



Workshop Starter

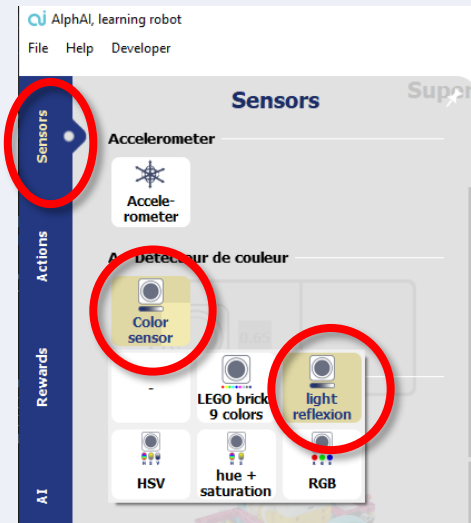
Pet the Spike hub

Pet the Spike hub

- 1 Fix the color sensor atop the Spike hub



- 3 Configure sensors in tab: Color sensor ► light reflection

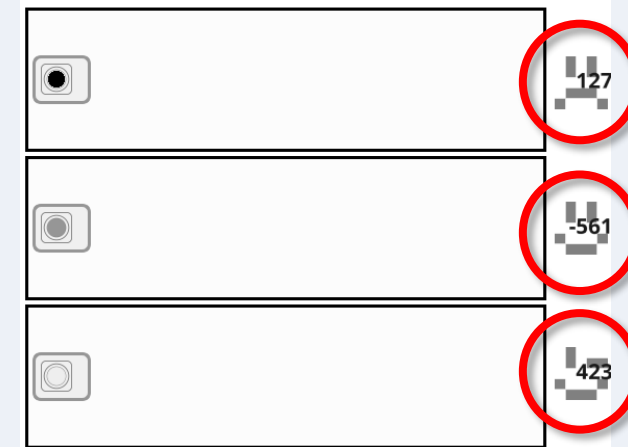


- 4 Configure actions in tab: Add action "wink"



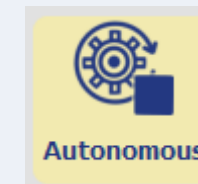
- 2 Connect to hub in the AlphaAI software

- 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"



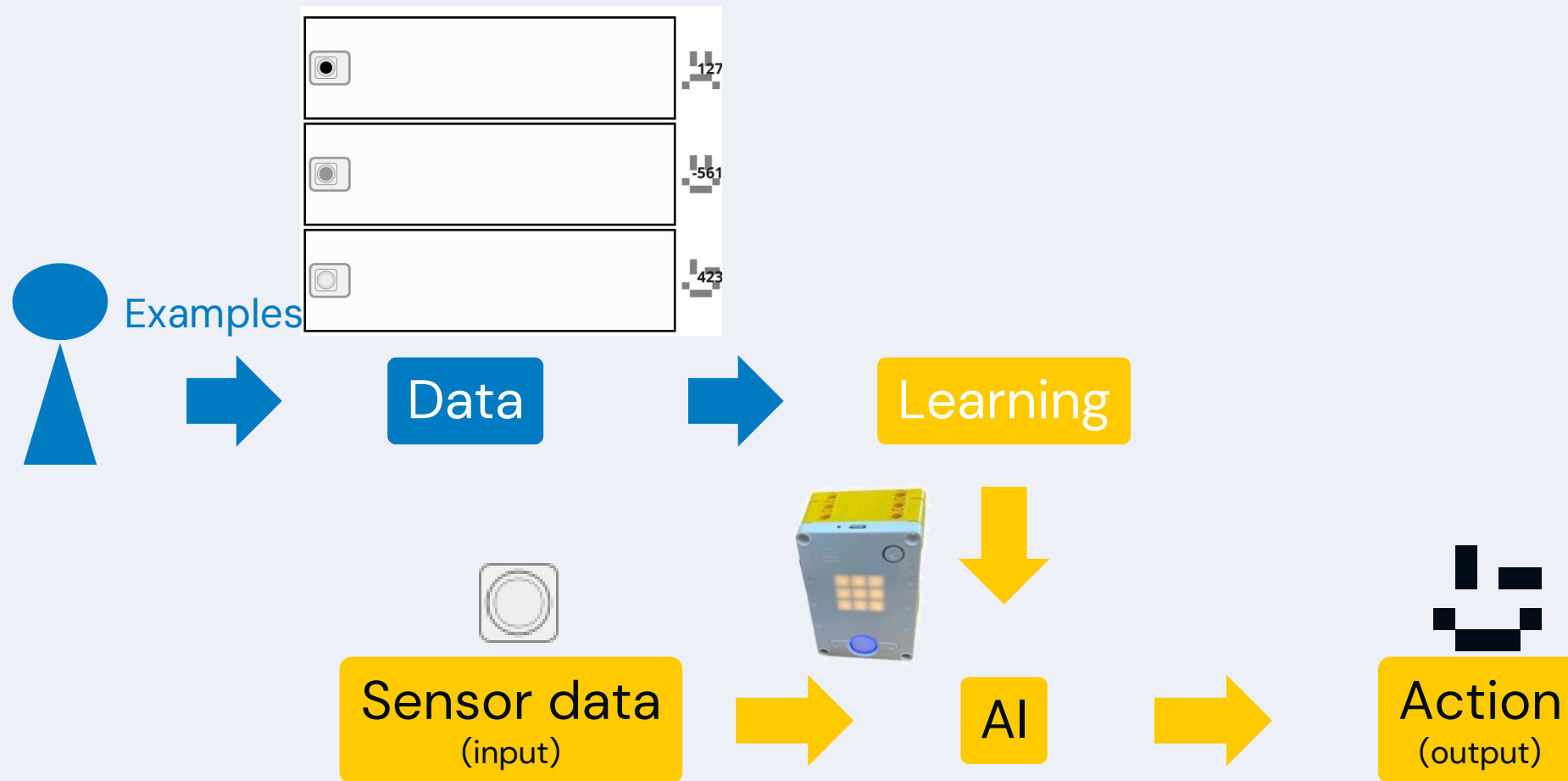
- 6 Press "autonomous: you can now pet your Lego robot and it will react ;-)

THAT'IT! THIS IS MACHINE LEARNING



What have we learnt?

- 1 An AI processes input and returns output
- 2 An AI **learns** from **data** provided by trainer



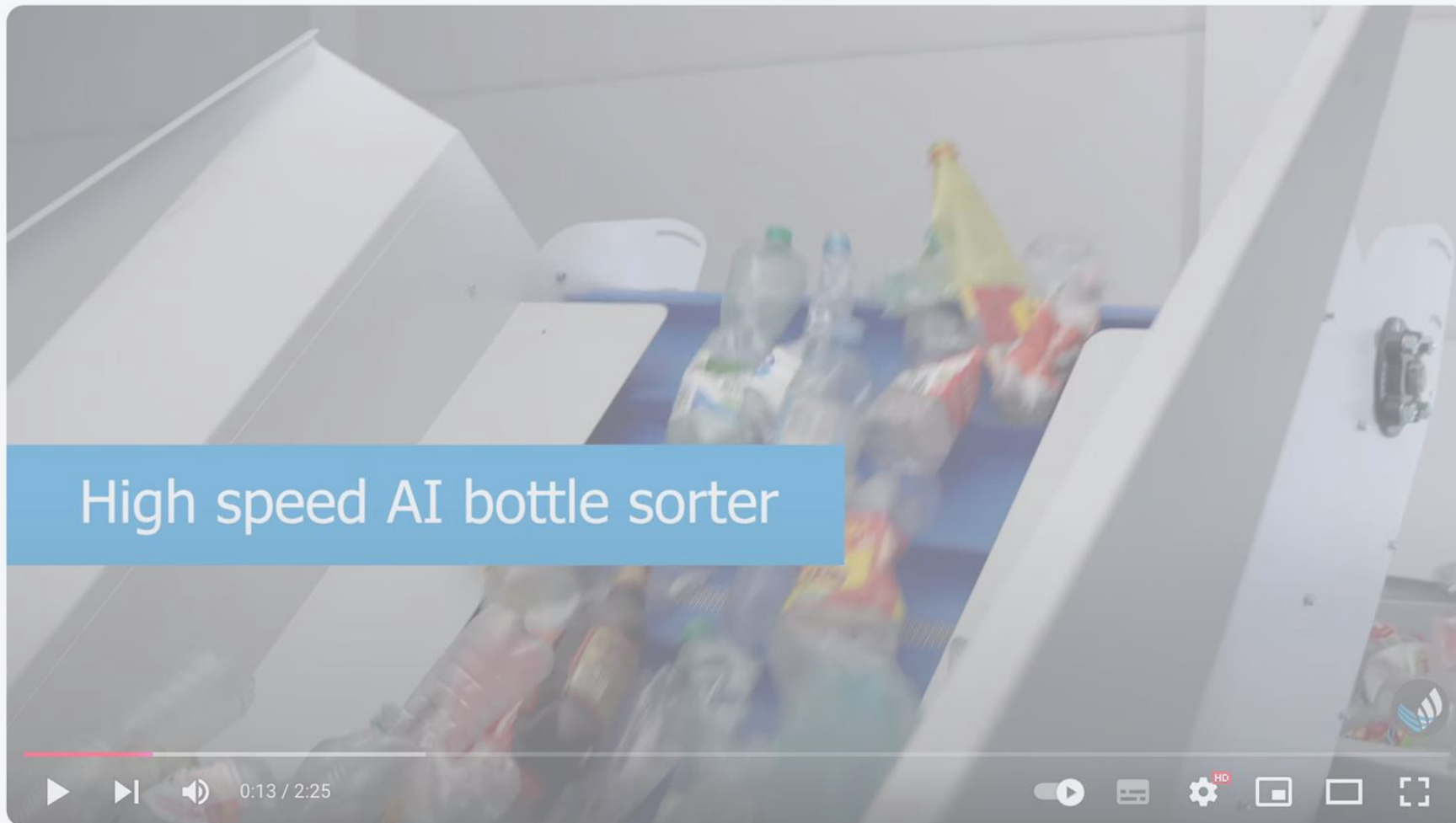


In-depth activity

Waste sorting machine

Robots can help us sorting waste

👉 Watch this video and analyse the technology used.



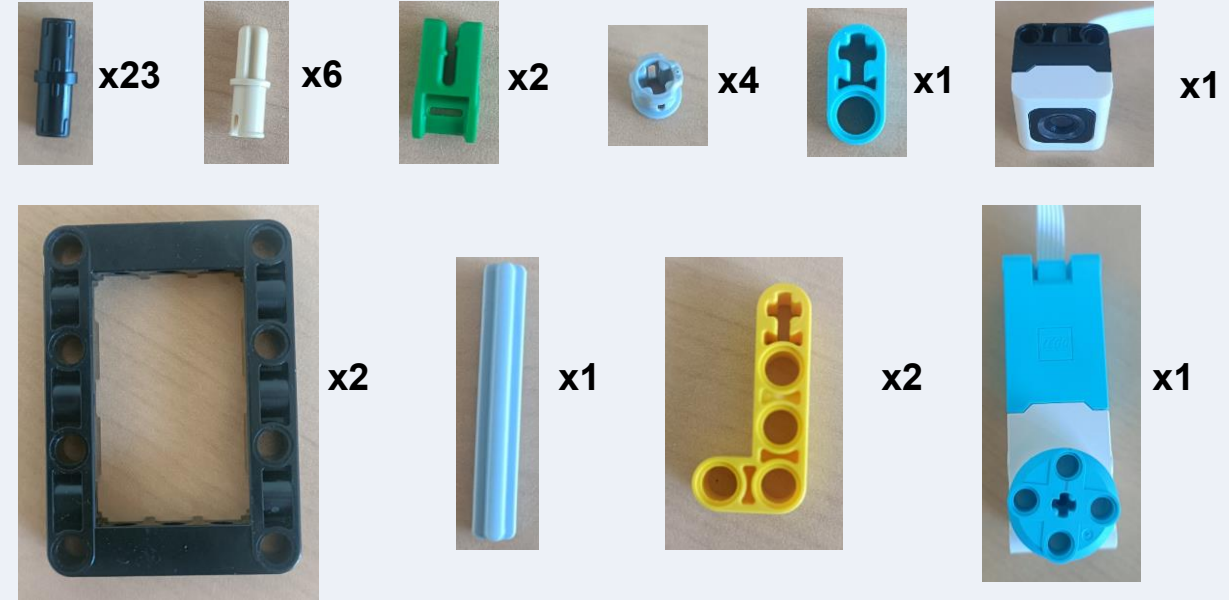
https://www.youtube.com/watch?v=E30VP9_0M98

Let us build our waste sorting machine



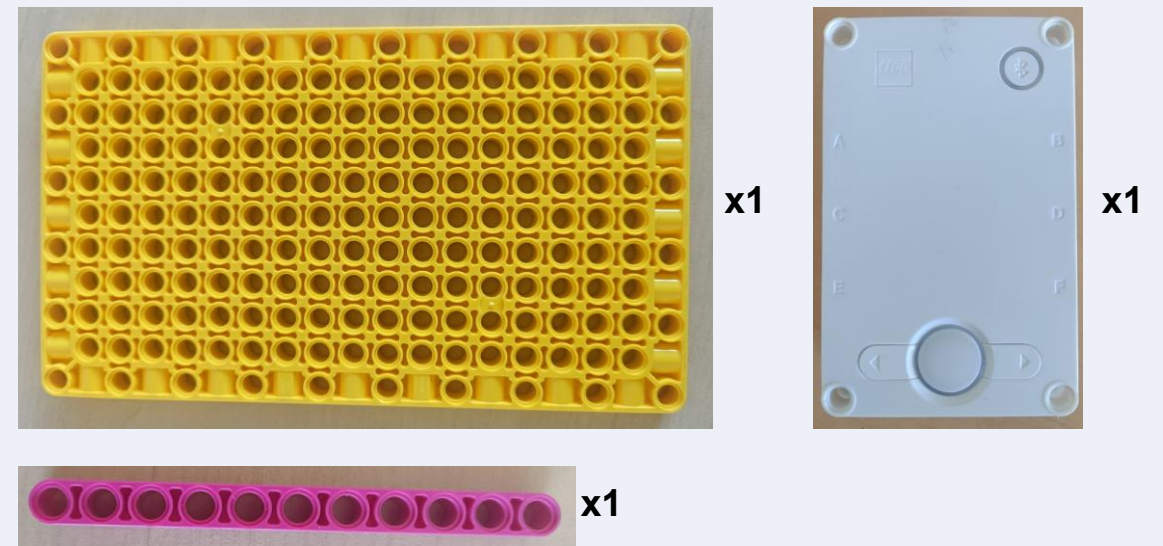
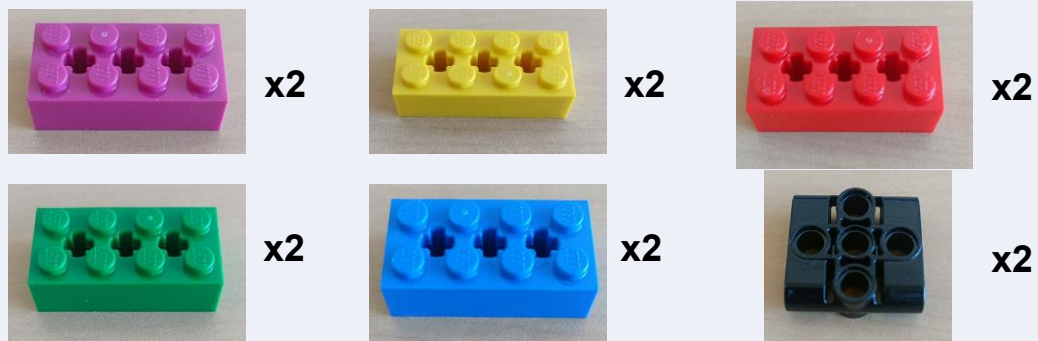
Build!

Pieces needed



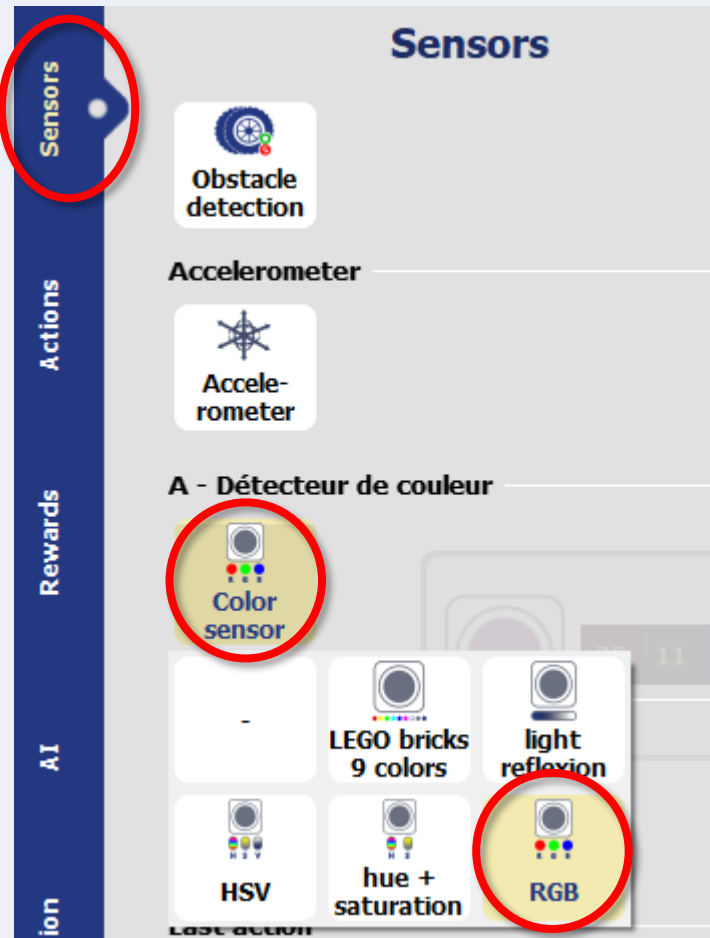
Use!

Pieces needed

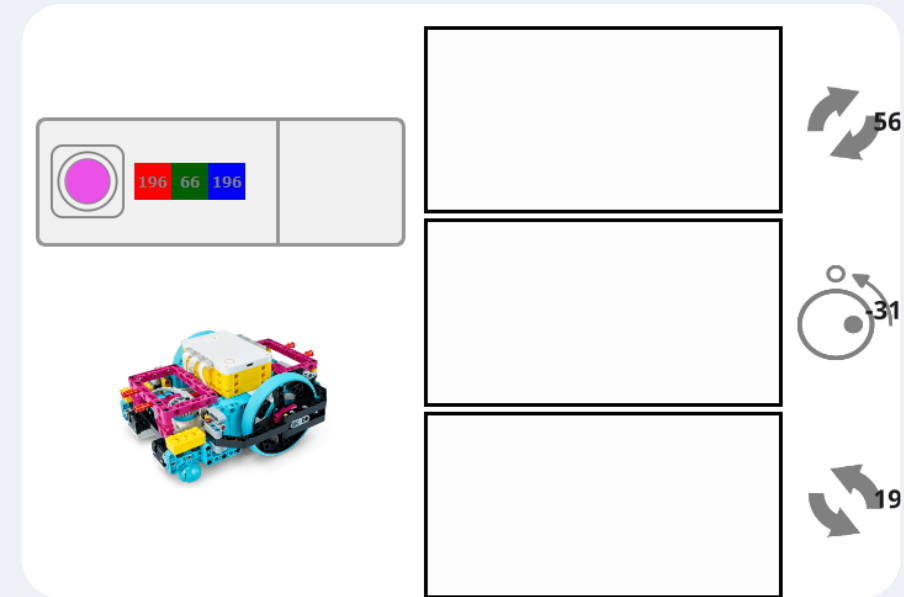


Configuration

- 1 Sensor: now use RGB mode of the color sensor

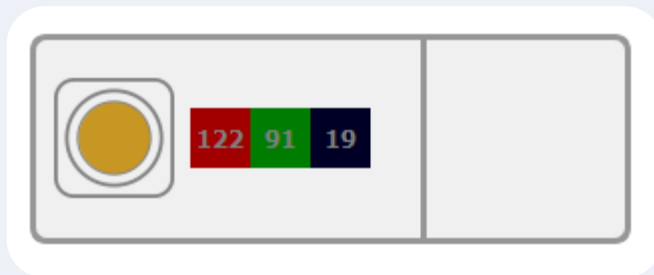
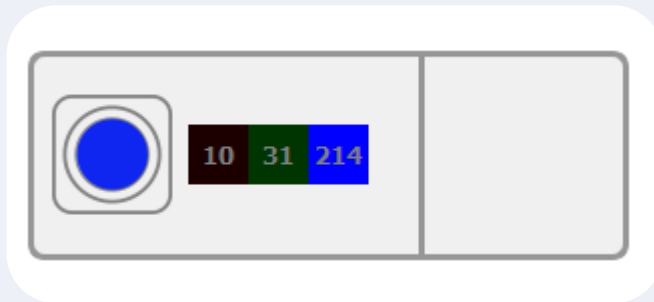


- 2 Actions: Replace action "Stop" by action "Reset motor"



Understand the RGB values

Approach color bricks to the color sensor,
and observe the display of Red-Green-Blue values

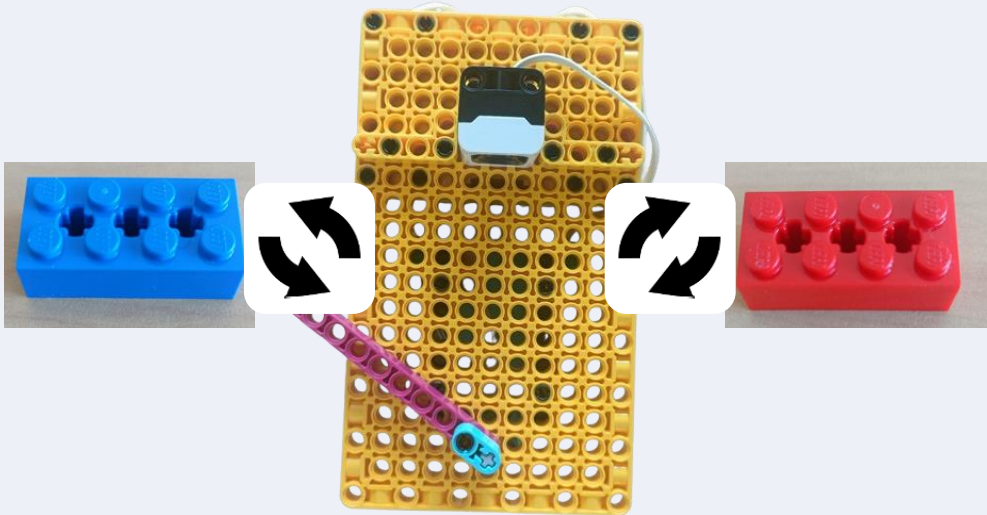


👉 Every color can be decomposed
of Red, Green and Blue values!!

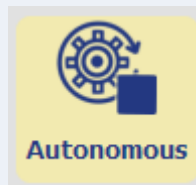
👉 What is the decomposition of
Yellow? Of Magenta?

Basic training

- 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!

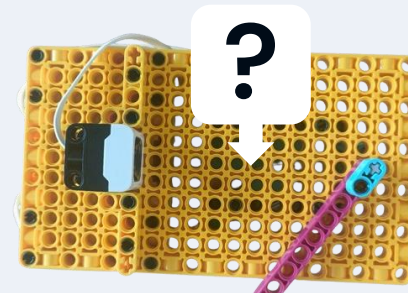


👉 Does your machine sort correctly blue and red pieces?

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

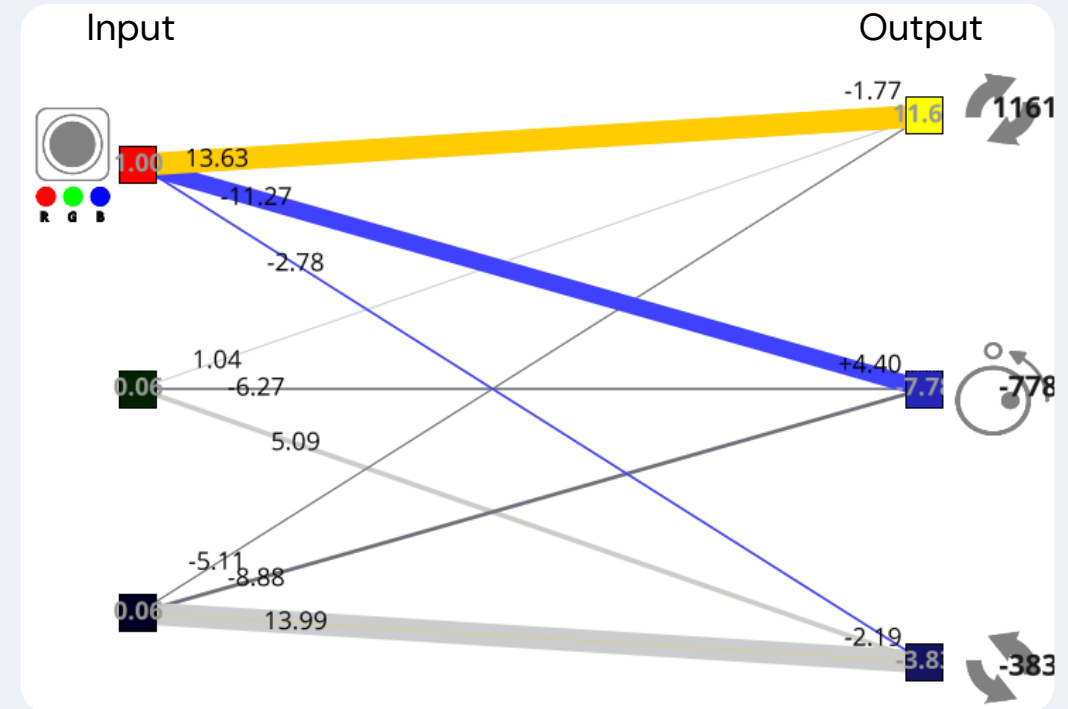


👉 What happens when the piece is placed too far from the sensor? Can we improve this?



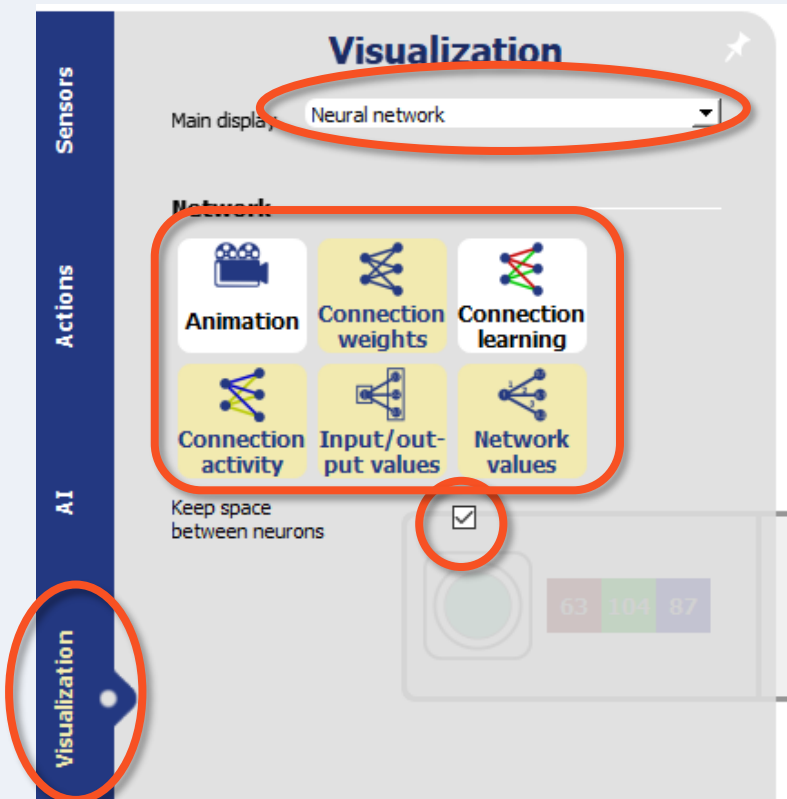
Now let's open the hood and see the neural network behind!!

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



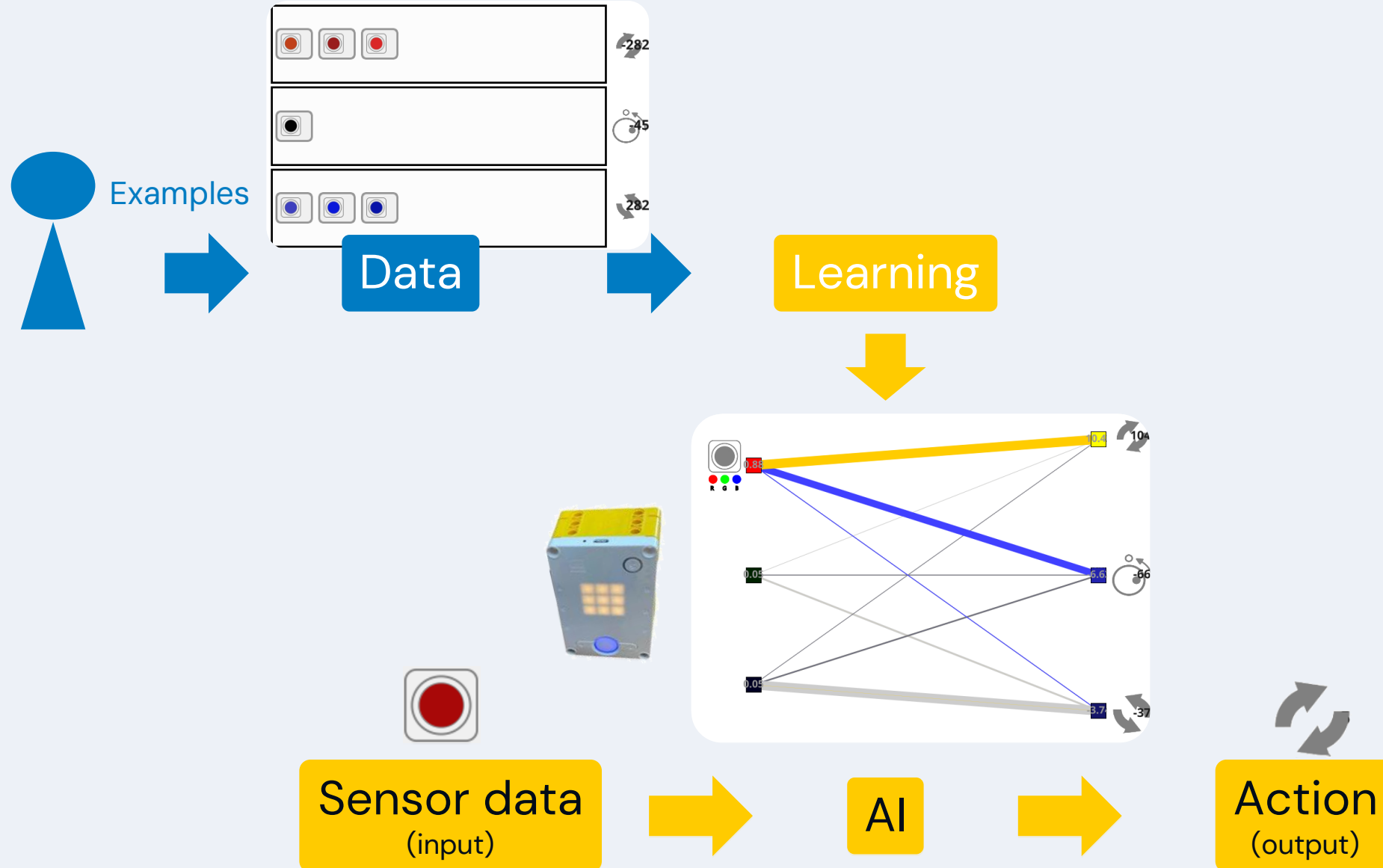
👉 Can you understand the “neural network” that appeared? What are its input, its output?

👉 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*?



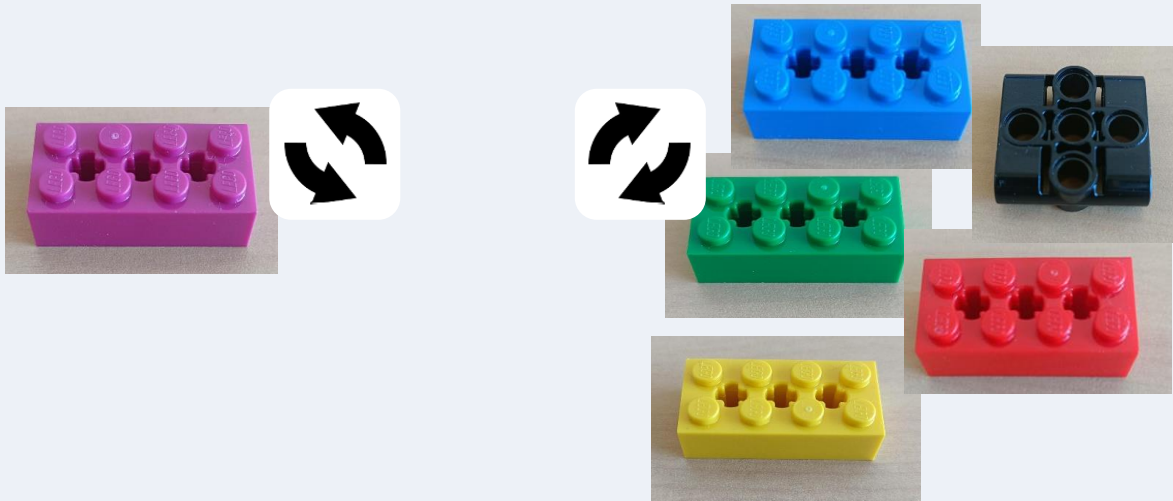
What have we learnt?

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



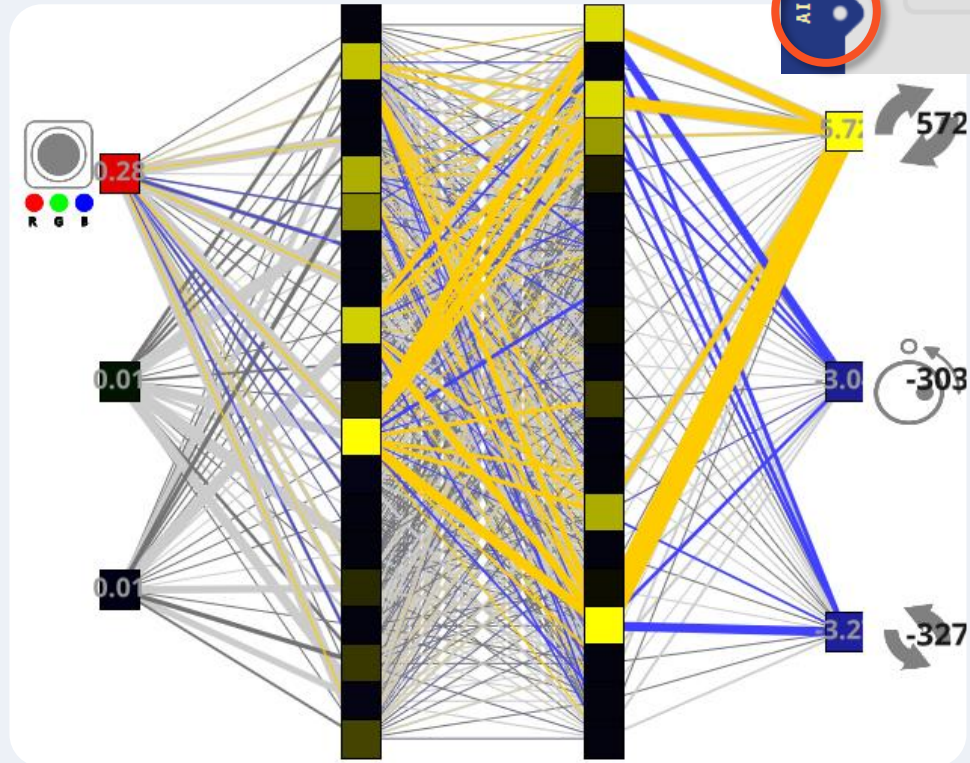
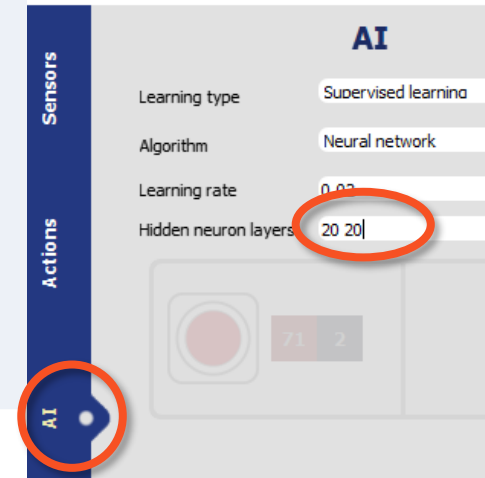
Let's make things more difficult!!

- 1 Try training the machine to sort magenta pieces on one side, and all other pieces on the other side.



👉 Can you explain why it does not work?

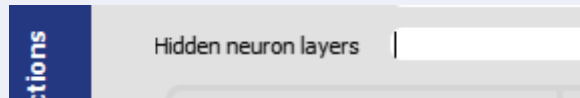
- 2 In the AI tab, add two hidden layers of 20 neurons each. Test your machine again!



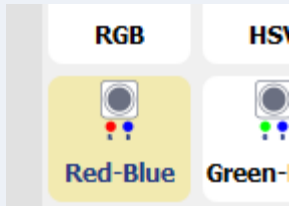
👉 Adding neurons to the network increases its flexibility to learn complex patterns!

One more level up! Explain what happened with the data graph

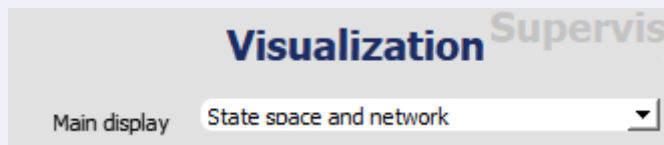
- 1 In the AI tab, remove the hidden layers



- 2 In the Sensor panel, change color mode to monitor only Red and Blue channels

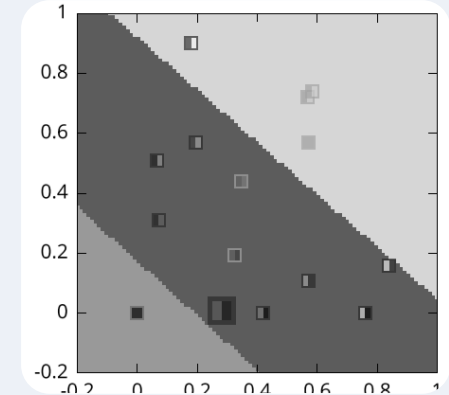


- 3 In the Visualization panel, switch Main display to “State space and network”

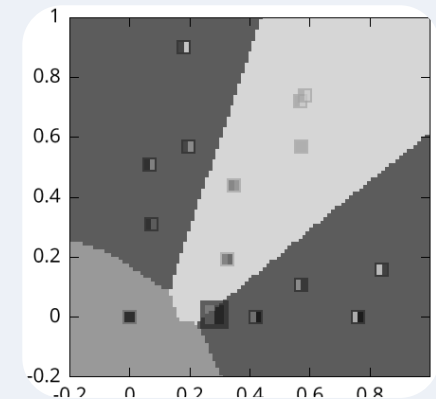
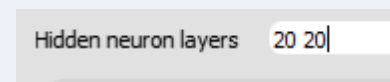


👉 Can you understand this graph that appeared?
See how the point moves for different colors.

- 4 Try training the AI to sort **red and blue** on the **right**, and **magenta** on the **left**.



- 5 Put back the two layers of 20 neurons and try the machine again!



👉 Adding neurons to the network increases its flexibility to learn complex patterns!