AlphaI, a learning robot for education to AI

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Demystify artificial intelligence

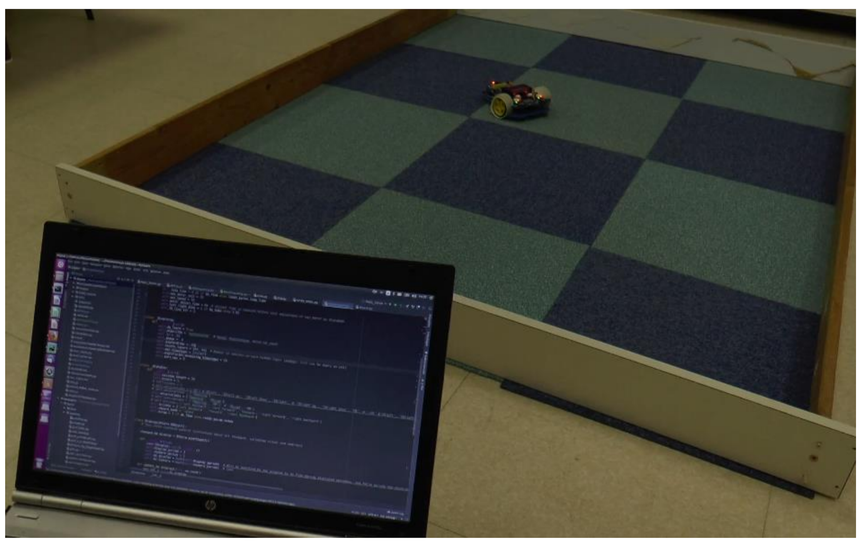
Artificial intelligence (AI) is spreading in our daily lifes. A new revolution is coming with *neurorobotics*, where robots interact in the physical world and learn autonomously.

As a consequence, AI fascinates, but also challenges society. The mere term itself "artificial intelligence" is actually a lure, and it is of primary importance to offer more comprehension of its principles to the general public.

The *AlphaI* robot has been developed to explain artificial intelligence to children. learns a simple behavior in front of children: navigate inside an arena and avoid obstacles. The mechanisms of its decision makings and learning are explained by using biology and the brain as a comparison, leading to passionate discussions with classrooms.

First learnings

Today, the prototype *AlphaI* uses deep reinforcement learning to learn how to move inside its arena in order to maximize its average speed. At startup, its behavior is random, but later on it learns to make straight lines and avoid obstacles.



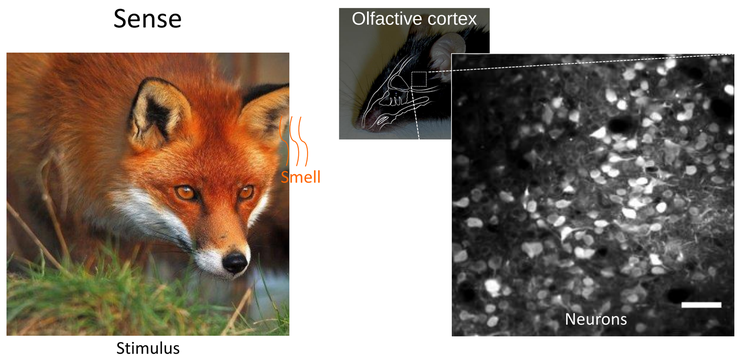
Presentation in schools

AlphaI is presented to classes with children from 6 to 14 years old. The mechanisms of its decision makings and learning are explained by using biology and the brain as a comparison. Scenarii of increasing complexity allow good grasping of the principles and algorithms involved. Children also acquire empathy for *AlphaI*, this generates amazing discussions about the comparison between human and machines, and on "how we learn".

Topics discussed with children (8-14 years old)

Neuroscience

Sense



Stimulus

Act

Behavior

Robotics and machine learning

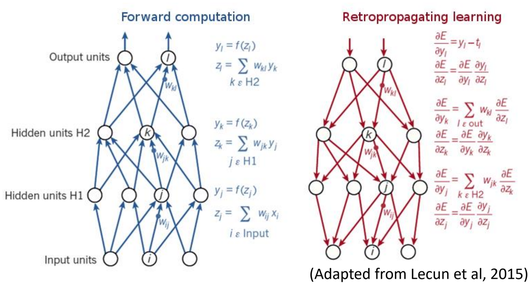
Reinforcement learning

Q-learning

$$Q(s_t, a_t) = E(R_{t+1}) + \gamma\, Q(s_{t+1}, a_{t+1})$$

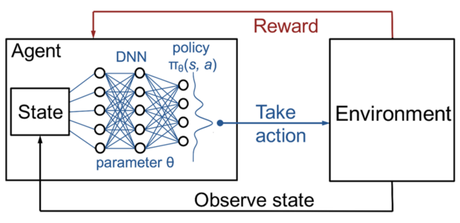
$$Q_{t+1}(s_t, a_t) = \underbrace{Q_t(s_t, a_t)}_{\text{actuel}} + \underbrace{\alpha_t(s_t, a_t)}_{\text{vitesse d'apprentissage}} \cdot \left(\overbrace{\underbrace{R_{t+1}}_{\text{recompense}} + \underbrace{\gamma}_{\text{facteur d'actualisation}} \underbrace{\max_a Q_t(s_{t+1}, a)}_{\text{valeur optimale estimee}}}^{\text{valeur apprise}} - \underbrace{Q_t(s_t, a_t)}_{\text{actuelle}} \right)$$

Deep learning



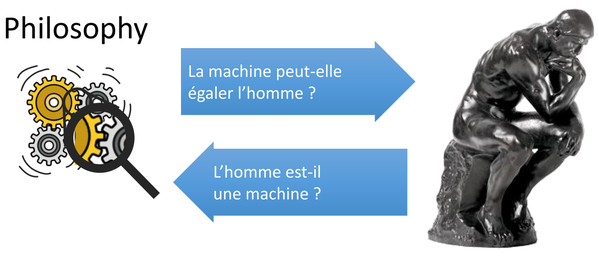
(Adapted from Lecun et al, 2015)

Deep reinforcement learning



Humanities

Philosophy



Literature

La Nature est un temple où de vivants piliers
*Laissent parfois sortir **de confuses paroles**;*
*L'homme y passe à travers **des forêts de symboles***
Qui l'observent avec des regards familiers.

Comme de longs échos qui de loin se confondent
Dans une ténébreuse et profonde unité,
Vaste comme la nuit et comme la clarté,
***Les parfums, les couleurs et les sons se répondent**.*

*Il est des **parfums frais** comme des **chairs d'enfants**,*
***Doux comme les hautbois, verts comme les prairies**,*
*— Et d'autres, **corrompus**, riches et triomphants,*

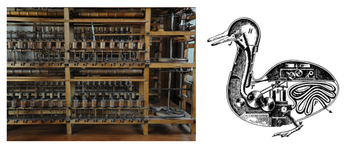
*Ayant l'expansion **des choses infinies**,*
*Comme **l'ambre, le musc, le benjoin et l'encens**,*
*Qui chantent les transports **de l'esprit et des sens**.*

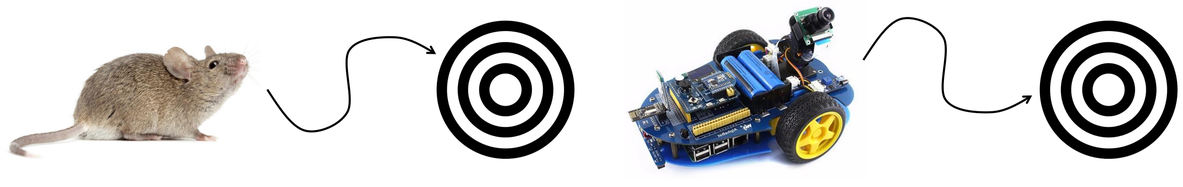
Charles Baudelaire, Les Fleurs du Mal

Our own learnings

Trials and errors
Exploration
Reward (and punition?)
Memorizing by acting

History



Future neuroscience project

Compare animal and robotic learnings