

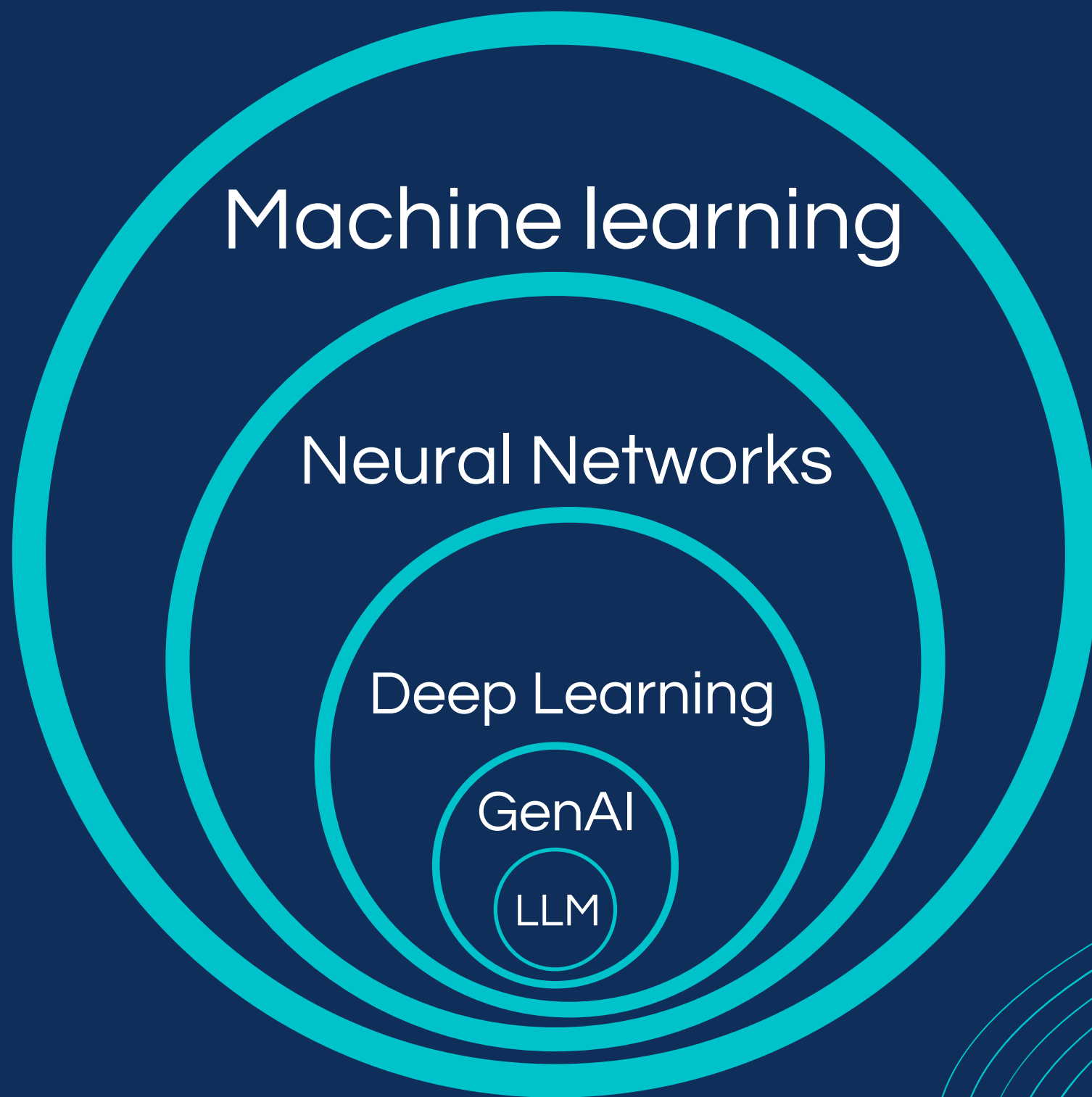
Master in Planning and
Management of Tourism Systems



Deep Learning

Nicola Cortesi

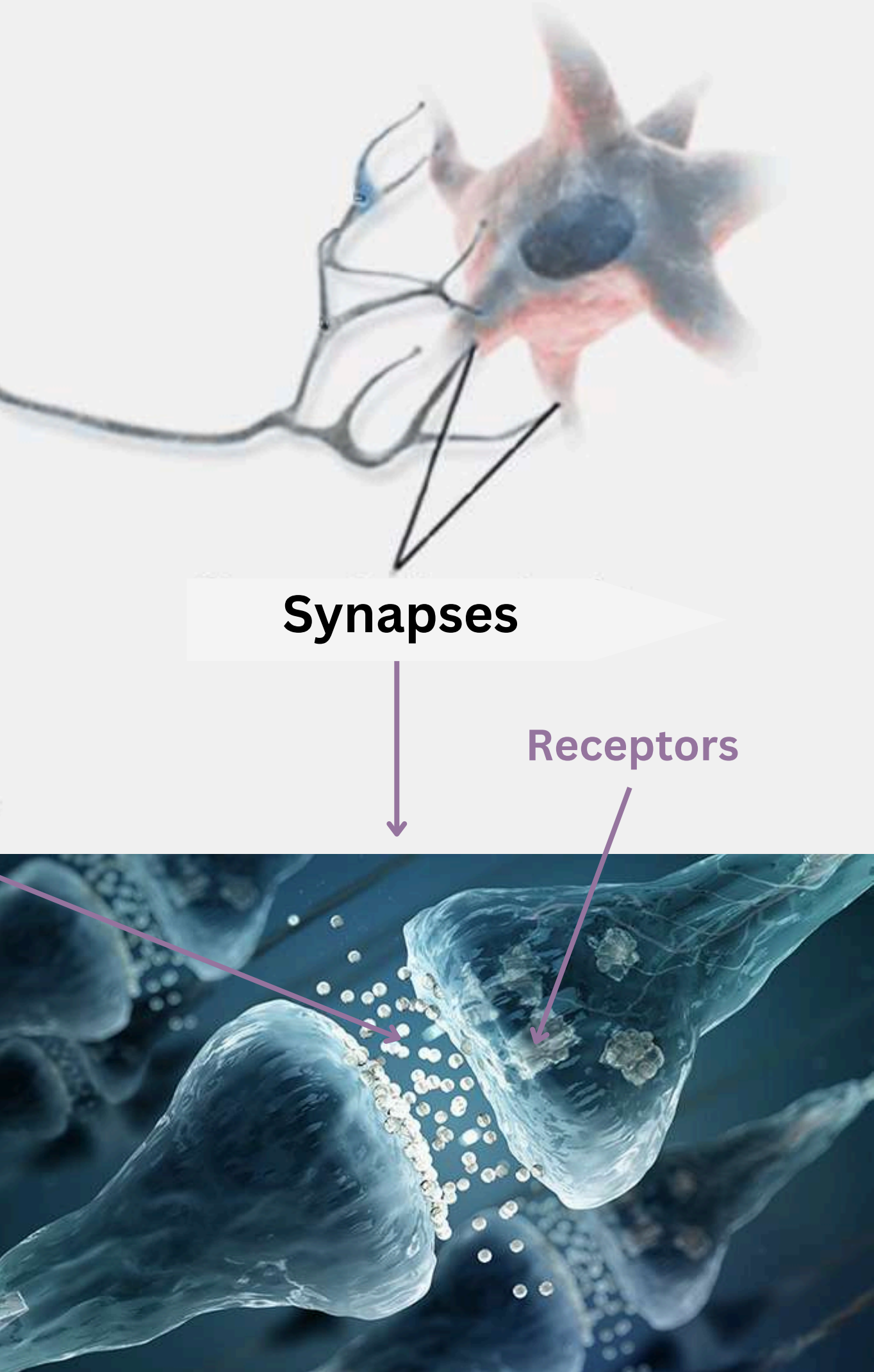
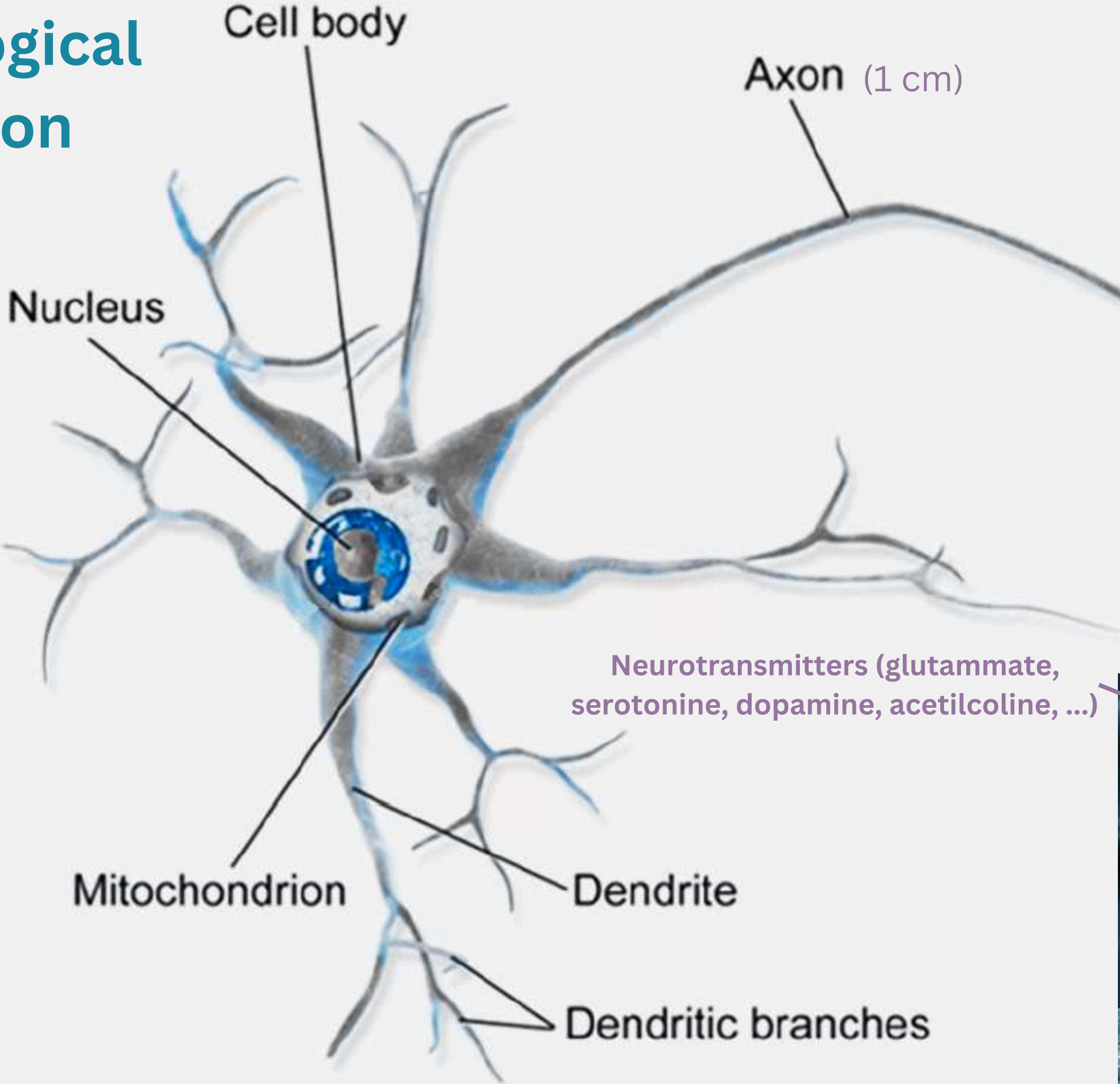
Artificial Intelligence



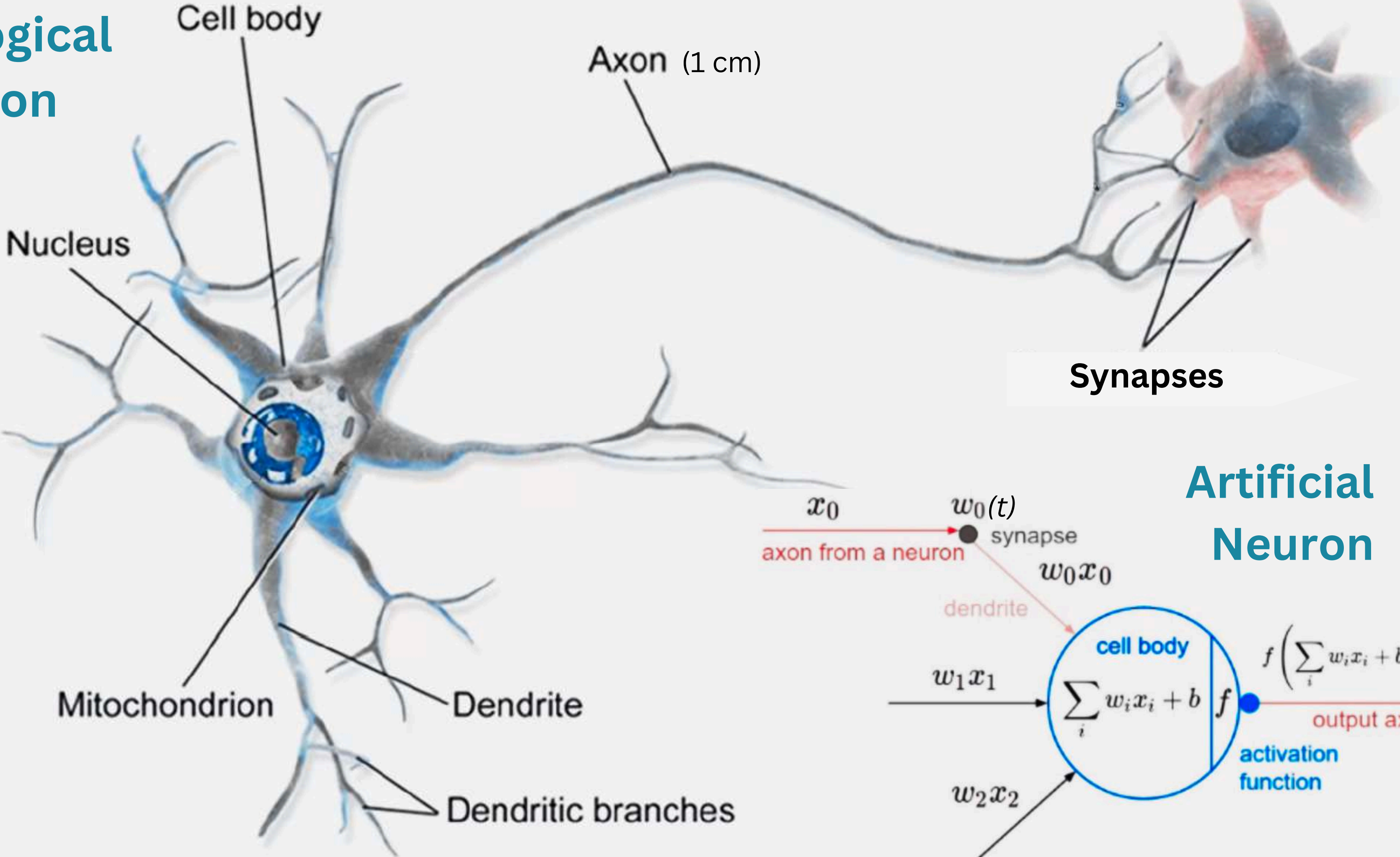
MACHINE LEARNING

Machine learning is a different approach to statistics. It consists in all algorithms that simulate how humans learn from data, finding the hidden relationships between data (e.g: find patterns, predict outcomes). The model used is not selected beforehand, but it is created by the data

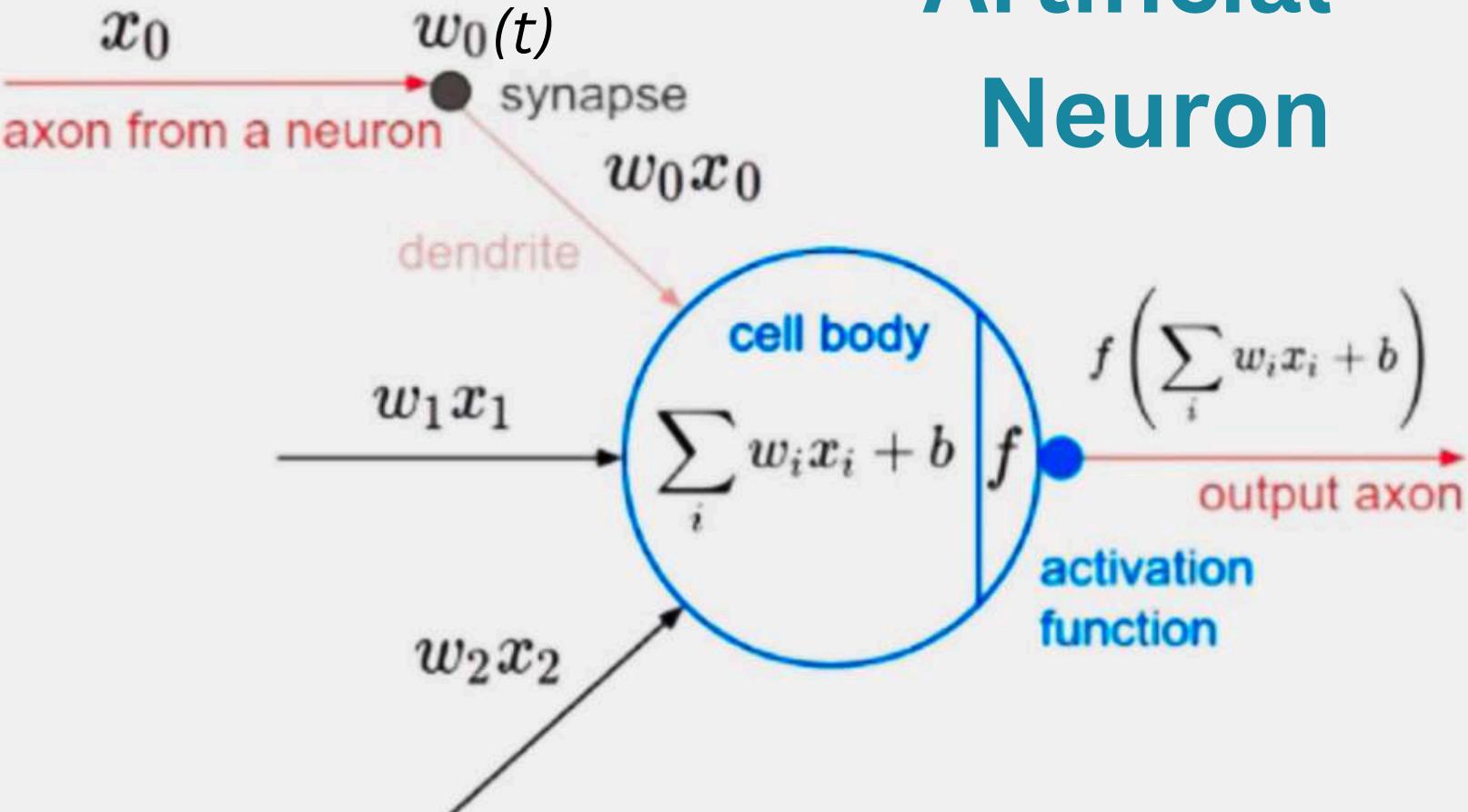
Biological Neuron



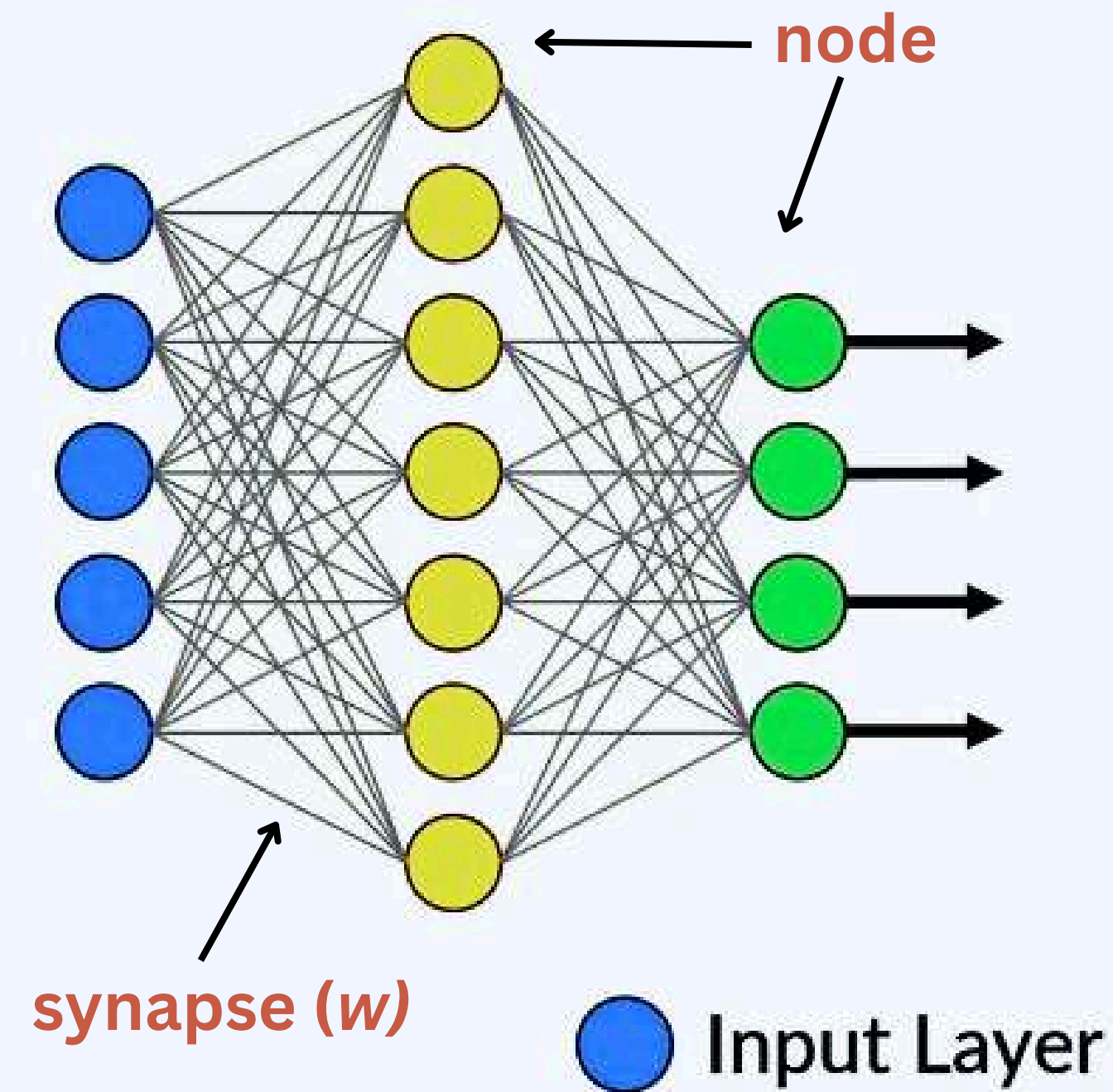
Biological Neuron



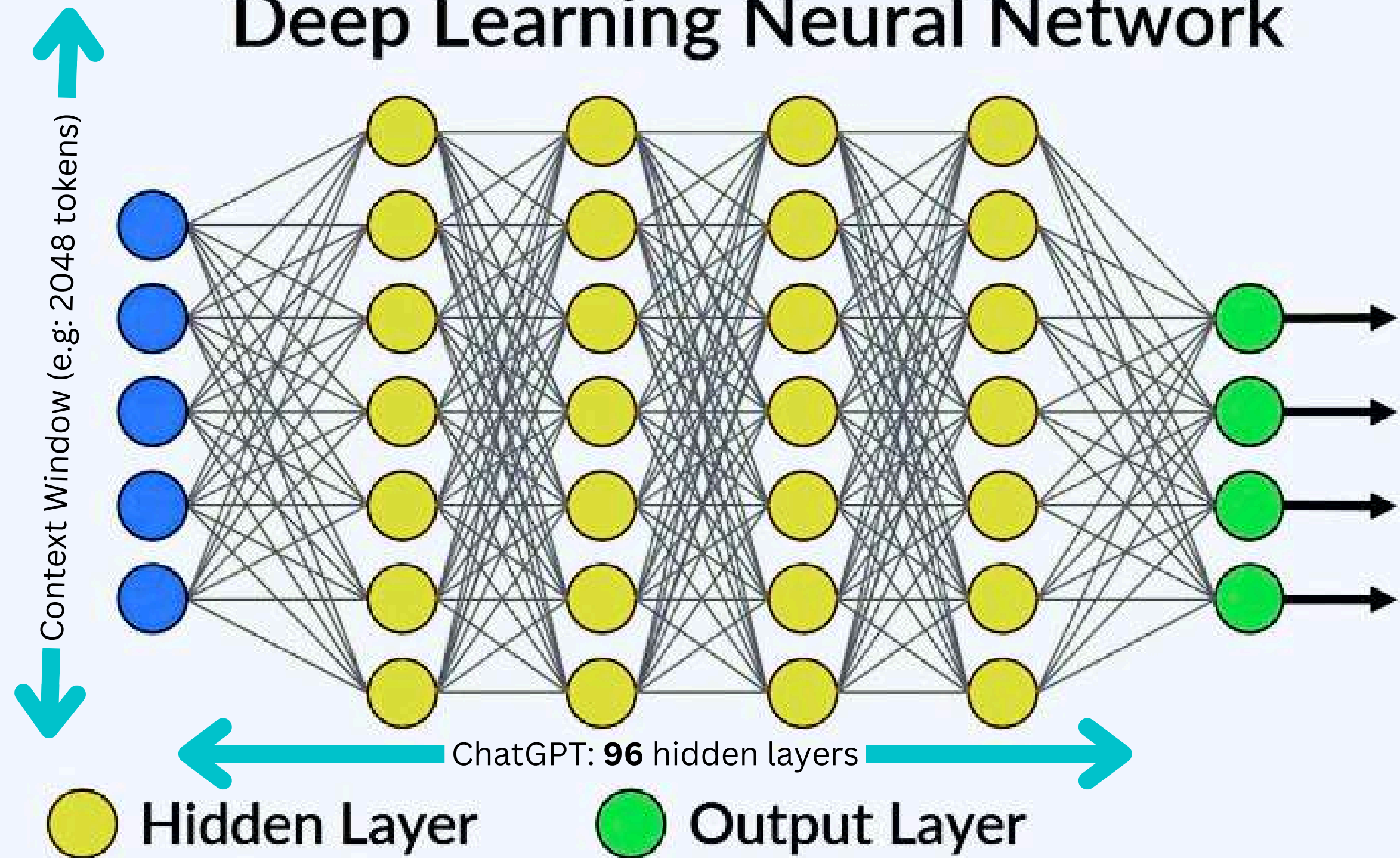
Artificial Neuron



Simple Neural Network



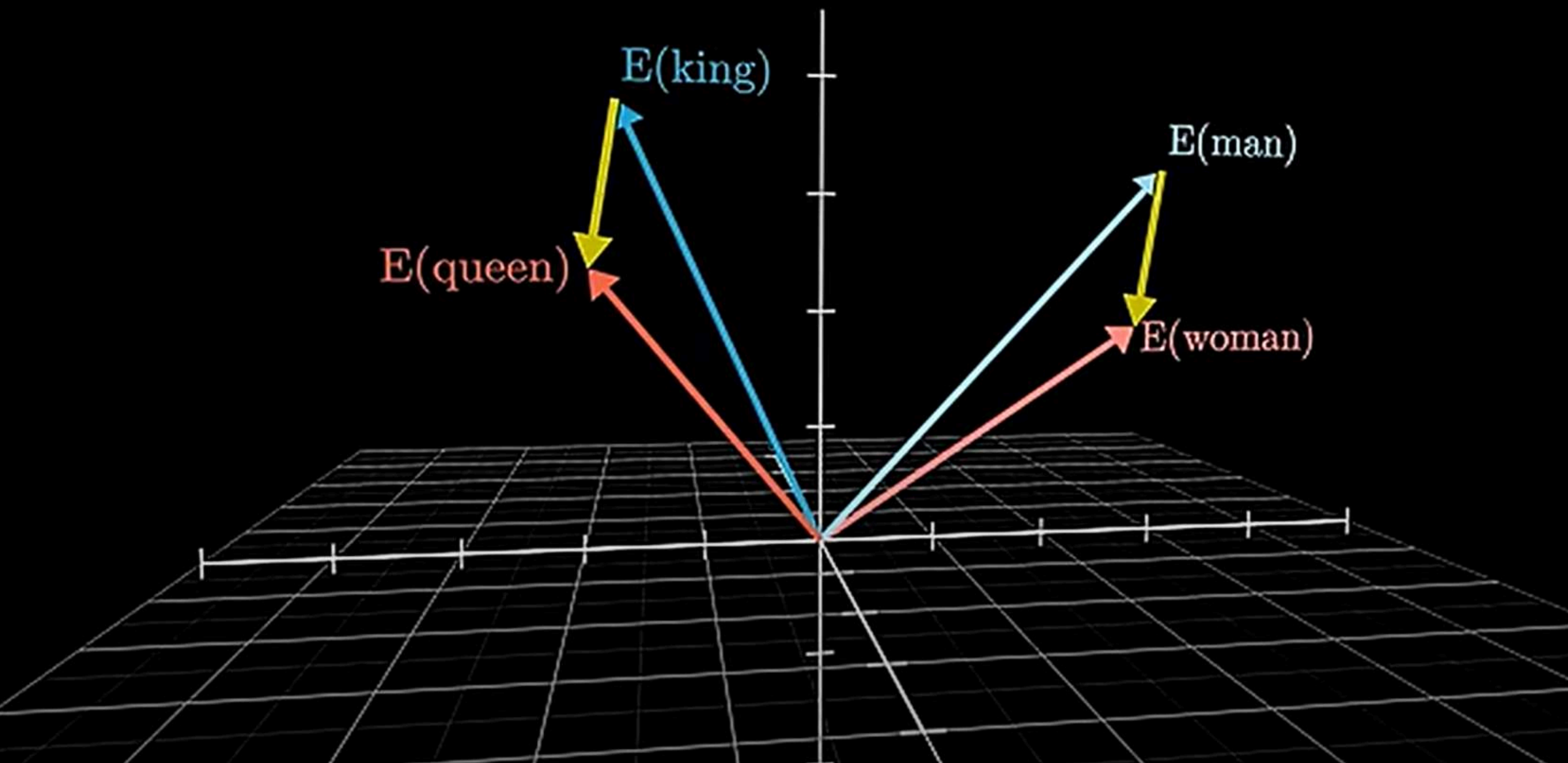
Deep Learning Neural Network



LLMs are **Artificial Neural Networks**. Any Neural Network with 4 or more layers is called a **Deep Learning Network (DNN)**



Each word/image/sound of the prompt of a LLM is called **token**. Each token is converted in a vector of thousand of numbers (12.000+ for ChatGPT-3) called **embedding** that try to capture the meaning of the word

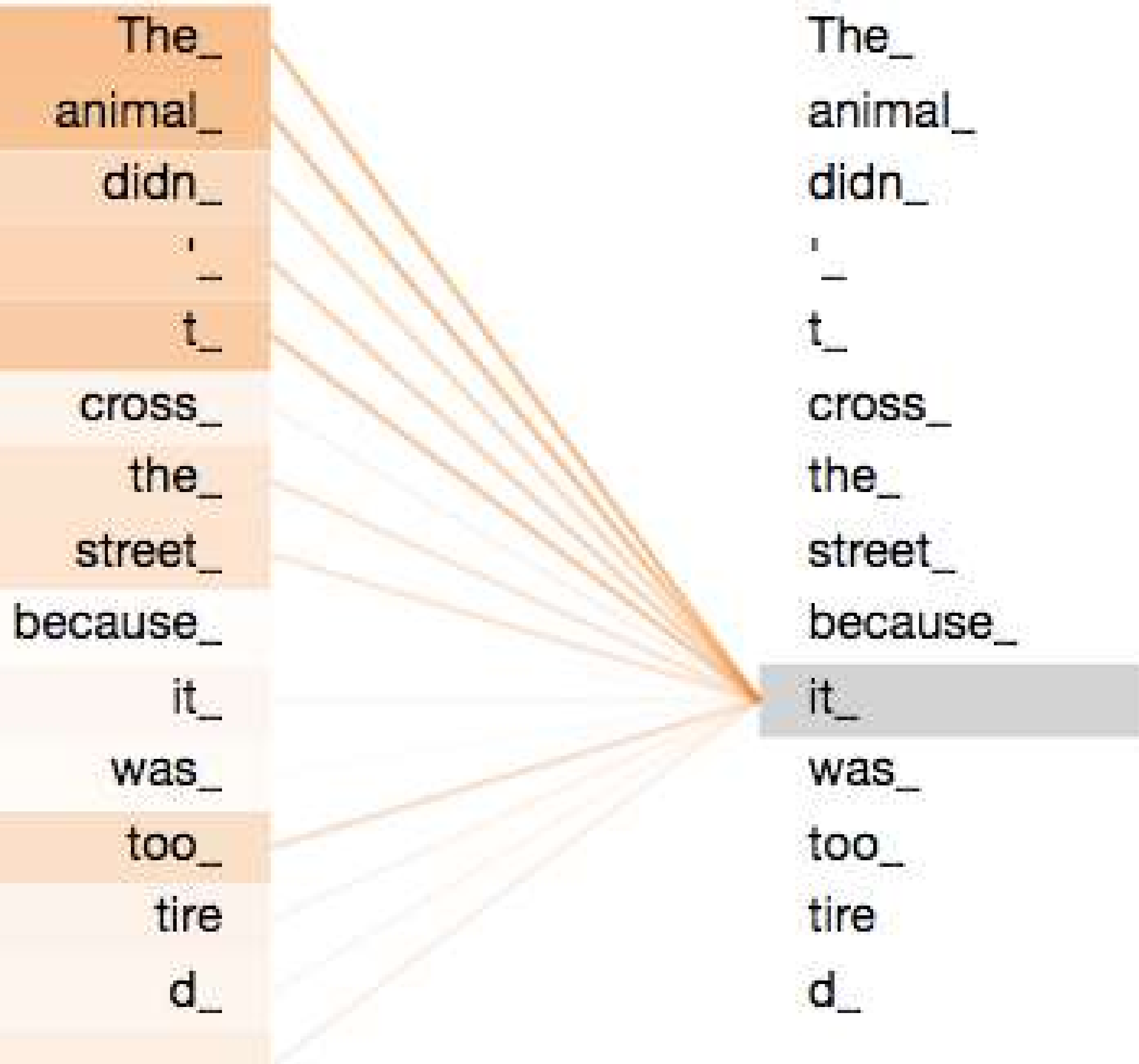


Embeddings can be visualized as multidimensional vectors

ATTENTION MECHANISM

The most important feature of the Transformer architecture is the **Attention mechanism**

It also solves the issue of words with more than one meaning (e.g: "cross")





All the embeddings of all tokens of the input sentence are modified by the attention mechanism, until they absorb the meaning of their context

(...) Detective Poirot discovered that the assassin's name was...



- John 25%
- Mary 18%
- Edward 15%
- Isaac 12%
- Lucy 10%
- Paul 9%
- Frank 7%

The model output is a probability distribution of all tokens that might come next. The computation performed to predict the last token is a function of the embedding of just the LAST WORD of the prompt!

ARTIFICIAL NEURONS VS BIOLOGICAL NEURONS

Main differences between Deep Learning and the human mind:

- Each neuron is simplified by the **weights w** , one for each synapse
- Artificial Neural Networks are **very schematic** and ordered in a simple way compared to biological ones
- Tokens, embedding, attention mechanism, activation function, training, feed forward and backpropagation **do not exist** in the real brain



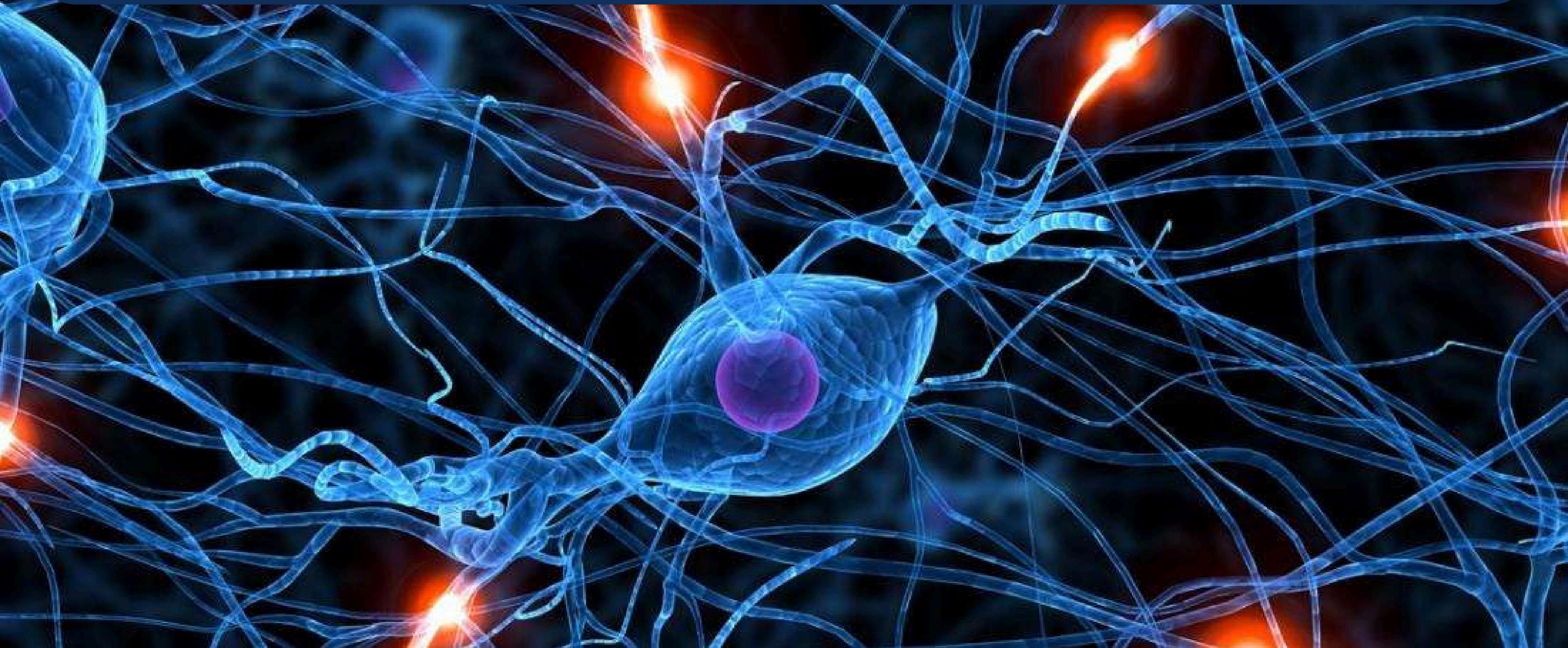
EMERGENT PROPERTIES

Deep Learning models can do things for which **they were not explicitly programmed**: once they are able to predict the following word in the sentence, they are also able to quickly learn how to summarize the sentence, or explain it better, or improve it, transform it in a tweet, in a poem, etc.

Also children are able to learn these tasks quickly once they learn the **structure** of a language

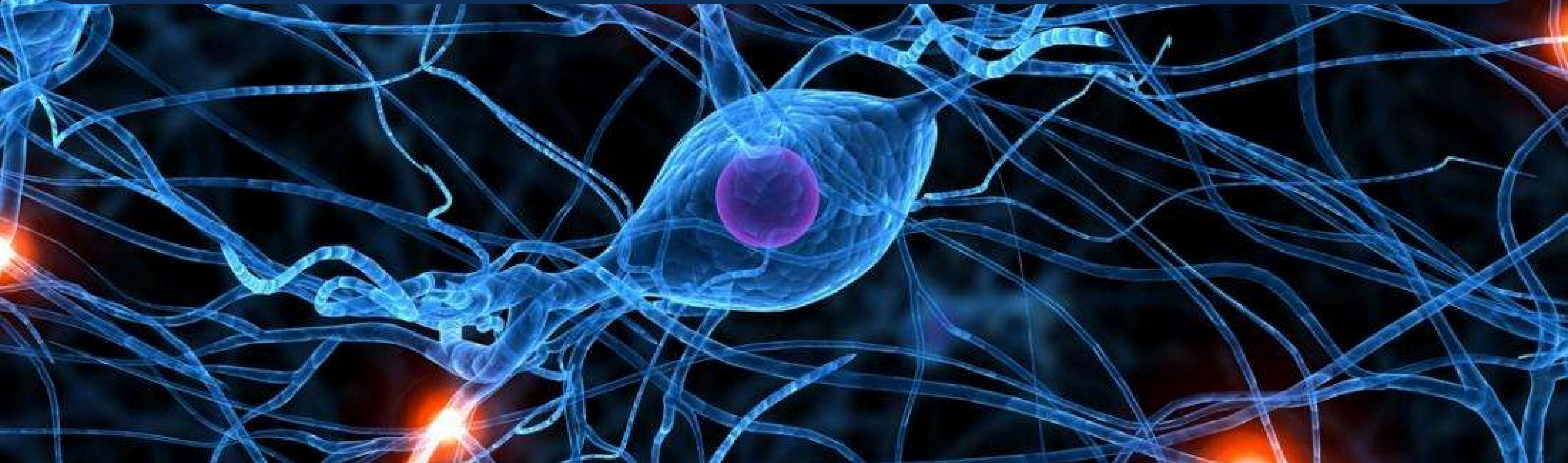


ChatGPT already passed the entrance test at the medical university, the Turing test and has a verbal QI of 155



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Input data of AI are limited to words, numbers, images and sounds, but they are not enough to really understand reality

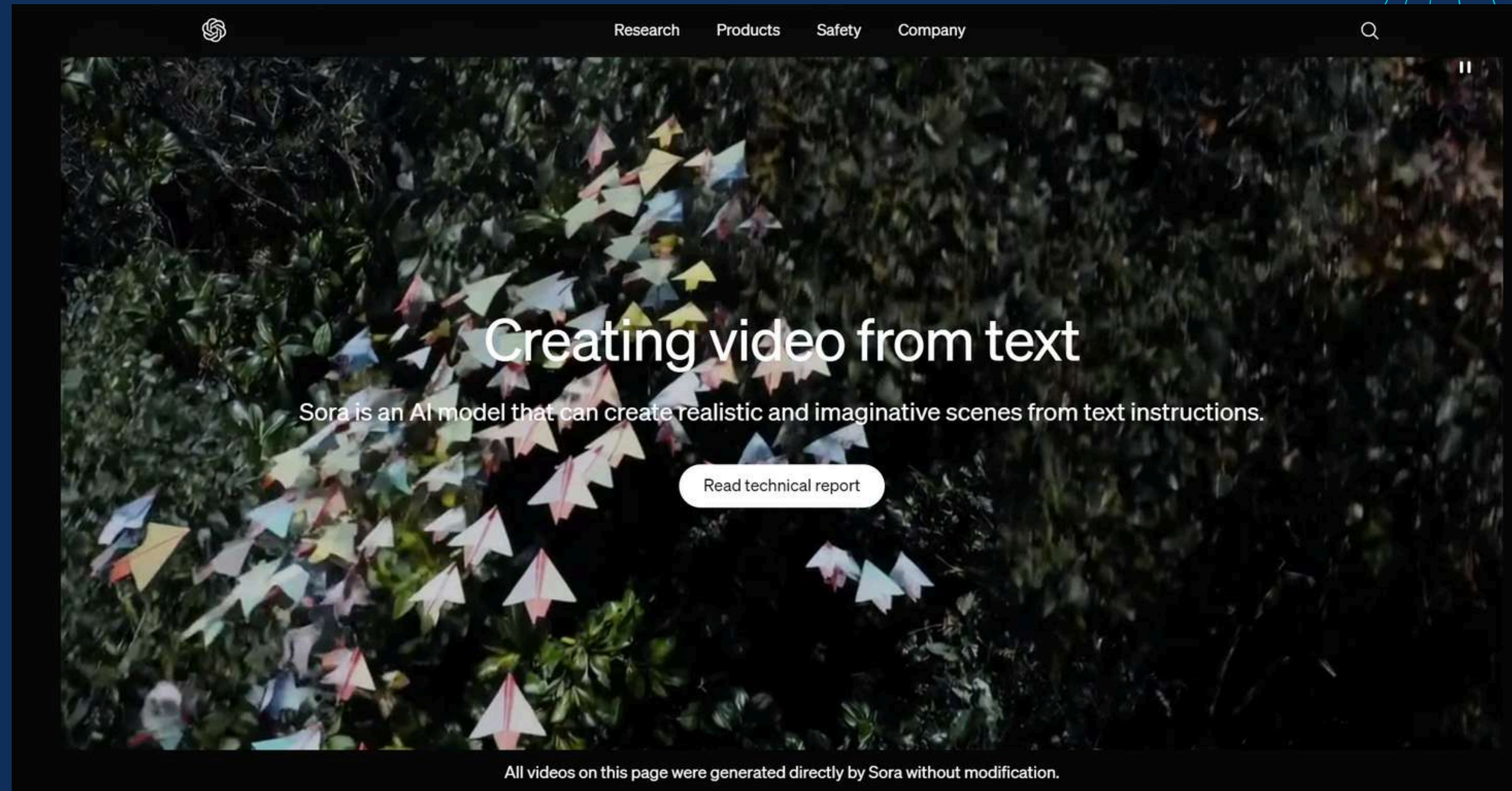




Next evolution of AI is called "Agents": a LLM that is not limited to just suggesting you what to do, but it will also do it in your stead!

TEXT TO VIDEO: LUMA DREAM MACHINE, SORA AI & HEYGEN

VIDEO TO MUSIC: V2A AI



<https://openai.com/index/sora/>

INSTANT VIDEO DUBBING

<https://www.youtube.com/watch?v=7IKab3HcfFk>

Youtube videos will soon be instantly dubbed in all languages for free



7:24 / 12:09



ARTICLES & VIDEOS:

Available the Moodle:

- Video on GenAI: <https://www.youtube.com/watch?v=2IK3DFHRFFw>
- Article: *Attention is all you need* (Vaswani et al. 2021)
- Norman Freeman recreated by AI:
<https://www.youtube.com/watch?v=oxXpB9pSETo>