KI: Potentiale für KMUs und Anwendungsbeispiele

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Intelligent Vision Applications

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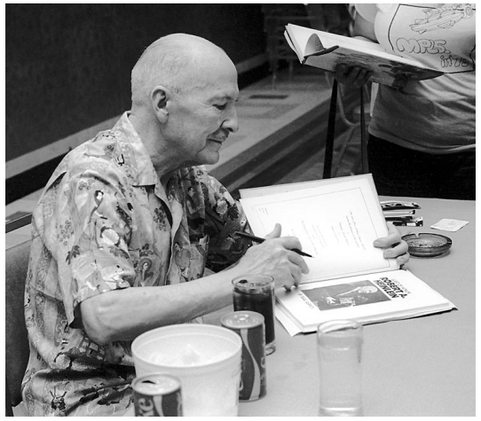
Defining (artificial) intelligence

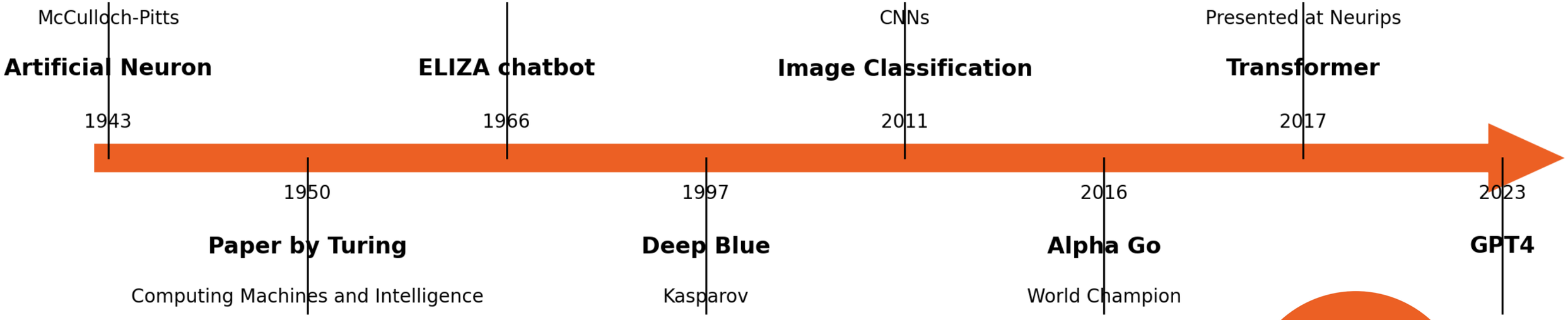
“A human being should be able to change a diaper, plan an invasion, butcher a hog, conn a ship, design a building, write a sonnet, balance accounts, build a wall, set a bone, comfort the dying, take orders, give orders, cooperate, act alone, solve equations, analyze a new problem, pitch manure, program a computer, cook a tasty meal, fight efficiently, die gallantly. Specialization is for insects.”



Source: wikipedia

Robert A. Heinlein, SciFi Author, 1907 - 1988

Prompt: create a timeline plot as follows. a nicely drawn time arrow should run from left to right in the middle of the picture, color in hex #ec6024, boldly drawn (it should be about a tenth of the image's height). On the very left, and above, place a vertical marker, the year 1943, the text Artificial Neuron, and McCulloch-Pitts underneath. Moving to the right, and below, place a vertical marker, the year 1950, the text Paper by Turing, and "Computing Machines and Intelligence" underneath. following in the same fashion as before, place alternating above/below: 1966 ELIZA chatbot, 1997 Deep Blue Kasparov, 2011 Image Classification CNNs, 2016 Alpha Go, World Champion, 2017, Transformer, Presented at Neurips, and 2023 GPT4. The timeline plot is meant for a presentation, not as a graph



User: In one sentence, what does the image you just created show?

Assistant: The image shows a visual timeline of significant milestones in artificial intelligence from 1943 to 2023, marked with key events and names, arranged along a bold orange arrow.

User: Put the last two entries of our chat in alternating speech bubbles as if we had tm'd them, and also include this very entry here. make that a png

1x

1 refinement step taken

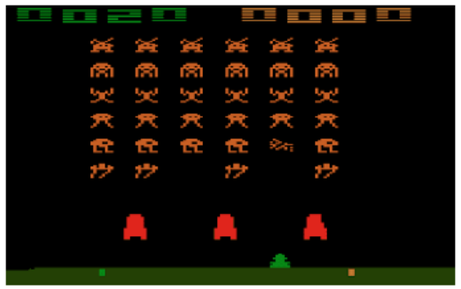
$$ip\!\!\!/A(p_2^2) + B(p_2^2) = ip\!\!\!/ + m_0 + \int \frac{d^4p_1}{(2\pi)^4}\gamma_\nu \frac{B(p_1^2) - ip\!\!\!/_1 A(p_1^2)}{p_1^2 A^2(p_1^2) + B^2(p_1^2)}\left(\delta_{\nu\mu} - \frac{(p_2-p_1)_\nu (p_2-p_1)_\mu}{(p_2-p_1)^2}\right) \times \frac{Z((p_2-p_1)^2)}{(p_2-p_1)^2}\left(\sum_{j=1}^{8}\tau_j(p_1,p_2;p_2-p_1)T_j^\mu\right)$$

- **Reinforcement learning**

Example use cases

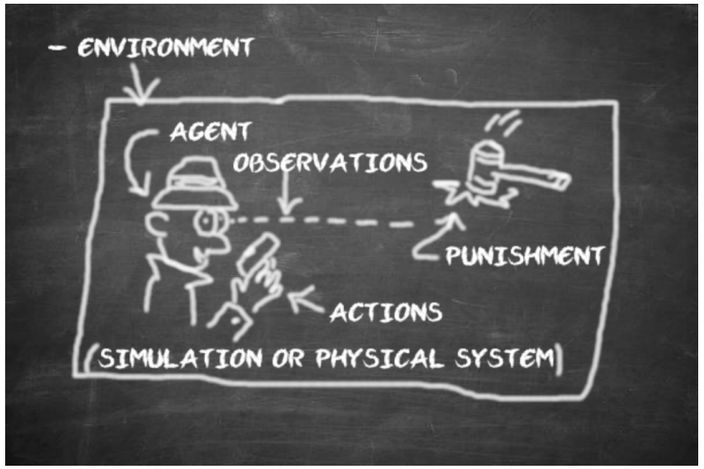
Src: wikipedia

Src: LEGO



Src: Space Invaders

Your Environment



Src: ABB

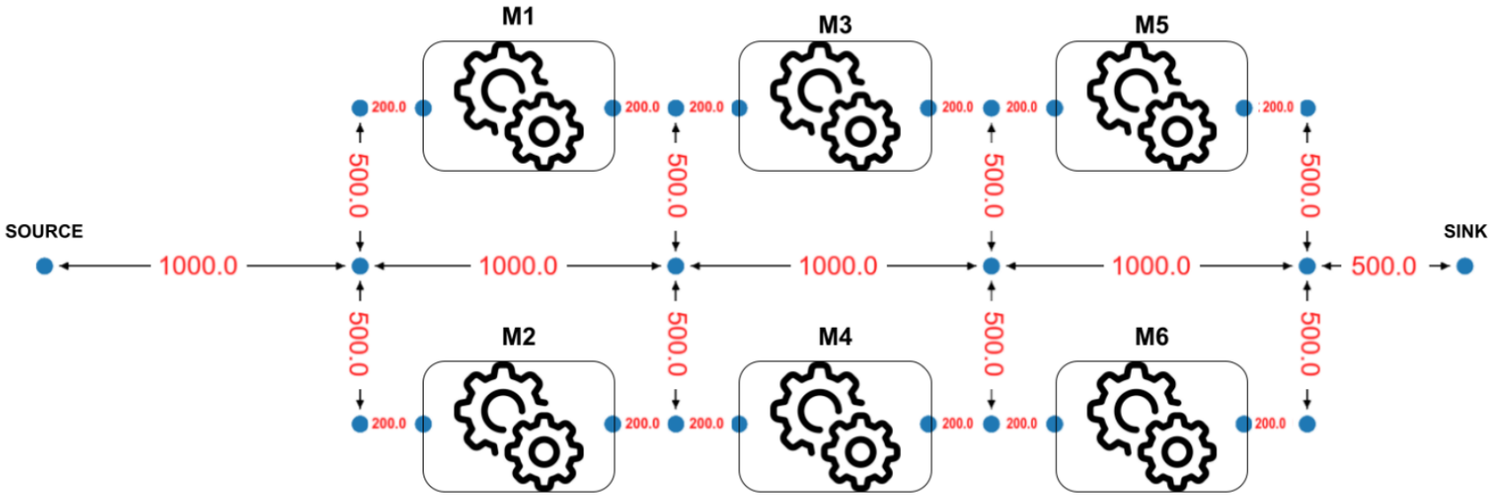
Src: BOSCH

Src: wikipedia

Src: HONDA

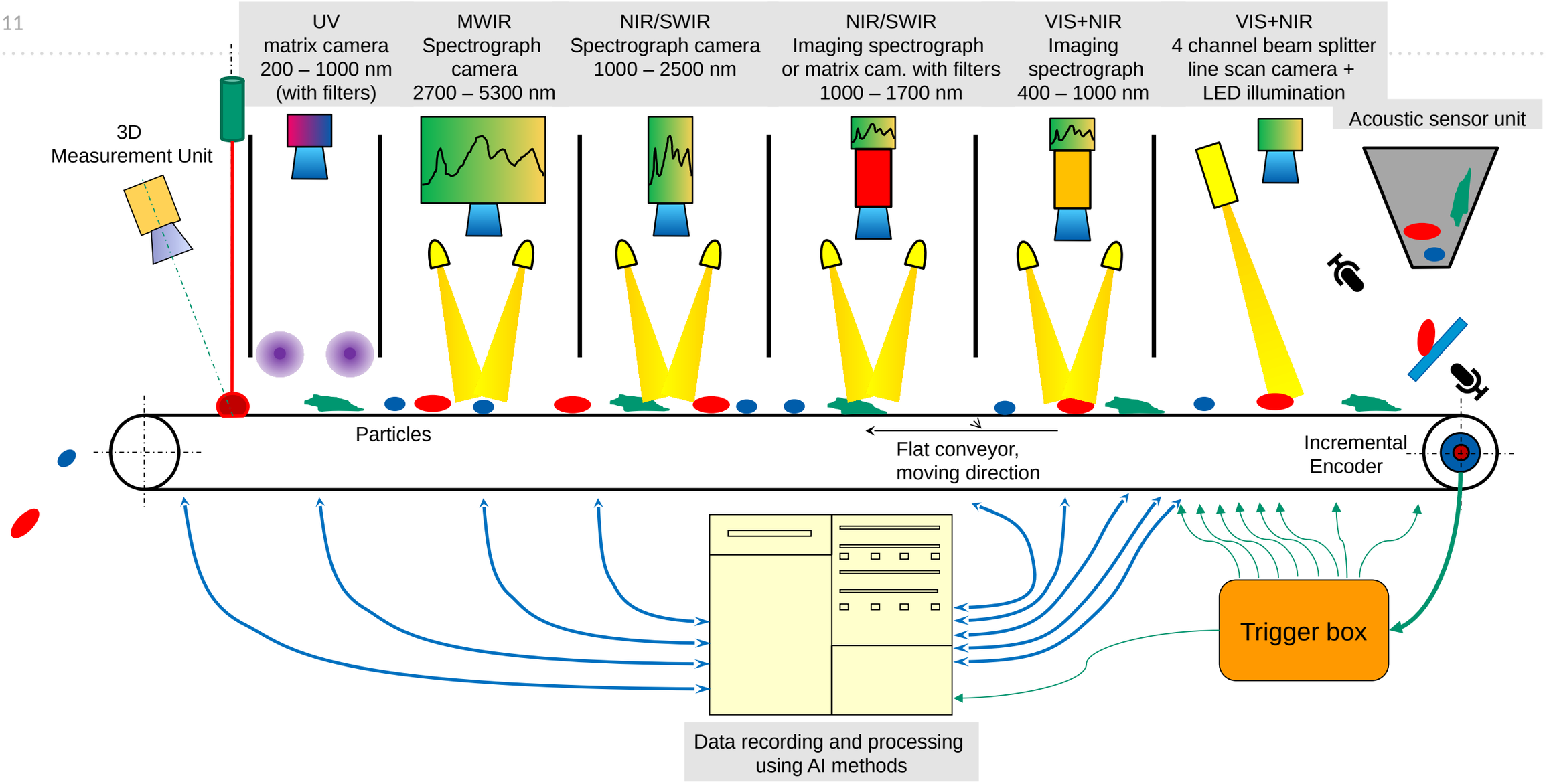
Source: https://www.automotivemanufacturingsolutions.com/robotics/agvs-find-their-way/35016.article

- **Use Case:**
-
- **Vehicle Management in a modular production context using Deep-Q -Learning**
- **L. Pouget, T. Hasenbichler, J. Auer, K. Lichtenegger, A. Windisch, [arXiv:2205.03294]**

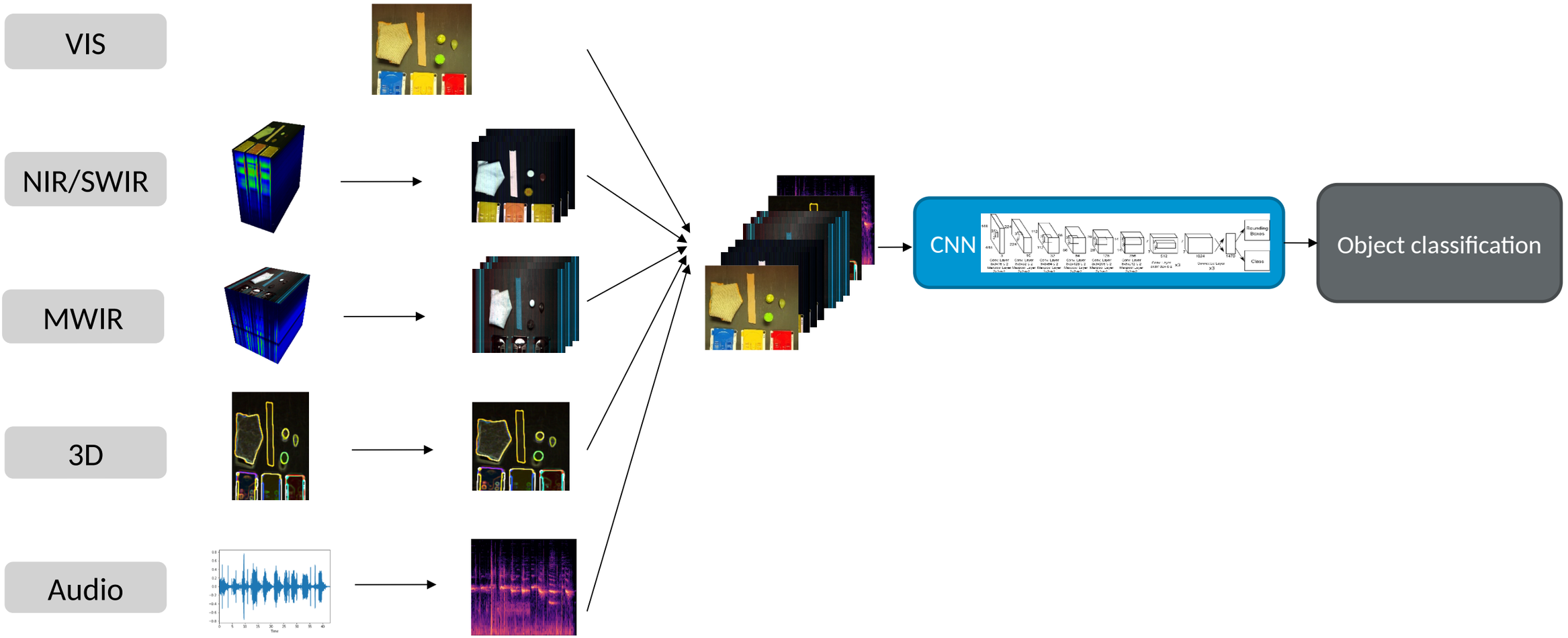


- **Use reinforcement learning to**
- **optimally dispatch/schedule**
- **Automated Guided Vehicles**
- **on a modular production system**
- **Comparison with heuristic approaches**
- **Find comparable performance**
- **of Deep-Q**
- **Increased robustness to noise**

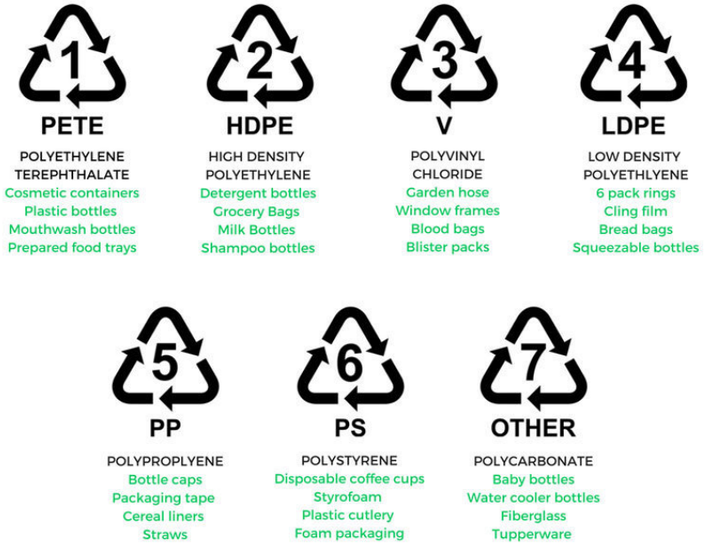
JR-Lab Processing Pipeline

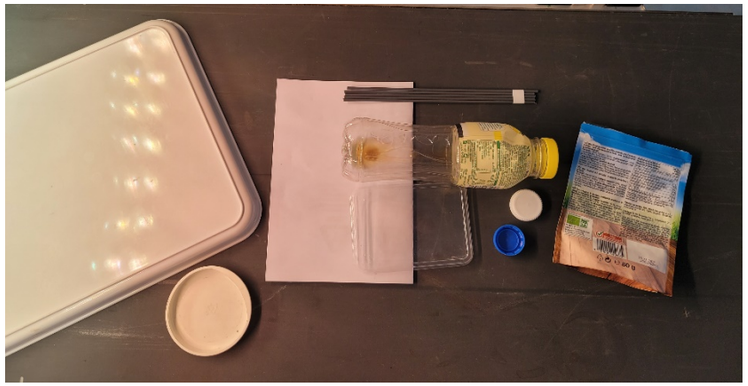


Object classification



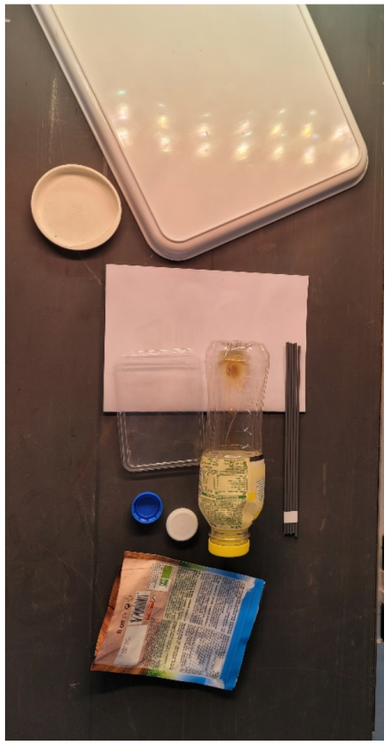
Use Case: Different Types of Plastics

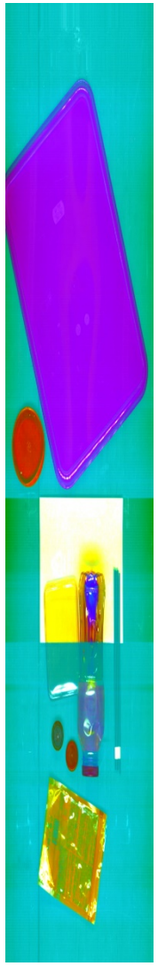




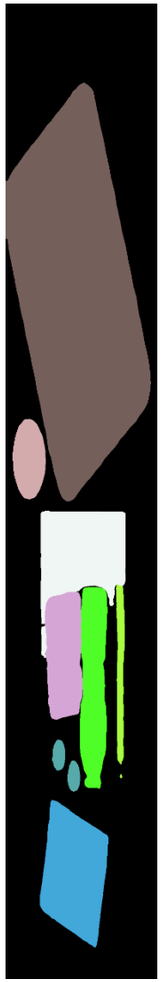
Results

Input

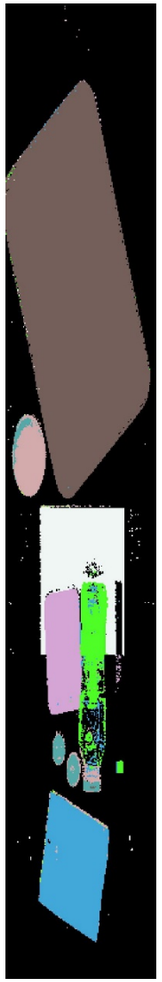




Ground truth



Conv1D: Classification results



Use Case: Contaminants in Wood Material

TEST

TRAIN

MDF

HDF

Painted HDF

Metal & Wood

Fabric

Paper

Stones

Glass

Plastics

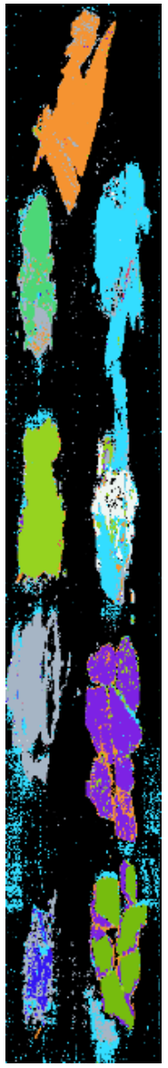
Other

Results

Input

Ground truth

Conv1D: Classification results

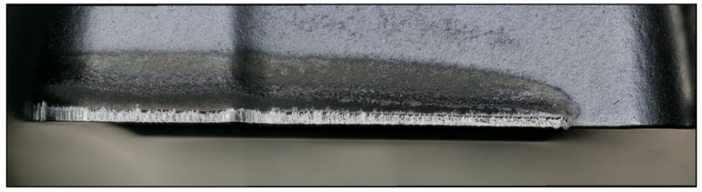


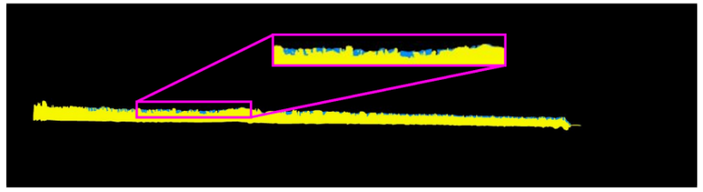
Use Case: AI-based configuration agent for AM

- Production parameters depend on material, design, production volume
- Done by experienced technician, a lot of trial/error, lengthy simulations
- Provide AI agent for proposing production parameters based on previous prints + quality assessment, simulations, explicit feedback
- Keep human in the loop
  - keep oversight, enable learning from proposed parameters
  - AI needs to provide explanations for parameters (argumentation based on similarities/differences to designs and materials in previous prints)

Source: pixabay.com

- **Use Case: Detecting wear on cutting edge of industrial drill**
-
- **Evaluation of Data Augmentation and Loss Function in Semantic Image Segmentation for Drilling Tool Wear Detection**
- **E. Schlager, A. Windisch, L. Hanna, T. Klünsner, E.J. Hagendorfer, T. Teppernegg, [arXiv:2302.05262]**



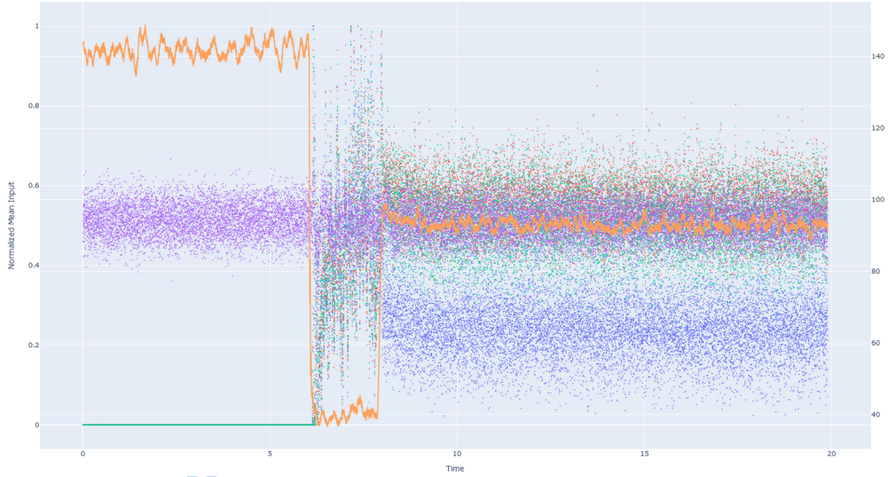


Left: Light optical microscopy image of cutting insert. Right: Associated mask with two types of wear marked in blue and yellow

- **Use a U-Net architecture to detect**
- **different types of wear on**
- **microscopy images of industrial drill**
- **cutting inserts**
- **Pipeline shows good results in**
- **detecting the different types of wear**

Use Case: crystAIr: Optimising combustion in gas turbines

- Keep combustion process in optimal range
  - no flame extinction, no flashbacks
  - important when transitioning to H_2 (faster processes)
- Burner printed (Inconel 718)
  - placeholders for piezo sensors
- Predict flashbacks from sensor data
  - no ground truth, learning stages from regular combustion process (reconstruction error)
  - classify combustion stages
  - ongoing: find patterns in the sensor data that indicate flashback early enough



Thank you for your attention!

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