

HOW DOES AI WORK?

*Alpha*AI software with Lego Spike

WHY Teach AI algorithms to everybody ???

(rather than only how to *use* AI ?)

$$W = \operatorname{argmin}_w \sum_k \sum_c \left(1 - e^{-\frac{M_w^c(x_i)}{\sum_c M_w^c(x_i)}} \right)^2$$

Use AI *better*



Foster engineering skills

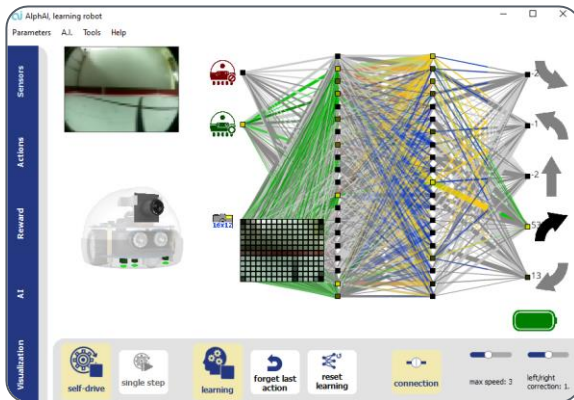


Address ethical questions



HOW: Teach AI algorithms by making them concrete !!

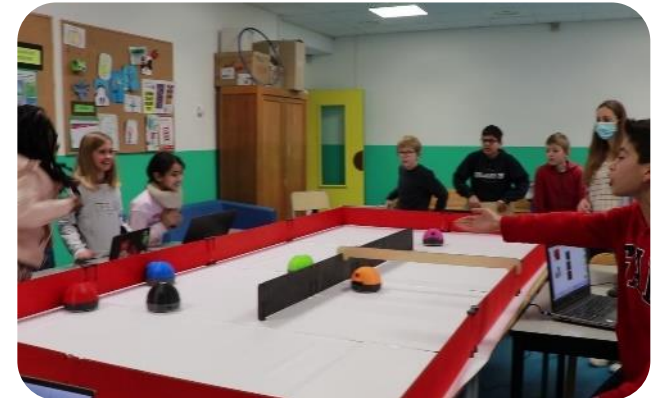
Visualize AI algorithms



Apply to physical robots

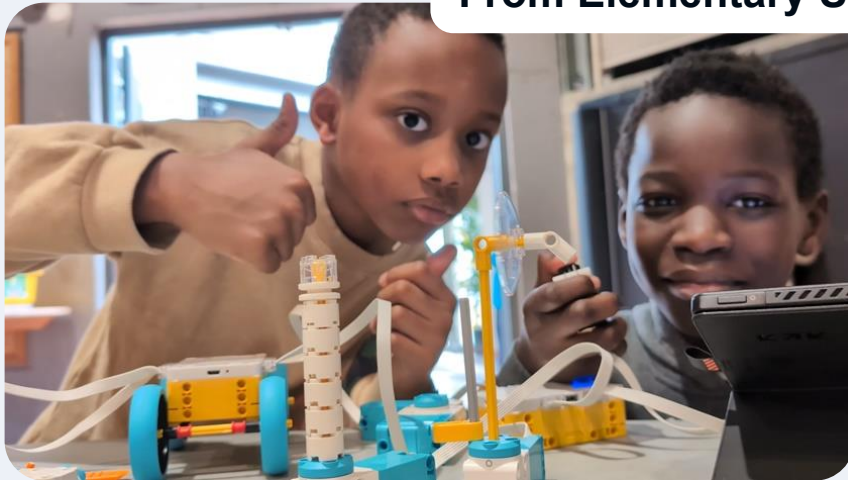


Playful activities



WHOM: From initiation to expert, at all ages!

From Elementary School...



to University!



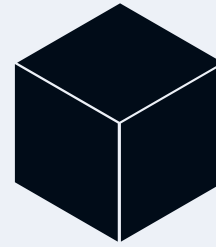
Corporate Training



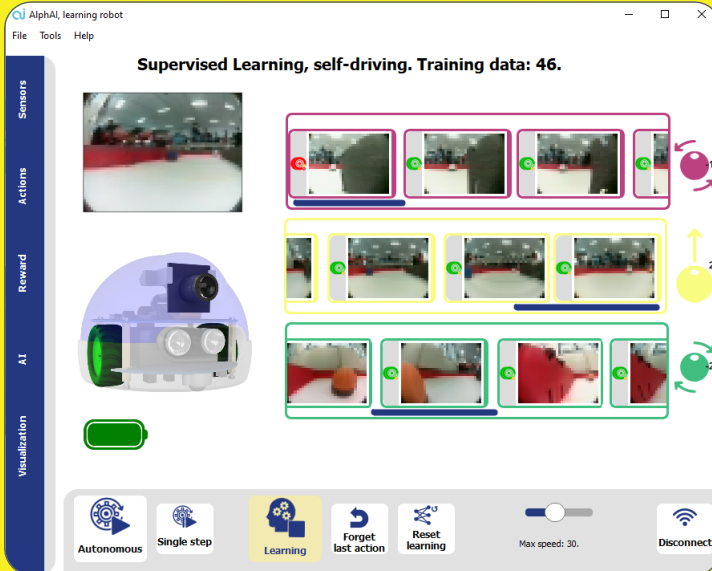
Worldwide adoption!



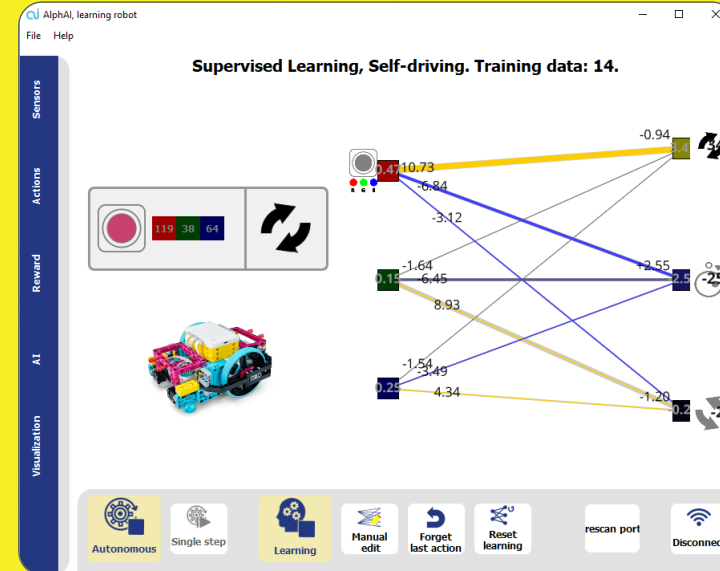
AlphaAI: Open the black box in 3 steps



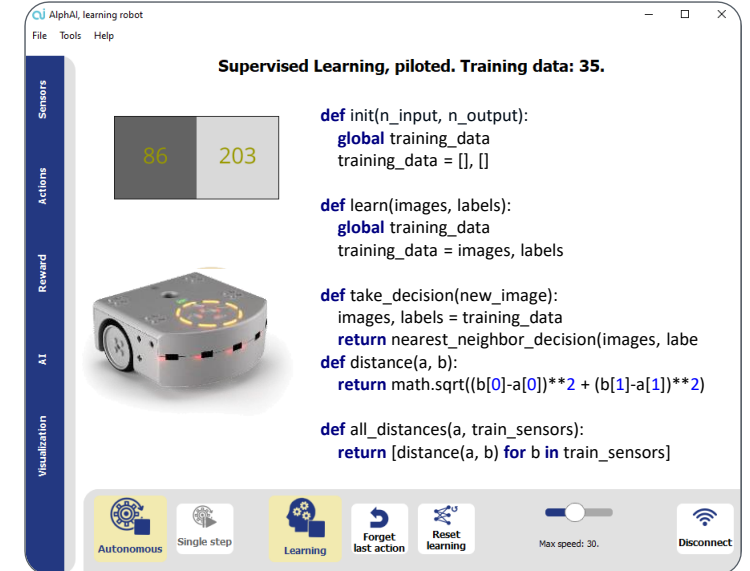
Discover AI & Data



Tinker with AI algorithms



Code in Python





Usage 1: Play with AI & Understand Data

Let even young Kids animate Robots Seamlessly
(easier than block coding)
Understand Sensor Data and Effectors
Understand AI Training and Testing



using AlphaAI robot



using Lego Spike





Usage 2: Tinker with AI Algorithms

Understand “How it works”

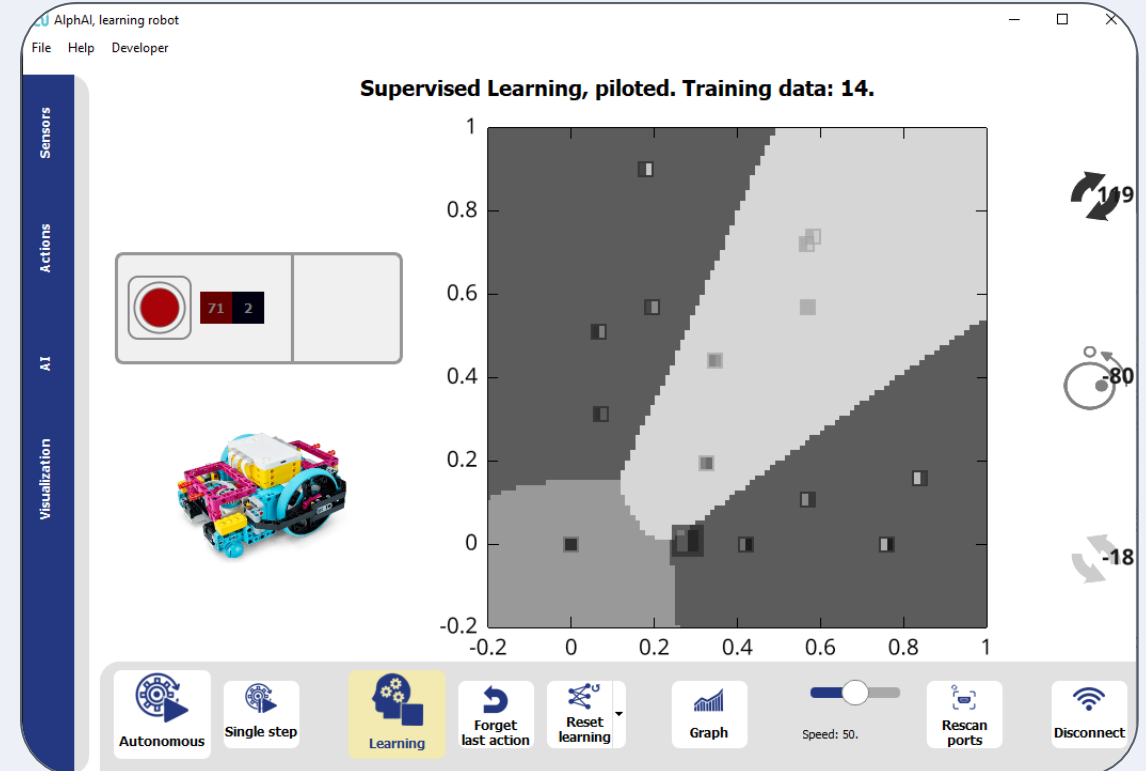
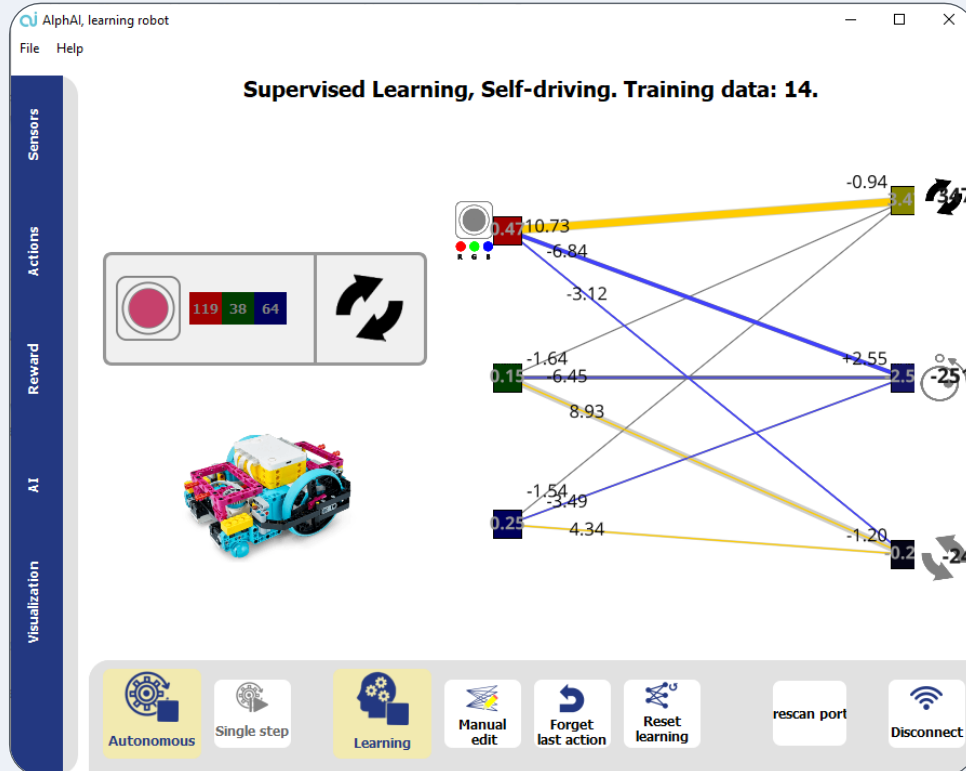
K-nearest neighbor algorithms

Neural Networks

Loss Minimization on the Training Data

Graph representation of Data and Decisions

Reinforcement Learning





Example Activities



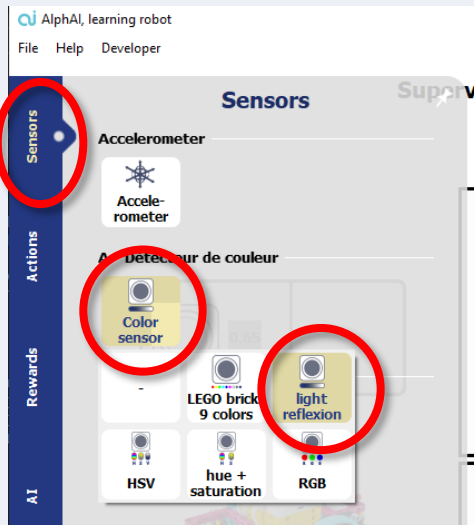
Initiation: Pet the Spike hub

1 Fix the color sensor atop the Spike hub

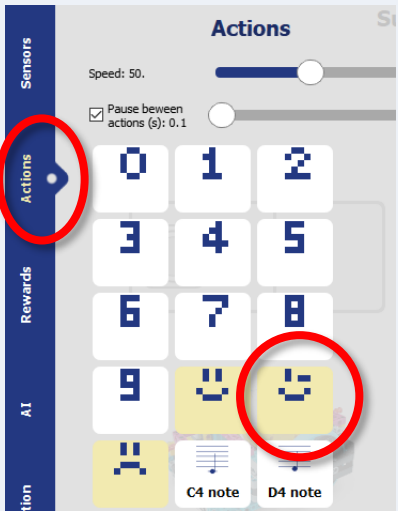


2 Connect to hub in the AlphaAI software

3 Configure sensors in tab: Color sensor ► light reflection

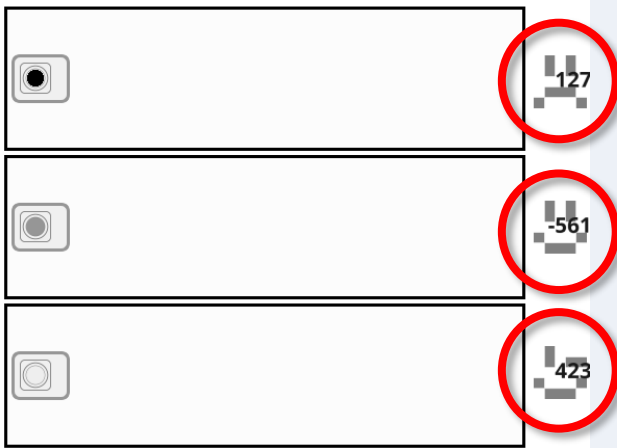
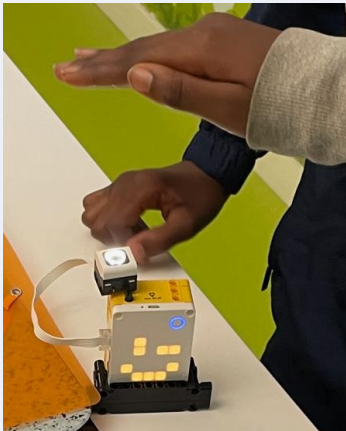


4 Configure actions in tab: Add action "wink"



5 Train your AI:

- Press "frown" action when sensor sees nothing
- Approach your hand and press "smile"
- Put your hand very close and press "wink"



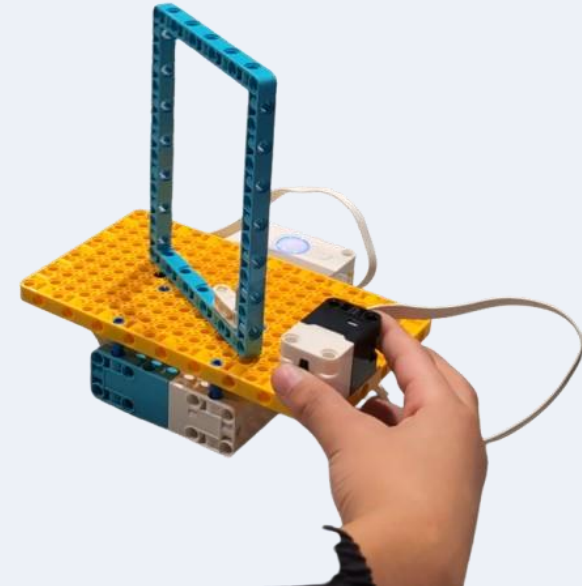
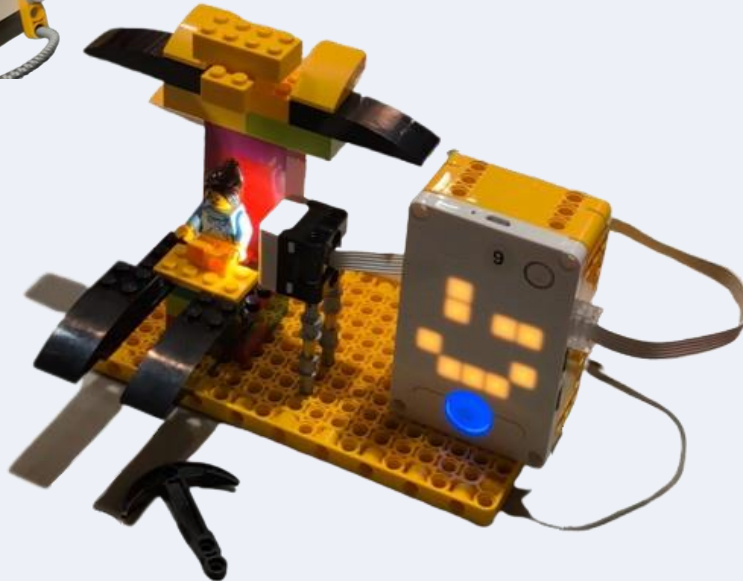
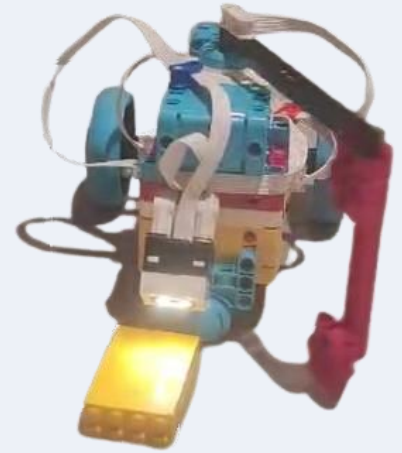
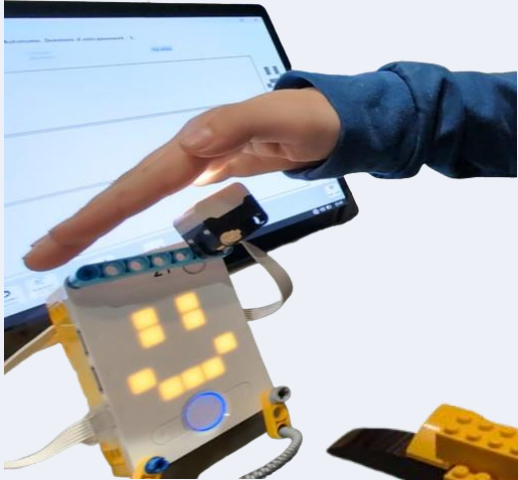
6 Press "autonomous: you can now pet your Lego robot and it will react ;-)

THAT'IT! THIS IS MACHINE LEARNING





Imagine and animate your robot!!



Waste sorting machine – Basics



building instructions available

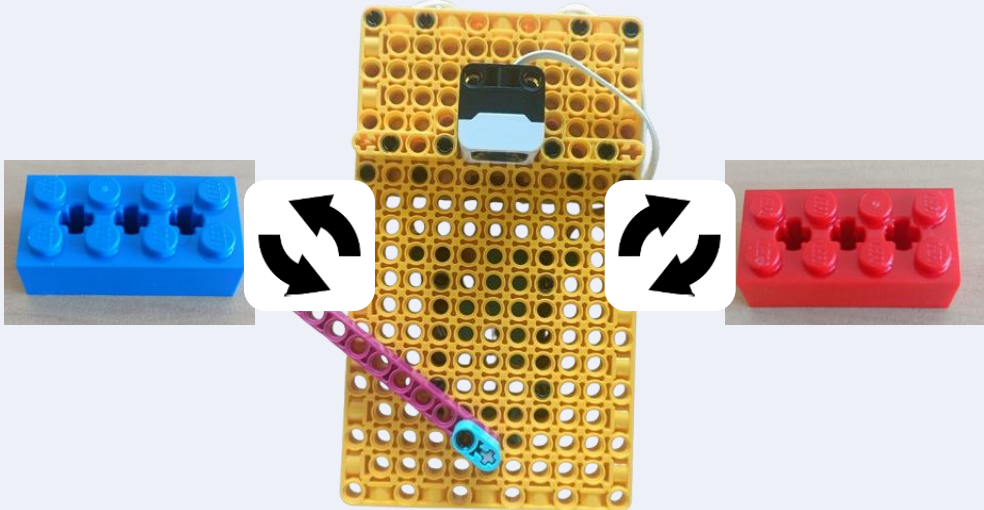
👉 Does your machine sort correctly blue and red pieces?

👉 What happens when presenting pieces of other colors? How are they sorted?

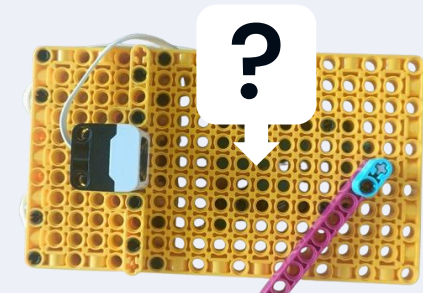
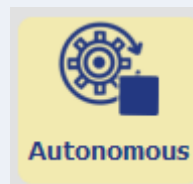


👉 What happens when the piece is placed too far from the sensor? Can we improve this?

- 1 Train your sorting machine to:
 - Push a **Red** lego piece to the **Right**
 - Push a **Blue** lego piece to the **Left**
 - **Reset motor** if not seeing anything



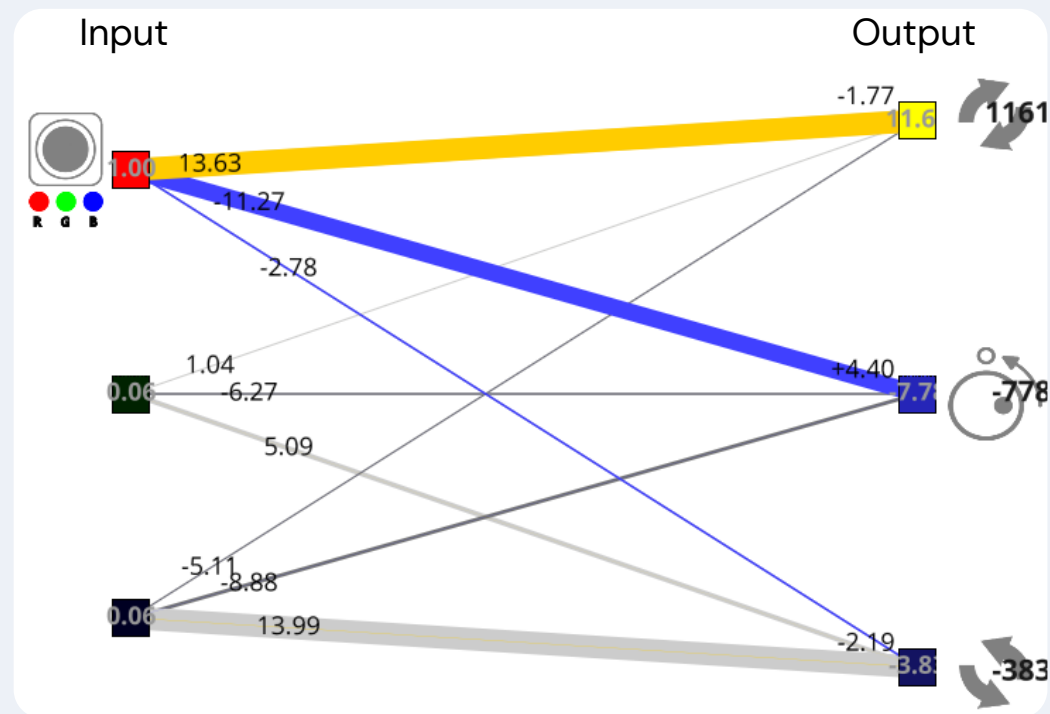
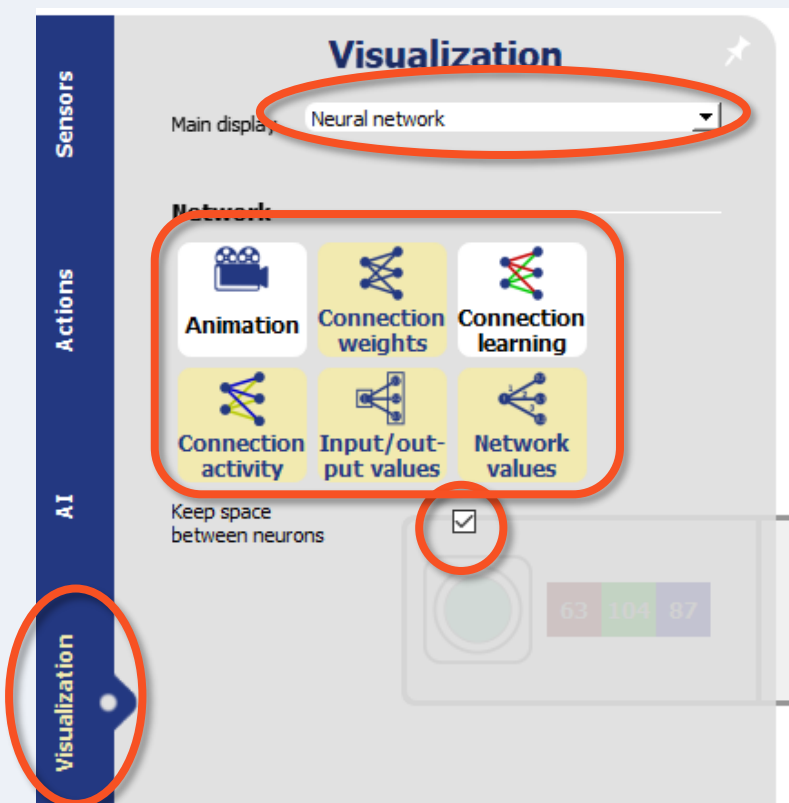
- 2 Hit “Autonomous” to test your machine!





Waste sorting machine – Neural Network

- 1 In the Visualization tab:
 - Switch Main display to “Neural Network”
 - Adjust other options as below



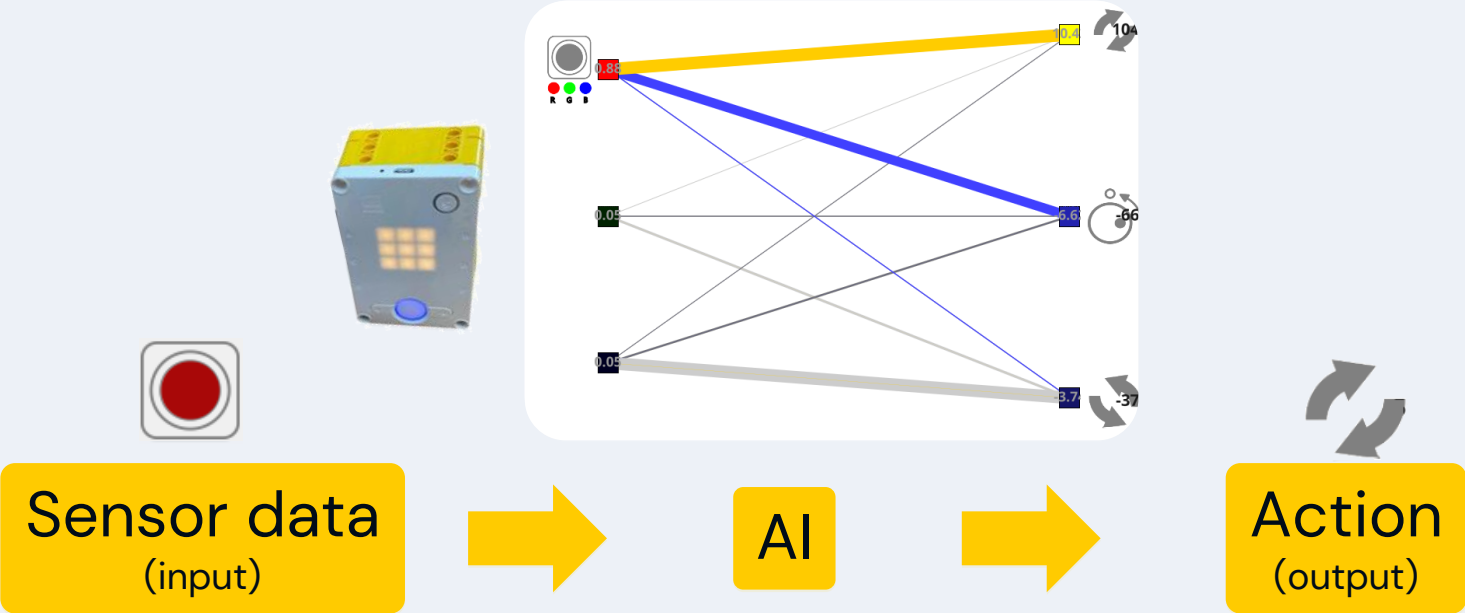
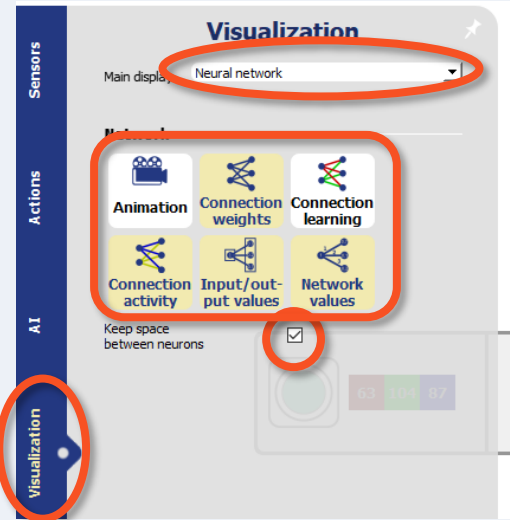
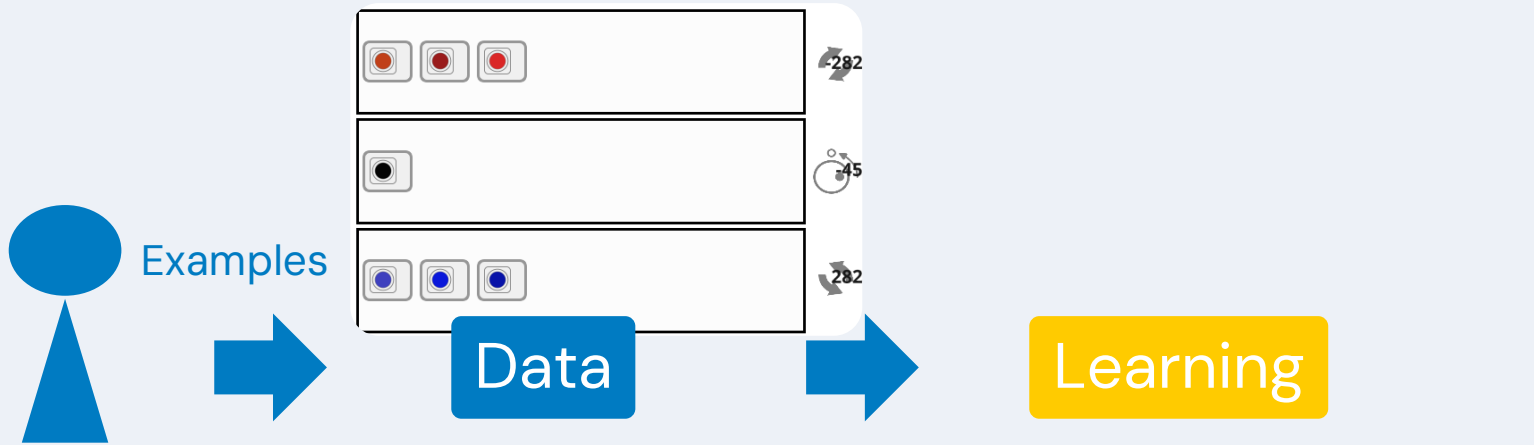
Can you understand the “neural network” that appeared? What are its input, its output?

How do input and output change when showing different colors? Does it make sense to you? Can you now understand why is *Yellow* sorted on the *Right*?



Waste sorting machine
– Under the hood

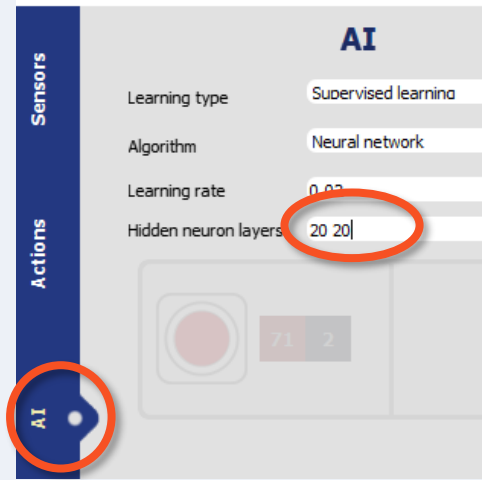
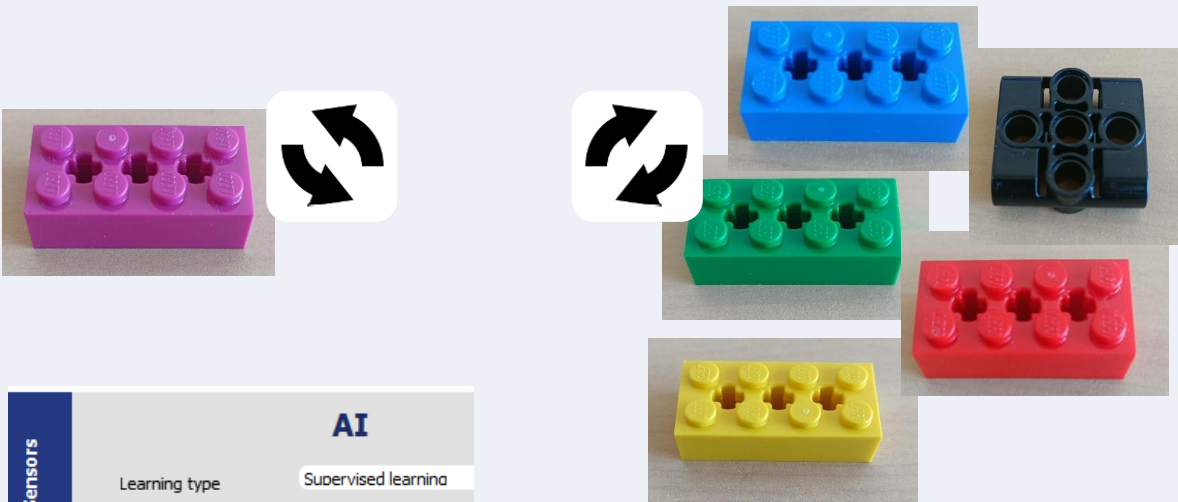
- 1 A **Neural Network** makes connections between input and output
- 2 **Learning** from the **data** consists in **adjusting the connections**



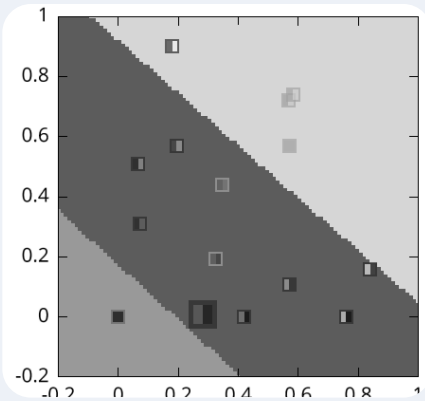
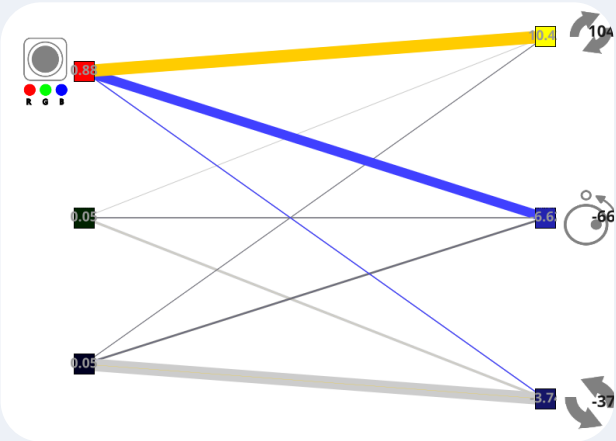


Waste sorting machine
– Simple vs. complex neural nets

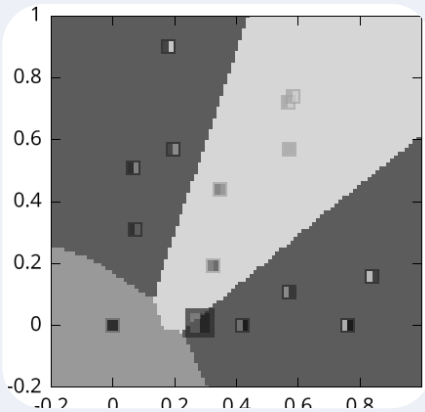
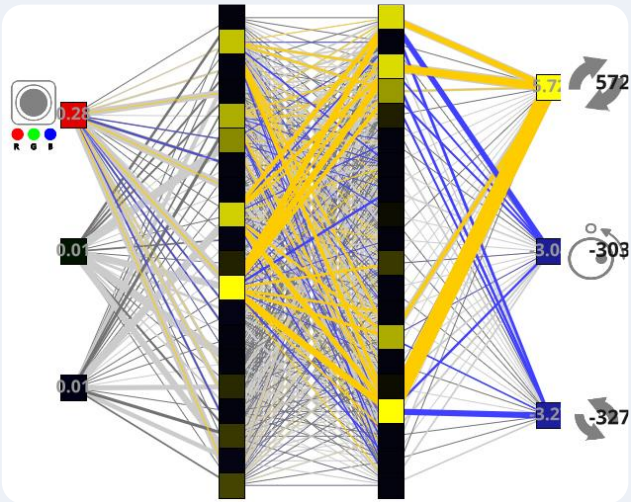
Only a multi-layers neural net can learn complex patterns of color sorting



Simple network → simple “rigid” learning abilities



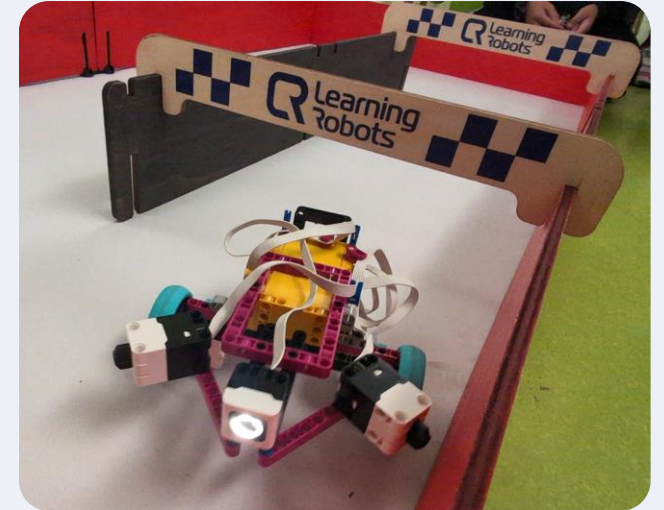
Multilayers network → “flexible” learning abilities





Robot racing

Give a goal, organize
some challenge



https://youtu.be/o_HWLYo_M_w



<https://youtu.be/kZ4ERijXWwE>

discovery



algorithms



Controlling robot from the PC camera



<https://youtu.be/zOKewYHcRx8?feature=shared&t=25>





Reinforcement Learning

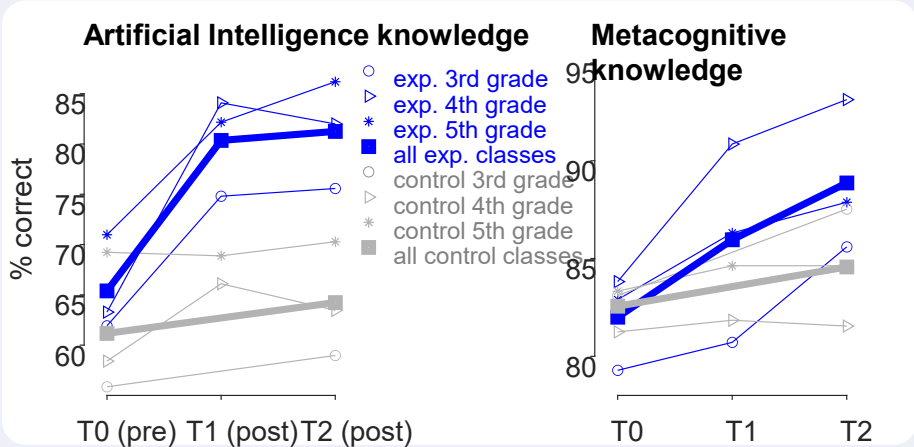


<https://youtu.be/heErEOgFuD>

Reinforcement Learning and Metacognition!



(Martin et al., 2023)



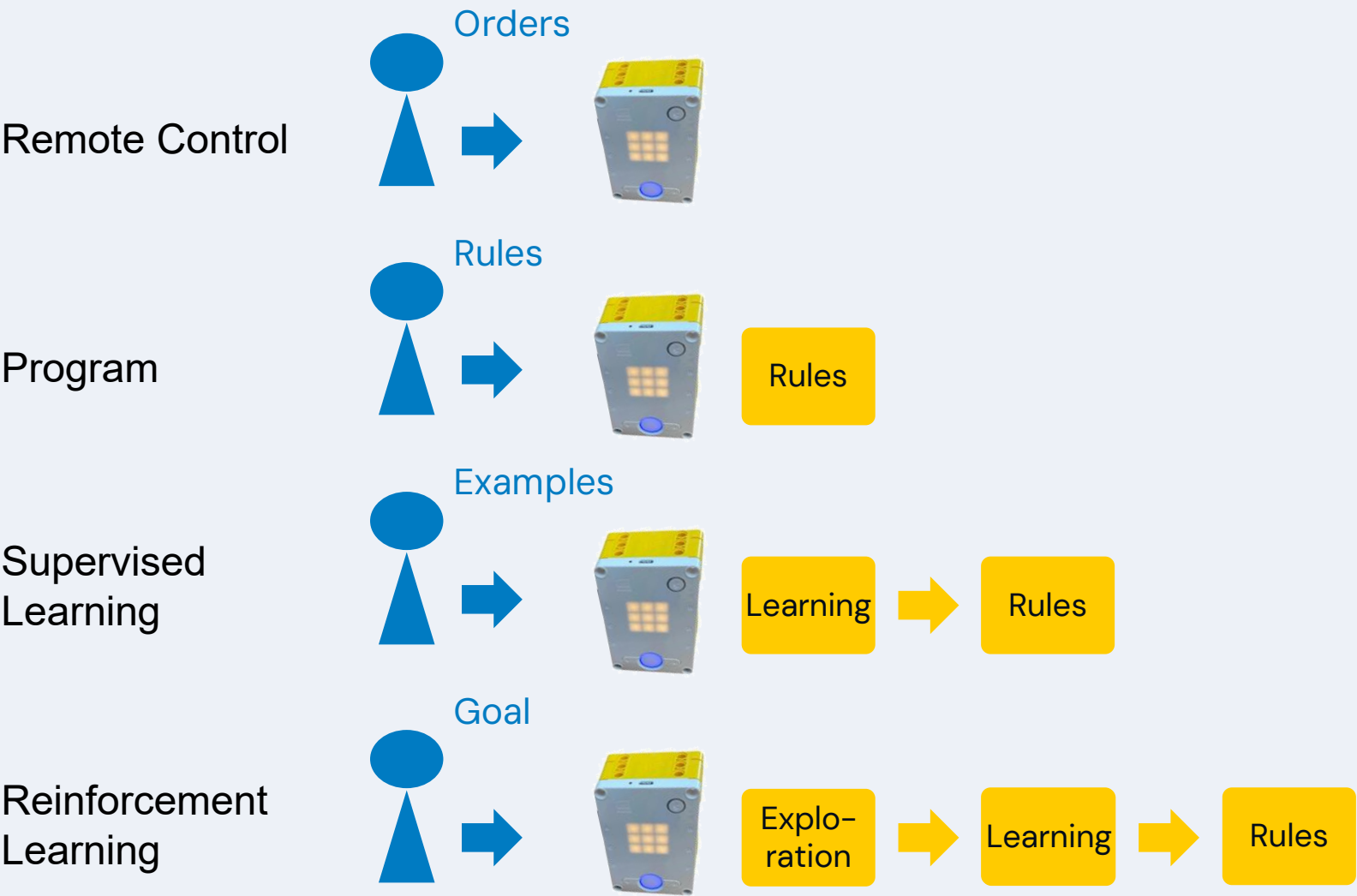
discovery



algorithms



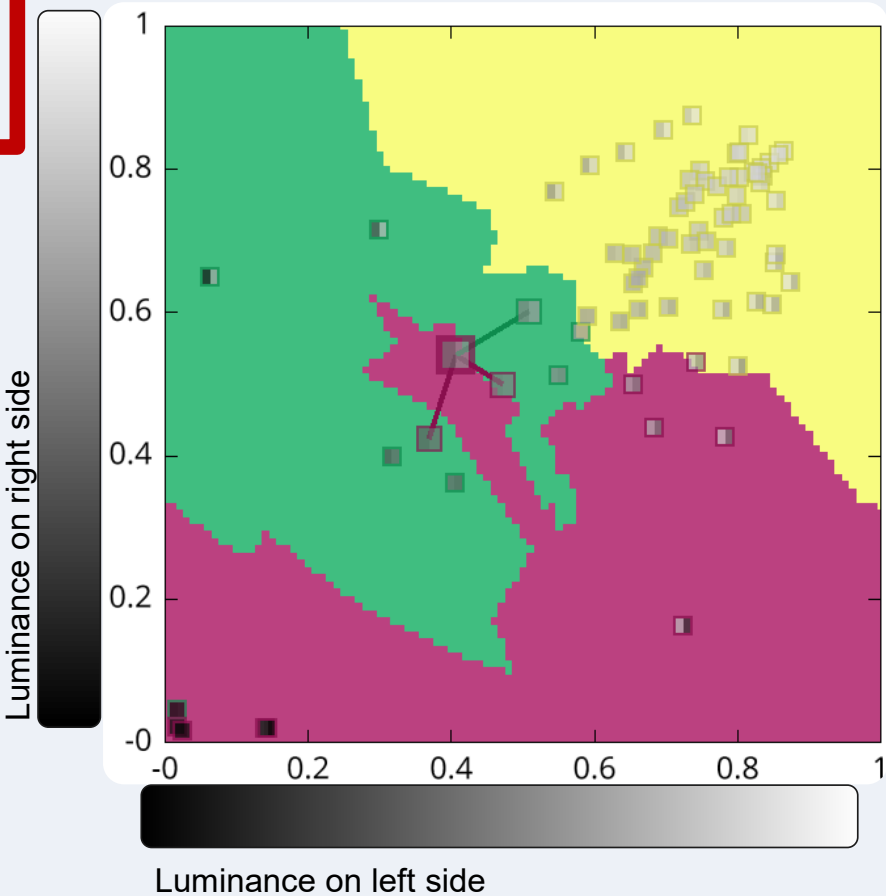
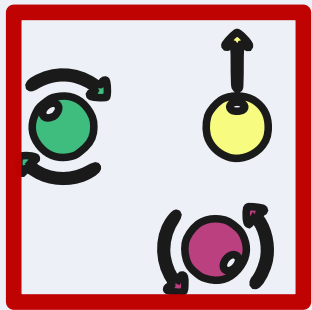
4 Levels of Autonomy of a Robot





More advanced algorithms

K nearest neighbors algorithms



Understand hidden neuron layers in details

