Associazione Italiana per l'Intelligenza Artificiale

# Artificial intelligence and the circular economy

Gianluigi Greco – President of AIxIA

# Italian Association for AI

**Born in 1988**

- It brings toghether the italian AI community
- More than 1.200 memebrs
- 60% academia, 40% industry

Trento 2018

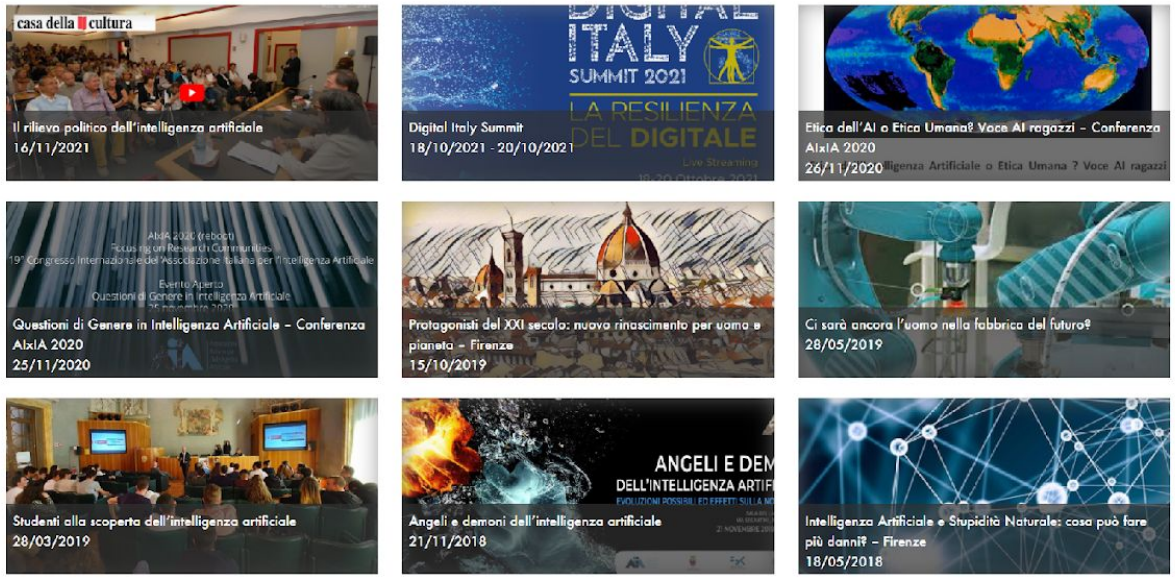
*virtual* 2020

Milano 2021

Genova 2016

Bari 2017

Cosenza 2019



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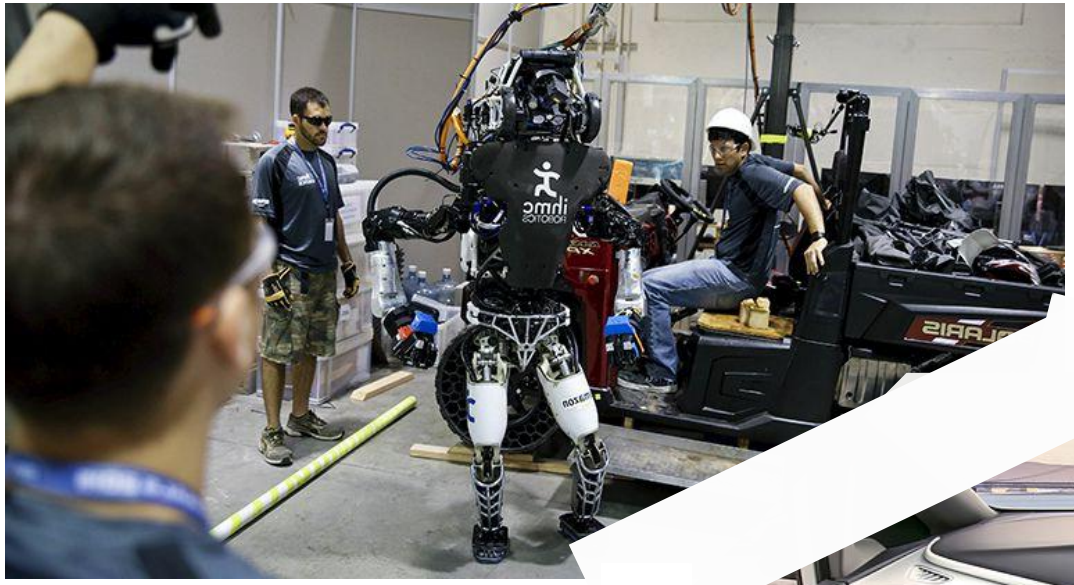
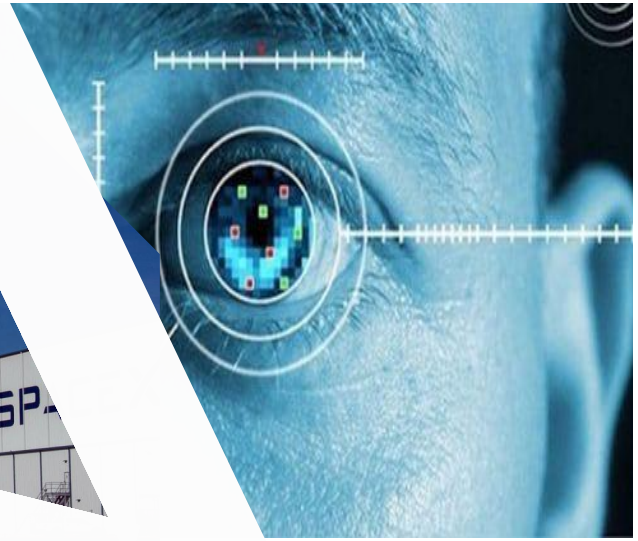
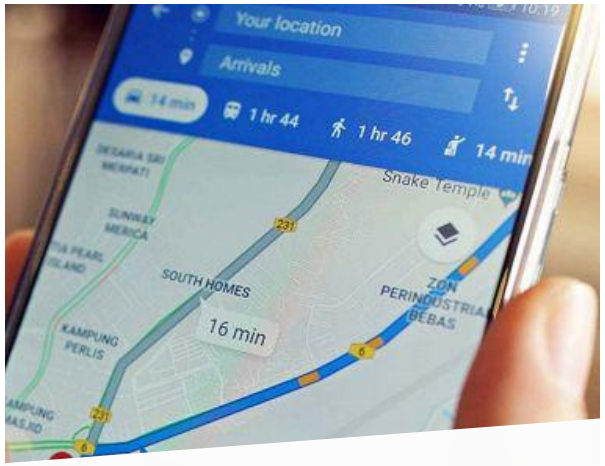
# An AI Society







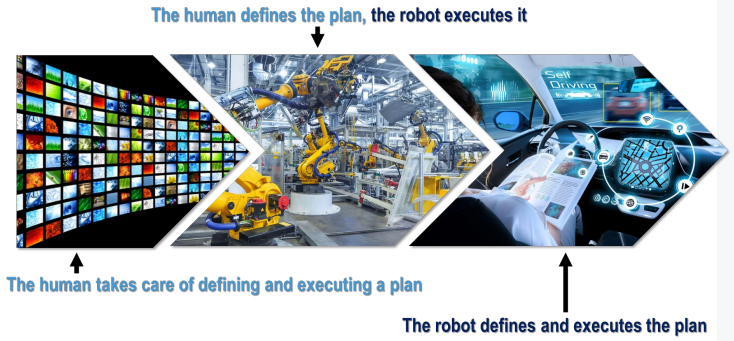
# Levels of Autonomy

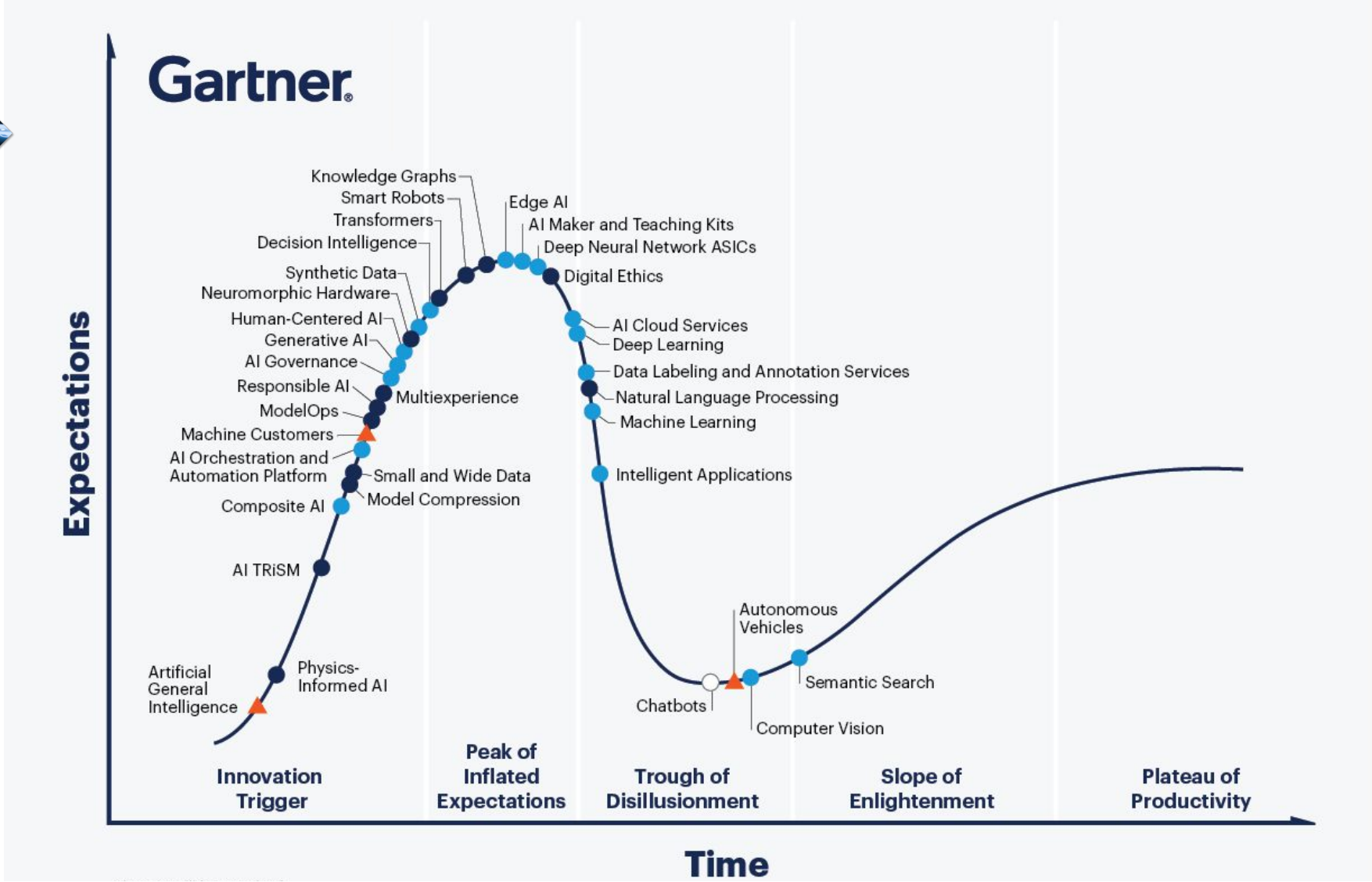
The human defines the plan, the robot executes it

The human takes care of defining and executing a plan

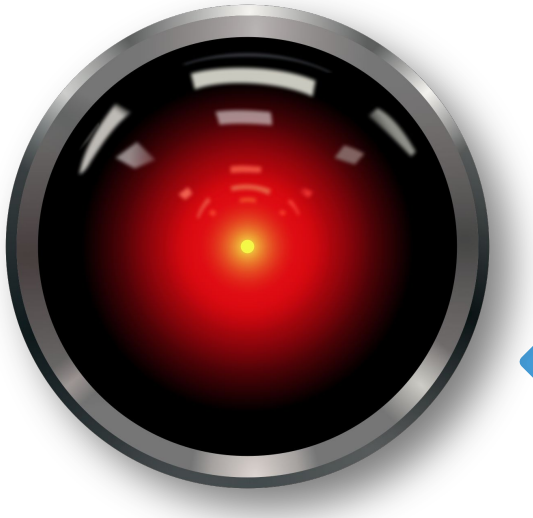
The robot defines and executes the plan

# AI Topics

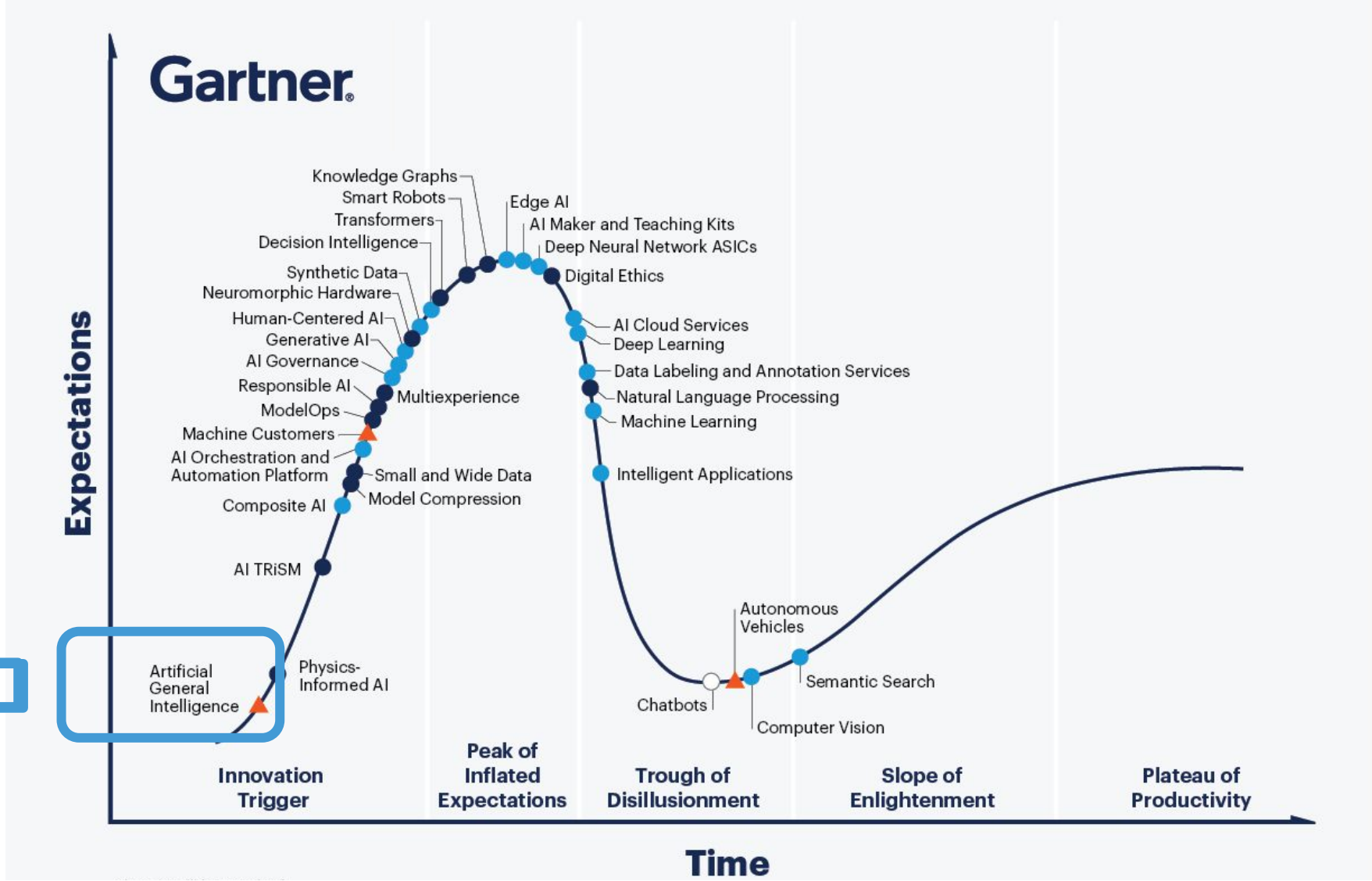

The human defines the plan, the robot executes it
The human takes care of defining and executing a plan
The robot defines and executes the plan


Gartner
Expectations
Time
Knowledge Graphs
Smart Robots
Transformers
Decision Intelligence
Synthetic Data
Neuromorphic Hardware
Human-Centered AI
Generative AI
AI Governance
Responsible AI
ModelOps
Machine Customers
AI Orchestration and Automation Platform
Composite AI
AI TRiSM
Artificial General Intelligence
Physics-Informed AI
Multiexperience
Small and Wide Data
Model Compression
Edge AI
AI Maker and Teaching Kits
Deep Neural Network ASICs
Digital Ethics
AI Cloud Services
Deep Learning
Data Labeling and Annotation Services
Natural Language Processing
Machine Learning
Intelligent Applications
Autonomous Vehicles
Semantic Search
Chatbots
Computer Vision
Innovation Trigger
Peak of Inflated Expectations
Trough of Disillusionment
Slope of Enlightenment
Plateau of Productivity

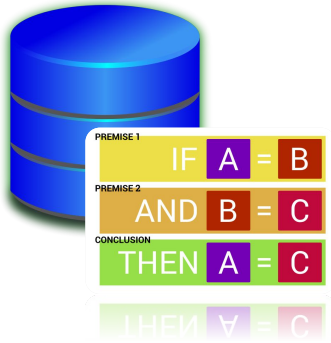
# AI Topics



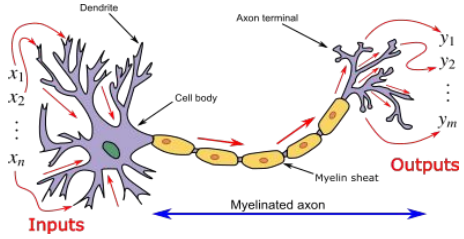
*GAI is still very far to come!*

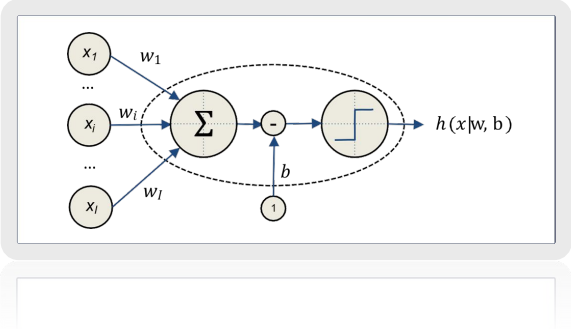


# AI Topics

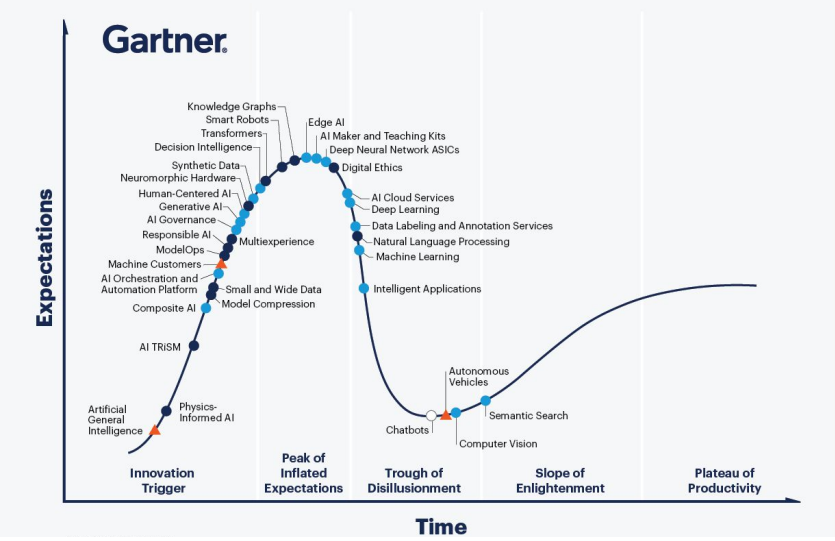



symbolic

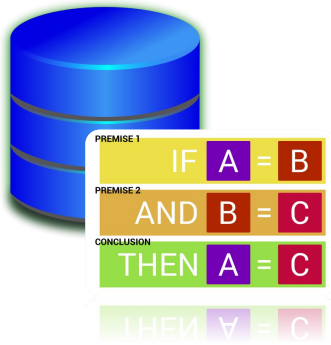


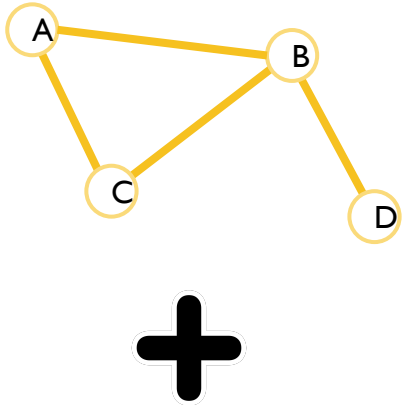



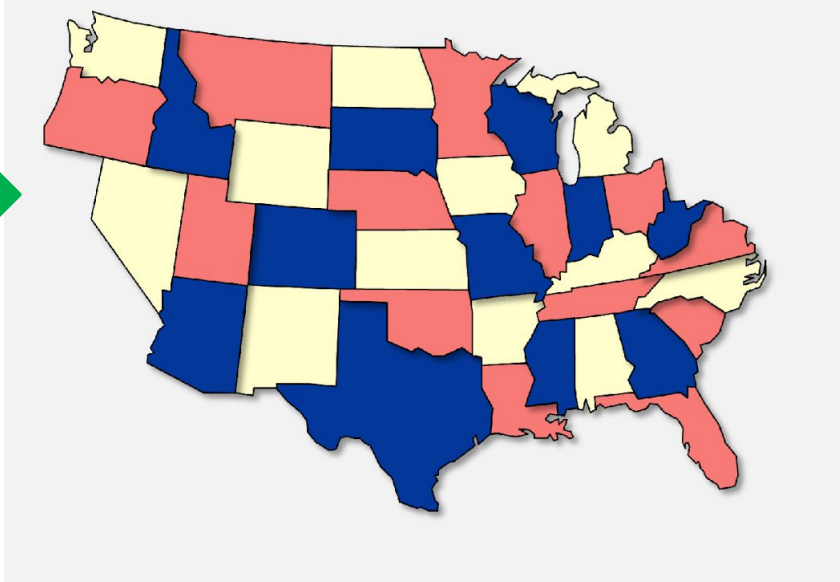

sub-symbolic



# Symbolic Approaches







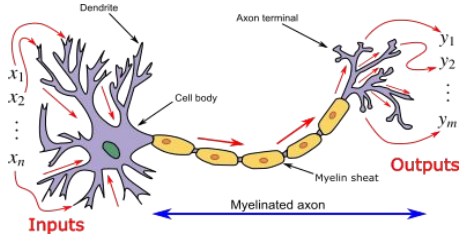
col(X, *red*) v col(X, *yellow*) v col(X, *blue*) :- node(X).

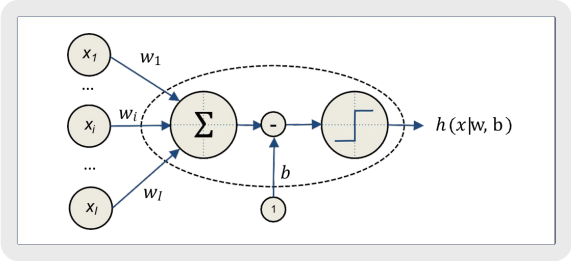
:- edge(X, Y), col(X, C), col(Y, C).

# Sub-Symbolic Approaches

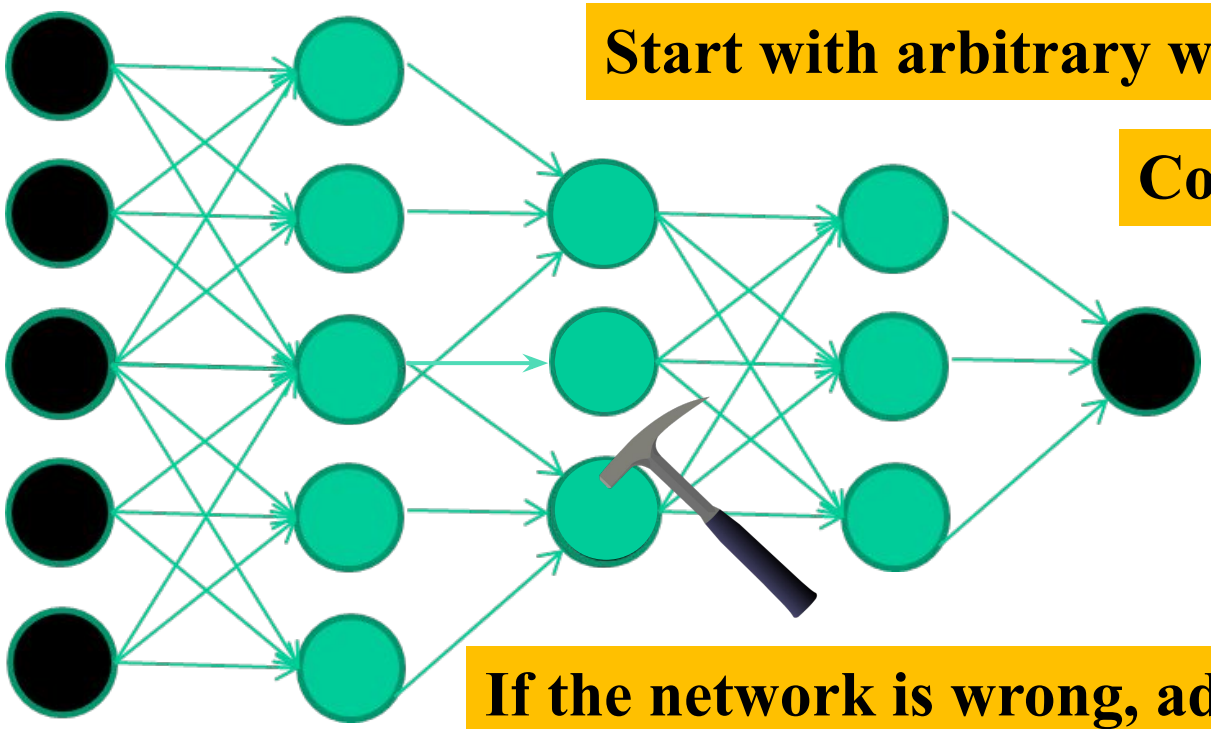




Yes



**Start with arbitrary weigths**

**Compute the output**

No

**If the network is wrong, adjust the weigths, and repeat**

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# Artificial intelligence and the circular economy

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# Artificial intelligence and the circular economy

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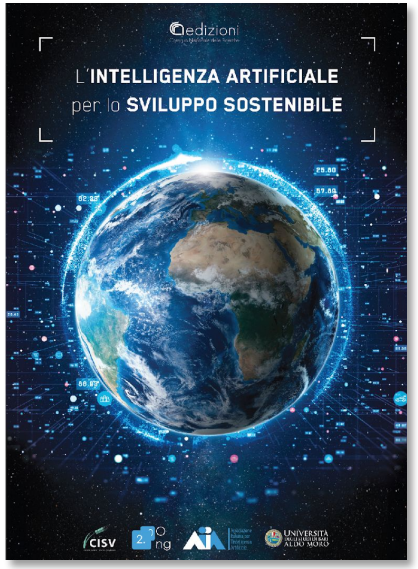
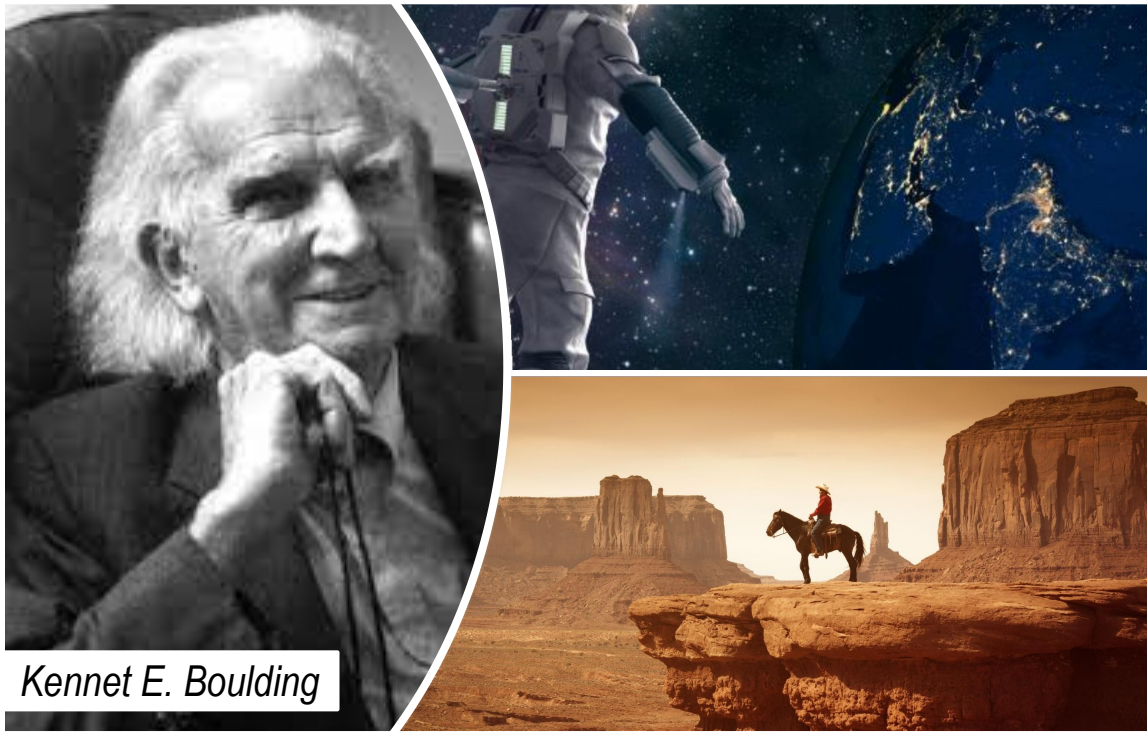
# The Spaceship Earth

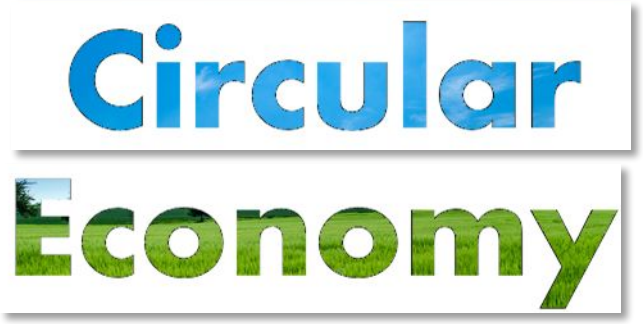
- **Enable a transition that is green, digital and planet-centric**
  - What are the real scarce resources today, which define the concept of economy?
  - What can AI do?



# The Global Goals

# AI meets Circular Economy

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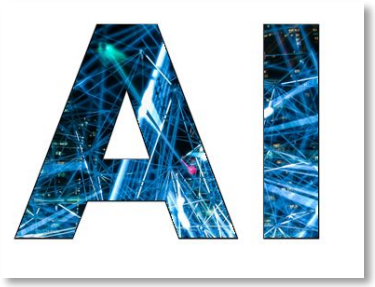


=

+127$ billion

+90$ billion

ELLEN MACARTHUR FOUNDATION

Google

**ARTIFICIAL INTELLIGENCE AND THE CIRCULAR ECONOMY**
AI AS A TOOL TO ACCELERATE THE TRANSITION

# AI meets Circular Economy

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**Design circular products, components, and materials**

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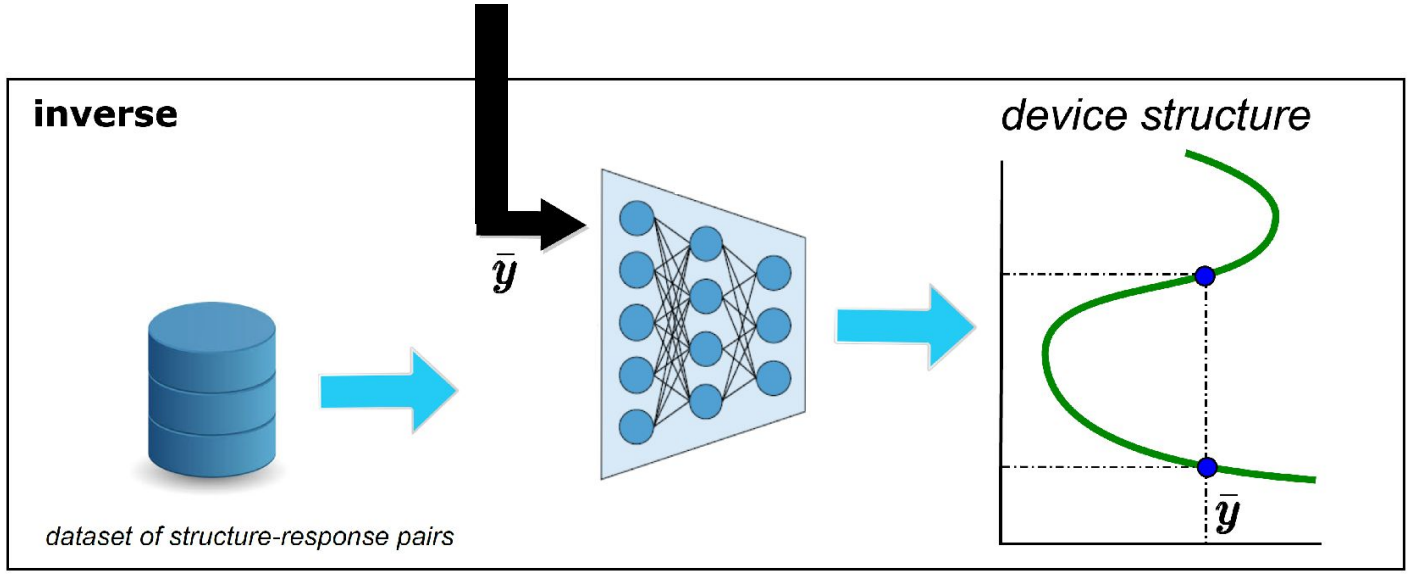
# AI meets Circular Economy

**Design circular products, components, and materials**



# AI meets Circular Economy

## Design circular products, components, and materials

- Incorporate (by design) constraints (e.g.) on toxicity and re-usability
- Avoid “trial and error” approaches
- Optimize design, enhance the life of the products
- Simulate different usage scenarios

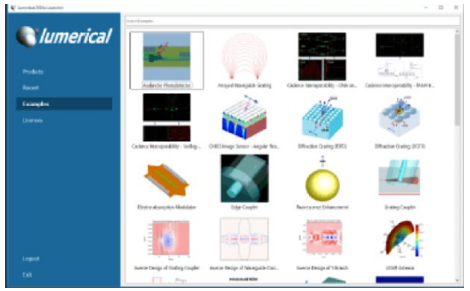
# AI meets Circular Economy

## Design circular products, components, and materials

Citrine Informatics

Motivo

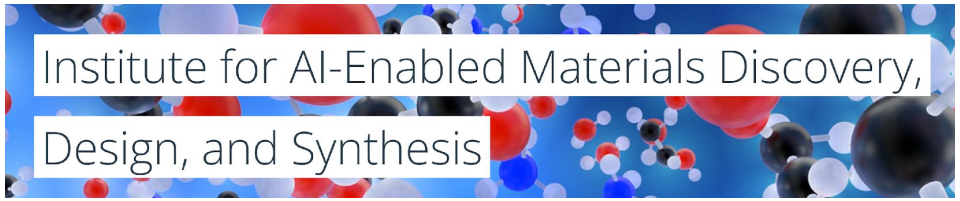
NotCo – Artificial Chef




Lumerical - photonics

AI Value
Wastemark

esa
Accelerated Metallurgy



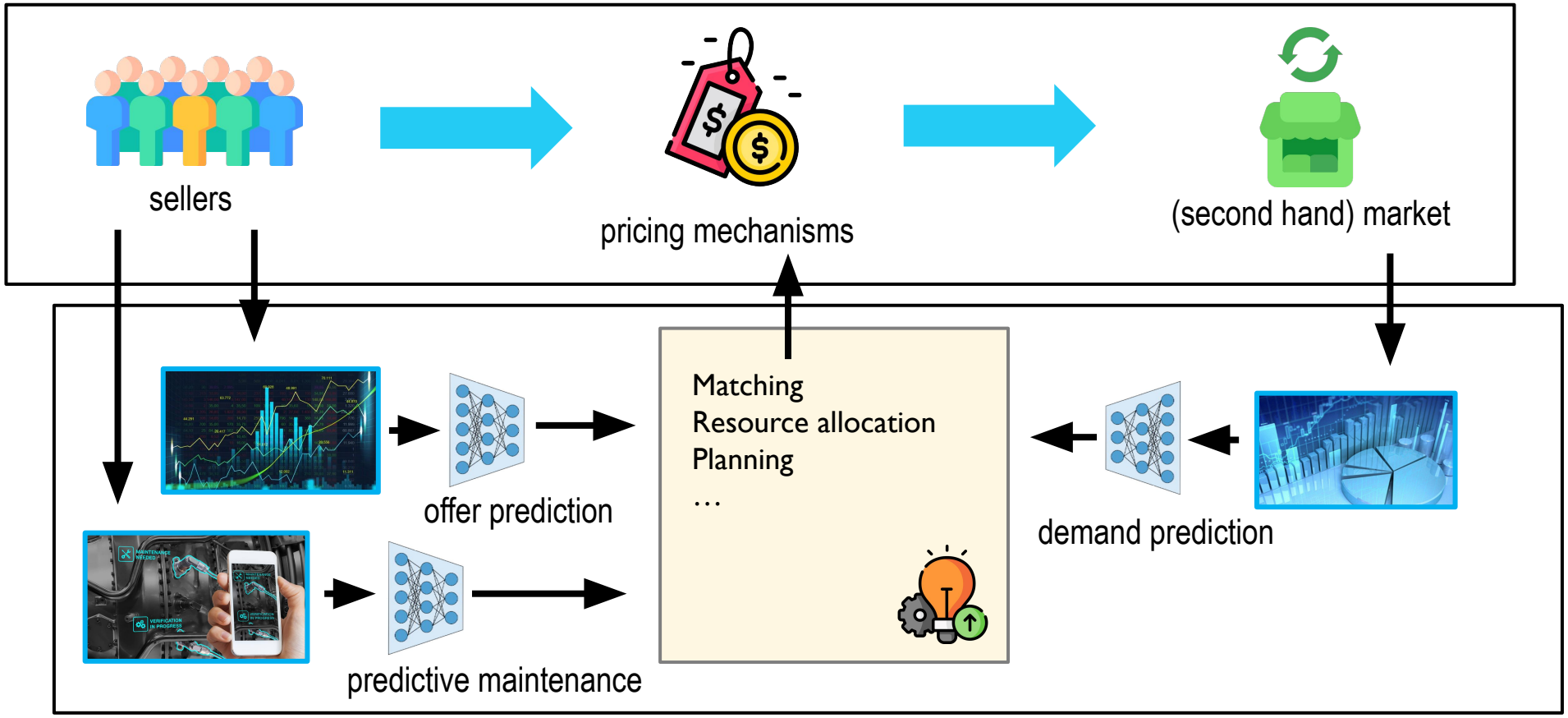

Penn State, MIT, and the University of Wisconsin-Madison

# AI meets Circular Economy

## Operate circular business models

# AI meets Circular Economy

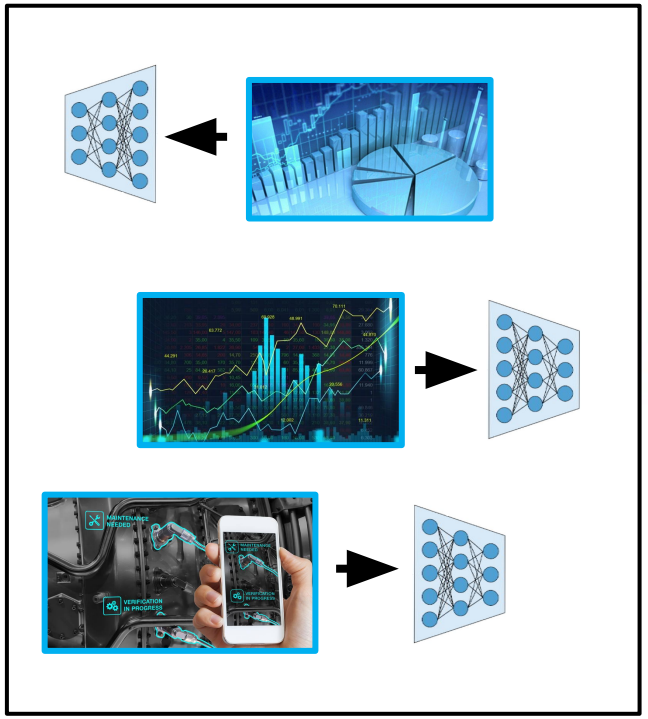
## Operate circular business models



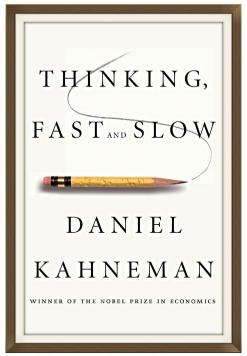

*icons: flatincon.com*

# AI meets Circular Economy

## Operate circular business models



FAST - subsymbolic




Matching
Resource allocation
Planning
…

SLOW - symbolic

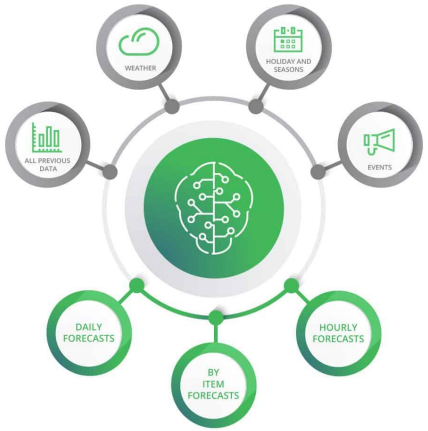
# AI meets Circular Economy

## Operate circular business models

- Create markets for used and rented products
- Transparency on options for further cycles
- Reduce waste in processes involving food
- Targeted marketing

# AI meets Circular Economy

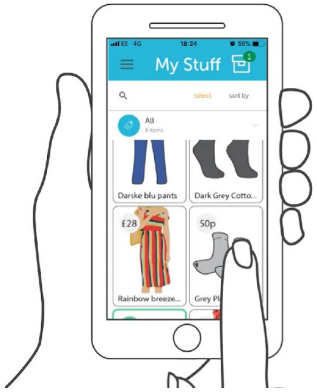
## Operate circular business models




Tenzo

Japan Weather Association

Wasteless




Stuffstr

Grid Resilience and Intelligence Project

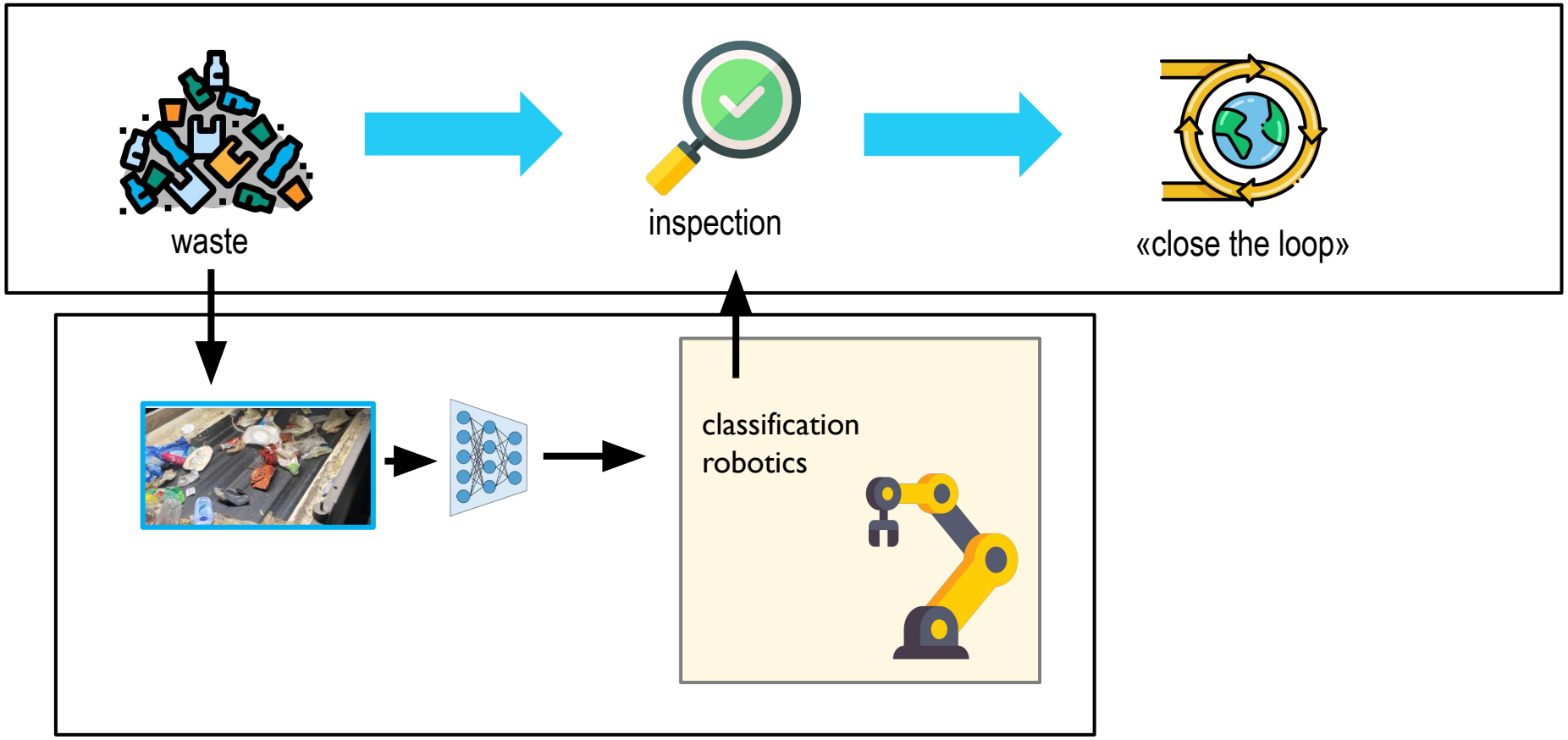
# AI meets Circular Economy

## Optimize the circular infratsructure

*icons: flatincon.com*

# AI meets Circular Economy

## Optimize the circular infratsructure




*icons: flatincon.com*

# AI meets Circular Economy

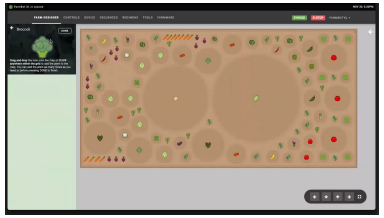
## Optimize the circular infratsructure

- Improve efficiency and efficacy
- Support to assess cosmetic and/or functional conditions
- Reduce waste in processes involving food
- Mature technologies to support to the circular economy

# AI meets Circular Economy

## Optimize the circular infratsructure

Nando – Re Learn



FarmBot

ZenRobotics

Harvest CRRO Robotics

Reconext

Clarke

TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA
Macroarea di Ingegneria

BackRep

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**and a few final warnings…**

# Artificial intelligence and the circular economy

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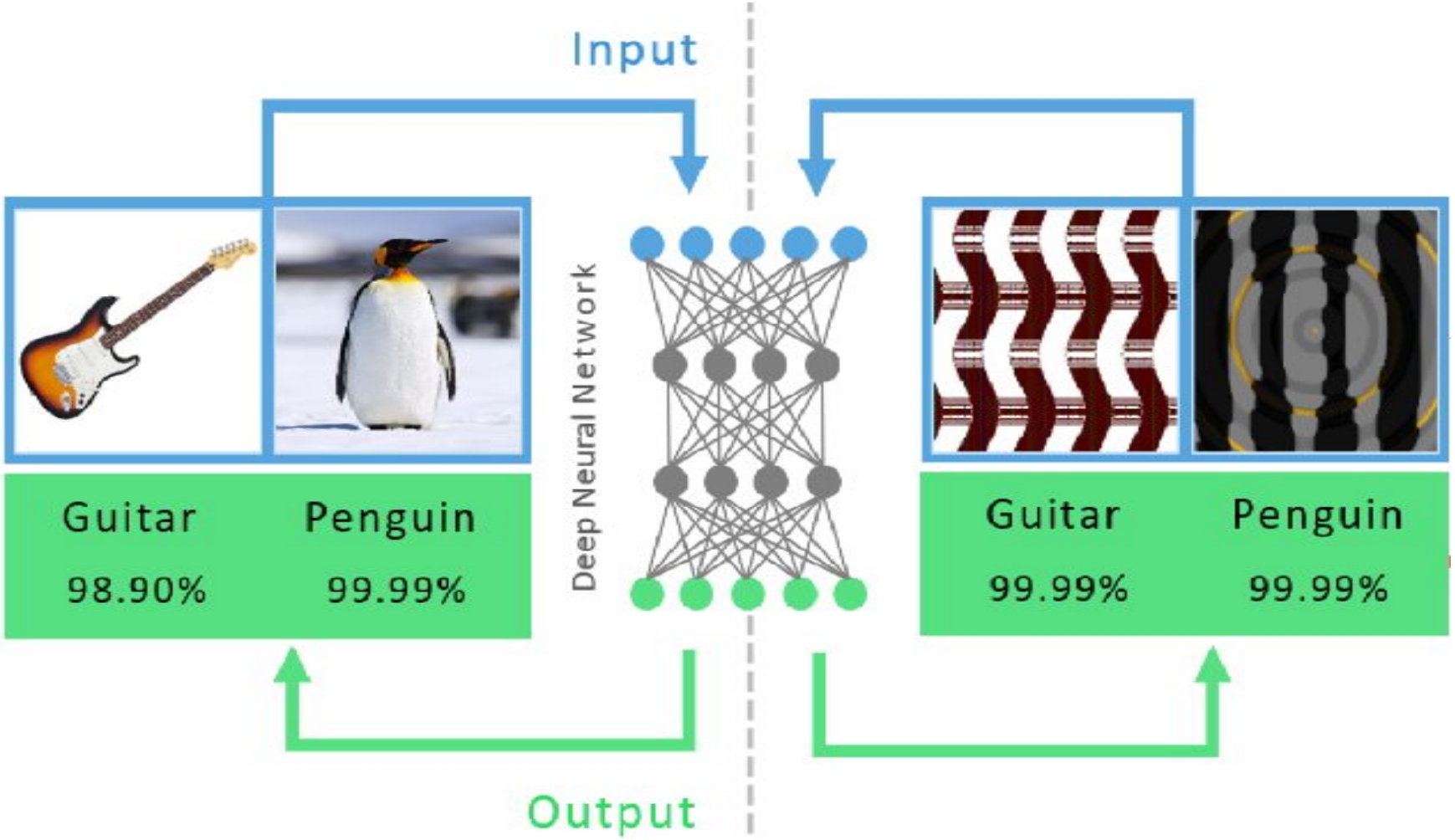
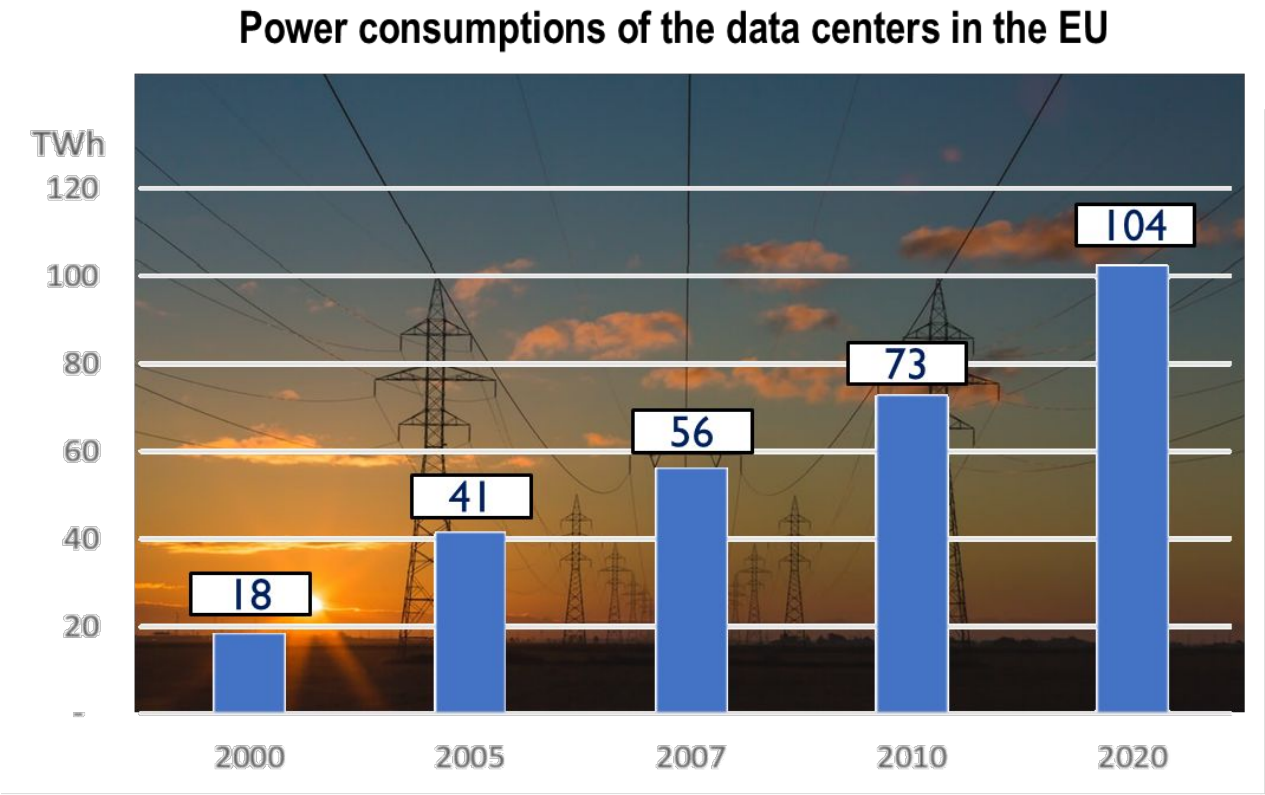
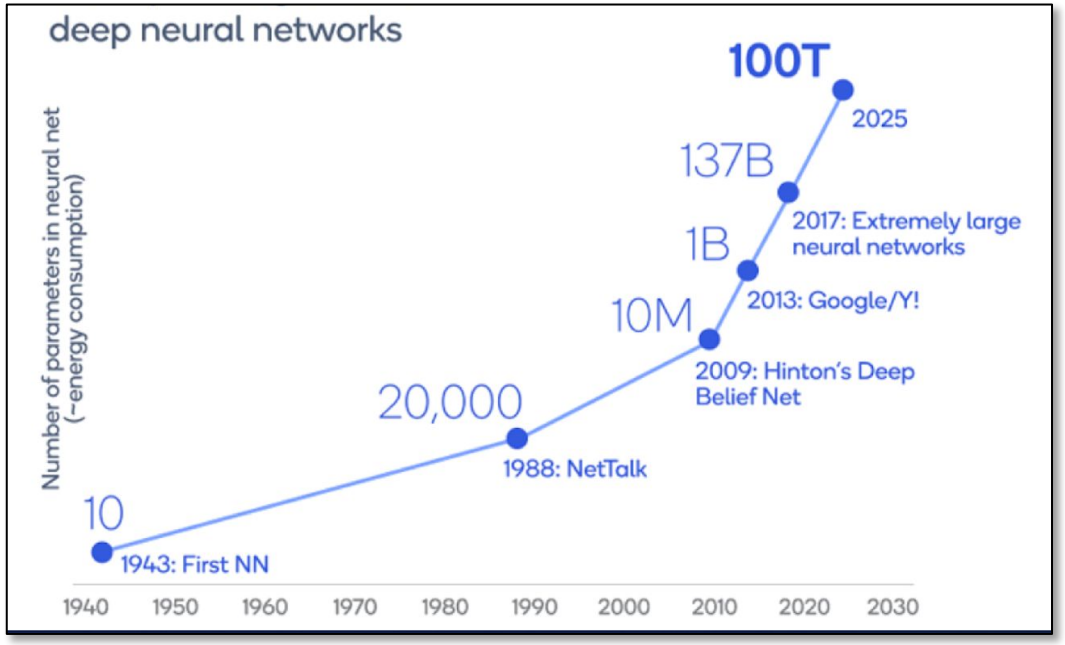
# Towards a Trustworthy AI




*Deep Neural Networks are Easily Fooled: High Confidence Predictions for Unrecognizable Images. In Computer Vision and Pattern Recognition (CVPR '15), IEEE,*

# Towards a Green AI



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# Thank you!