Challenges and opportunities for AI & robotics in smart manufacturing

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AI and robotics systems for smart manufacturing

We are at the heart of a strategic turning

NET Zero

2050 objectives call for strategic manufacturing transformations

60%

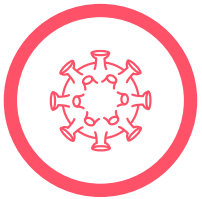
data growth/year, and exponential technologies must drive x10 innovation thinking

41+ bn

Connected devices and things by 2025, require deep IT/OT convergence across value chains

2/3

Digital native customers in the world ask for on-demand, personalized, 360° experience



60%

value chains have been disrupted by the pandemic, requiring new resilience initiatives for the future

only 30% of Industry 4.0 programs have been scaled

(McKinsey)

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AI and robotics systems for smart manufacturing

From product-centric to service-centric models and ecosystems

Products	Smart products & services
Mass production	Mass personalization & sustainability
Ownership	Pay as-you-go

Industrial Age

Markets are predictable

Centralization for efficiency

Makes optimal decisions slowly

Top down and hierarchical

Towards Industry X.0

Digital is the enabler

Data and AI are the key

Sustainability is the imperative

Digital Age

Markets are changing rapidly

Flexibility to embrace change

Makes rational decisions quickly

Organic and spontaneous

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AI and robotics systems for smart manufacturing

Industrial robots

Fixed robots

Articulated

SCARA

Delta

Cartesian

Cylindrical

Mobile robots

AGVs
Automated Guided Vehicle

AMRs
Autonomous Mobile Robot

https://robotnik.eu/
https://www.evsint.com/robotic-arms-used-in-manufacturing/

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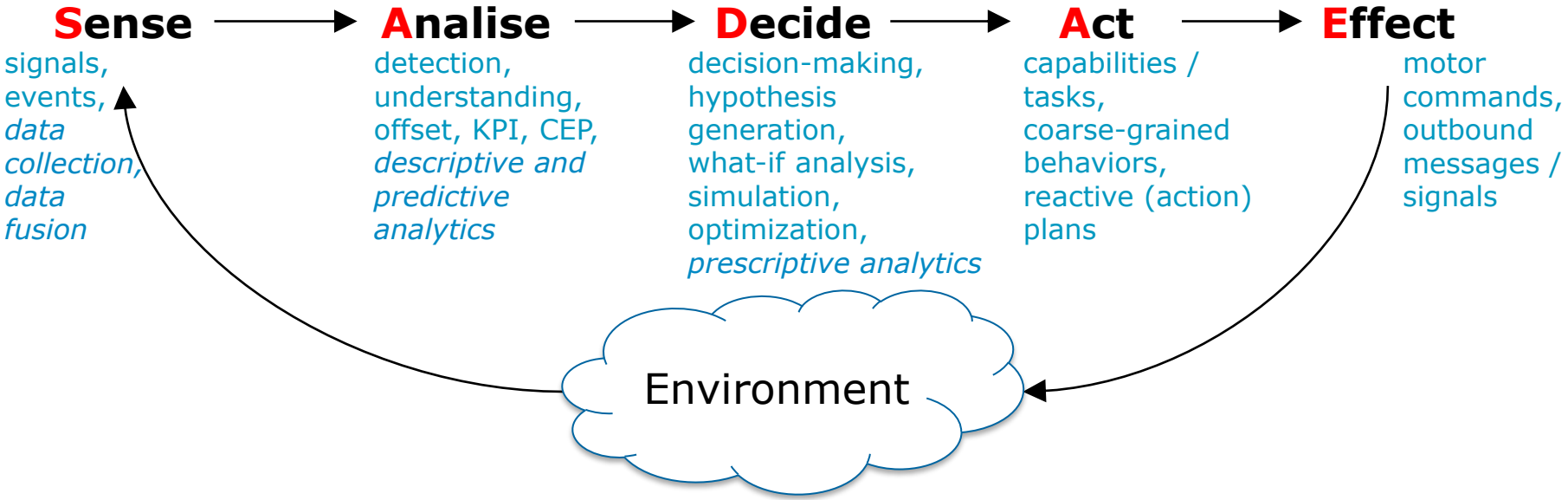
Collaborative robots (cobots)

https://www.kuka.com/nl-be/toekomstige-productie/cobot_c-_-mens-robot-samenwerking/cobots

AI and robotics systems for smart manufacturing

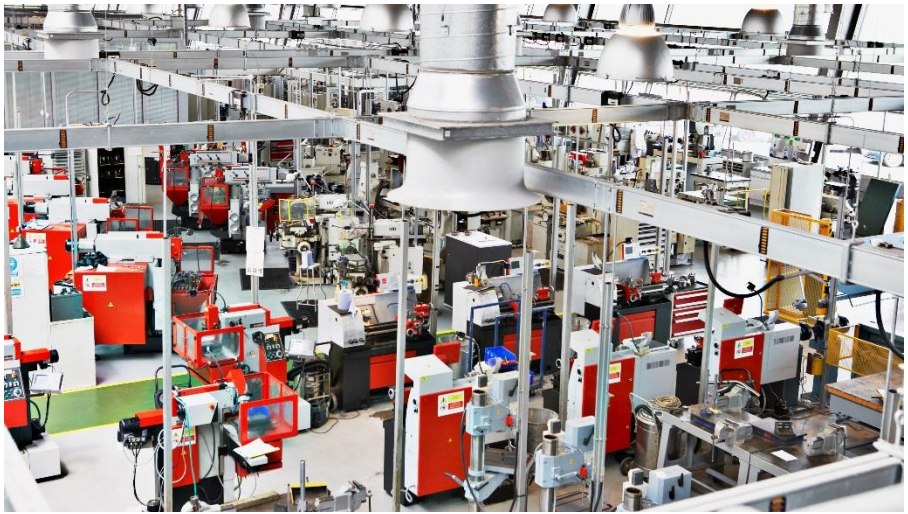
Embodied AI for robotics control loop

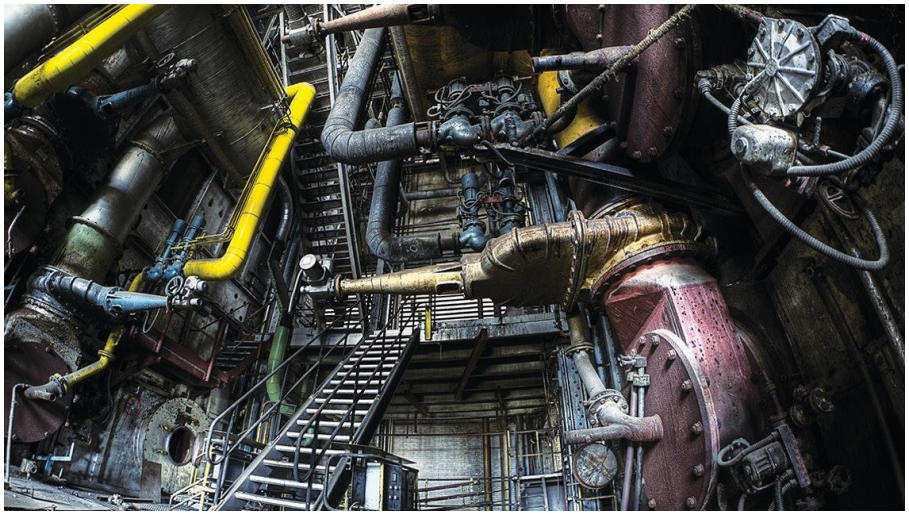


AI and robotics systems for smart manufacturing

Challenges and trends: availability of data

- Legacy equipment and equipment heterogeneity





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Challenges and trends: dynamic, unstructured and complex environments

- Robots must be able to perceive the environment and react to unexpected events

https://img.automationworld.com/files/base/pmmi/all/image/2020/02/AW2002_F2_25e4d77431cb79.png?auto-format&fit-max&w-1440

AI and robotics systems for smart manufacturing

Challenges and trends: security, safety and trustworthiness

Human agency & oversight

Technical robustness & safety

Privacy & data governance

Transparency

Diversity, non-discrimination

Societal & env. wellbeing

Accountability

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Challenges and trends: ethical issues

Workers without appropriate skills

Replacement of humans

Informed choice and deception

AI & Robotics in Industry4.0

Use-cases

Predictive maintenance

- Maintain machinery before failure
- Identify causes of failures
- More efficient maintenance operations
- Prevent lost revenue from production failures

Zero-defect and zero-waste

- Increase quality of the products and waste generated during manufacturing
- ZDM requires real-time control of the process
- Holistic approach

Human robot collaborative production line

- Effective and highly automated production line
- Robots cannot perform all tasks
- Allow workers to focus on added-value tasks
- Safety mechanisms

https://ifr.org/case-studies/industry-robots-case-studies

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Questions

Thank you!

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