Réseau de neurones artificiels et apprentissage profond

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Équipe-projet Modal

La Journée de l'Enseignement de l'Informatique et de l'Algorithmique
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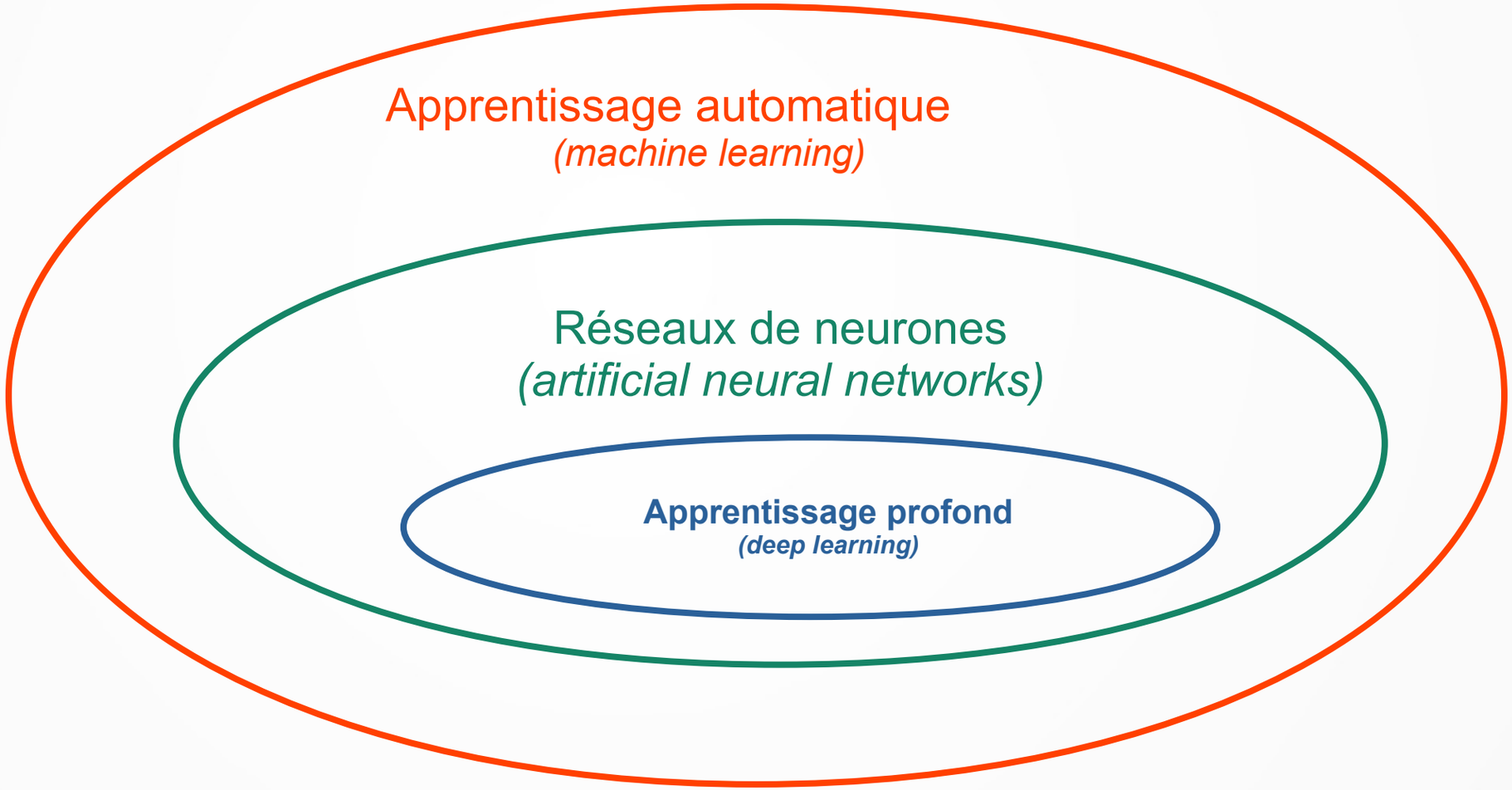
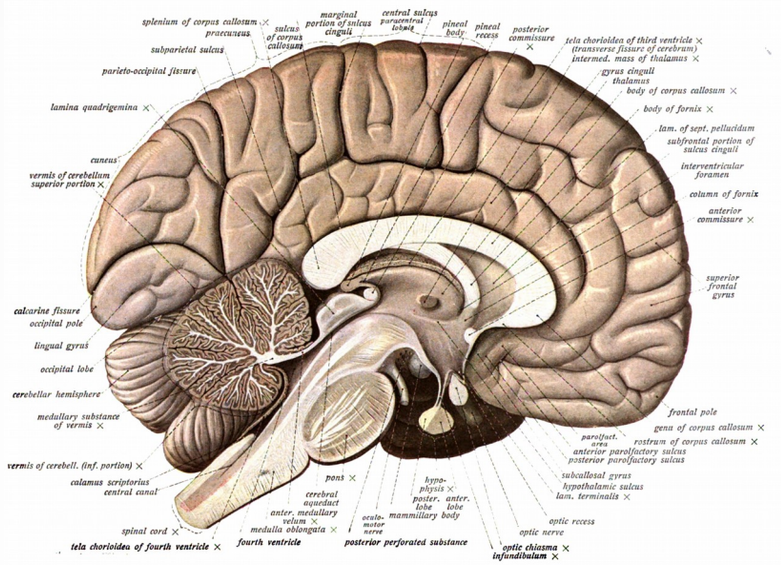
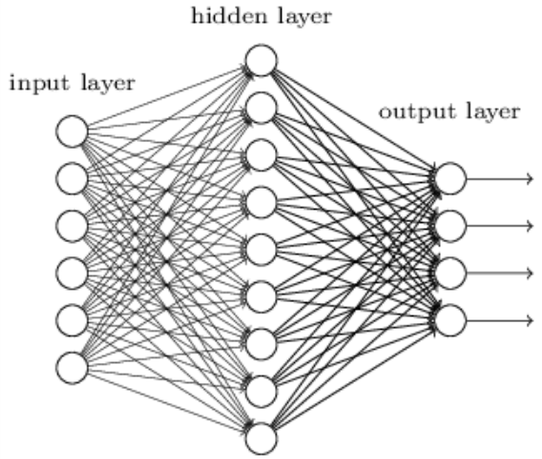
IA : Intelligence artificielle
(AI : Artificial intelligence)

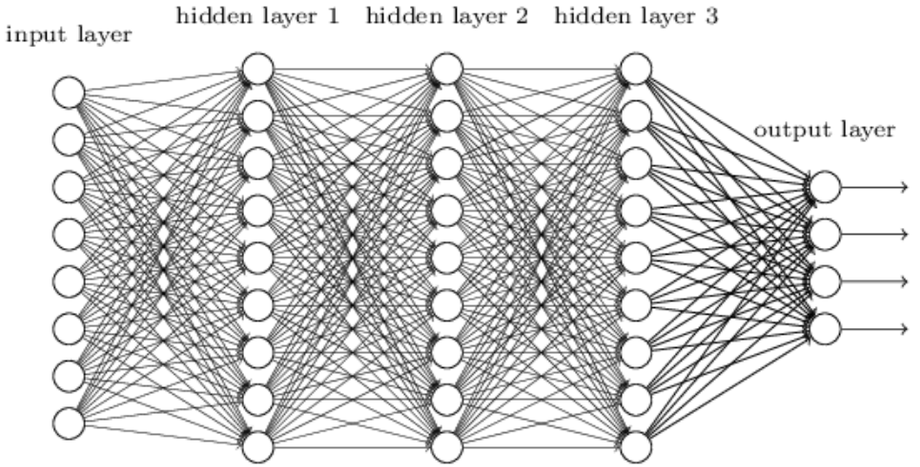




"Non-deep" feedforward neural network



Deep neural network



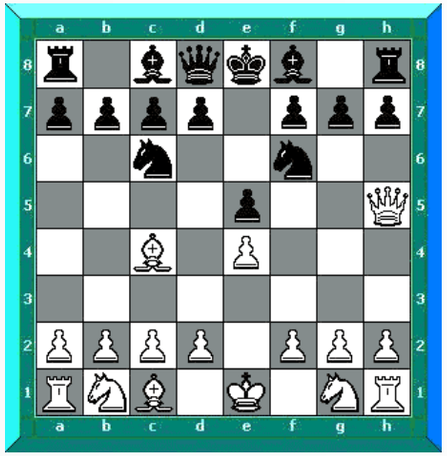
Source:
https://stats.stackexchange.com

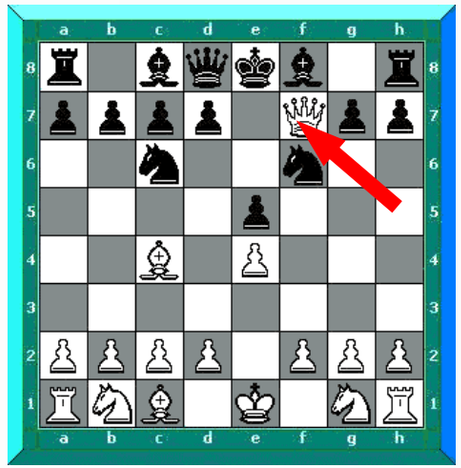

« 2 »

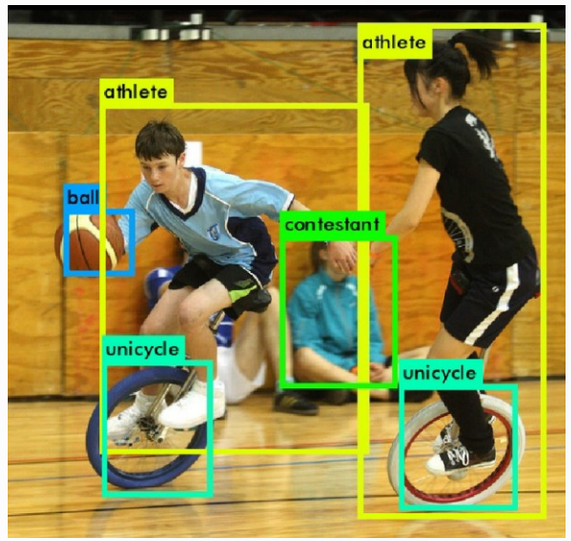
« banane »

« It is a banana. »

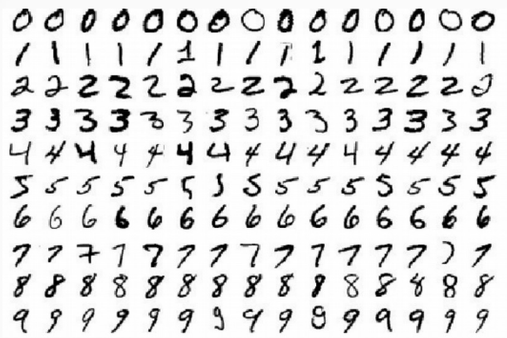
« C’est une banane. »

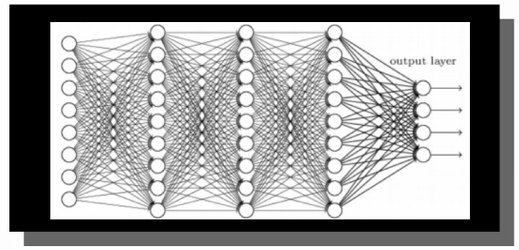





athlete
athlete
ball
contestant
unicycle
unicycle

Phase d’apprentissage





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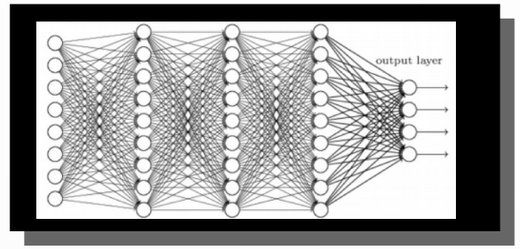
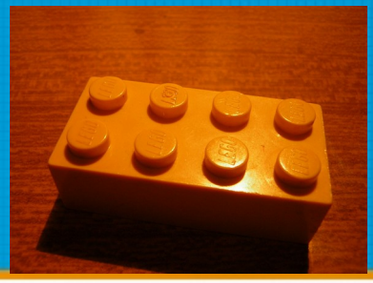
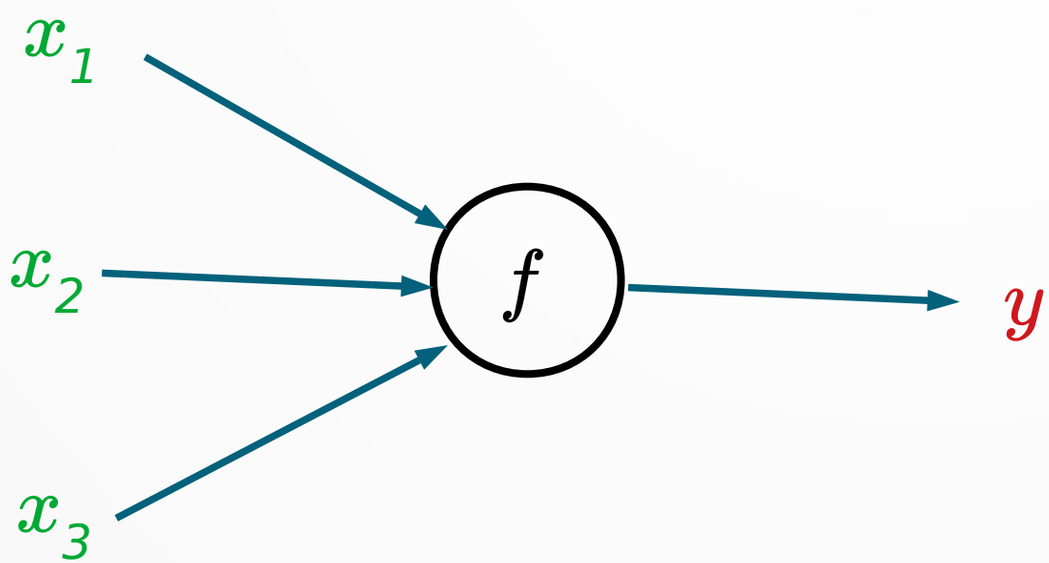
Phase de prédiction

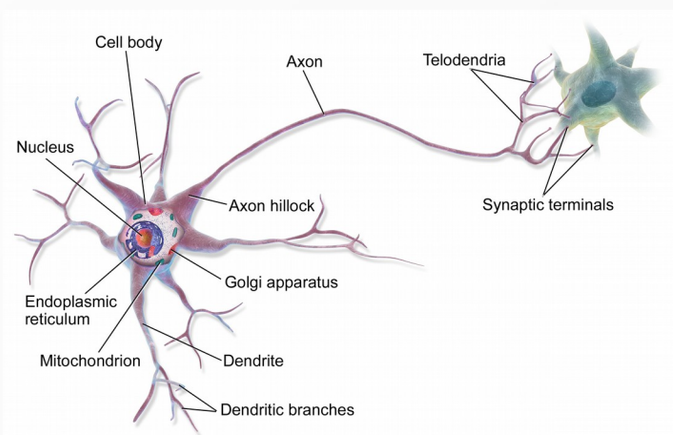


« 2 »

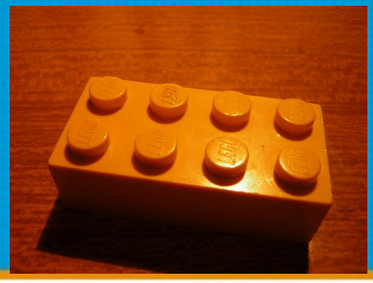
La neurone artificielle

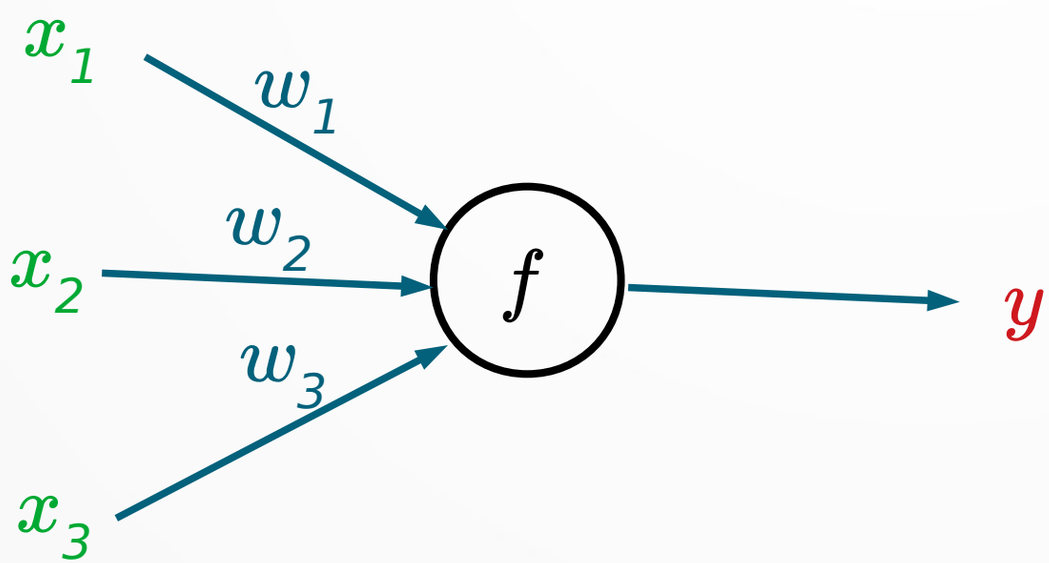






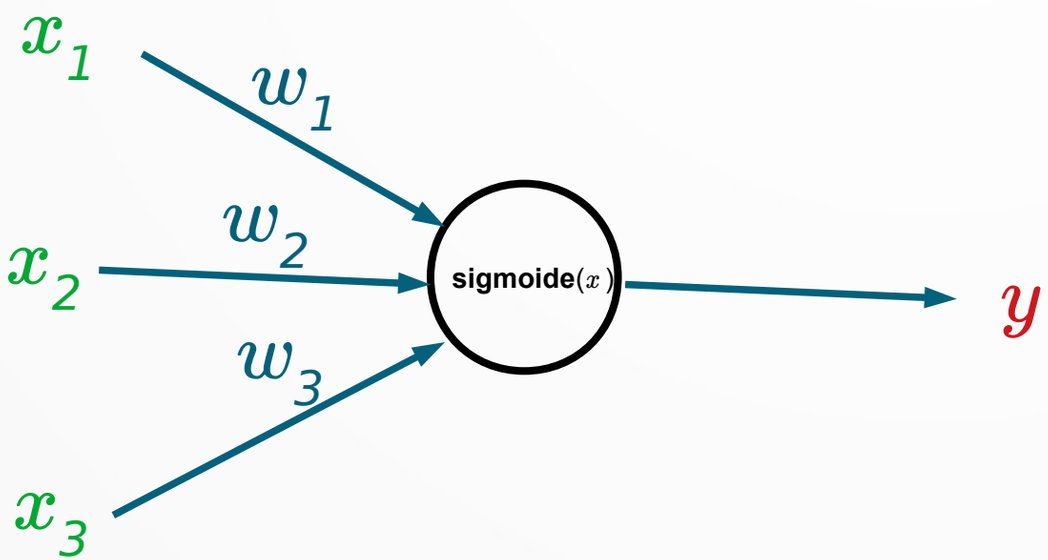
La neurone artificielle

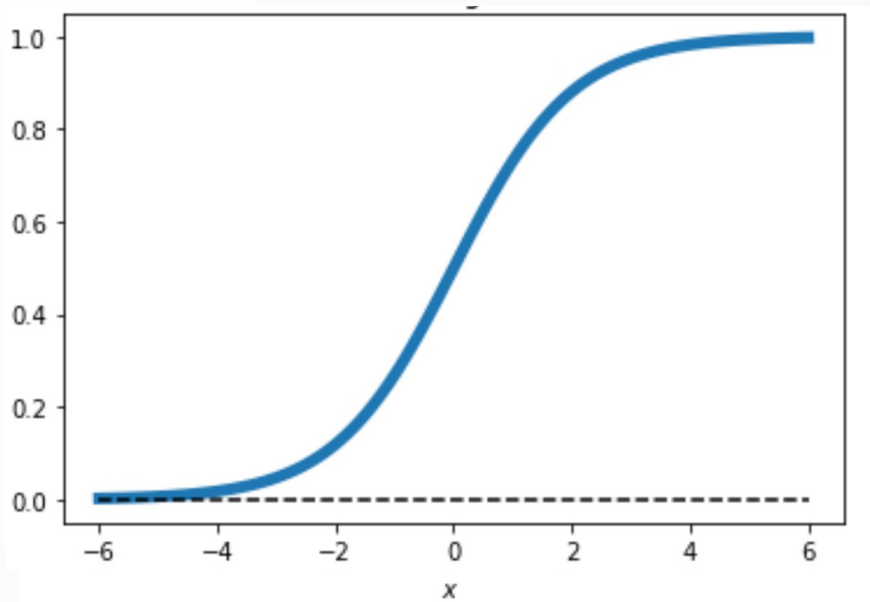




$$f(w_1x_1+w_2x_2+w_3x_3+\ldots) = y$$

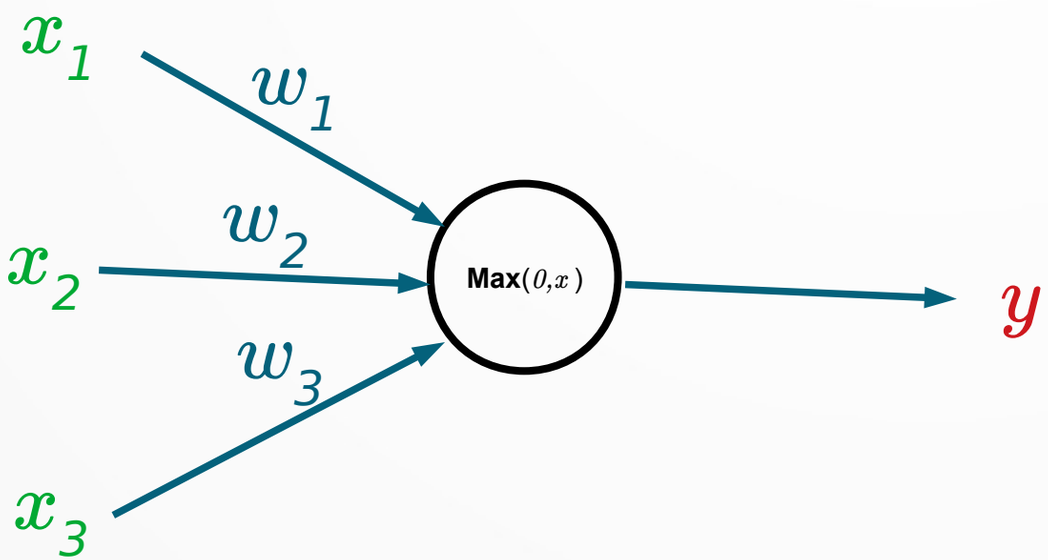
La neurone artificielle

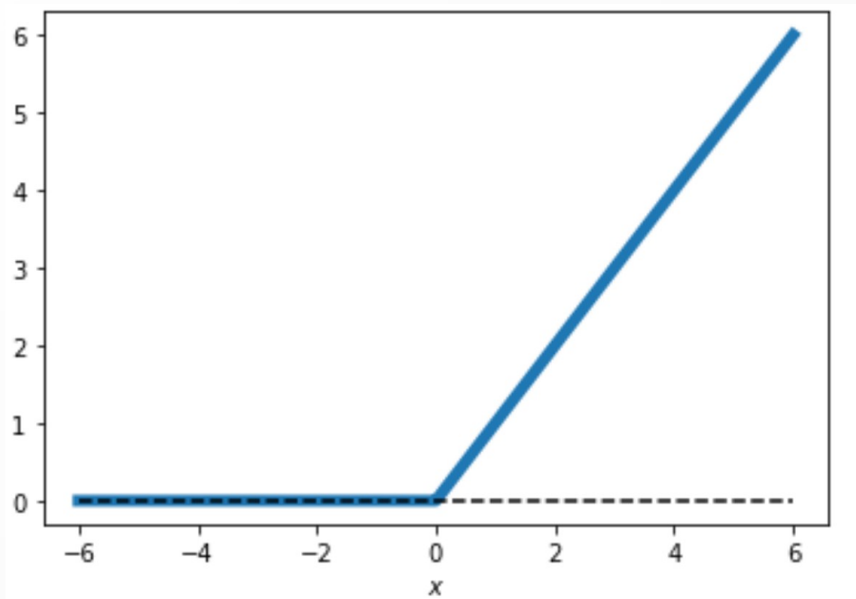




$$\text{sigmoide}(w_1x_1+w_2x_2+w_3x_3+\ldots) = y$$

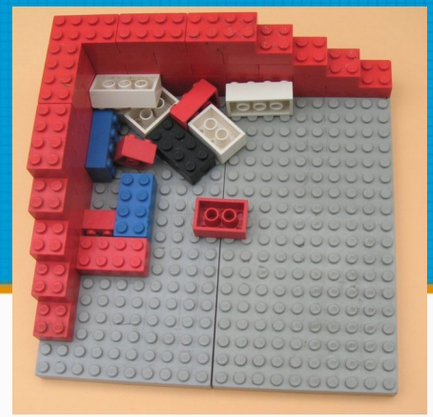
La neurone artificielle

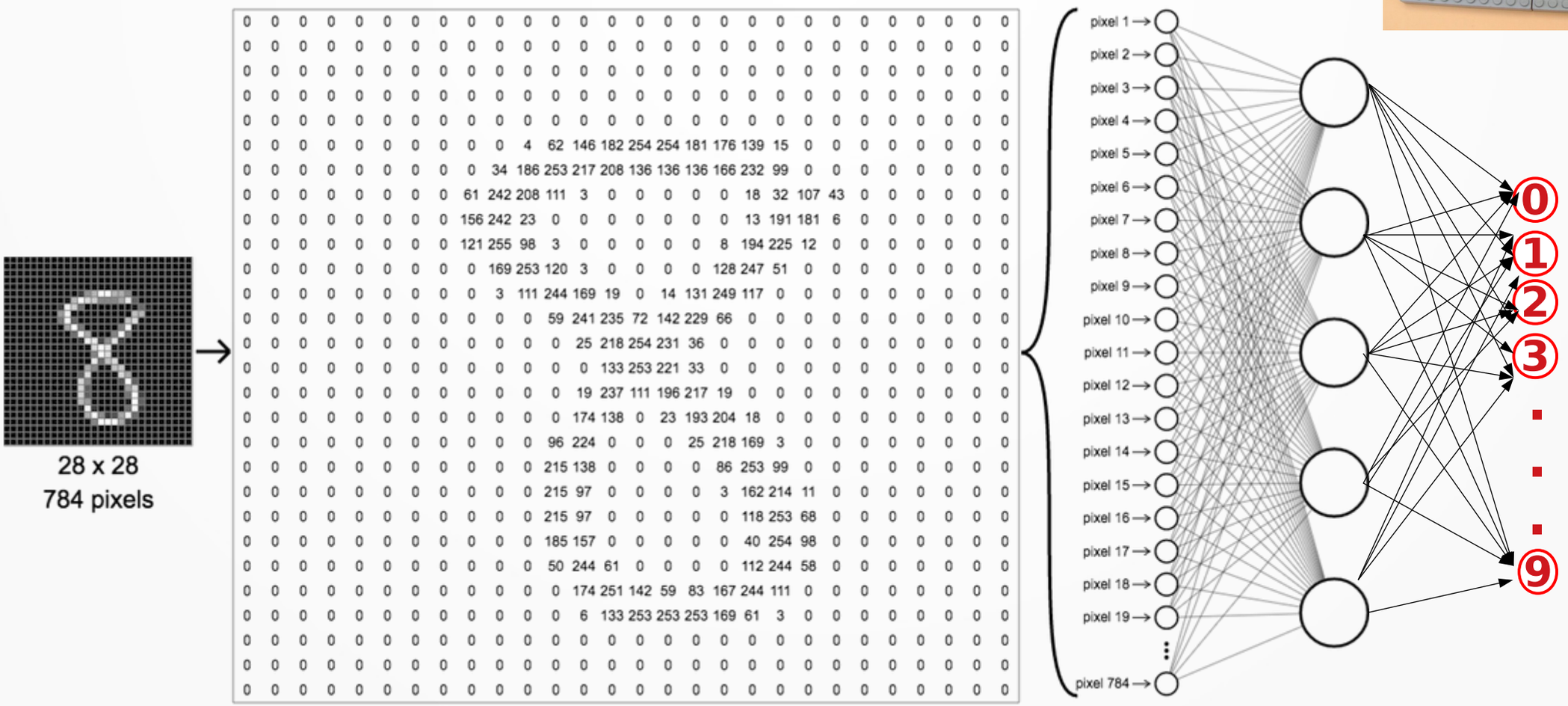




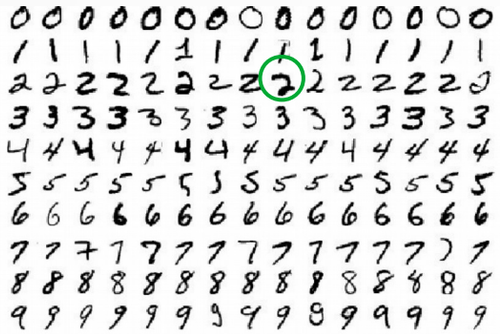
$$\text{Maximum}(0,\ w_1x_1+w_2x_2+w_3x_3+\ldots) = y$$

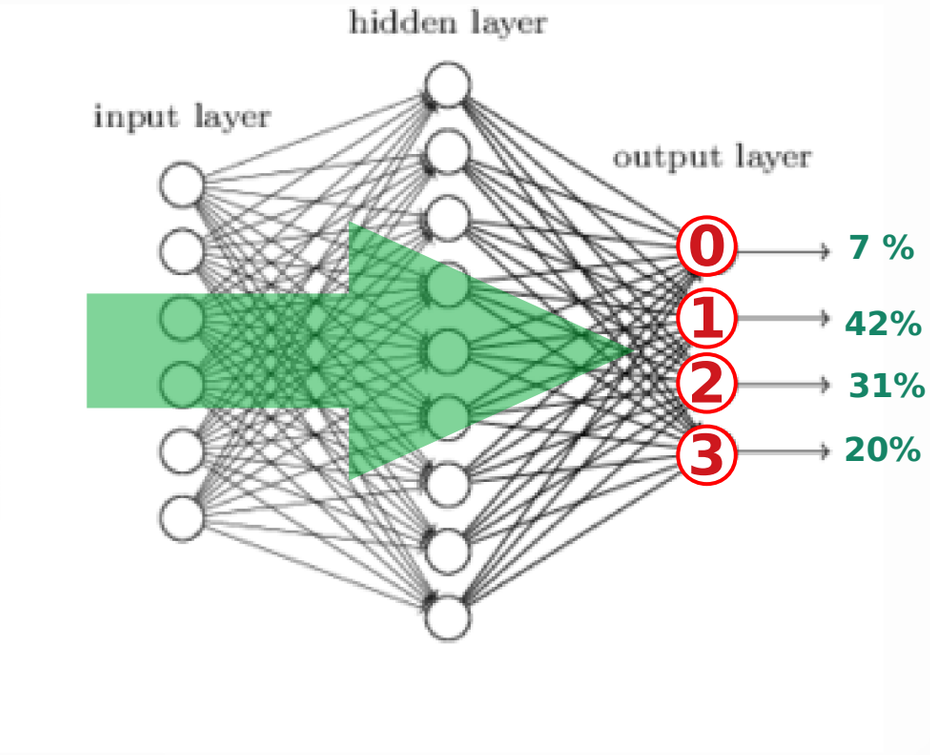
Un réseau de neurones





Source : « NUMBRE—A NUMBer REcognizer Neural Network », Roshan Noronha





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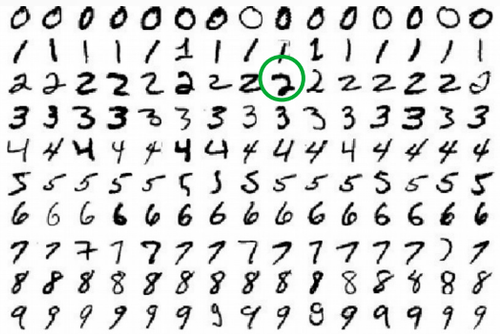

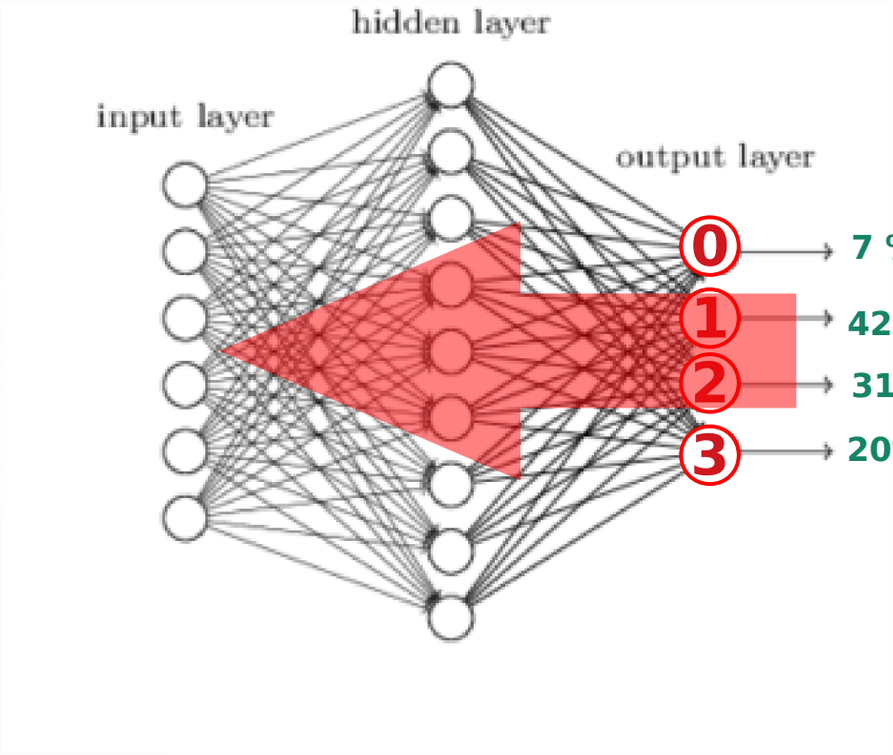


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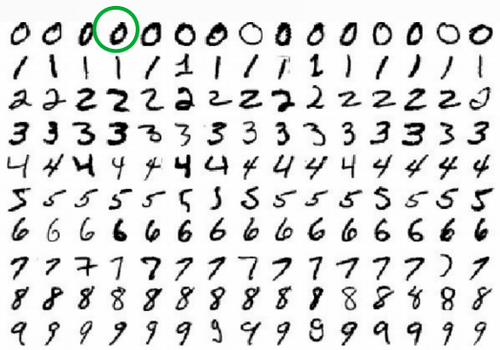

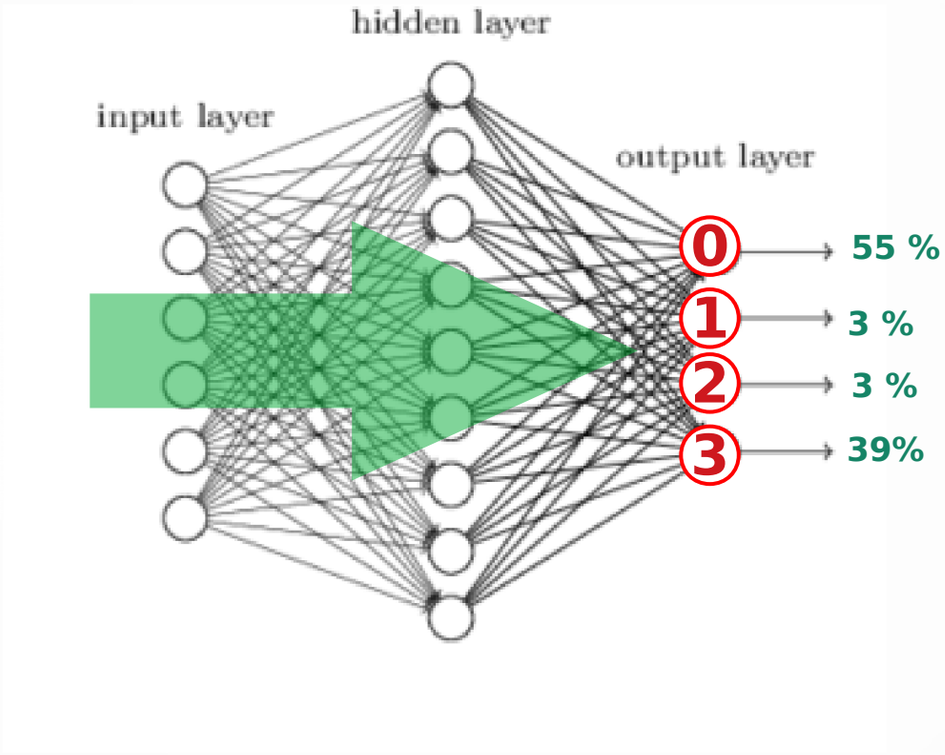


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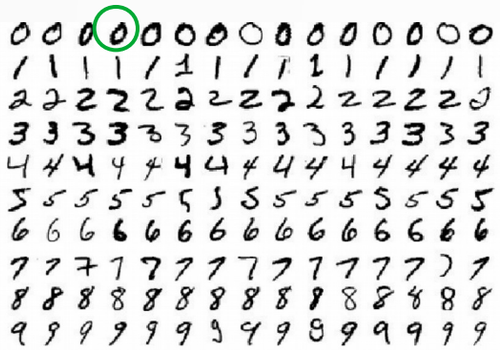

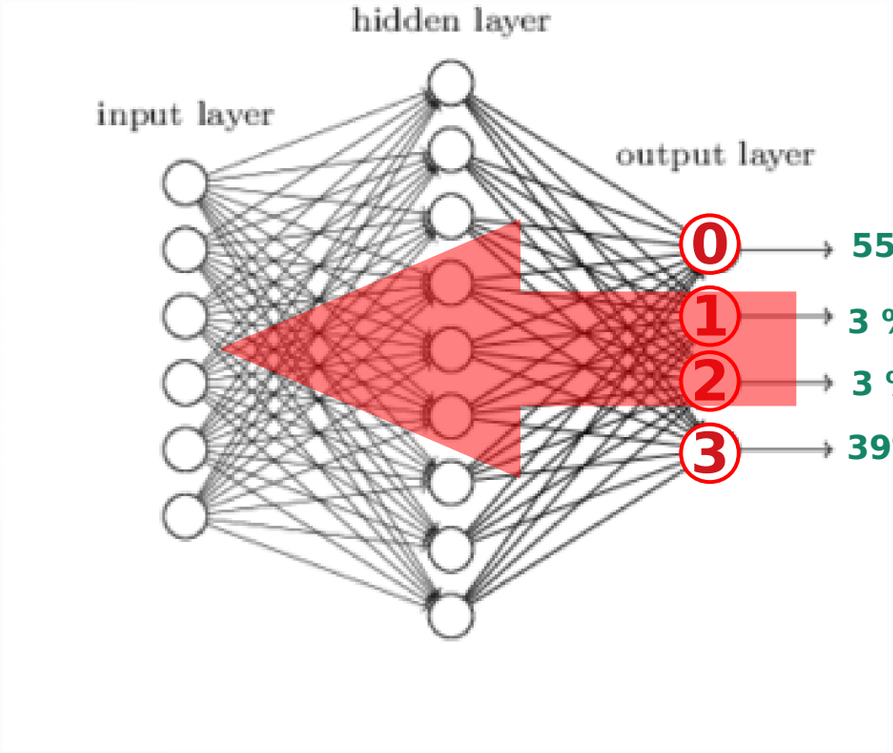


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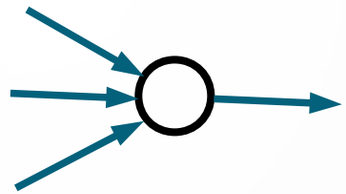
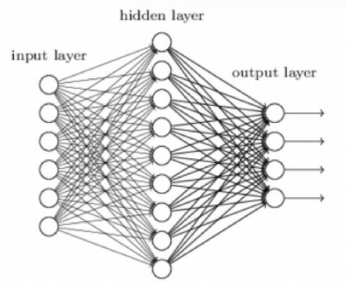
Intermède historique

- 1950-1960: Perceptron (le neurone)

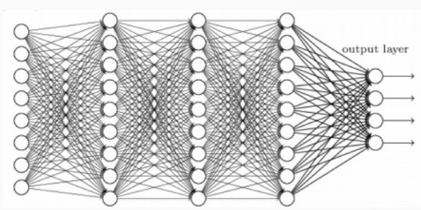


- 1980-1990: Réseau de neurones à deux couches



- 1995-2005: *L'hiver des réseaux de neurones*

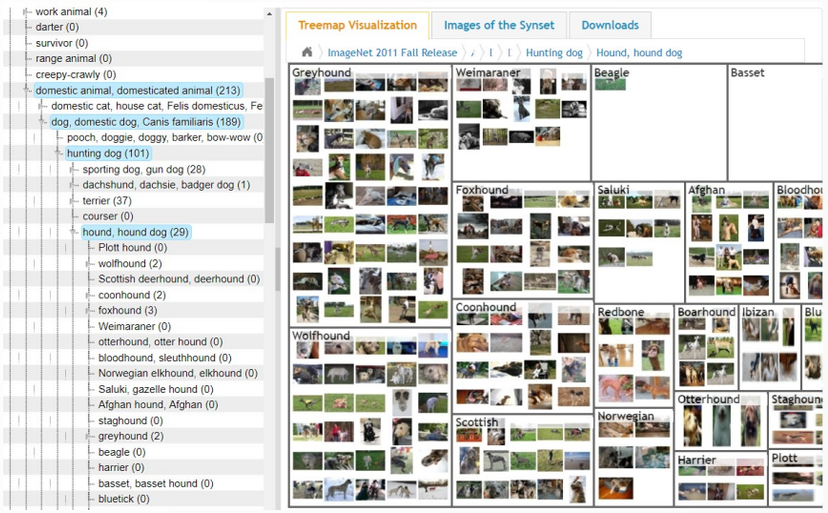
- 2006 - .... : Réseaux de neurones profonds



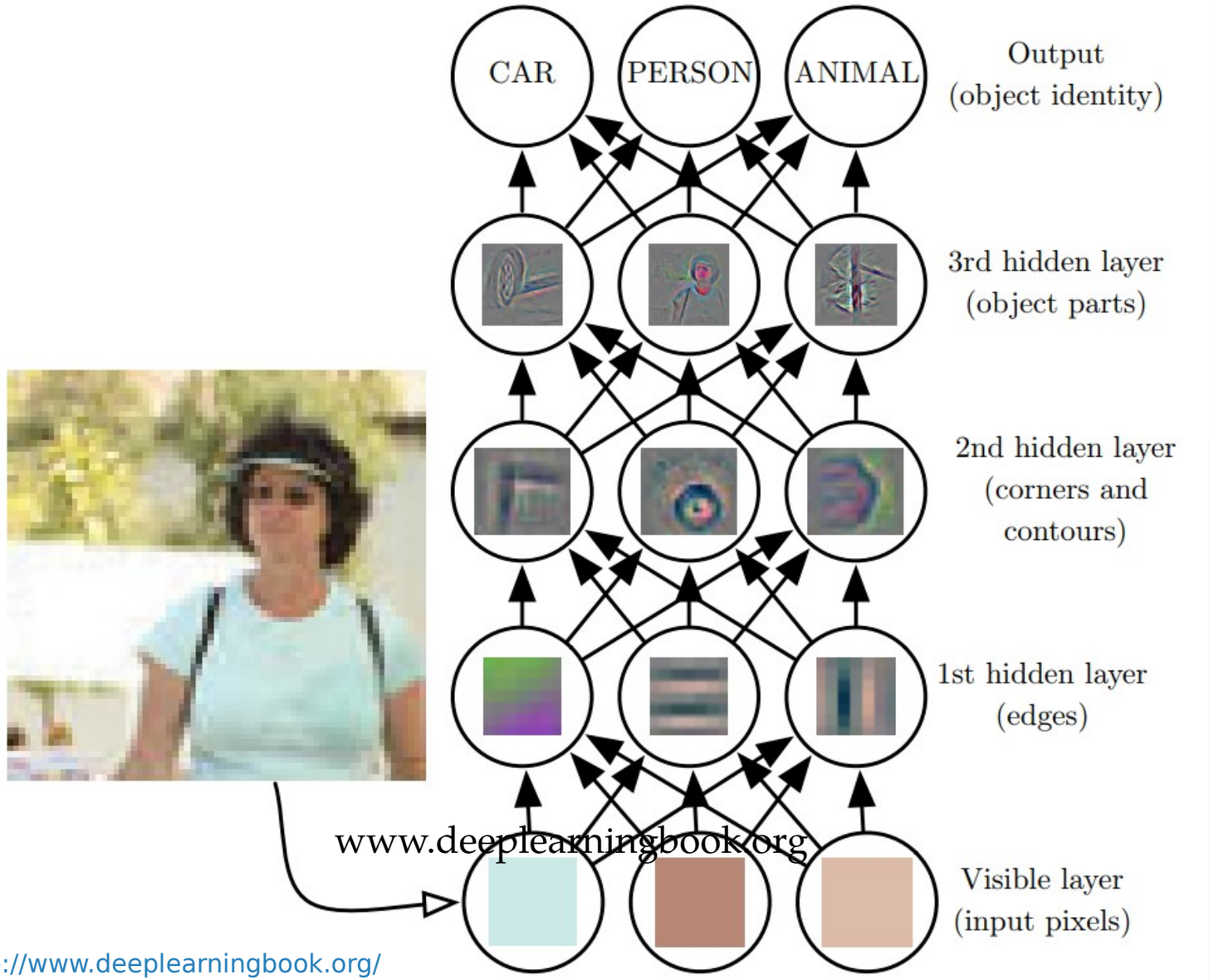
La renaissance

- Recherche scientifique
- Grand jeux de données
- Puissance de calcul
- Intérêt des grandes industries

  (Google, Facebook, Amazon, Microsoft, ...)

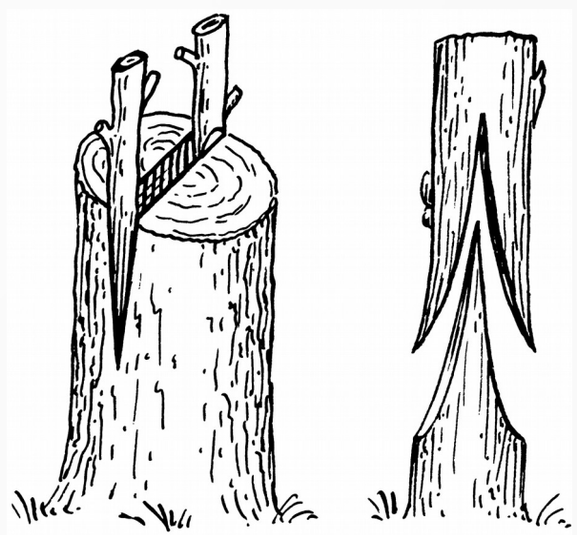


Apprentissage de représentations



Source : http://www.deeplearningbook.org/

Bouturage



La nouvelle technologie [?] permet les crypto-monnaies

← T = 3 → ← T = 3 →

France – Paris + Italie = Rome

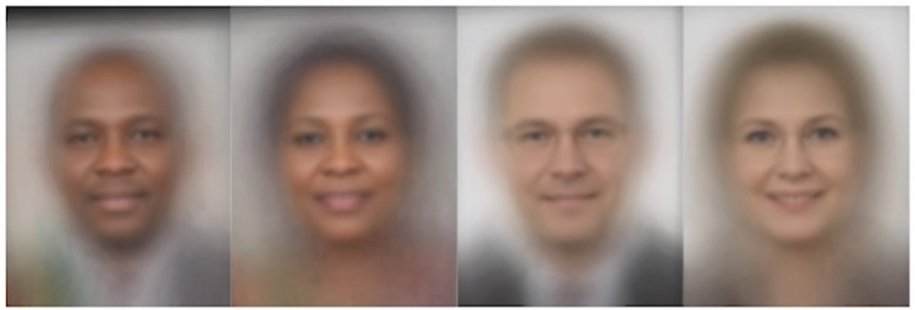
Relationship	Example 1	Example 2	Example 3
France - Paris	Italy: Rome	Japan: Tokyo	Florida: Tallahassee
big - bigger	small: larger	cold: colder	quick: quicker
Miami - Florida	Baltimore: Maryland	Dallas: Texas	Kona: Hawaii
Einstein - scientist	Messi: midfielder	Mozart: violinist	Picasso: painter
Sarkozy - France	Berlusconi: Italy	Merkel: Germany	Koizumi: Japan
copper - Cu	zinc: Zn	gold: Au	uranium: plutonium
Berlusconi - Silvio	Sarkozy: Nicolas	Putin: Medvedev	Obama: Barack
Microsoft - Windows	Google: Android	IBM: Linux	Apple: iPhone
Microsoft - Ballmer	Google: Yahoo	IBM: McNealy	Apple: Jobs
Japan - sushi	Germany: bratwurst	France: tapas	USA: pizza

Source : **Mikolov et al., Efficient Estimation of Word Representations in Vector Space, 2013**

Attention aux biais

Homme – Programmeur + Femme = Ménagère

Gender Classifier	Darker Male	Darker Female	Lighter Male	Lighter Female	Largest Gap
Microsoft	94.0%	79.2%	100%	98.3%	20.8%
FACE++	99.3%	65.5%	99.2%	94.0%	33.8%
IBM	88.0%	65.3%	99.7%	92.9%	34.4%

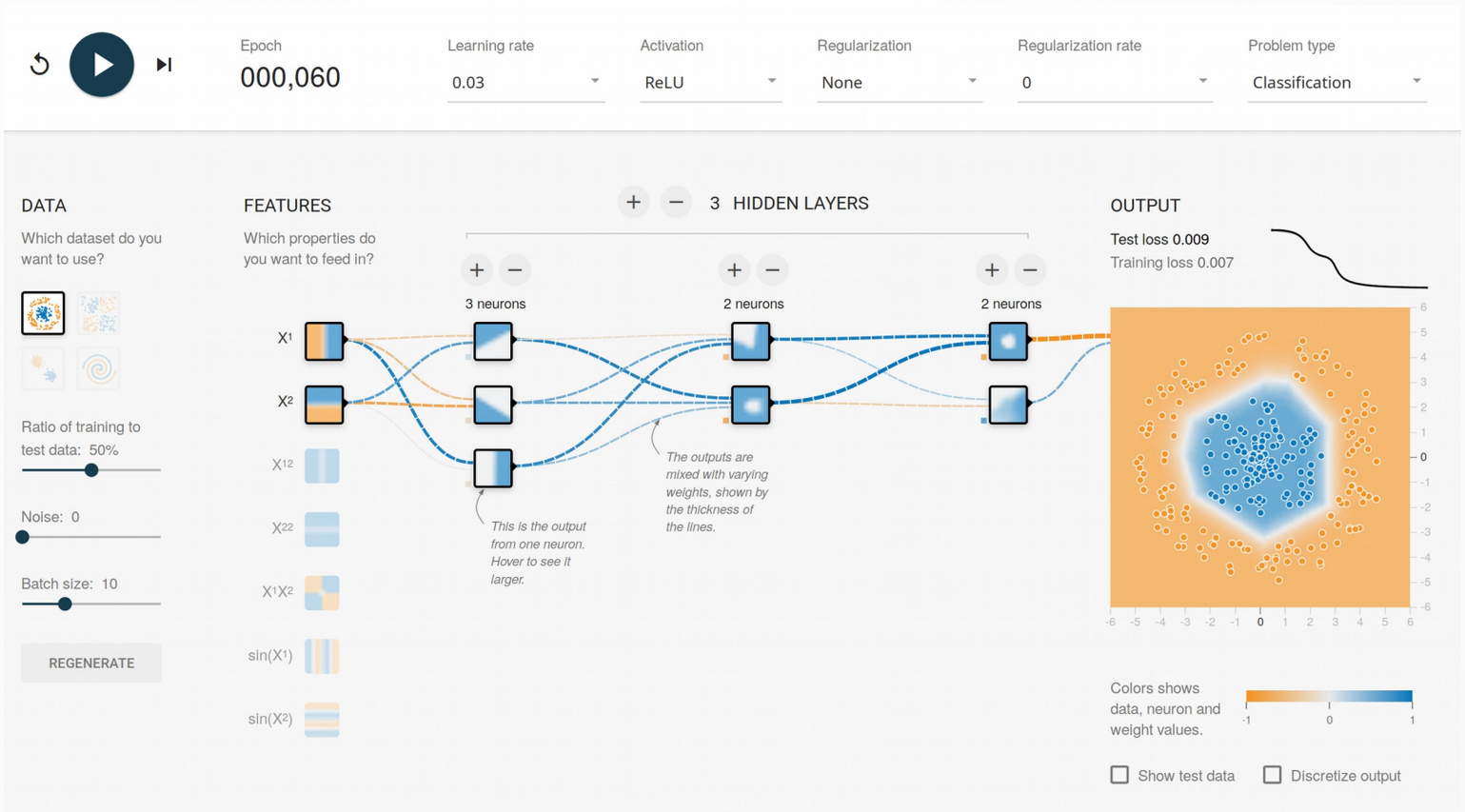


Source : « Five Things That Scare Me About AI », Rachel Thomas

En terminant…

- Le domaine progresse très rapidement !
- Actuelles forces des réseaux de neurones :
  - Succès empiriques impressionnants
    (images, vidéos, reconnaissance de la parole, traduction, …)
  - Flexibilité
  - Permets le transfert d'une tâche à une autre («bouturage»)
- Actuelles faiblesses des réseaux de neurones :
  - Demande beaucoup de « bidouillage »
  - Requiers de grandes bases d'apprentissage
  - Difficilement interprétables

Démo



https://playground.tensorflow.org/