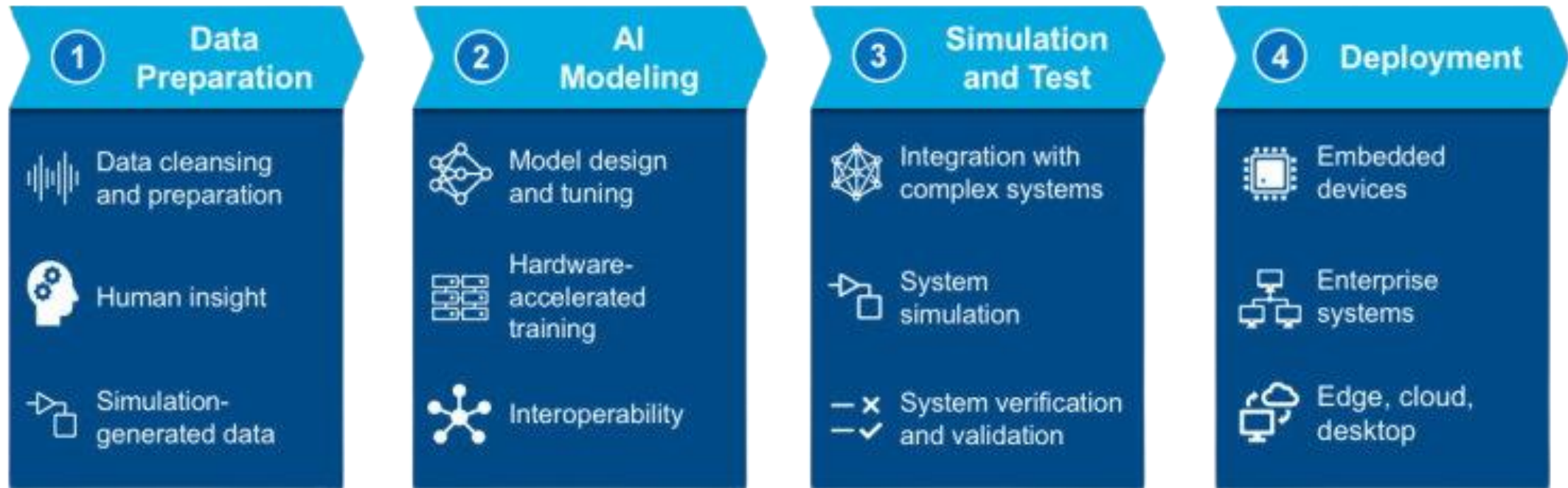
DL is a subset of ML which uses neural networks for in-depth data processing and analytical tasks. DL leverages multiple layers of artificial neural networks to extract high-level features from raw input data, simulating the way human brains perceive and understand the world.

Generative AI

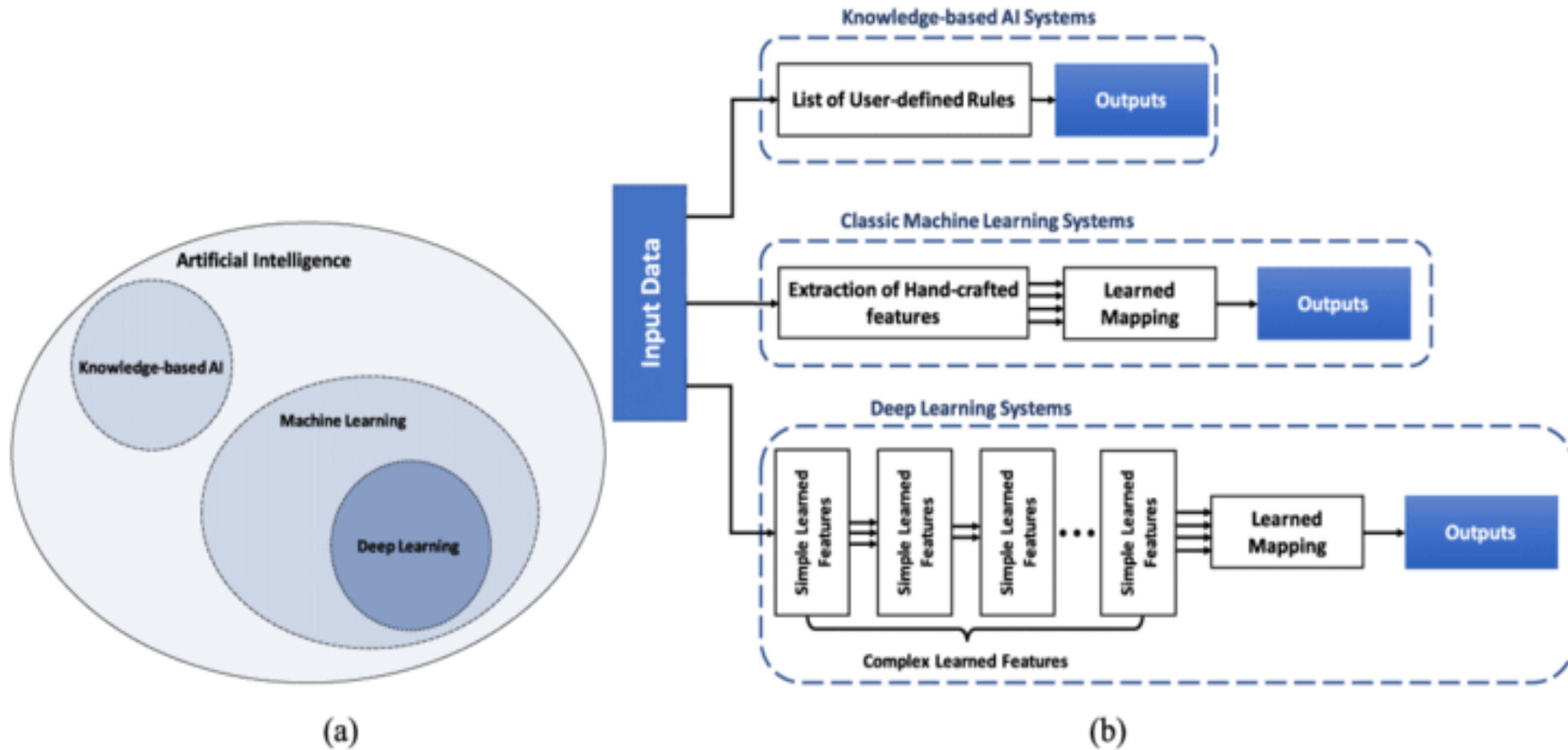
Generative AI is a subset of DL models that generates content like text, images, or code based on provided input. Trained on vast data sets, these models detect patterns and create outputs without explicit instruction, using a mix of supervised and unsupervised learning.



AI Engineering Process



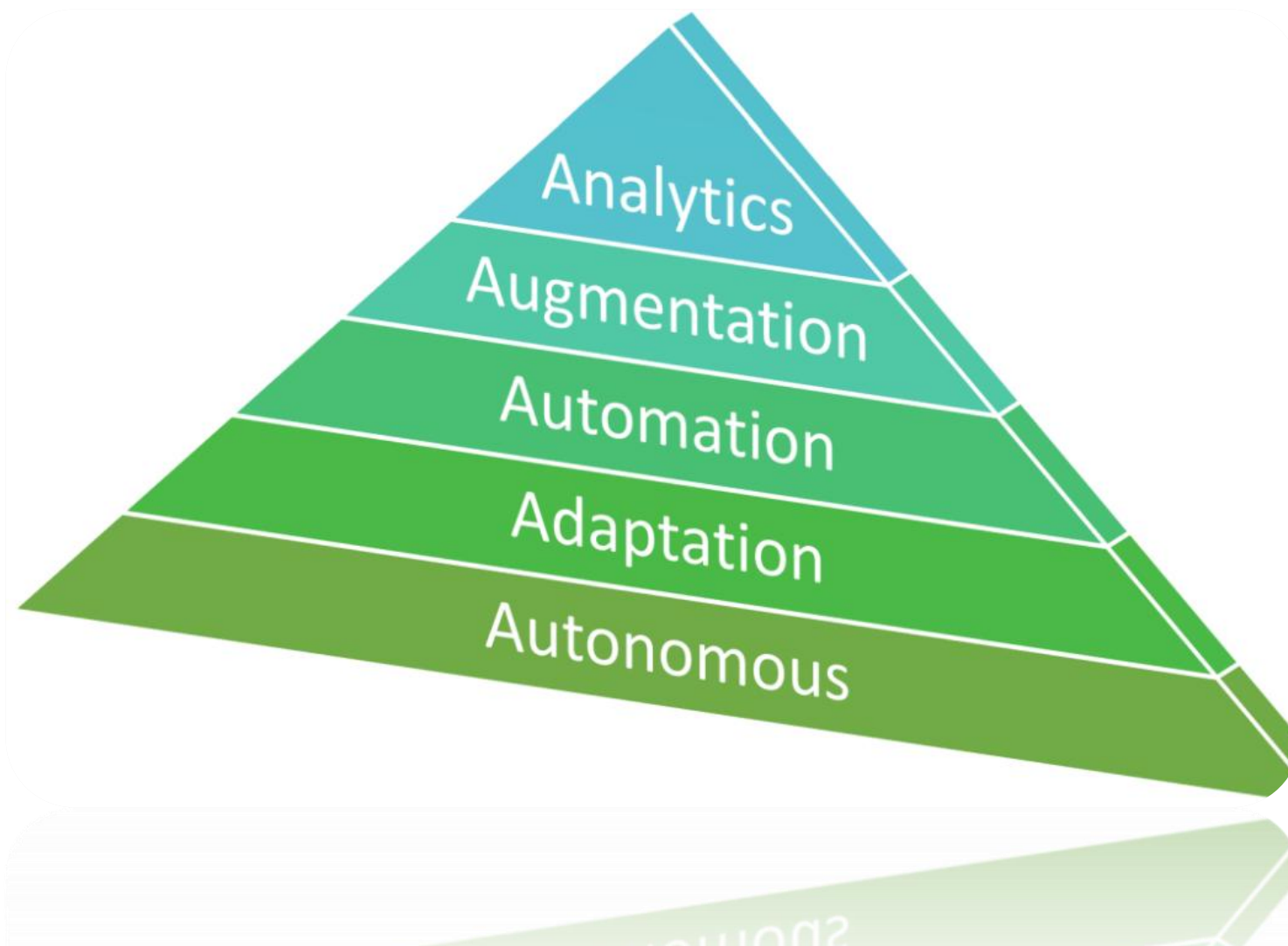
AI “Problem-Solution Fit”



Topics

- A Correct Understanding of AI
- **AI Transformation in Manufacturing**
- Key Technologies for AI in Quality Control

5A's of AI



INDUSTRY USE CASES FOR GENERATIVE AI IN MANUFACTURING



Generative AI's ability to predict patterns through data and augment existing analytics leads to numerous use cases for manufacturers:



**AI-Driven Product
Design and
Development**



**Machine
Automation and
Optimization**



**Customer
Acquisition and
Relationship**

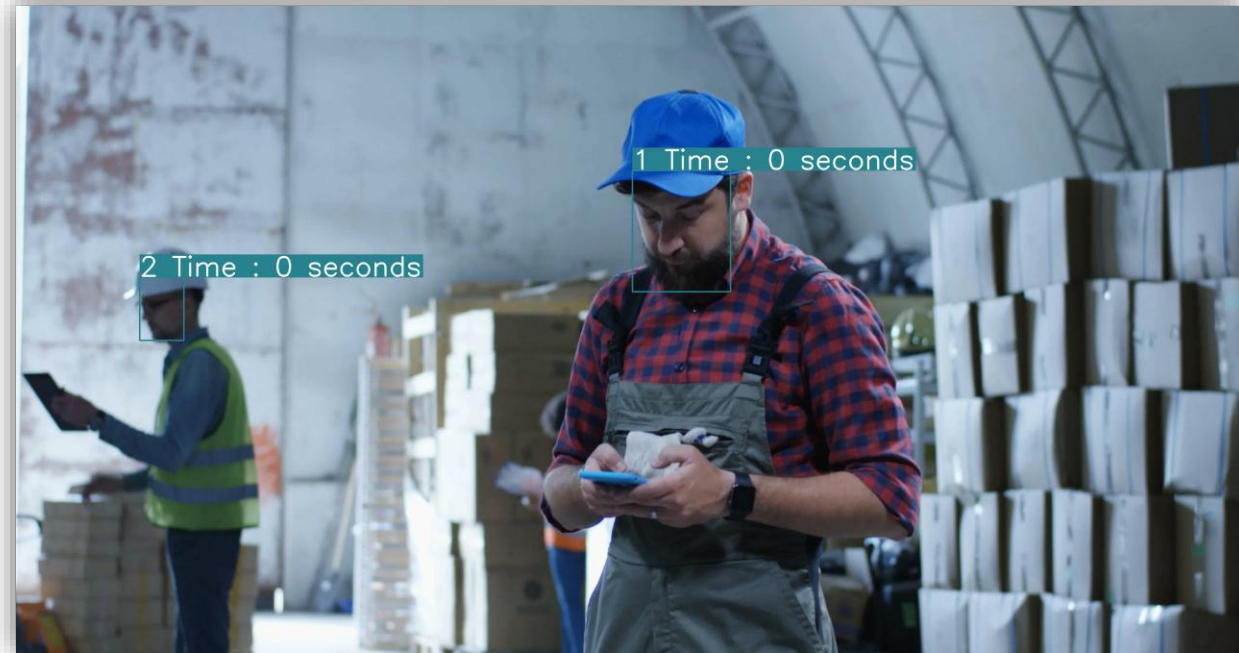
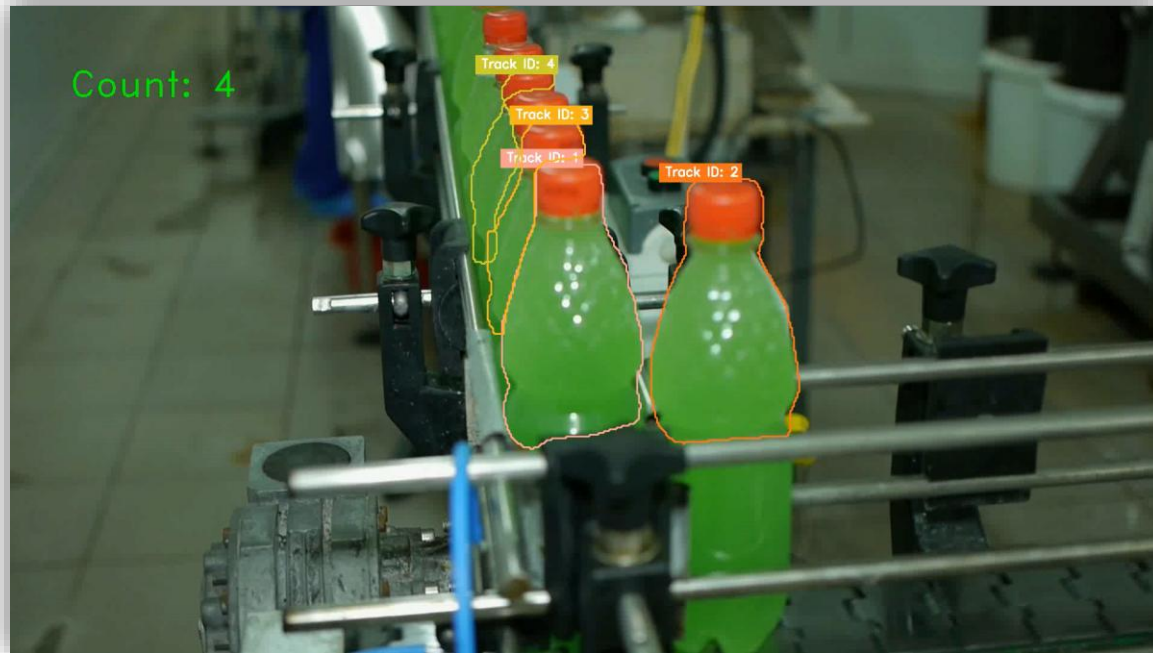


**Better
Quality
Control**



**Predictive
Maintenance**

Process Optimization



Back

Save

Measurement Name

PID20250228_PB8S_E001

Process Name

Packing Items (B_01)

Operator Name

U_001

Videos List

Add New Video

Cycle4.mp4

1 Mar 2025

Total Clips: 0/5

Cycle3.mp4

1 Mar 2025

Total Clips: 5/5

Cycle2.mp4

1 Mar 2025

Total Clips: 5/5

Cycle1.mp4

1 Mar 2025

Total Clips: 5/5

Open Report

Start Processing

Back

Save

Clipping: Step 5

Cycle4.mp4

1

2

3

4

5

0:27 0:31

No. of Steps List

Step	Description	Value	Category
1	Pick the box		
2	Collect items to pack		
3	Pack the items in box		
4	Seal the box		
5	Place on delivery shelf		

Add New Step

Previous Step

Next Step

Back

Now Viewing: PID20250228_PB8S_E001

Measurement Summary

Measurement Report

Measurement Summary

Time Format: Sec

Process name: Packing Items (B_01)

Operator Name : U_001

Cycle Time (C/T) Analysis

Cycle	1	2	3	4	5	6	7	8	9	10
Total Duration	21.2	32	18.2	34.9	26.5	30.4	24.9	13.7	22.3	29

Minimum Cycle Time	13.7
Maximum Cycle Time	34.9
Cycle Time Fluctuation	21.2
Average Cycle Time	24.2

Cycle Time Per Step

Avg Min Max Fluct

Step 5: Place on delivery shelf

3.1	1.3	7.8	2.4	6.6
1	2	3	4	5

Overall Process Analysis

Avg Min Max

Duration Summary

VA (Value Added)

NVA (Non-Value Added)

NVA (Non-Value Added)

Previous Report

Next Report

TECHNOLOGY

FOR

AUTOMATION

EXPO 2025

19-20-21

March 2025

ศูนย์ประชุมและแสดงสินค้านานาชาติ

ณ ขอนแก่น

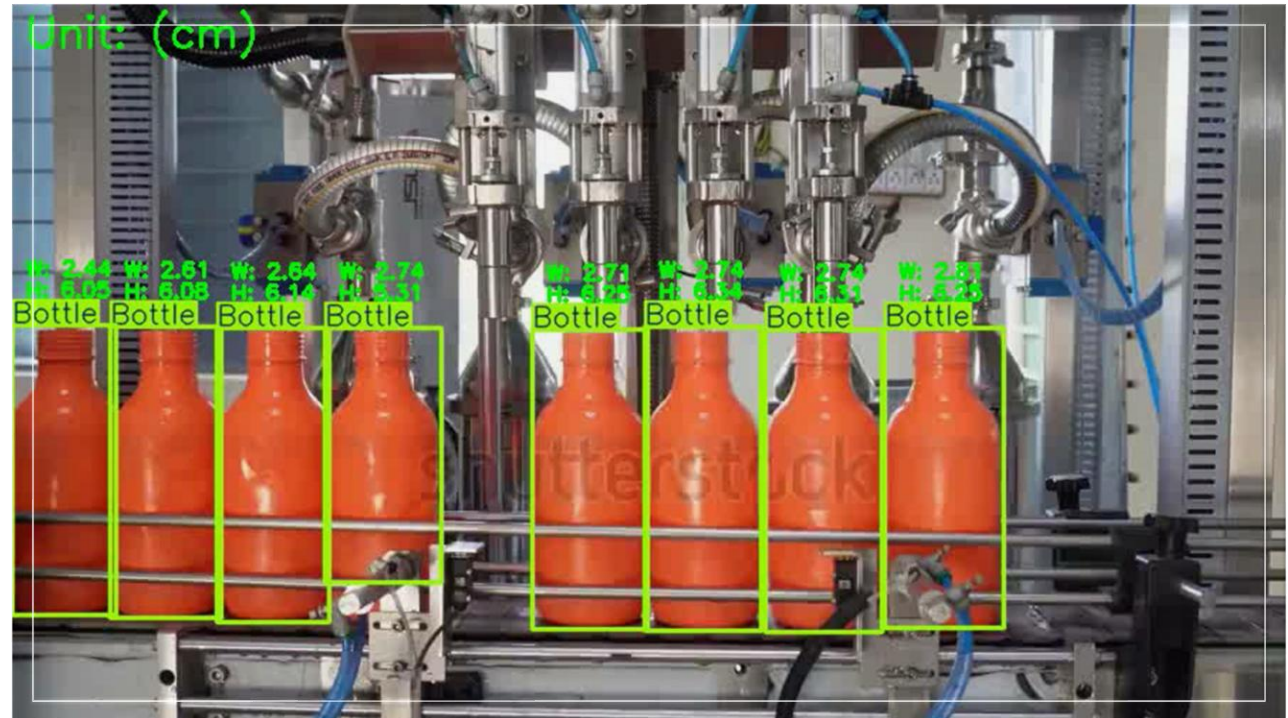
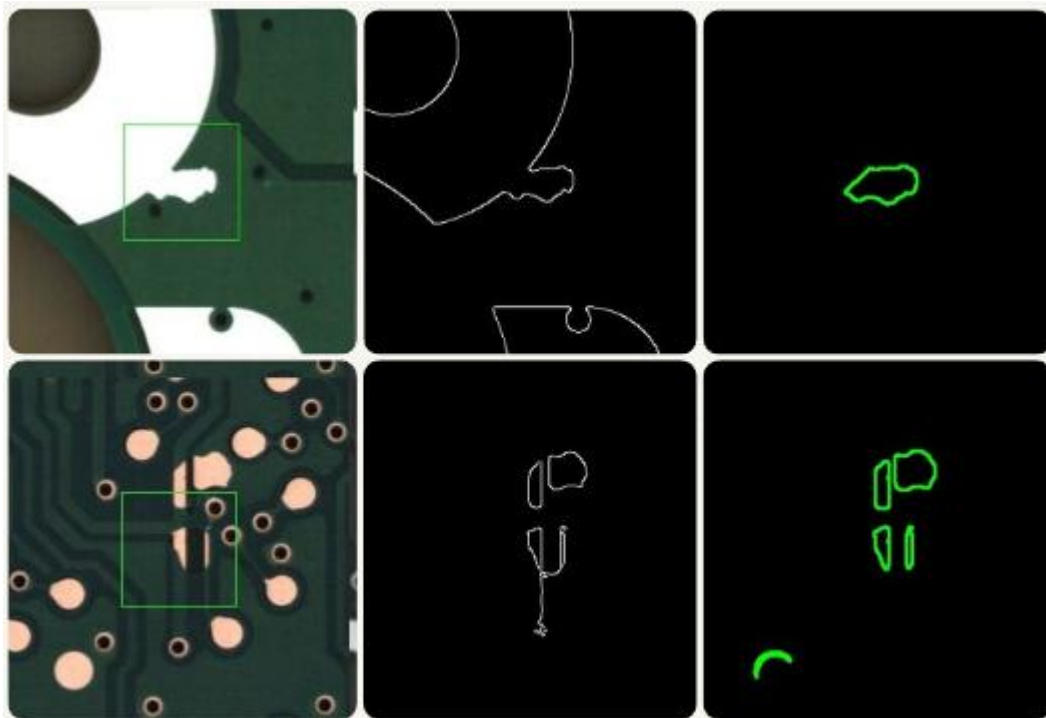
SMART

MANUFACTURING

Process Optimization

- **Product Design**
 - Explore design possibilities for components, structures, or products based on specified parameters and constraints.
- **Manufacturing Process**
 - Analyze production data to identify inefficiencies, and other areas for improvement in the production process.
- **Supply Chain**
 - Predict production demands to allow optimizing warehouse requirements, logistics and distribution networks.

Quality Control



Quality Control


- Analyze images and sensor data to automate the detection of anomalies, defects, and other deviations from quality standards in the delivered products.
- This helps factories to ensure product consistency, reduce scrap rates, and improve product quality.

Predictive Maintenance

FINALSCANUser_001 Admin

Finalscan | Panel Reader

< PRPID001



Select Image Data:

- 1. Panel_Indicator_1.jpg
- 2. Panel_Indicator_2.jpg
- 3. Panel_Indicator_3.jpg

Live Panel Status

7-segment	Light-switch 1	Light-switch 2
OK	NG	NG
Light-switch 3	Light-switch 4	Potential... 1
OK	OK	OK
Potential... 2	NG	

Predictive Maintenance

- Analyze sensor data from equipment to predict potential failures and maintenance needs before they occur.
- Factories can schedule preventive maintenance activities, minimize downtime, and extend equipment lifespan.

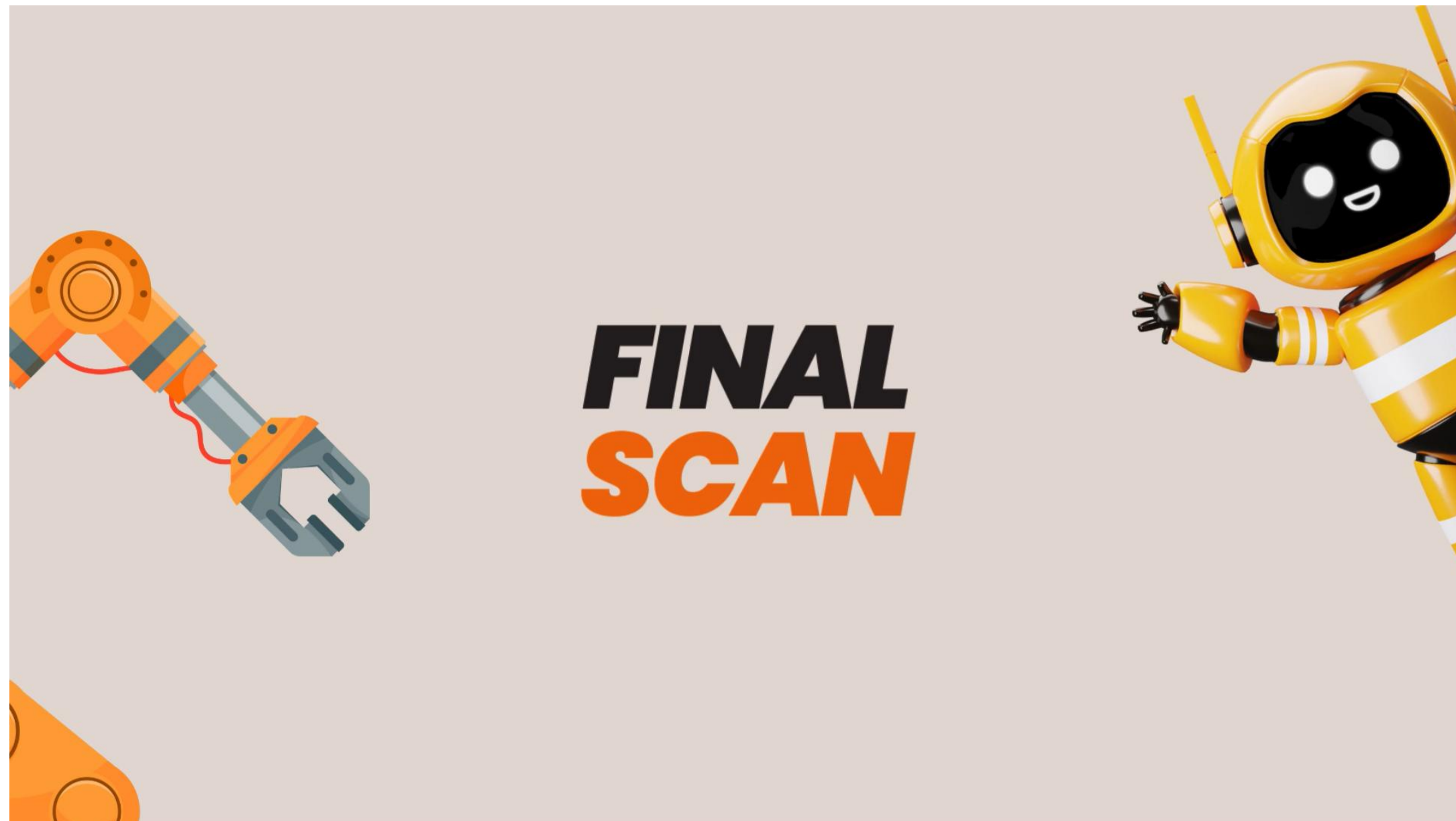


Topics

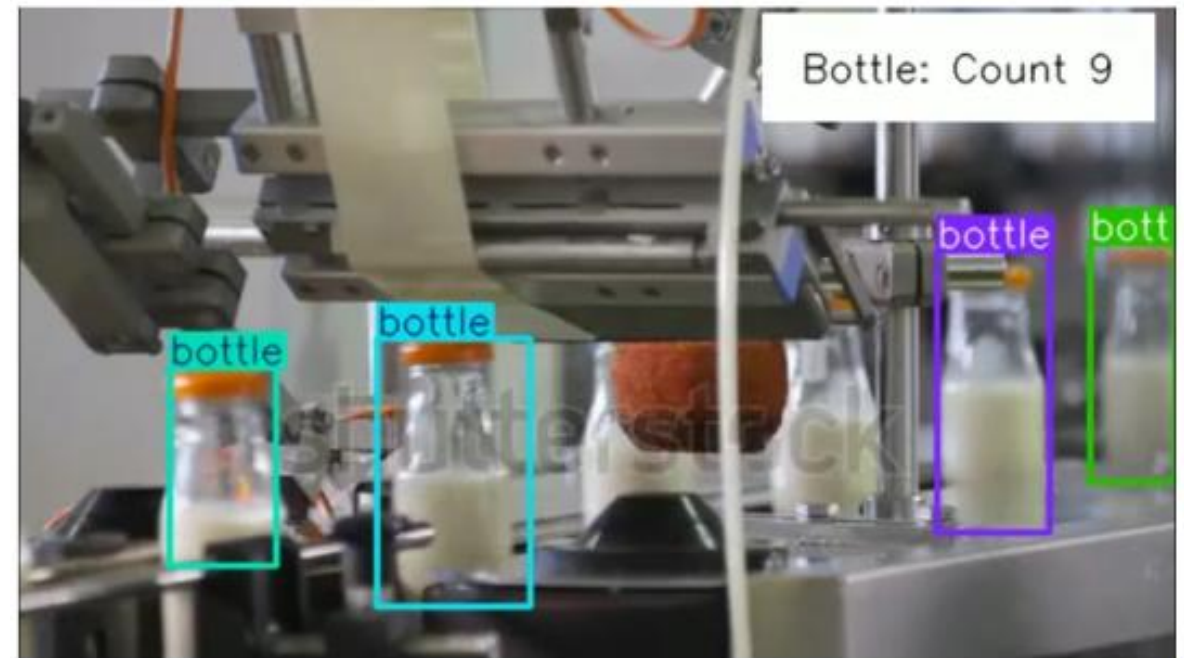
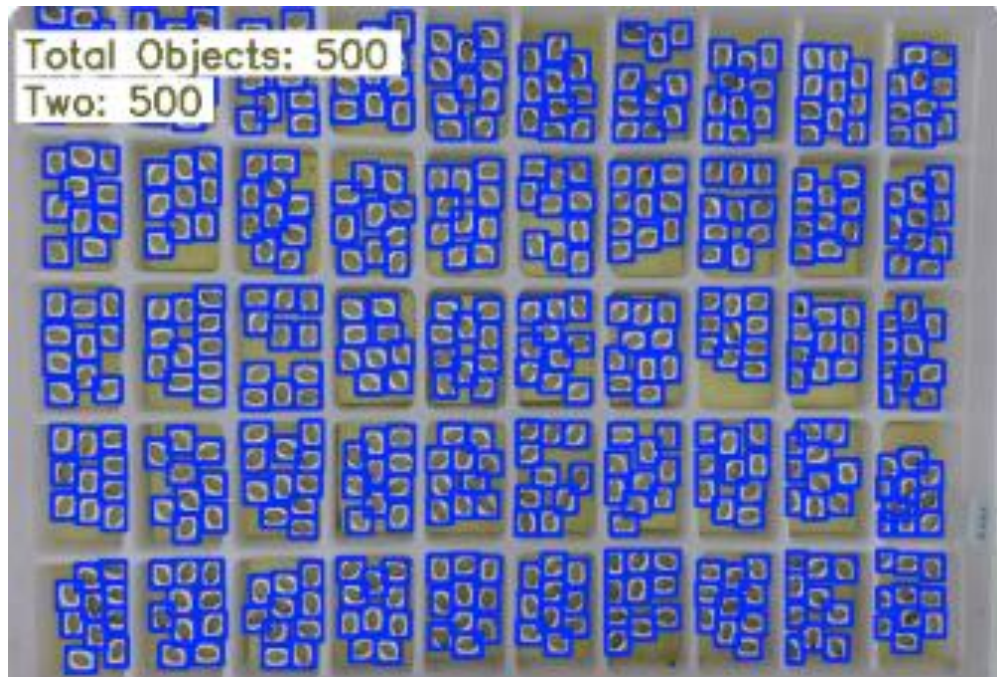
- A Correct Understanding of AI
- AI in Process Management & Monitoring
- Key Technologies for AI in Quality Control

Key Technologies

- Computer Vision
- Machine & Deep Learning
- Generative AI
- Edge AI & IoT Integration
- Robotic Process Automation (RPA)

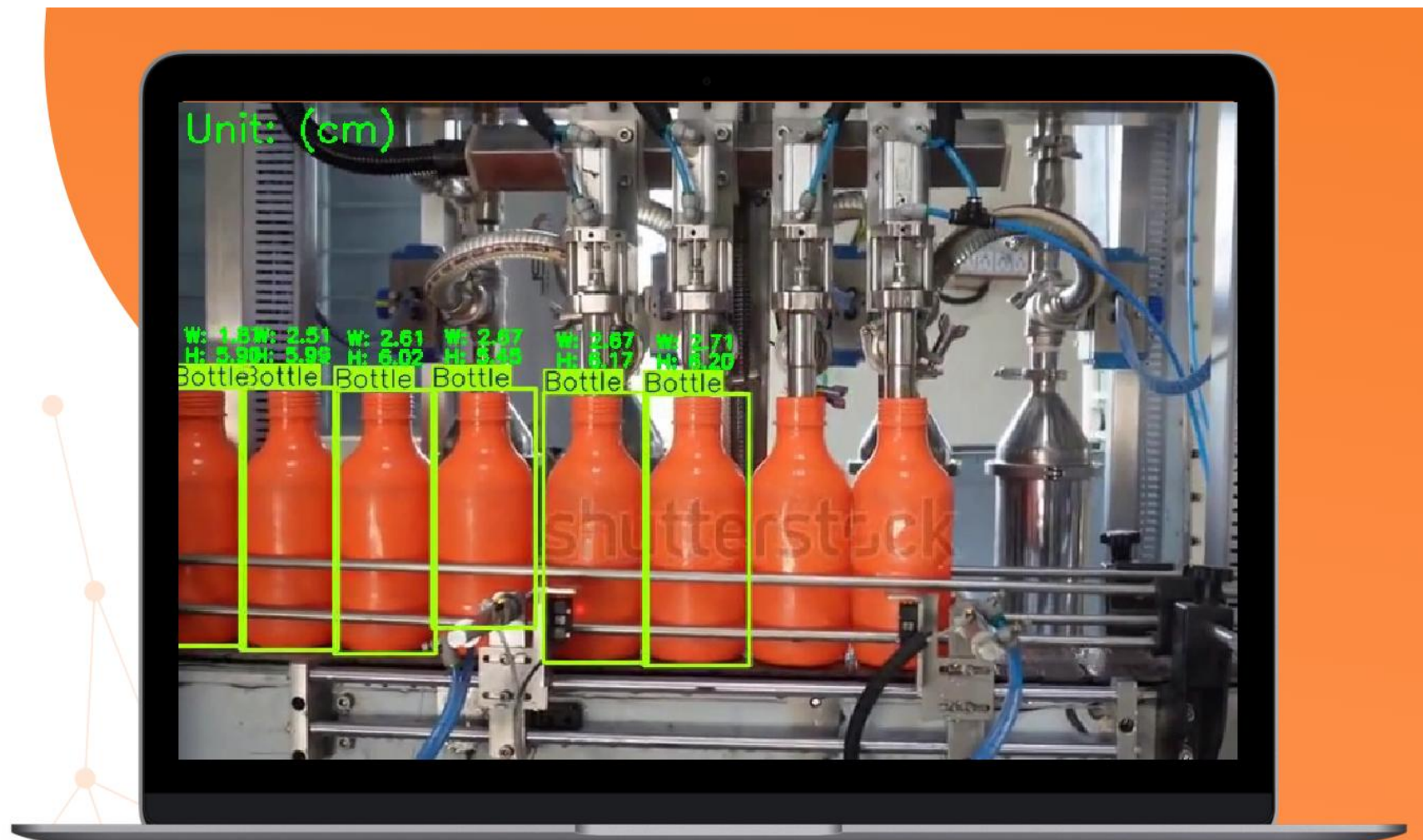


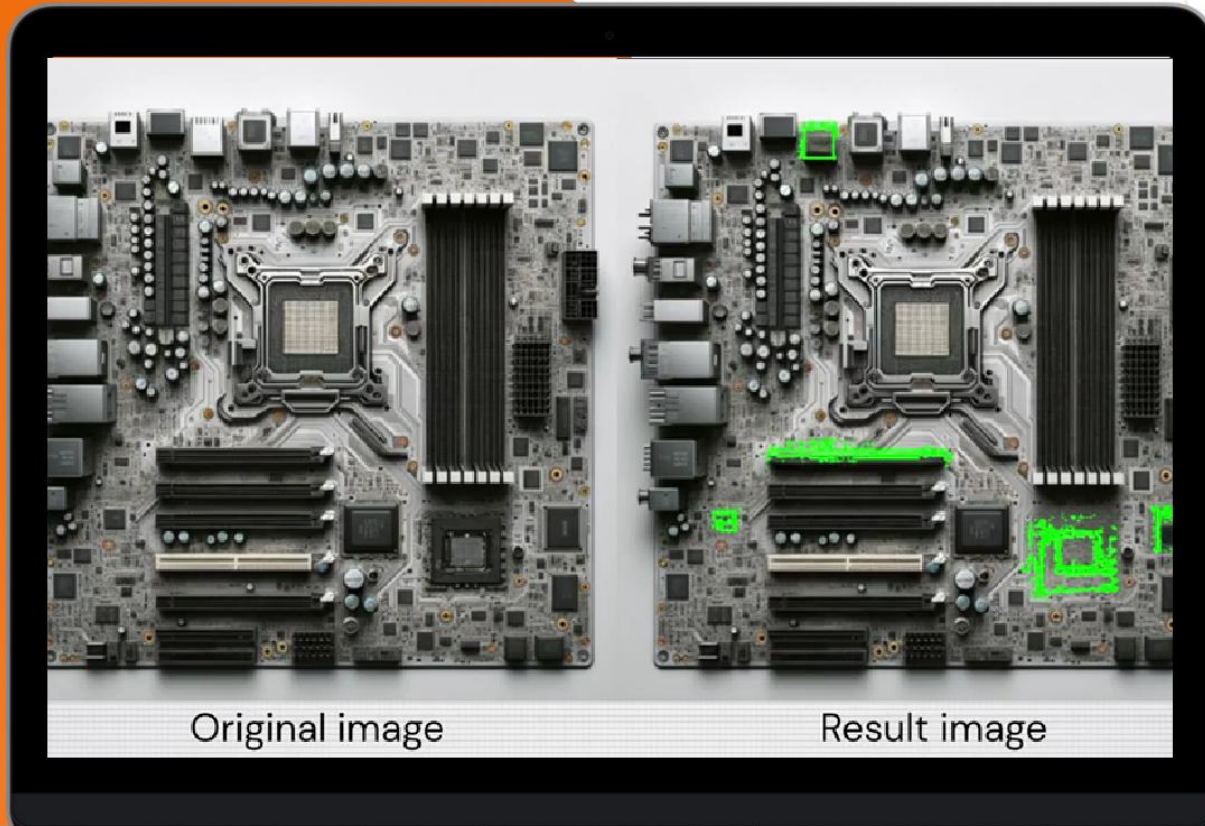
Counting Inspection



DIMENSION INSPECTION

Smart Item Pattern Recognition to Detect, Adjust, & Highlight Item Dimensions



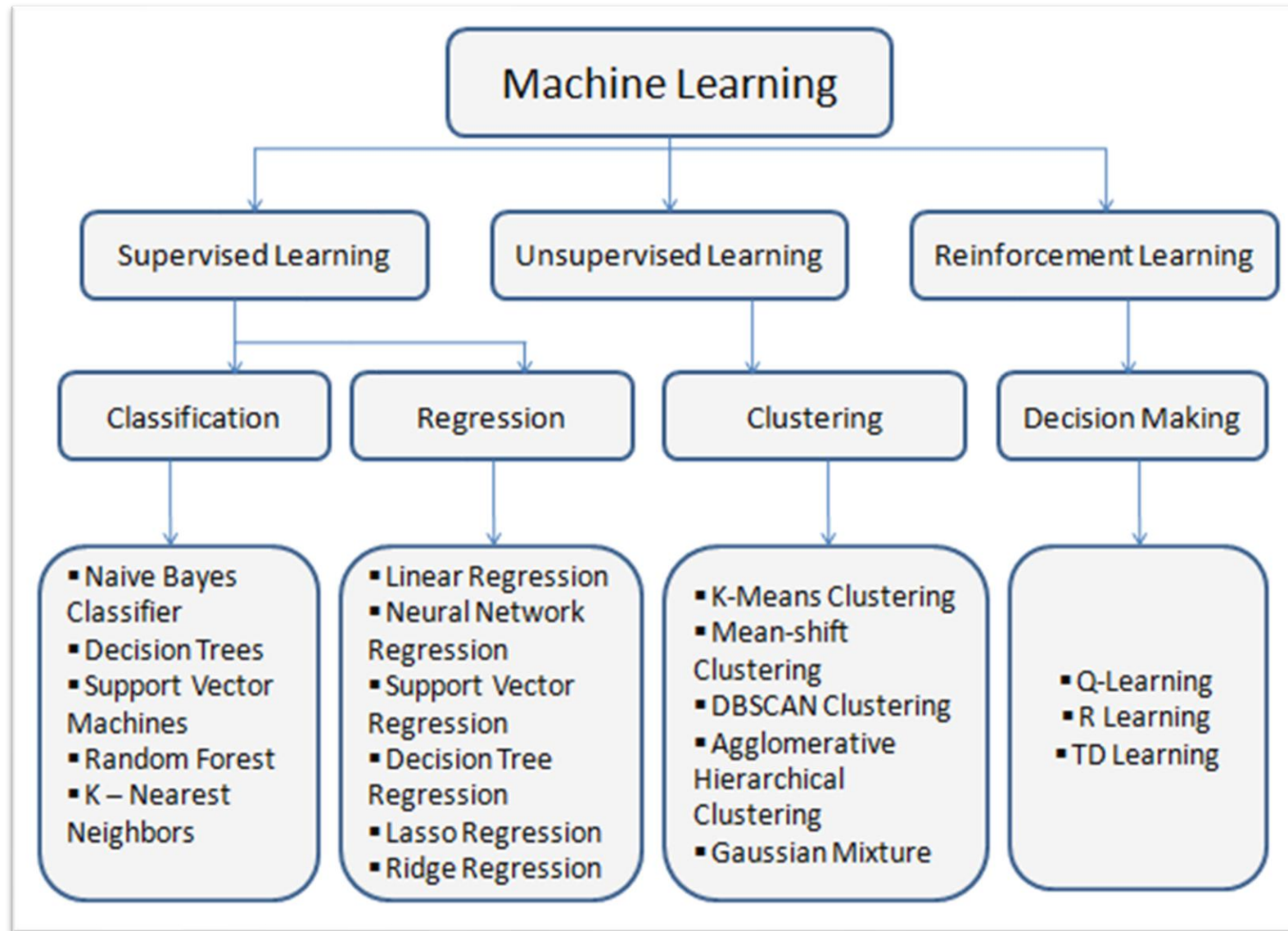


Original image

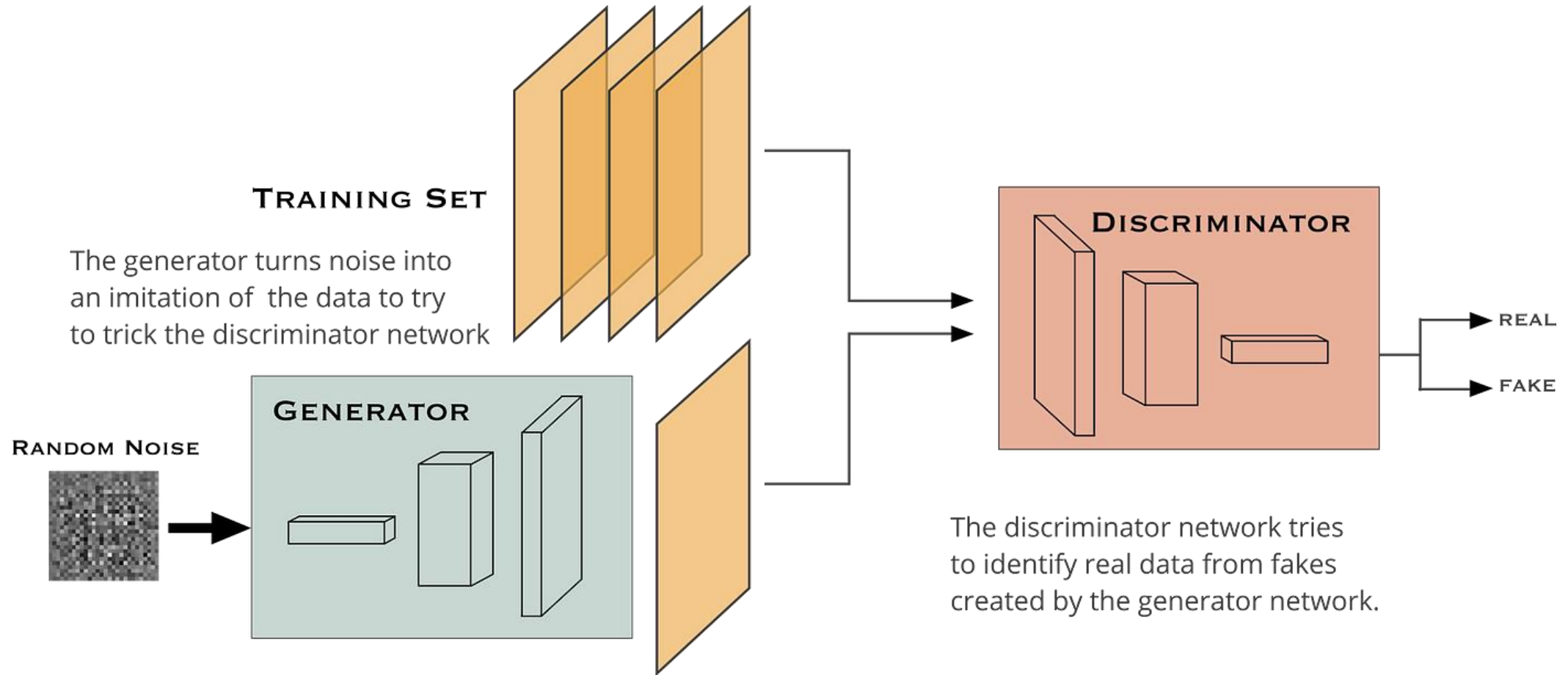
Result image

SURFACE INSPECTION

Ensuring Consistent Quality through
Advanced Image Analysis



Generative AI*



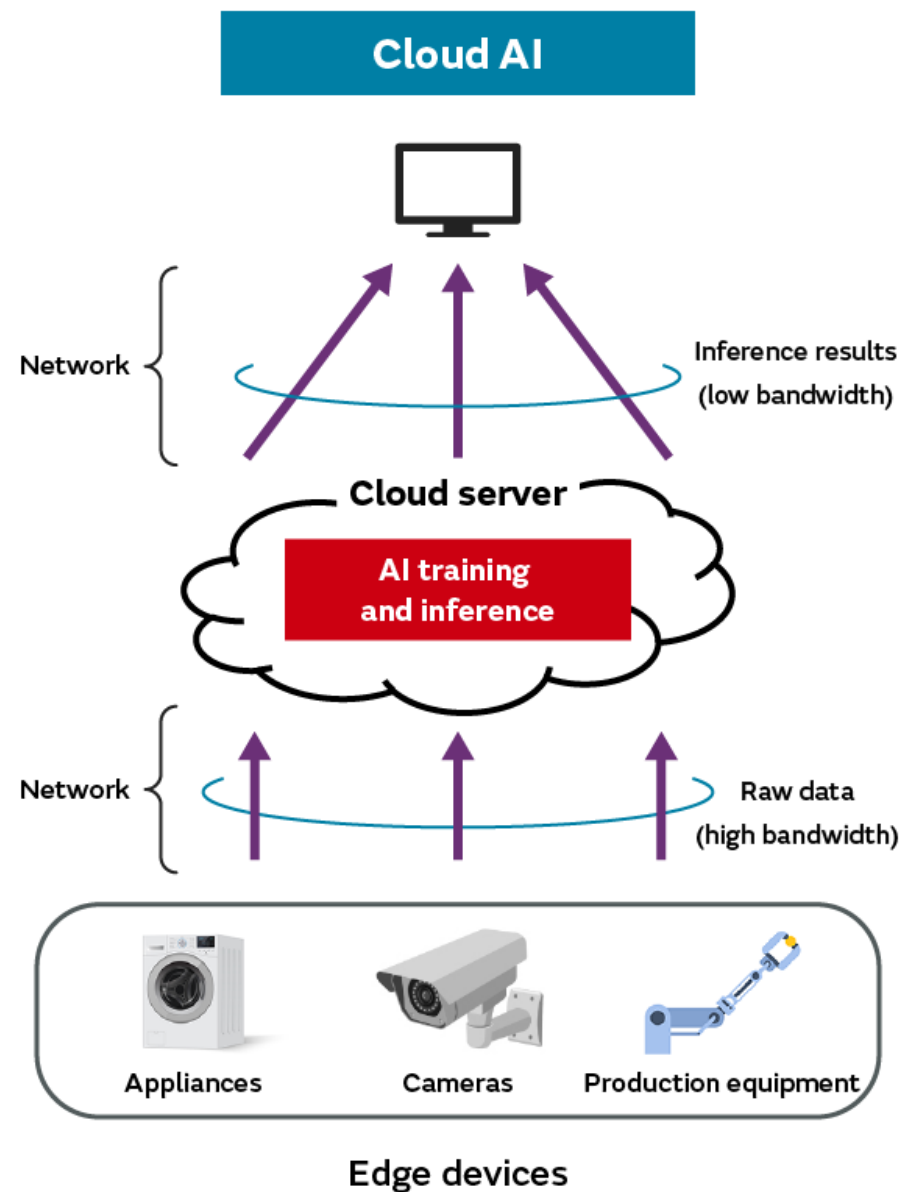
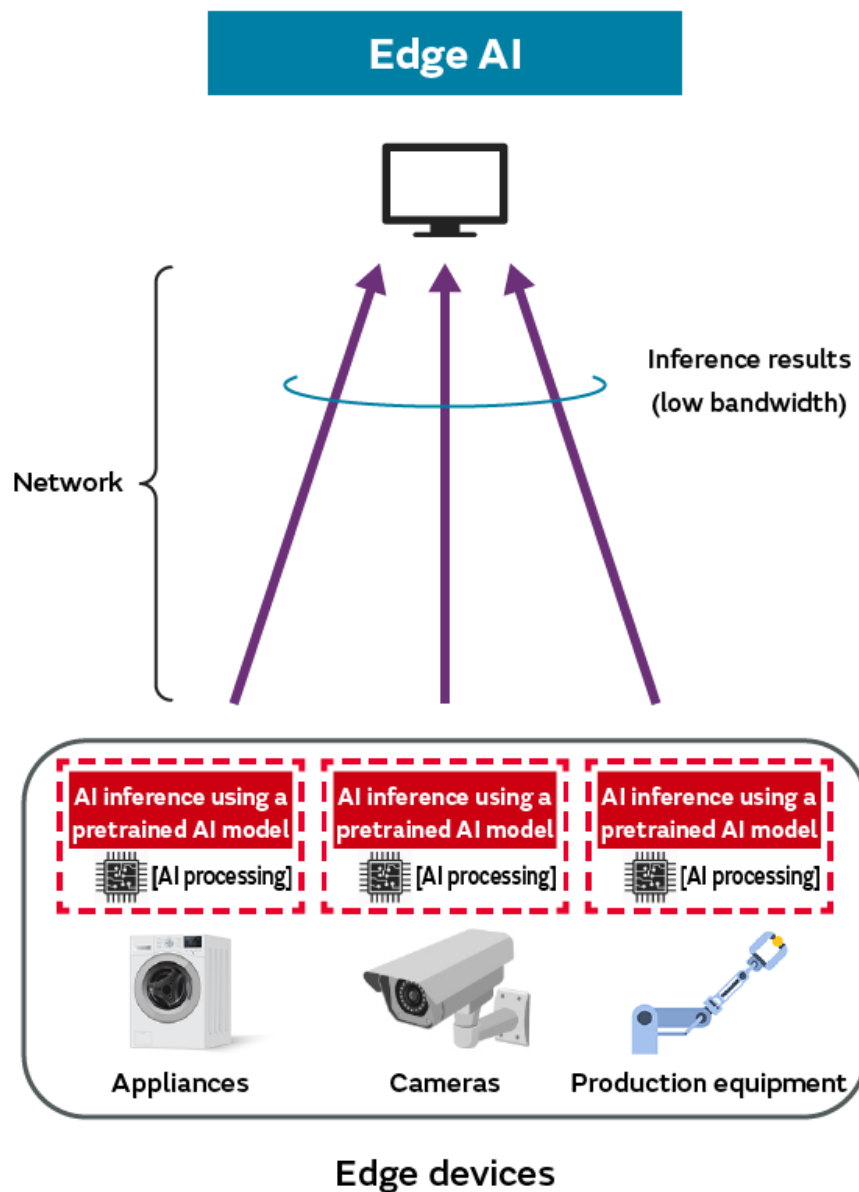


Image source: www.murata.com

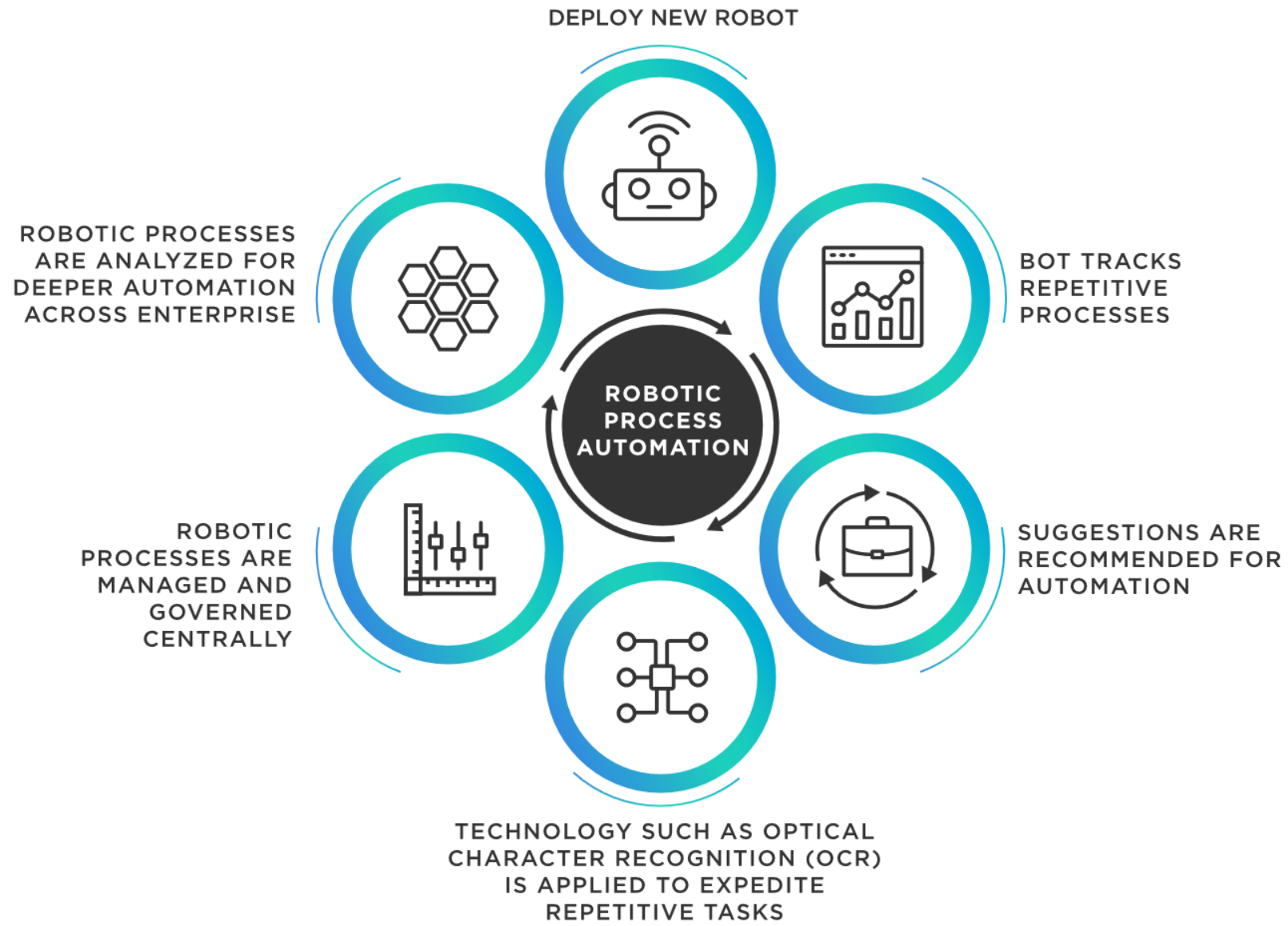


Image source: www.tibco.com