Introduction to AI and machine learning

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23rs of April 2024

Hochschule
München
University of
Applied Sciences

Munich Center for
Digital Sciences and AI

AI in Culture and Art
BIDT Digitalisierungskolleg

I. Brief history of AI

The connectionist vs symbolic approach
Connectionism: artificial neuron and perceptron
Symbolism
Revenge of connectionism

II. How do machines learn ?

Optimizing an artificial neural network

III. How do humans train machines ?

The development cycle of ML
How ML experts train machines?

IV. How to develop interactions with ML?

The Marcelle toolkit

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The connectionist vs symbolic approach

Connectionist approach of AI : belief that intelligence emerge from the interaction of simple and low-level units: biological neurons.

Symbolic approach of AI : belief that intelligence use high-level, human-readable symbols to represent problems and logic to solve them.

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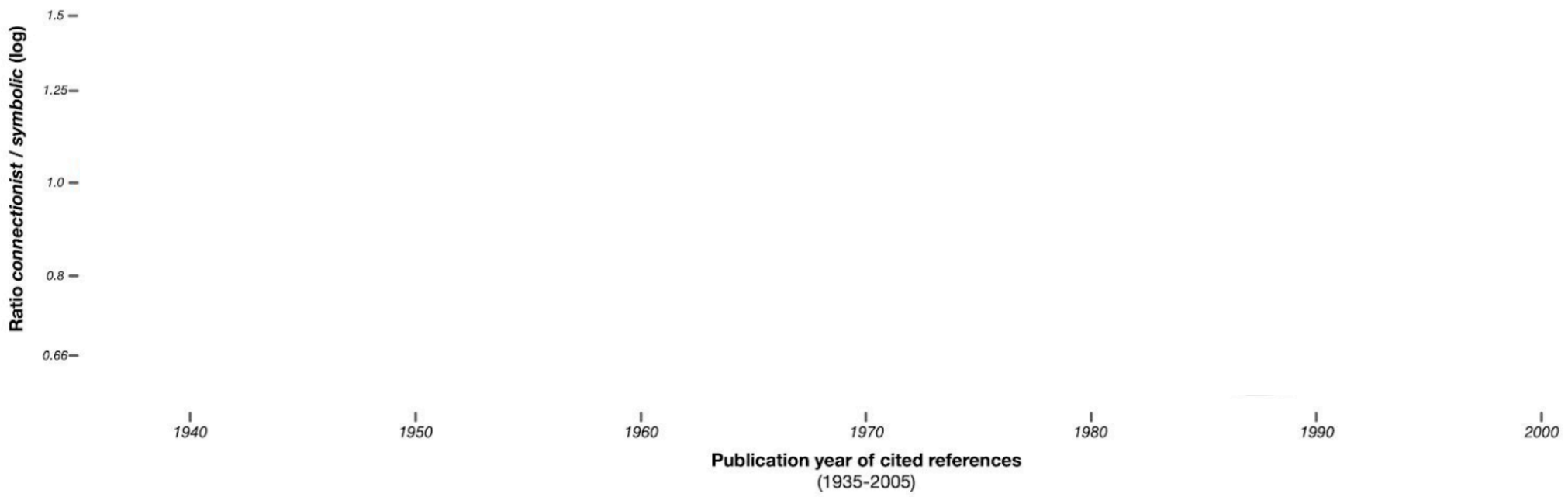

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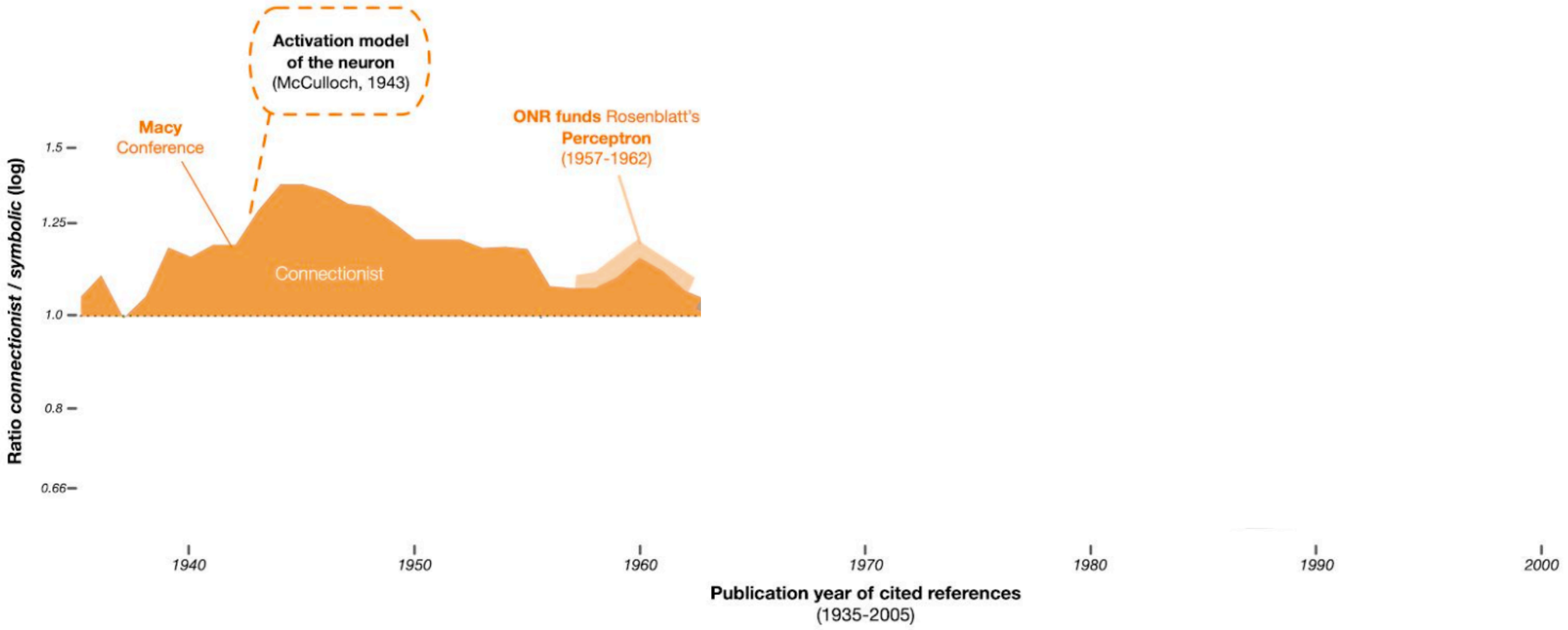

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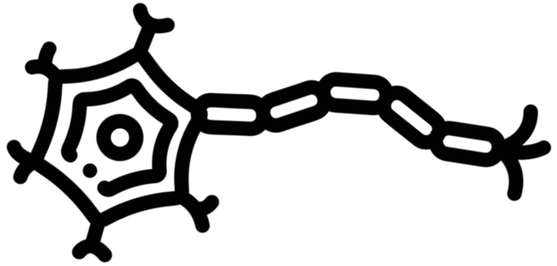

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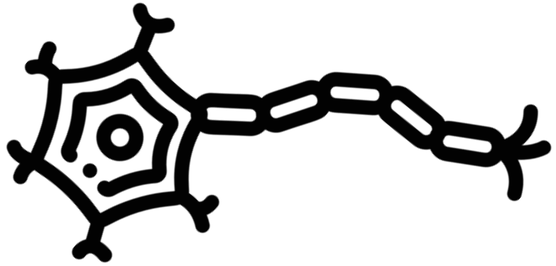

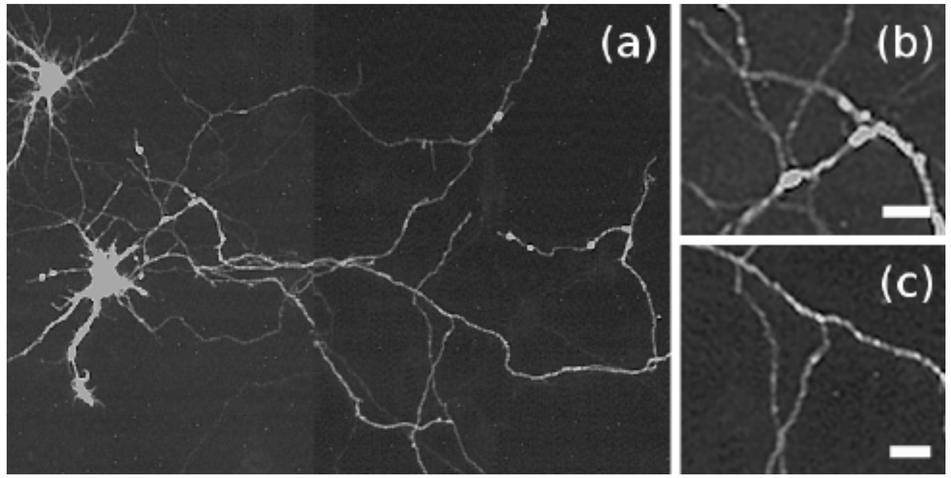

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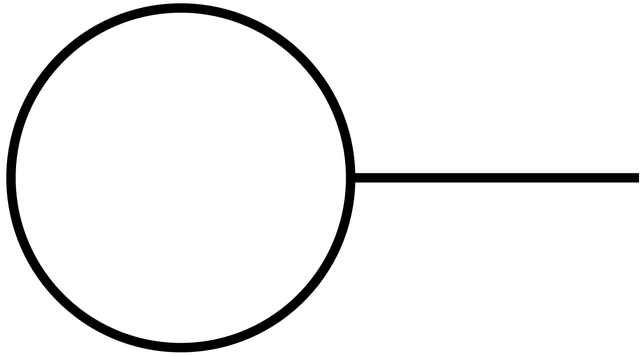

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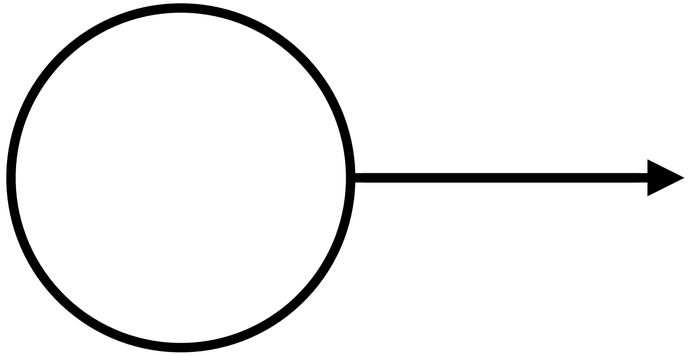

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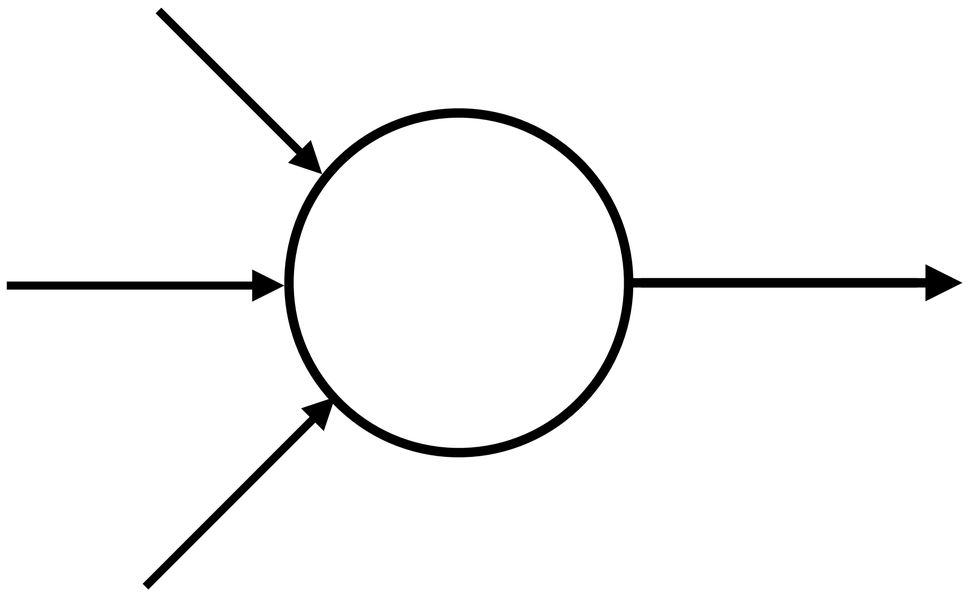

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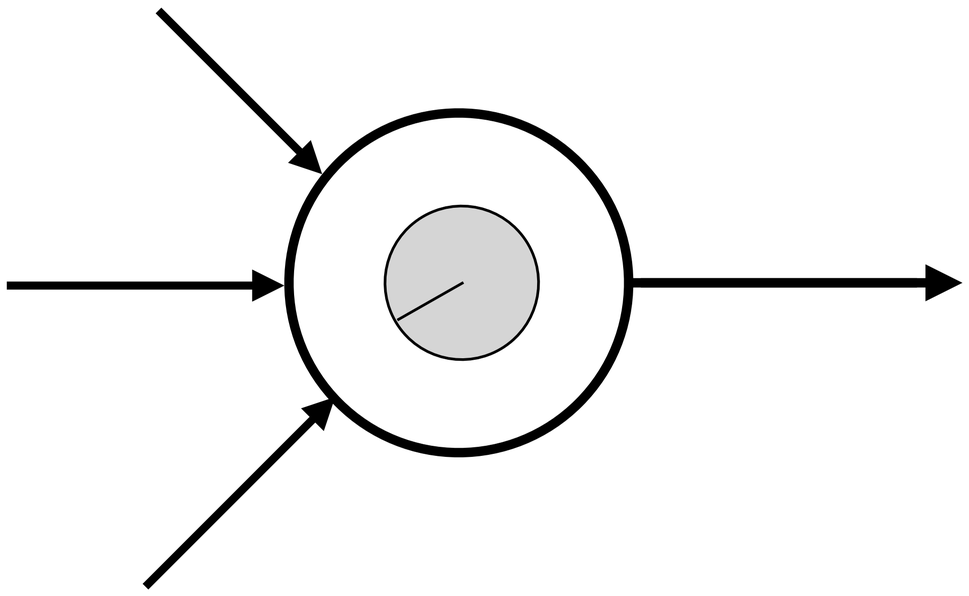

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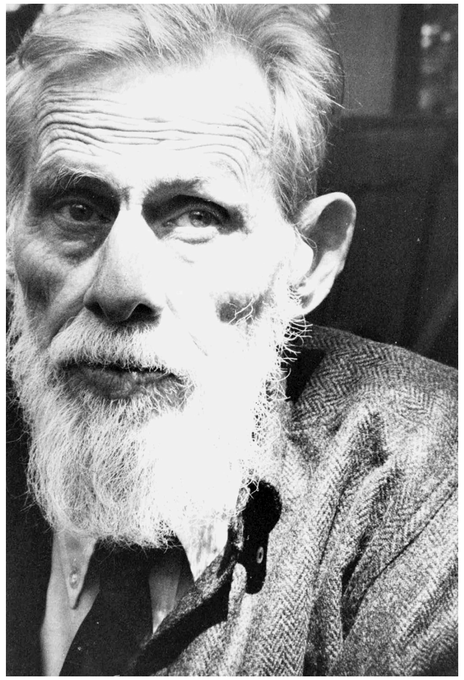
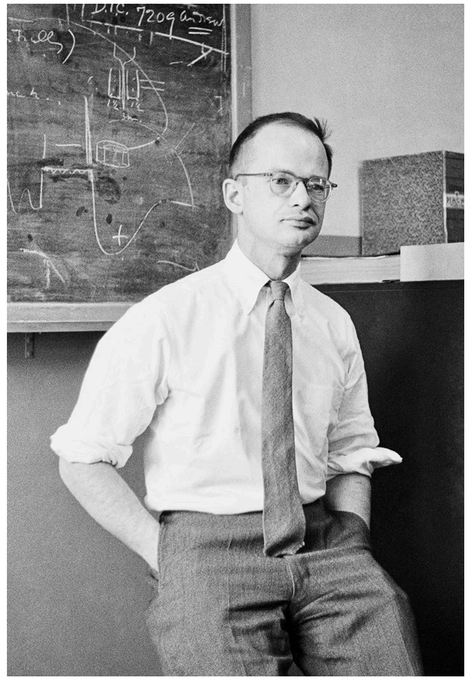


Warren S. McCulloch



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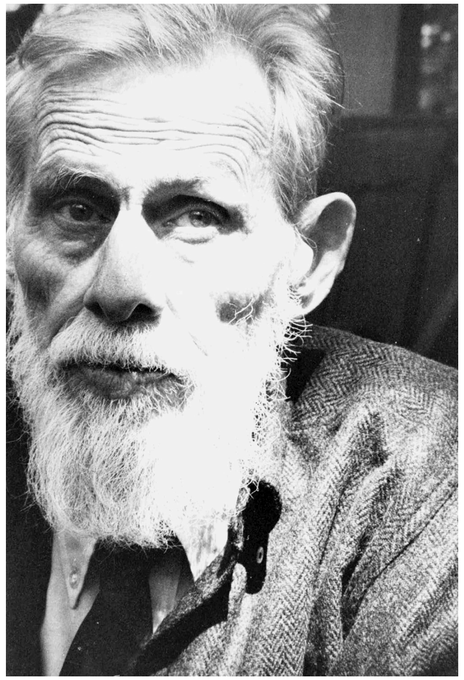

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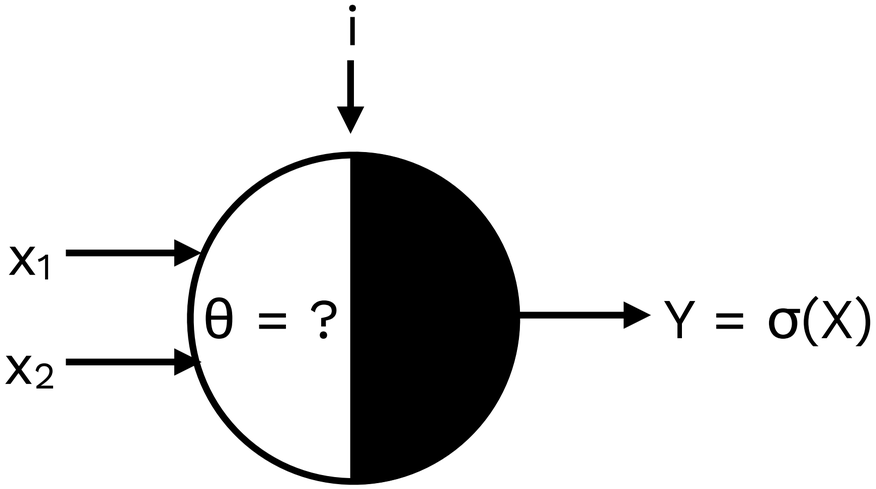

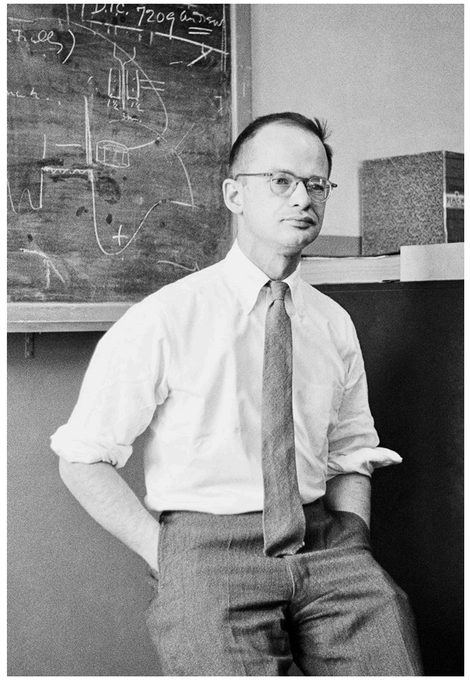

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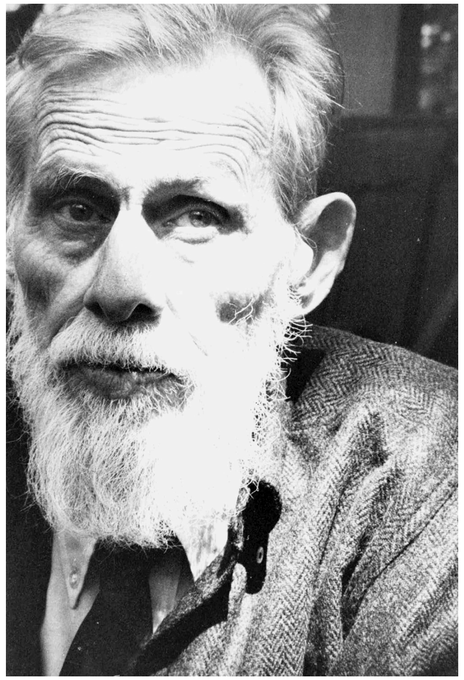

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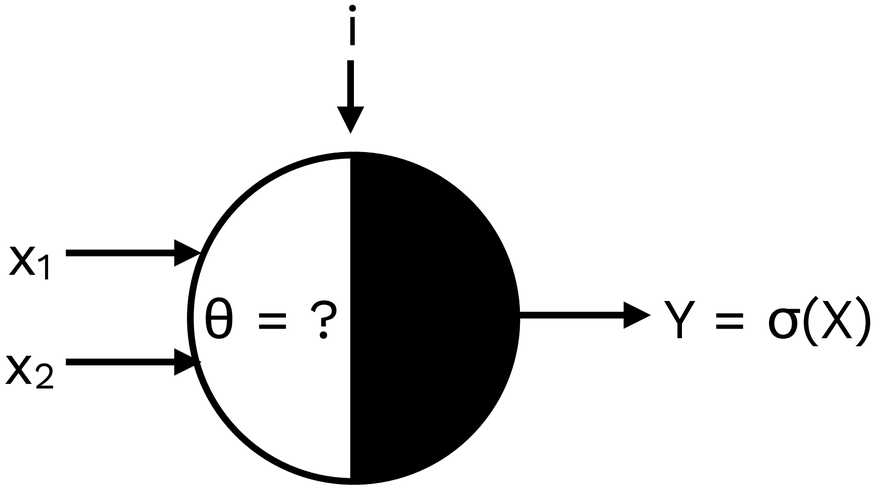
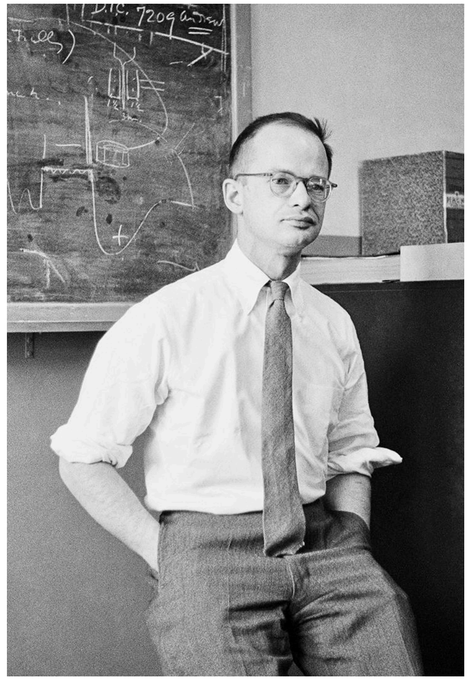


$$\sigma(\mathbf{x}) = \begin{cases} 1 \text{ if } \sum_{k=1}^{n} x_k > \Theta \text{ and } i = 0, \\ 0 \text{ otherwise.} \end{cases}$$



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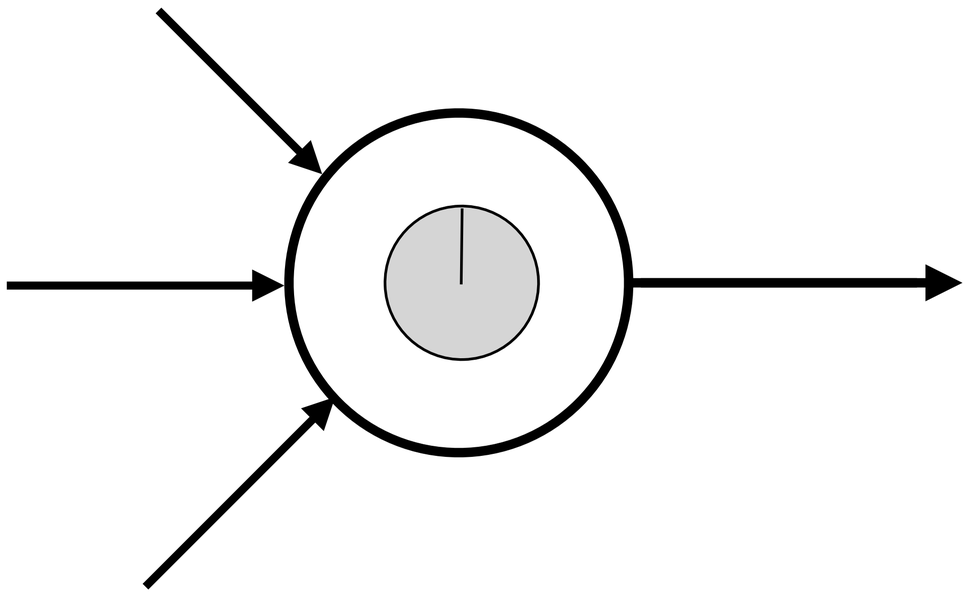

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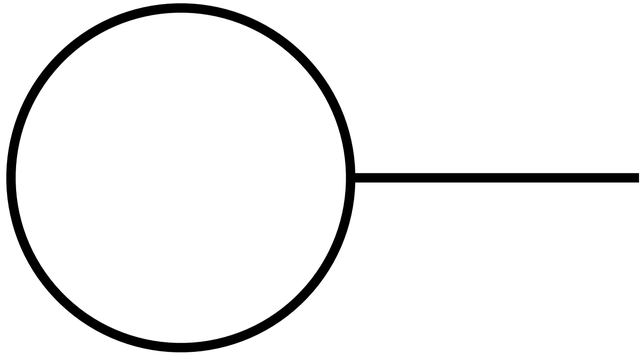

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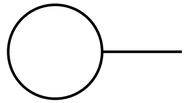
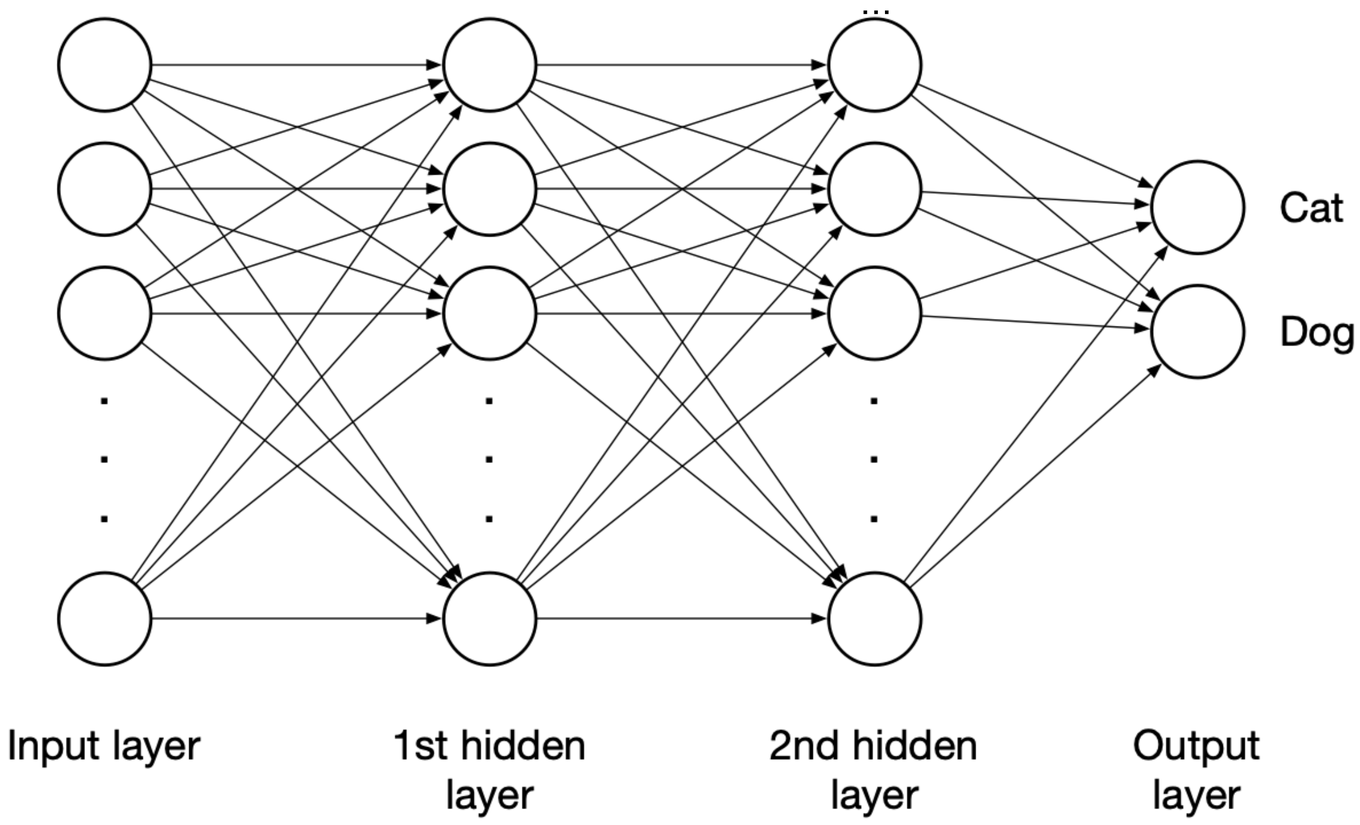


Connectionists : the perceptron



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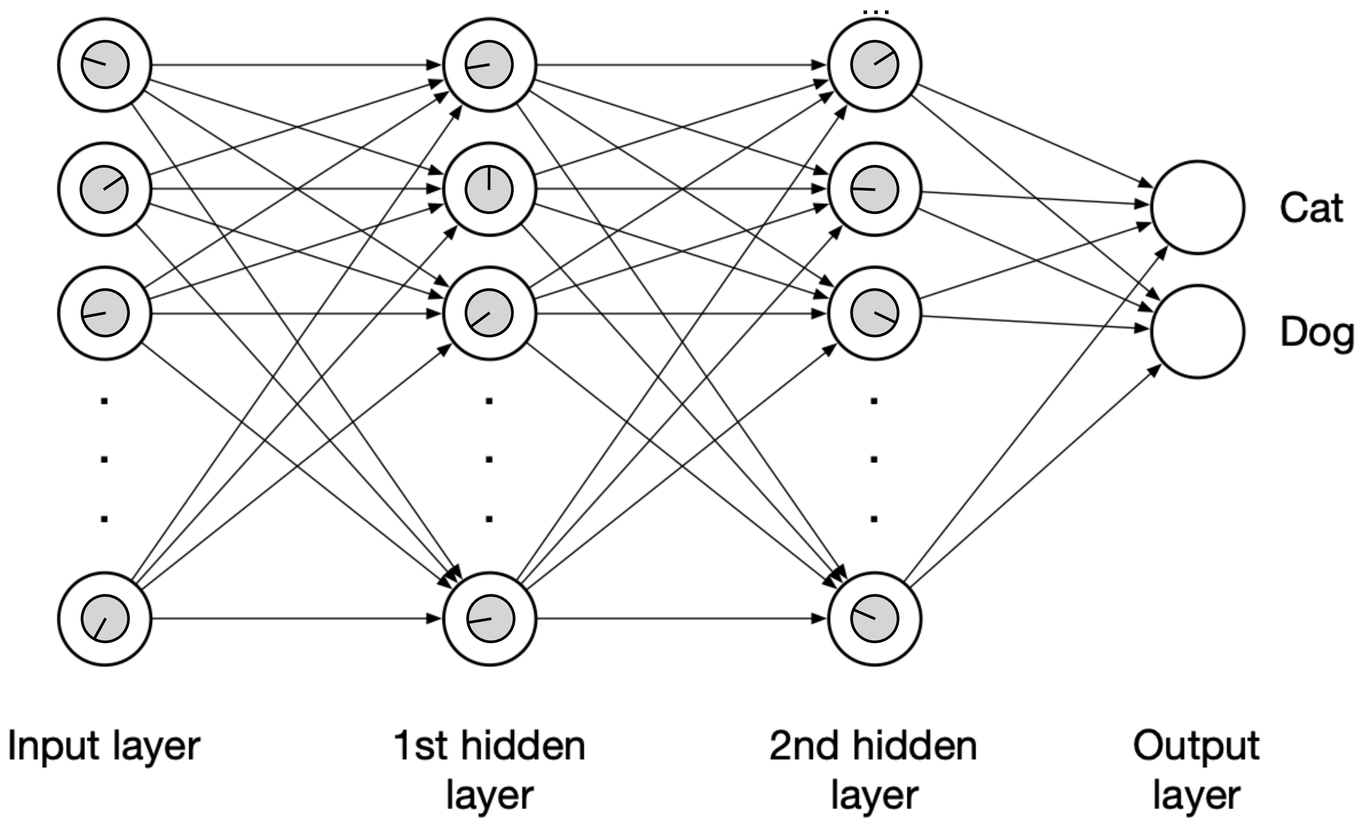

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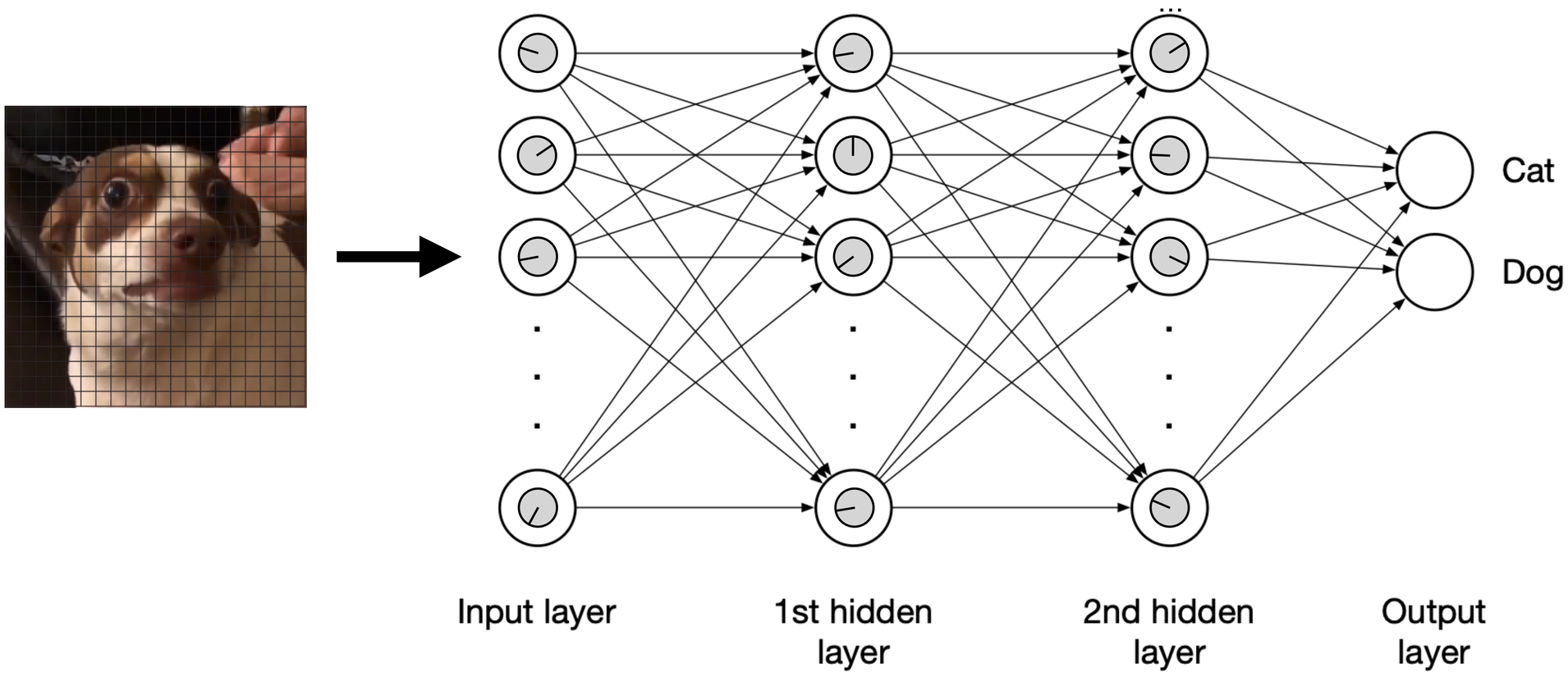

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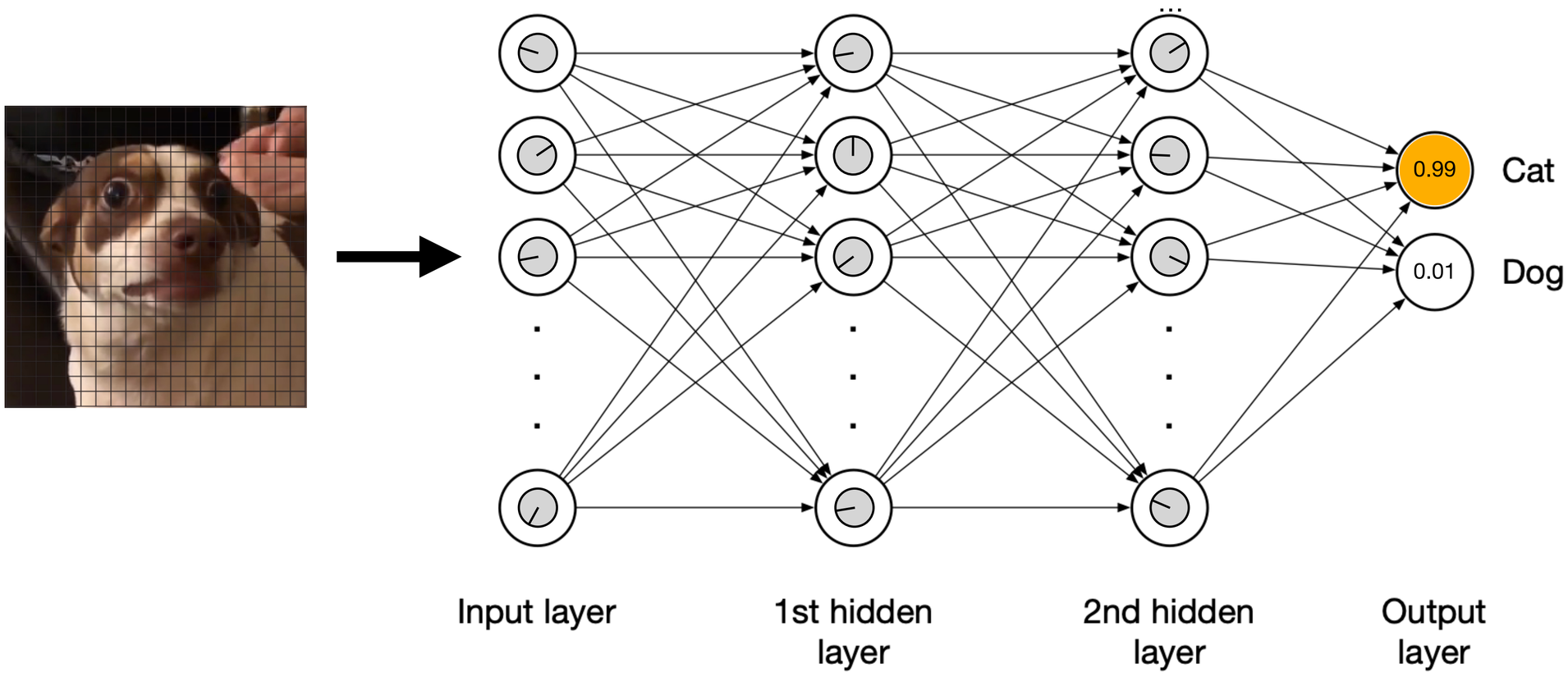

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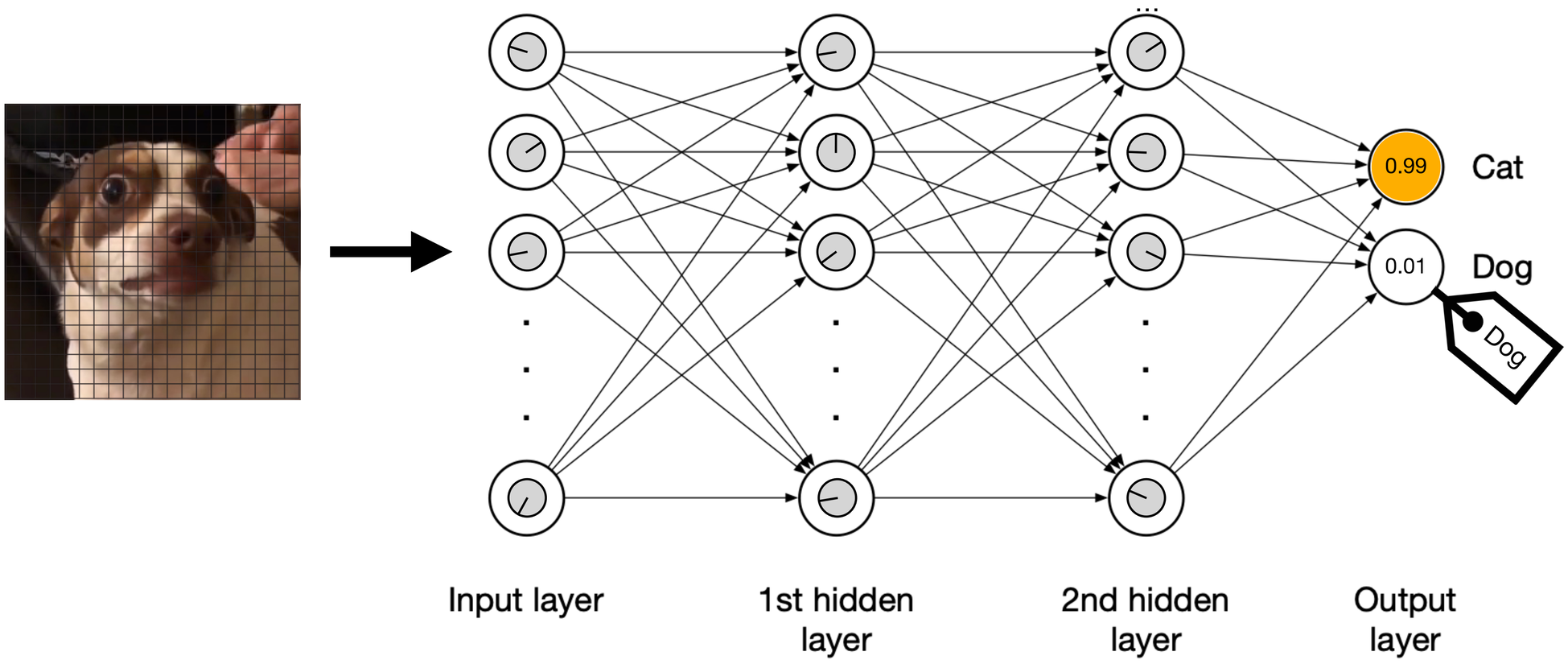

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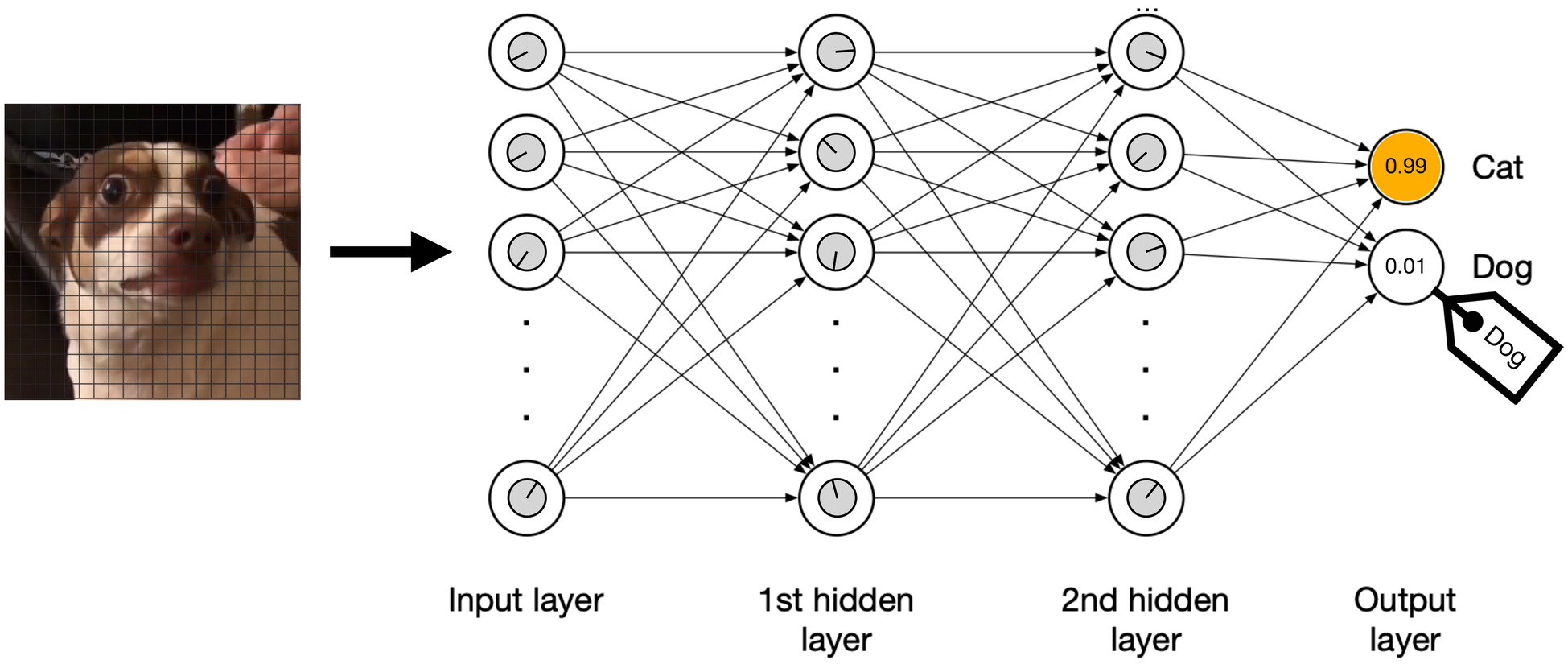

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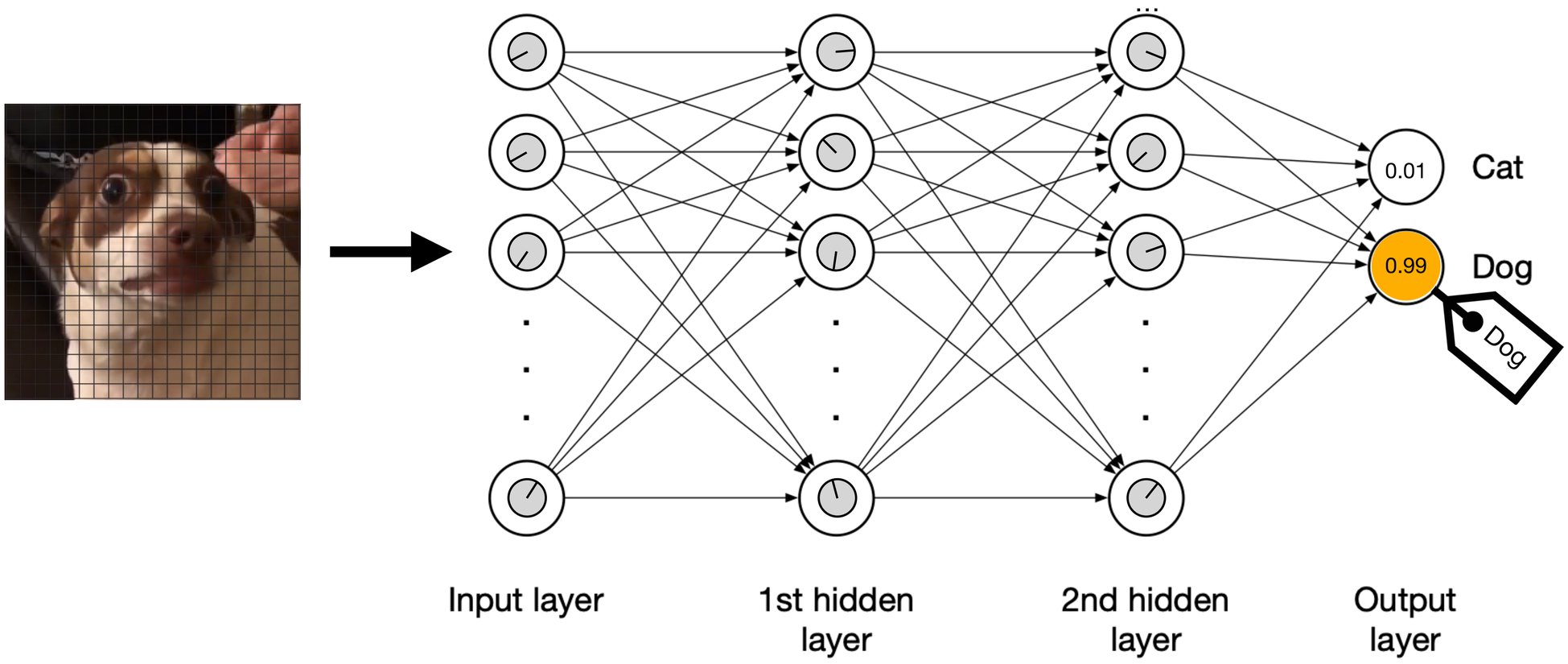


I. Brief history of AI

Connectionists

The perceptron (1957)

FIG. 1 — Organization of a biological brain. (Red areas indicate active cells, responding to the letter X.)

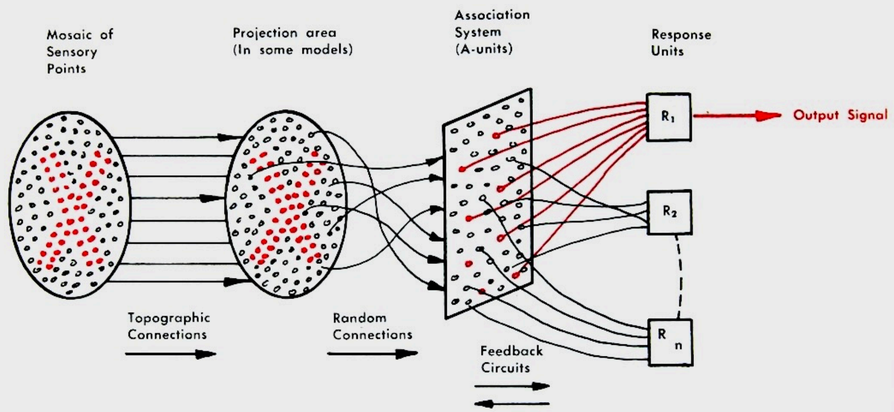
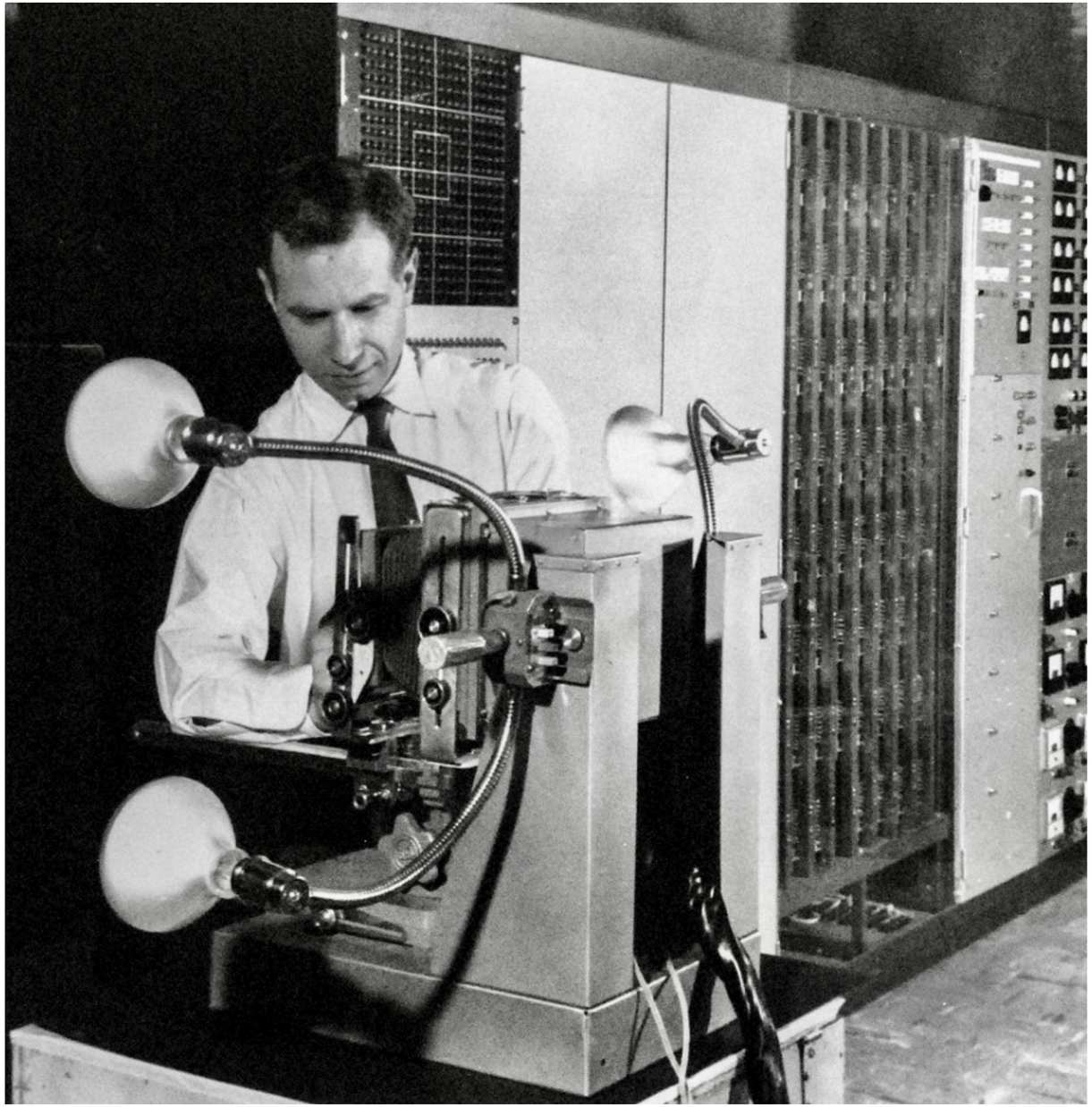


FIG. 2 — Organization of a perceptron.



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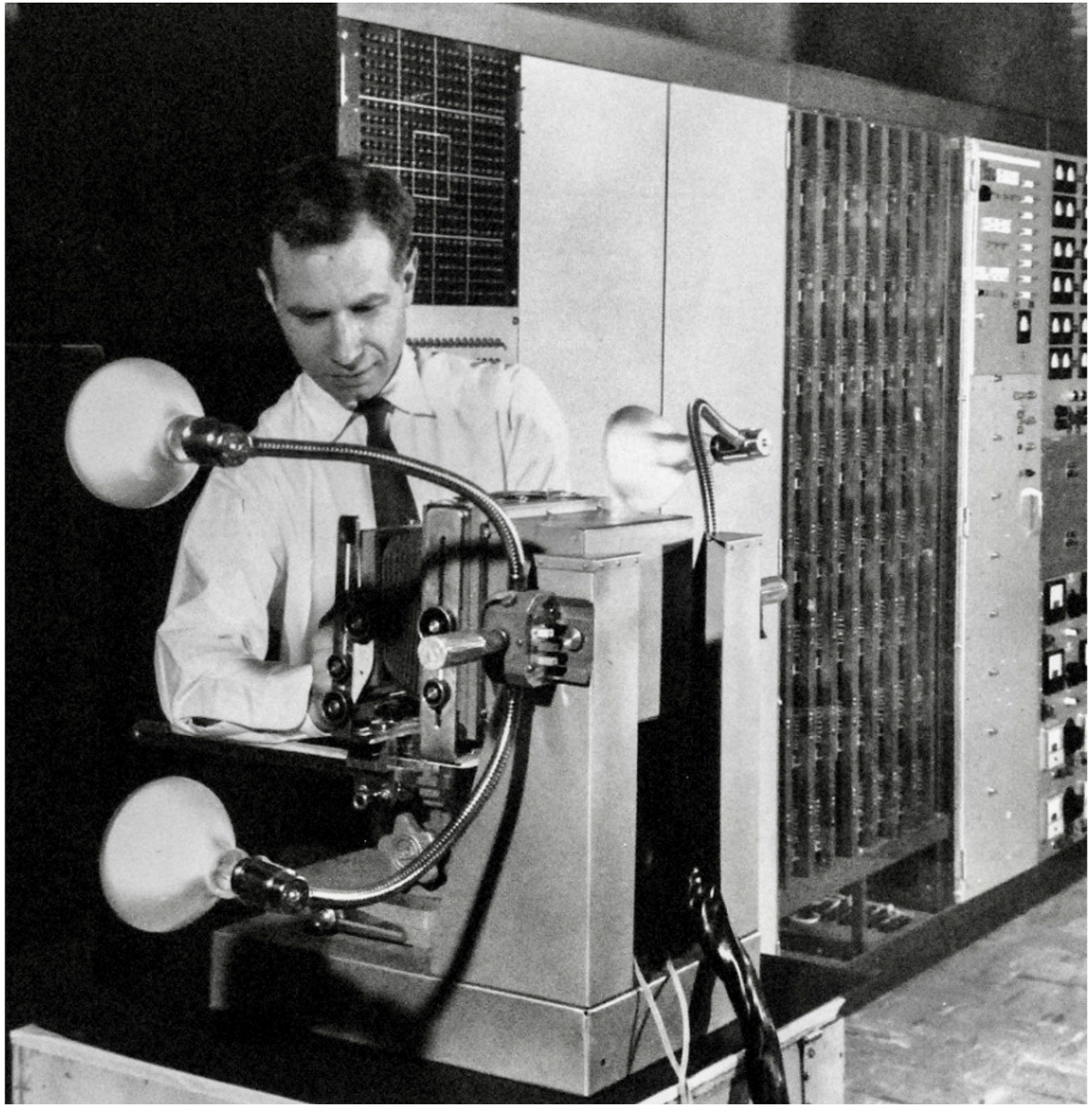

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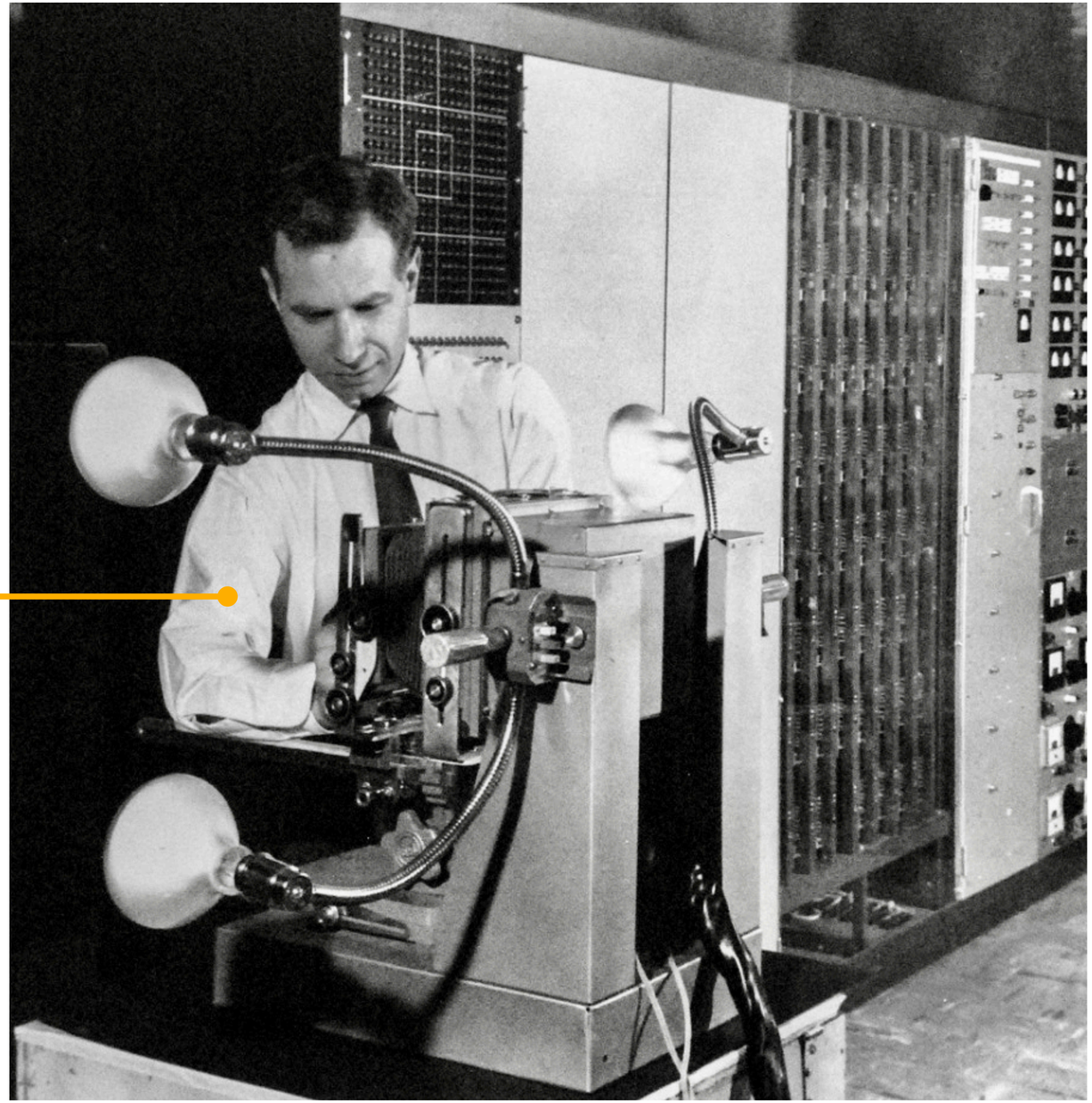

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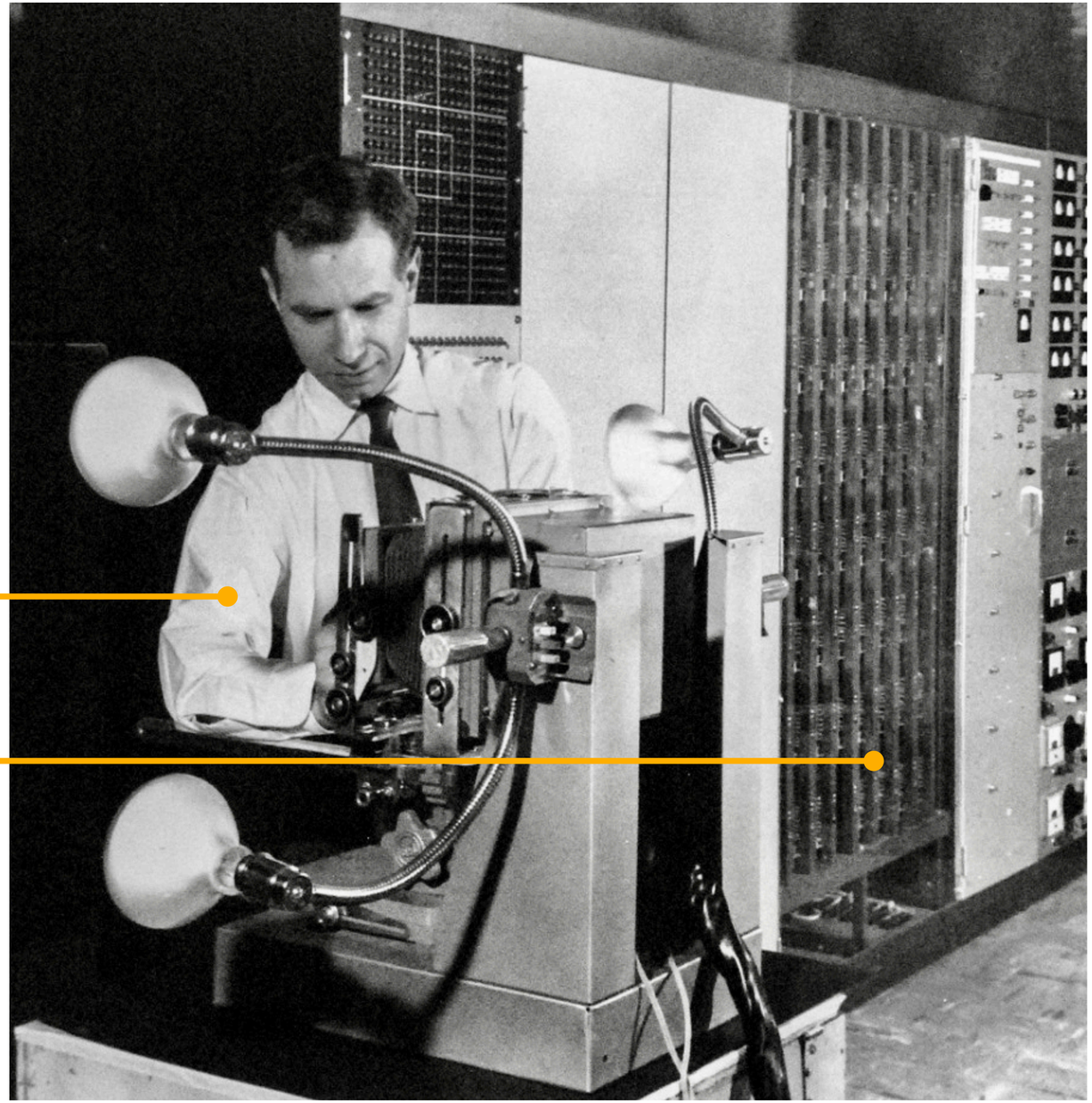

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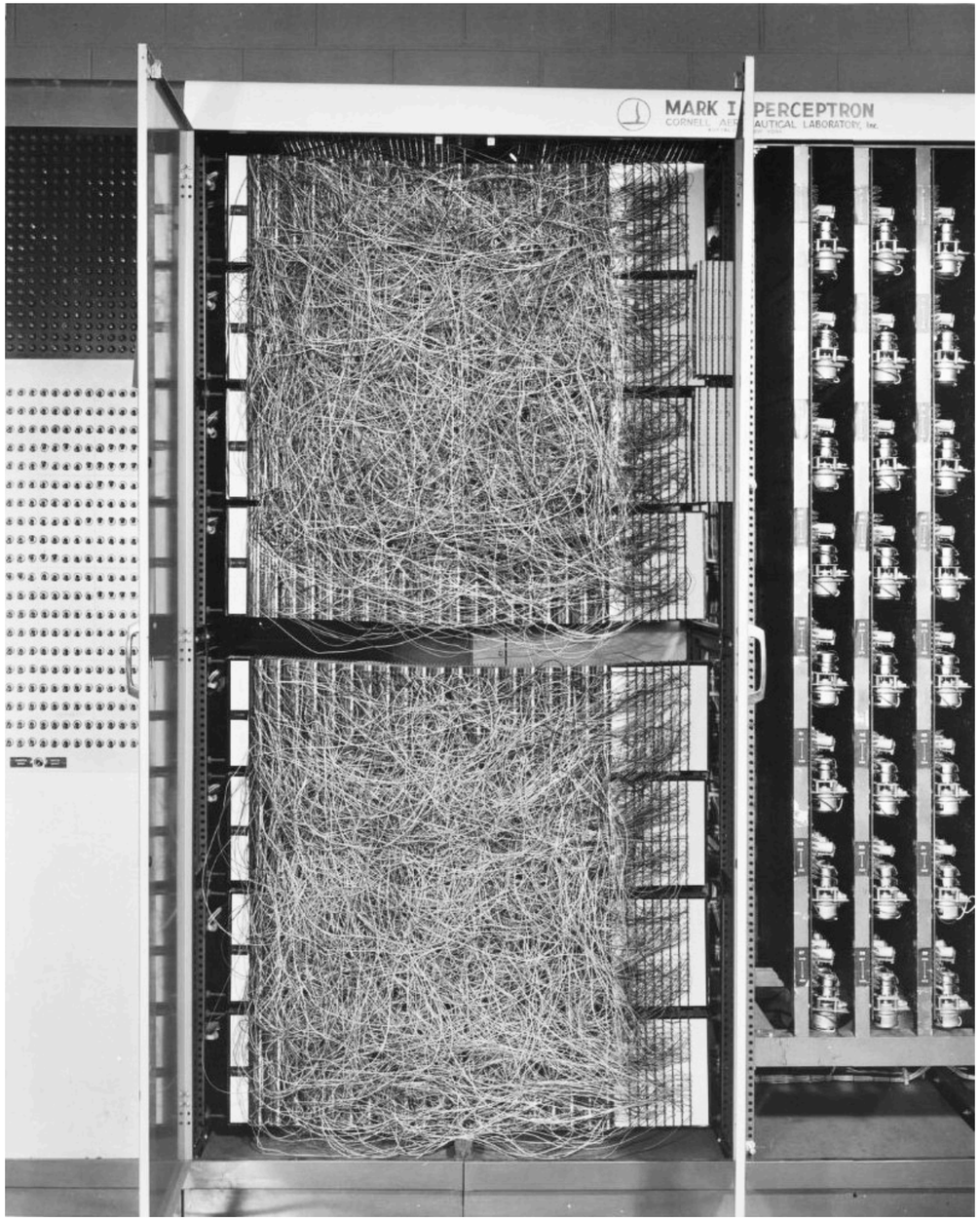

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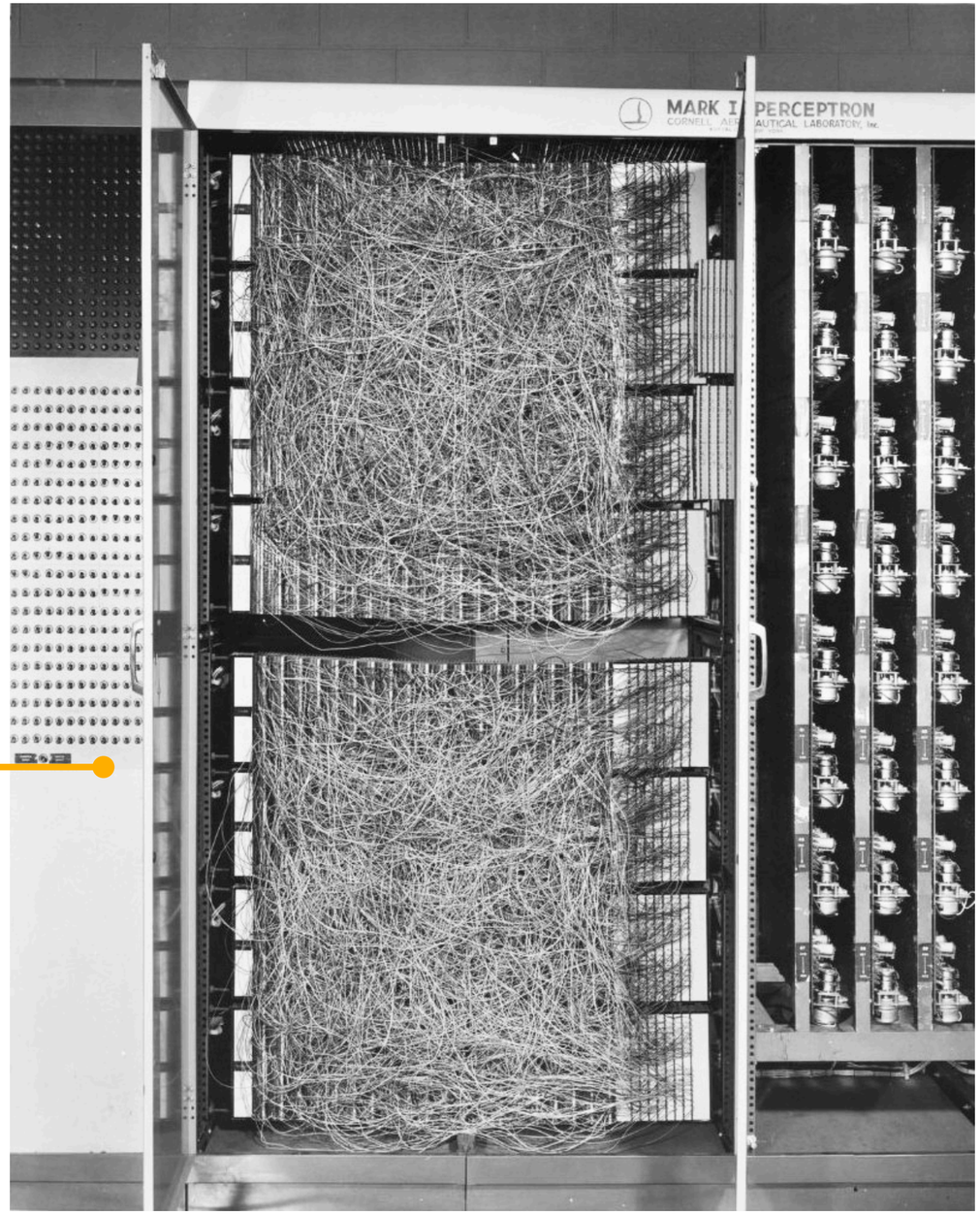
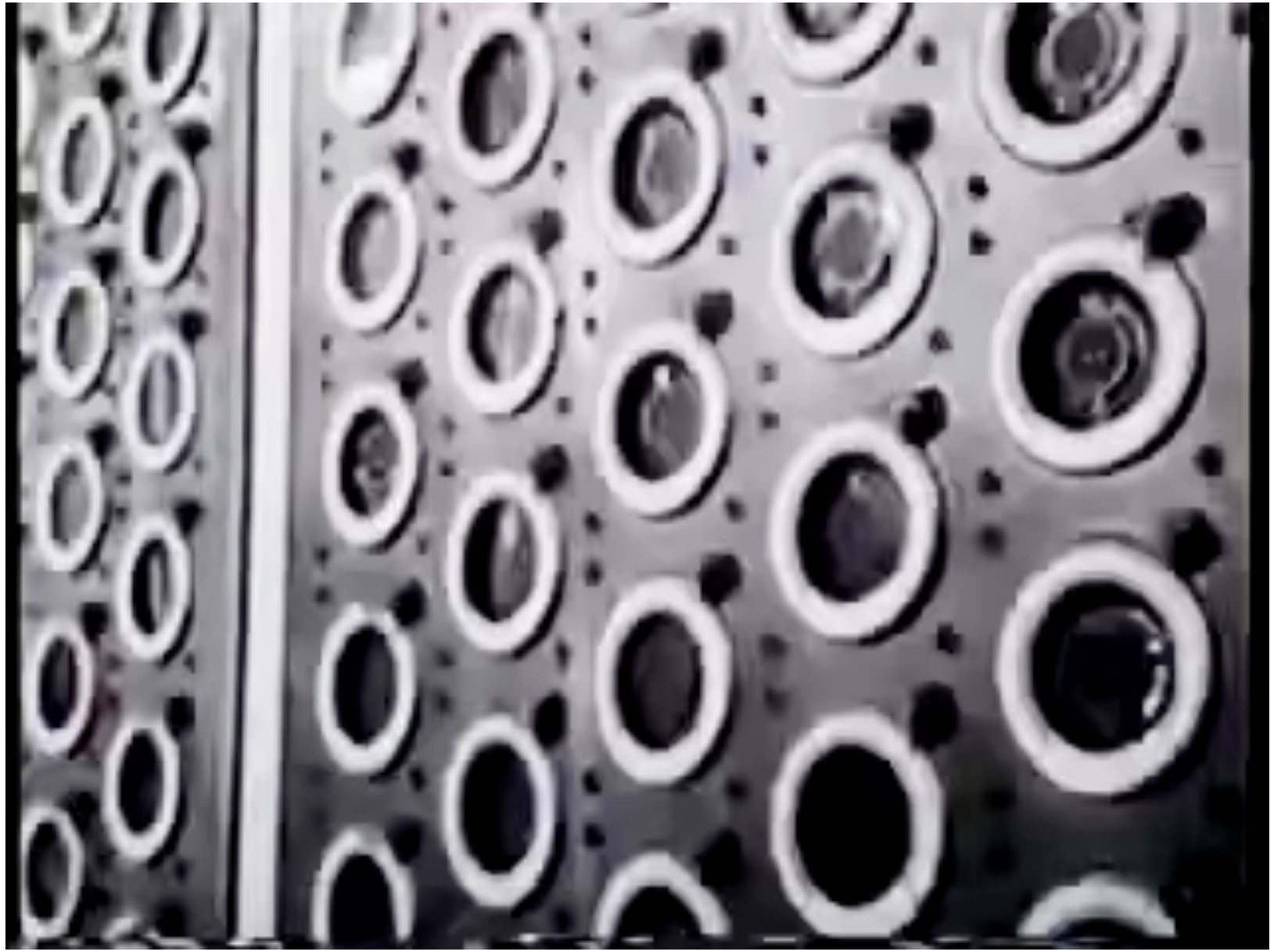
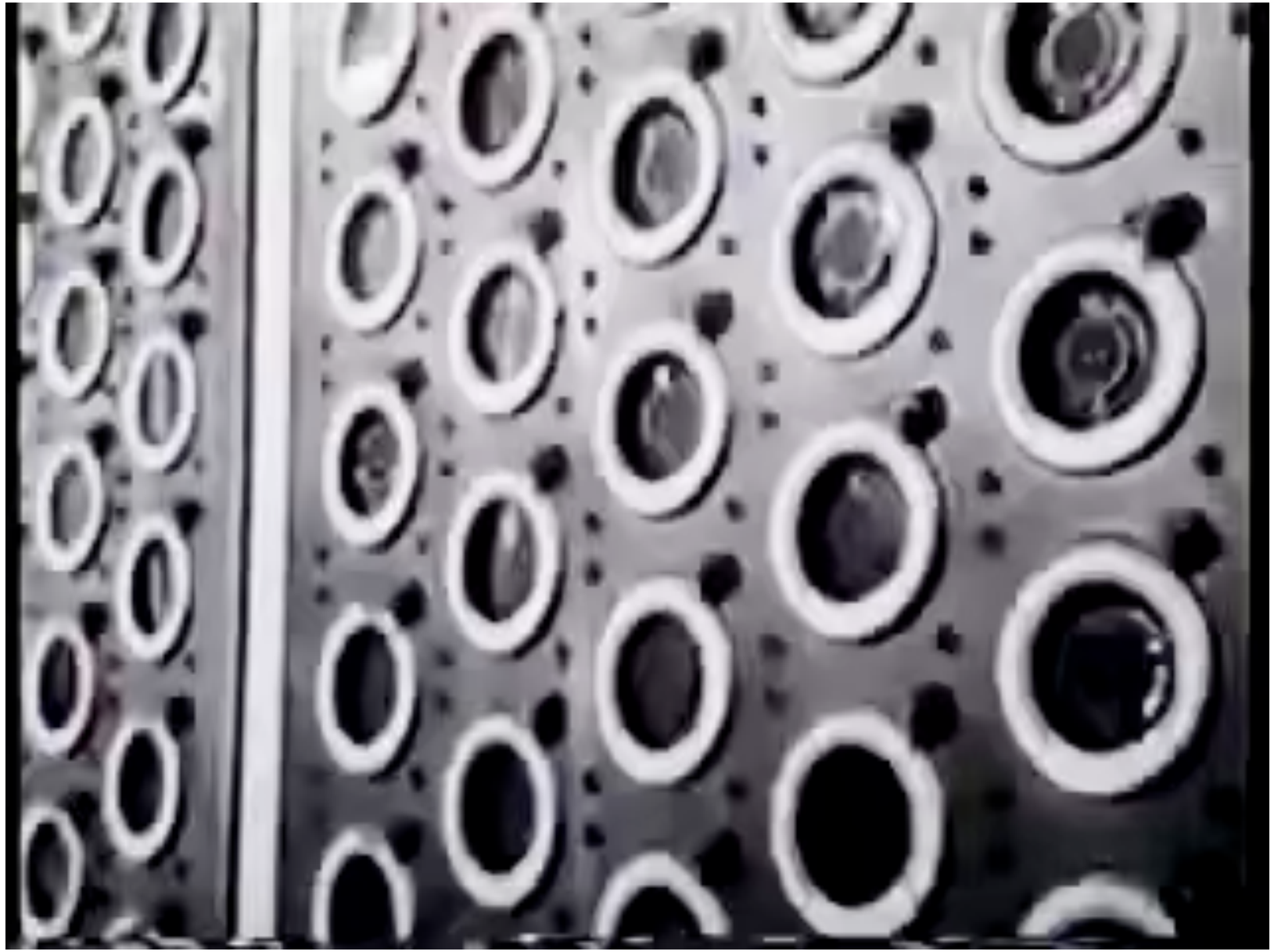




Source: https://www.youtube.com/watch?v=cNxadbrN_aI&t=1s



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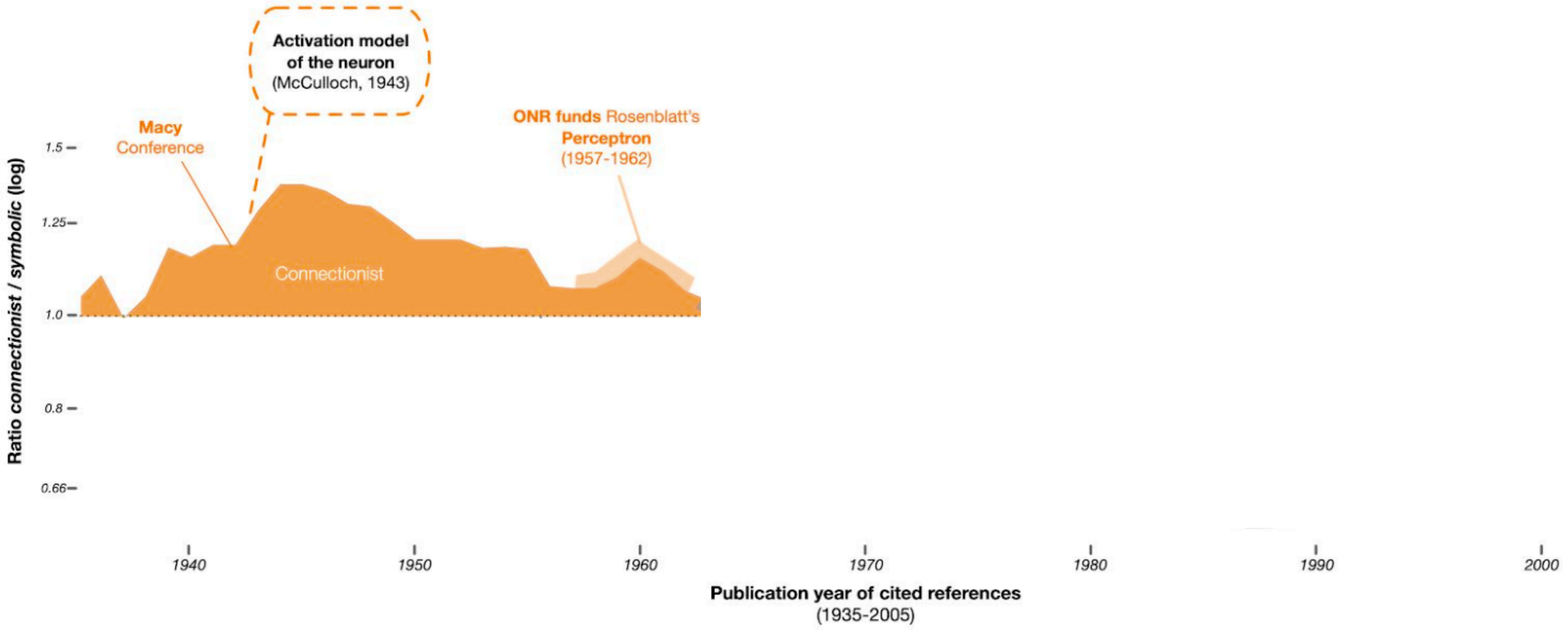

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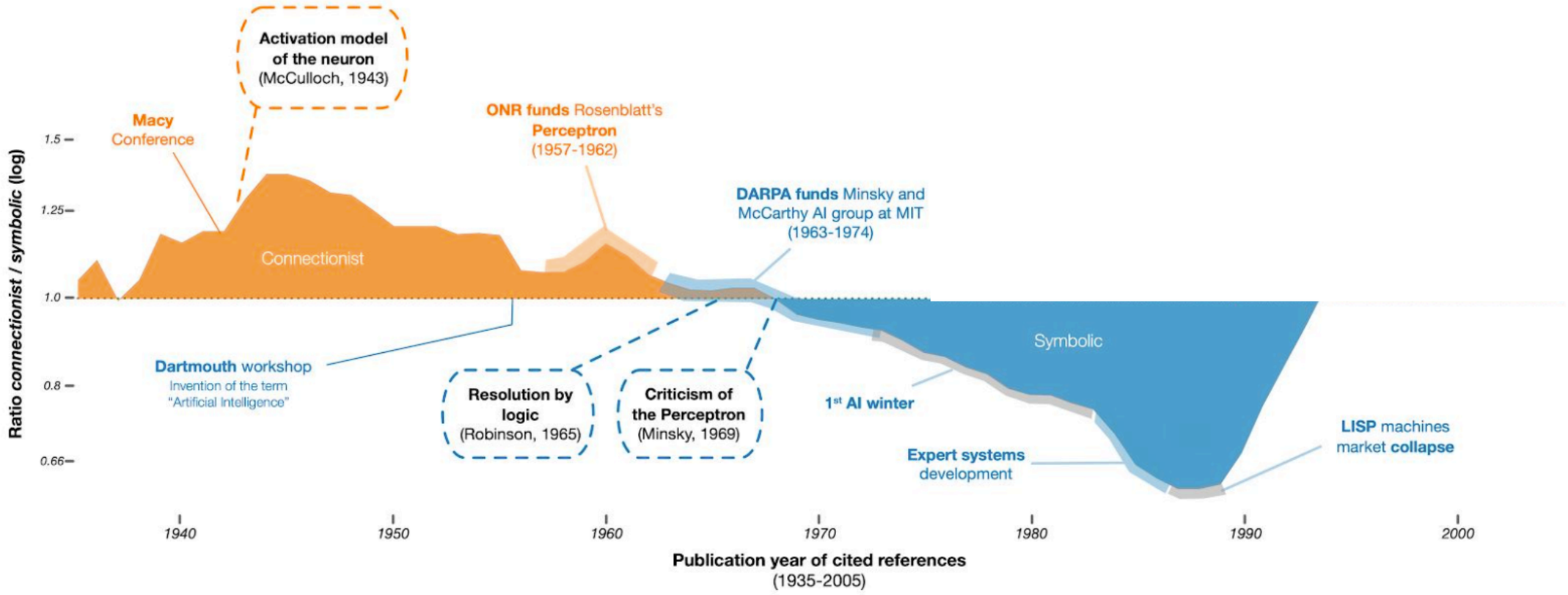

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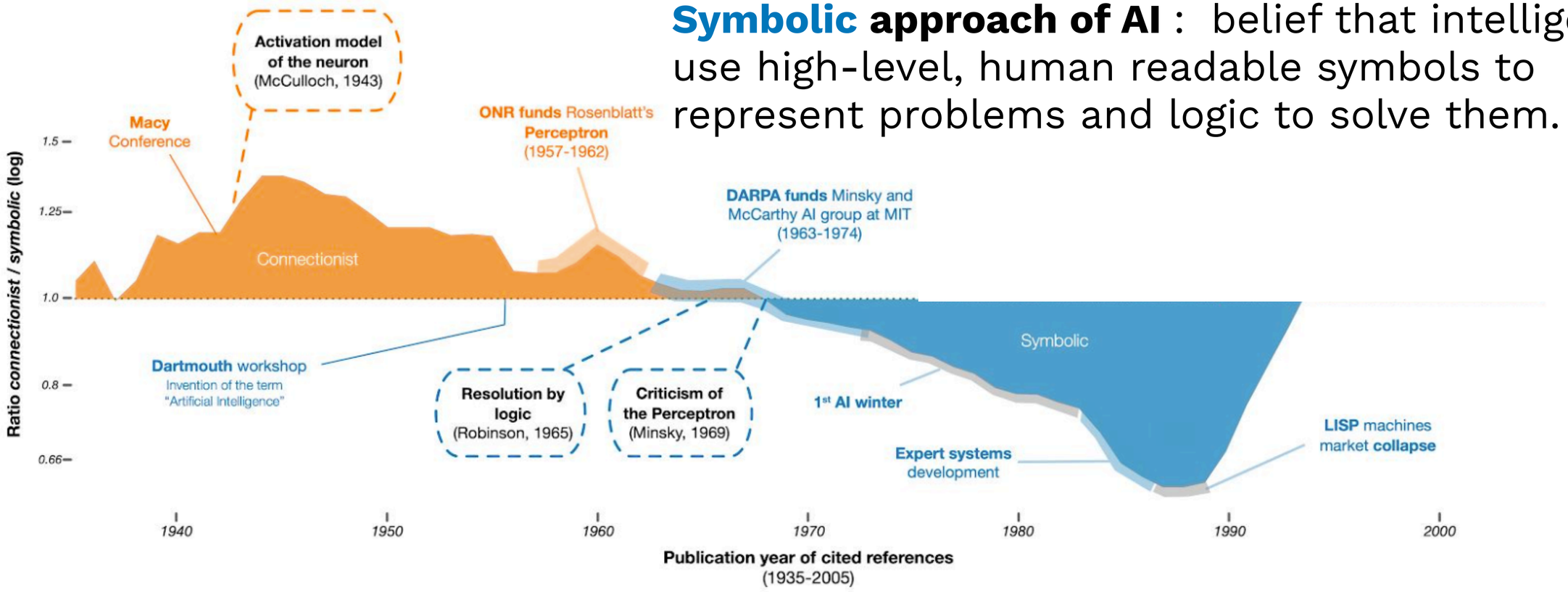

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* Model the mind with symbols and logic is hard

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Symbolists : Toy problems

* Model the mind with symbols and logic is hard
* Simplification led to toy problems (e.g., chess)

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Symbolists : Expert systems (1980s)

Expert system : system trying to reproduce domain-experts' reasoning from knowledge base and inference rules

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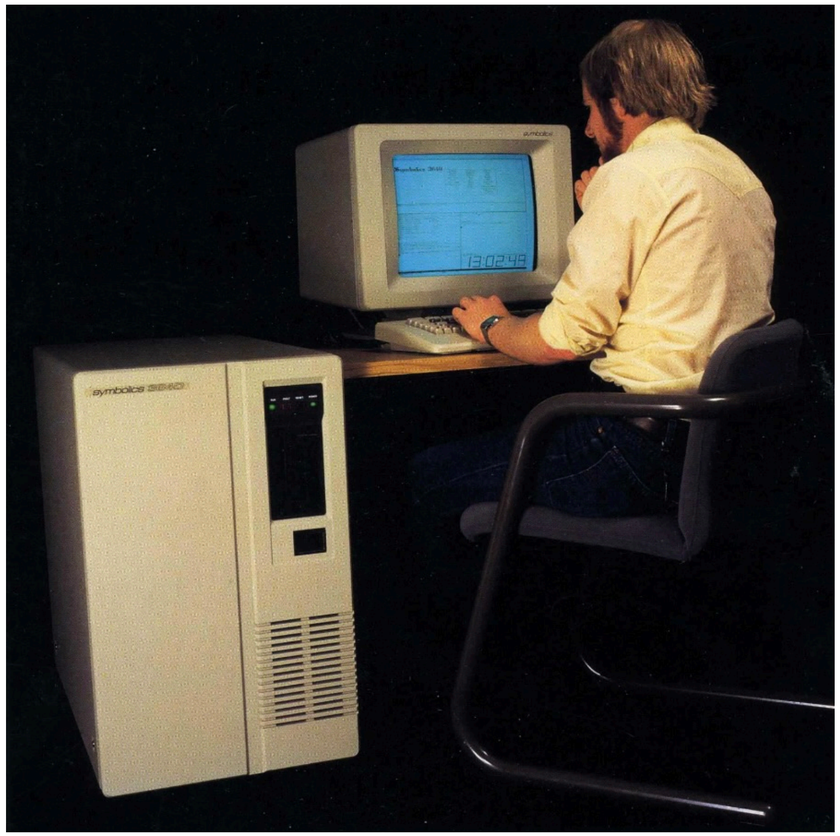
Symbolics 3640 LISP machine



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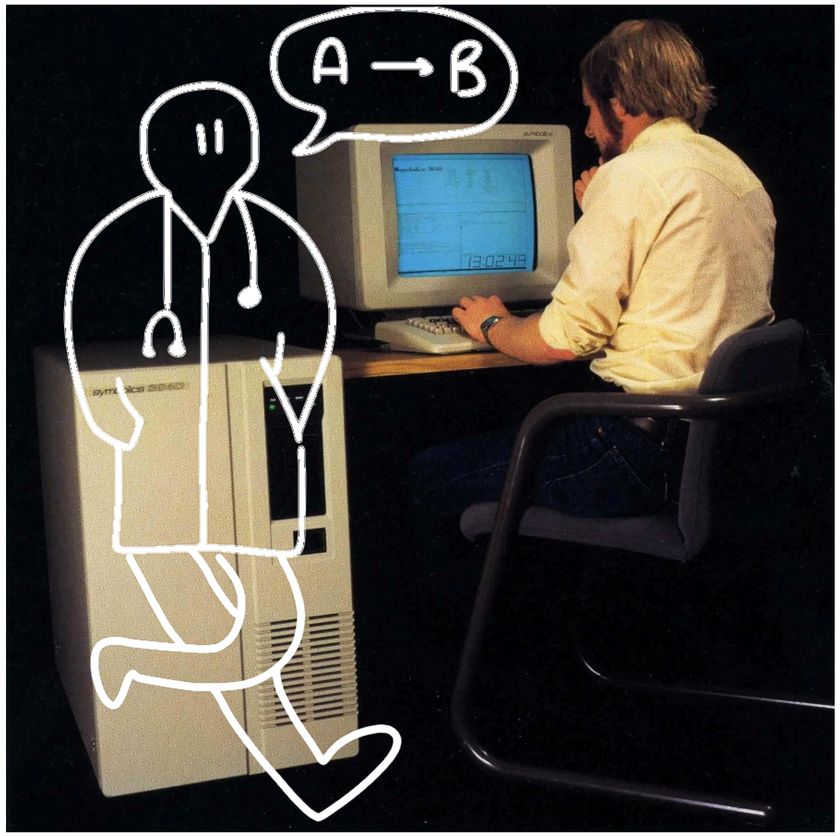

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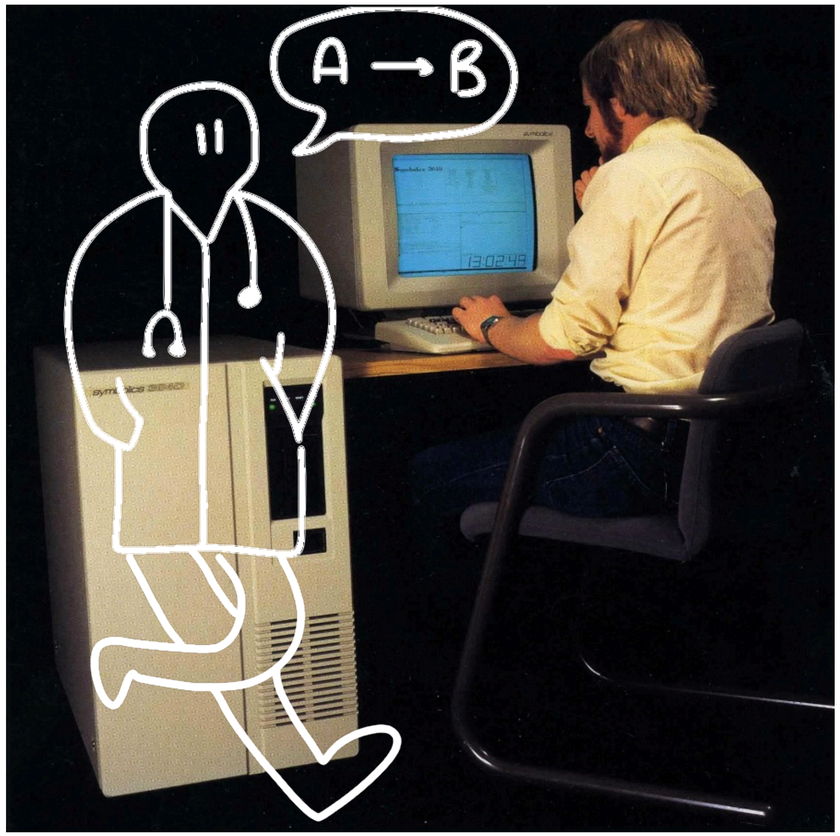

Expert system : system trying to reproduce domain-experts' reasoning from knowledge base and inference rules

It failed ! Why ?

→ Difficult knowledge acquisition on LISP machines
→ Intractable inferences with large knowledge base/rules
→ Economic collapse of LISP machines

Cardon, D., Cointet, J. P., & Mazieres, A. (2018). Neurons spike back: The Invention of Inductive Machines and the Artificial Intelligence Controversy. *Réseaux: communication, technologie, société*

I. Brief history of AI

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The connectionist vs symbolic approach
Connectionism: artificial neuron and perceptron
Symbolism
Revenge of connectionism

II. How do machines learn ?

Optimizing an artificial neural network

III. How do humans train machines ?

The development cycle of ML
How ML experts train machines?

IV. How to develop interactions with ML?

The Marcelle toolkit

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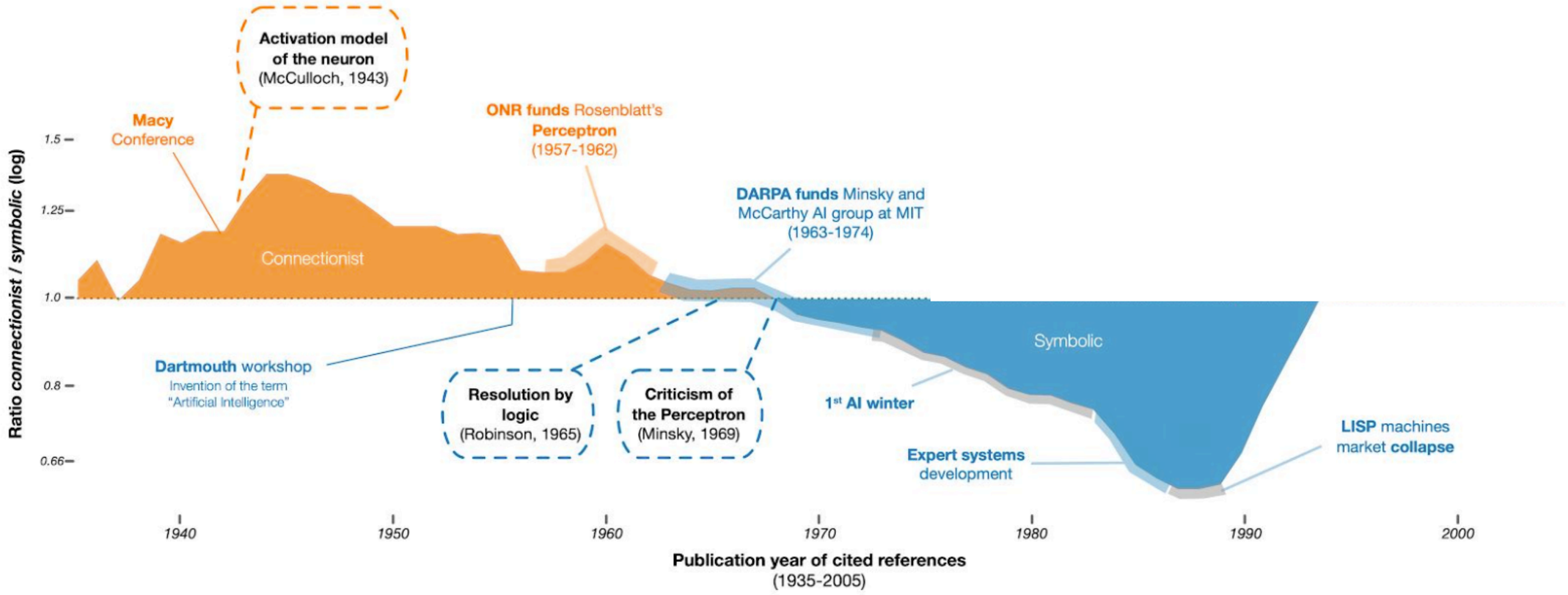

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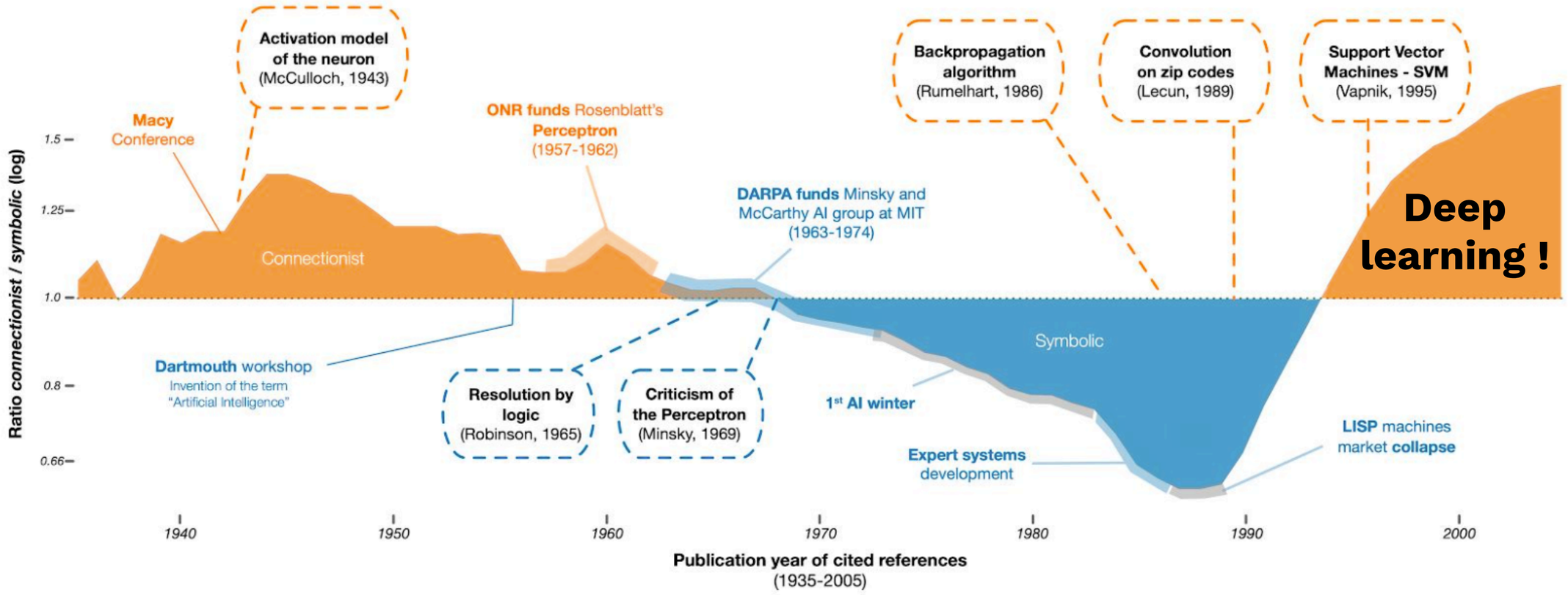

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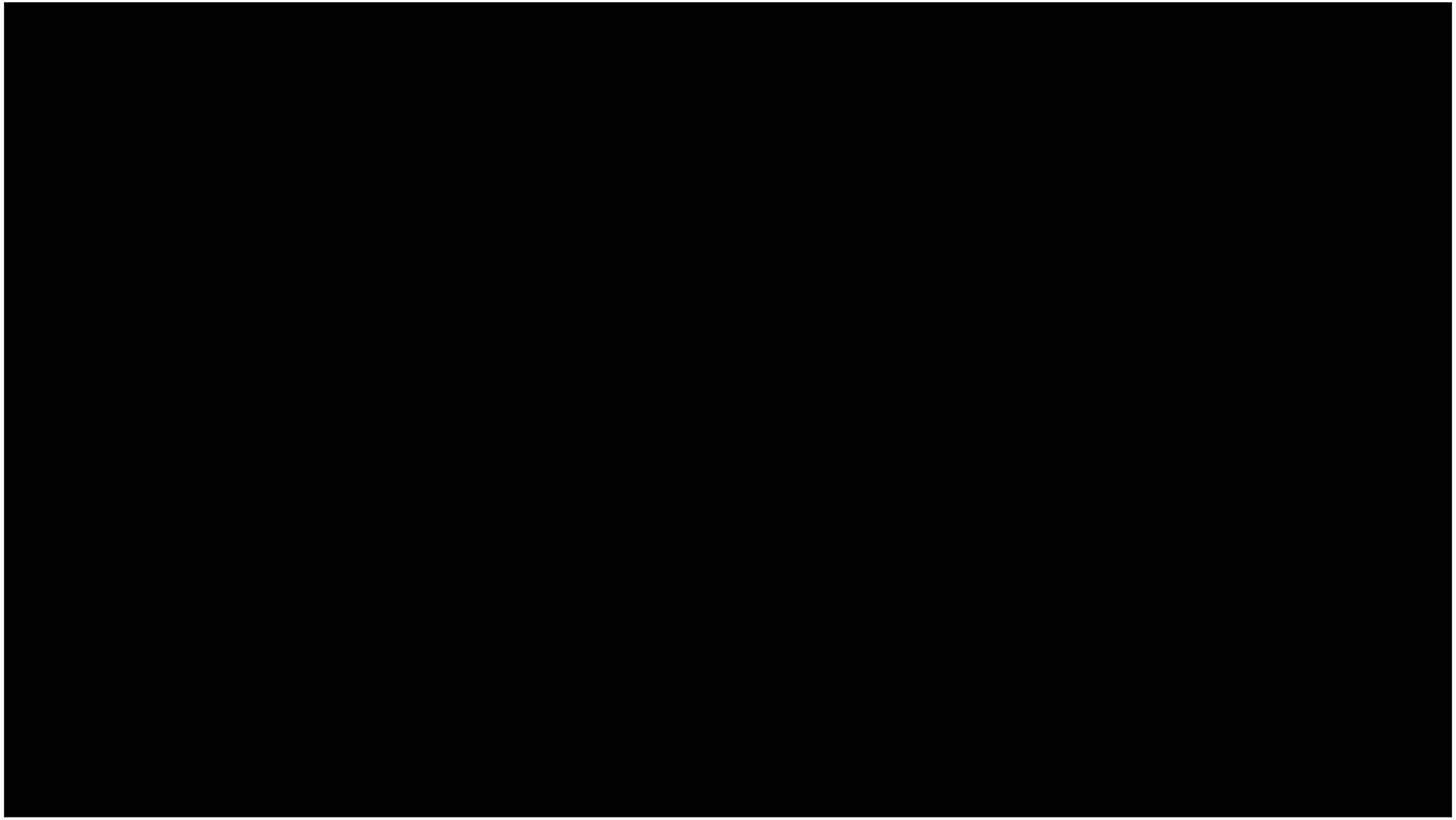

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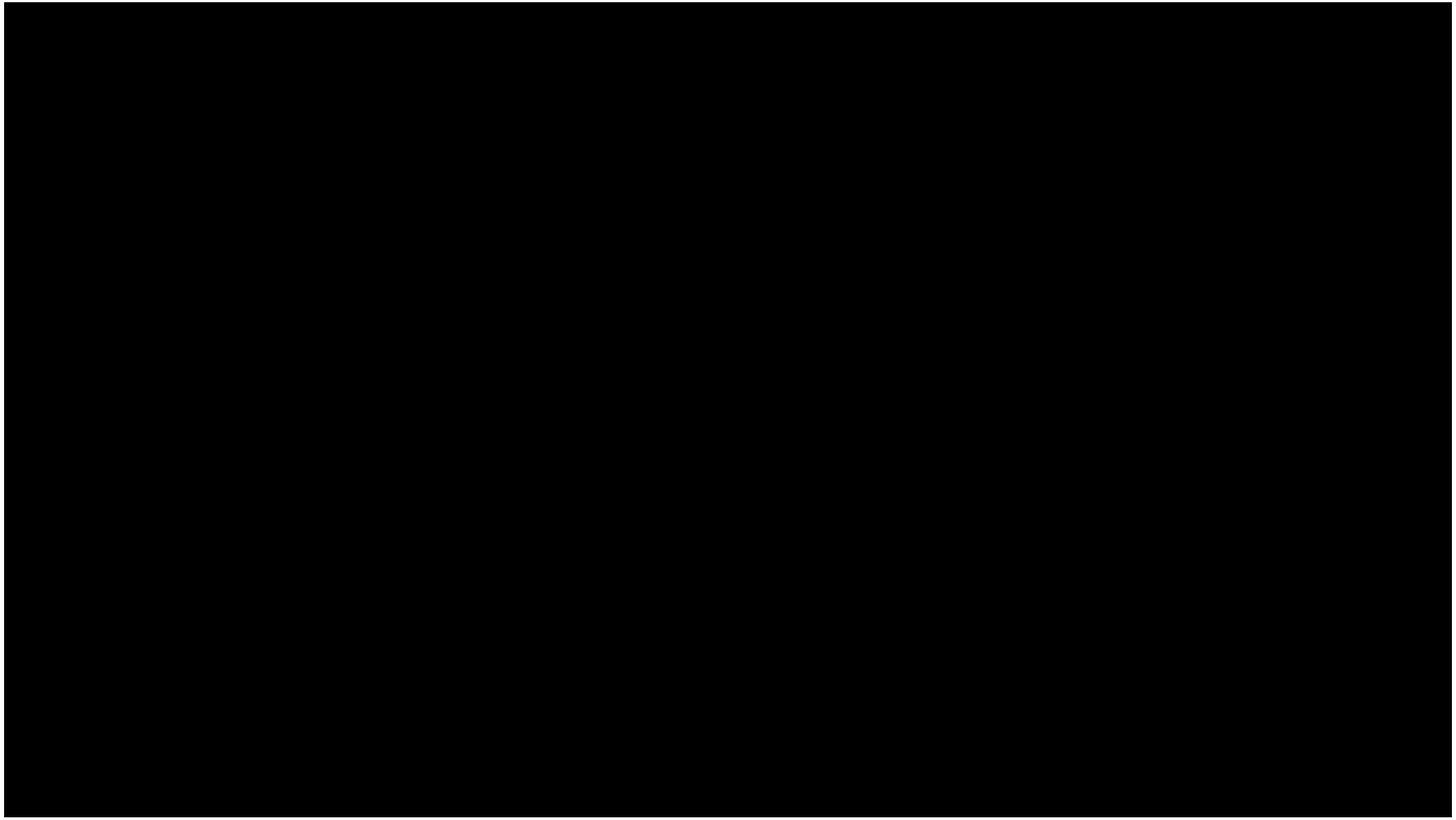

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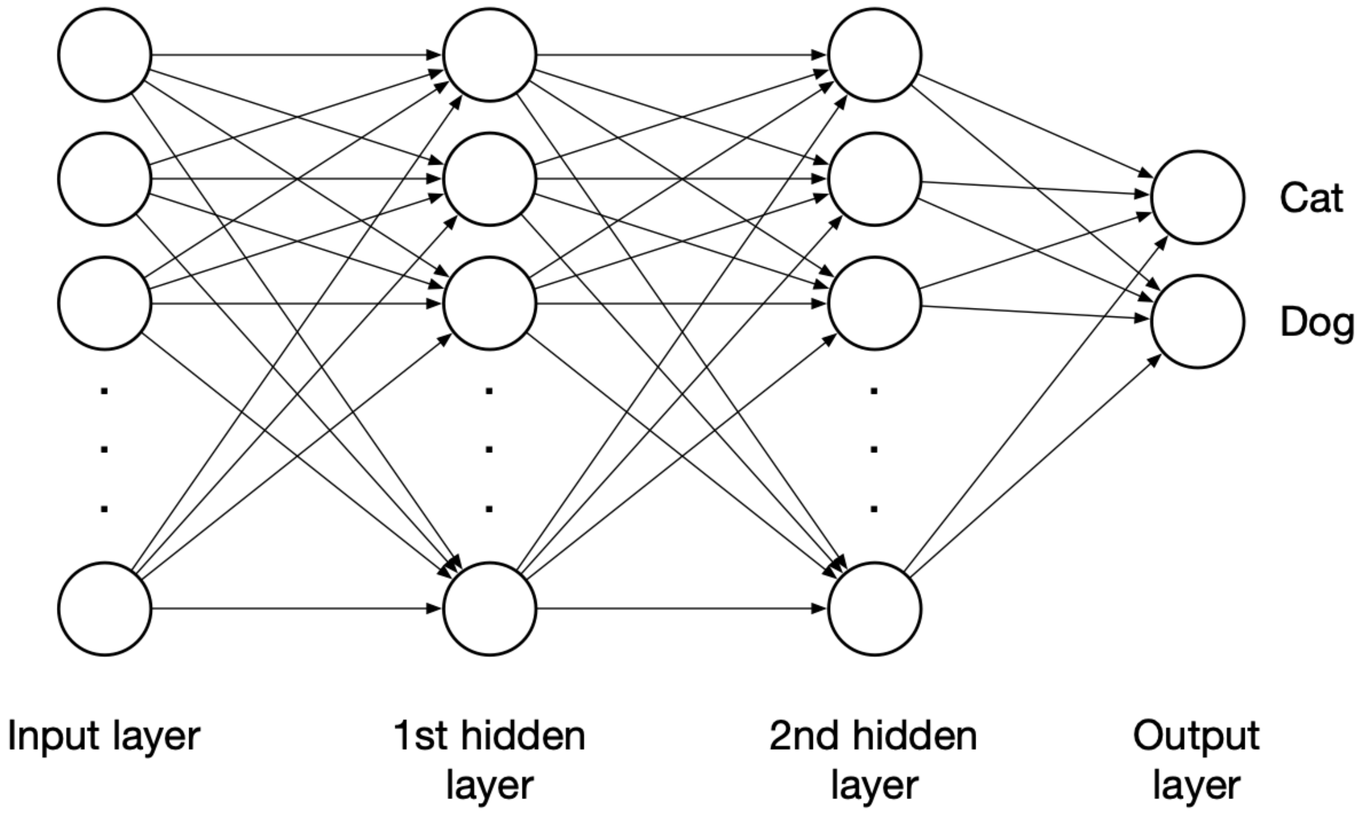

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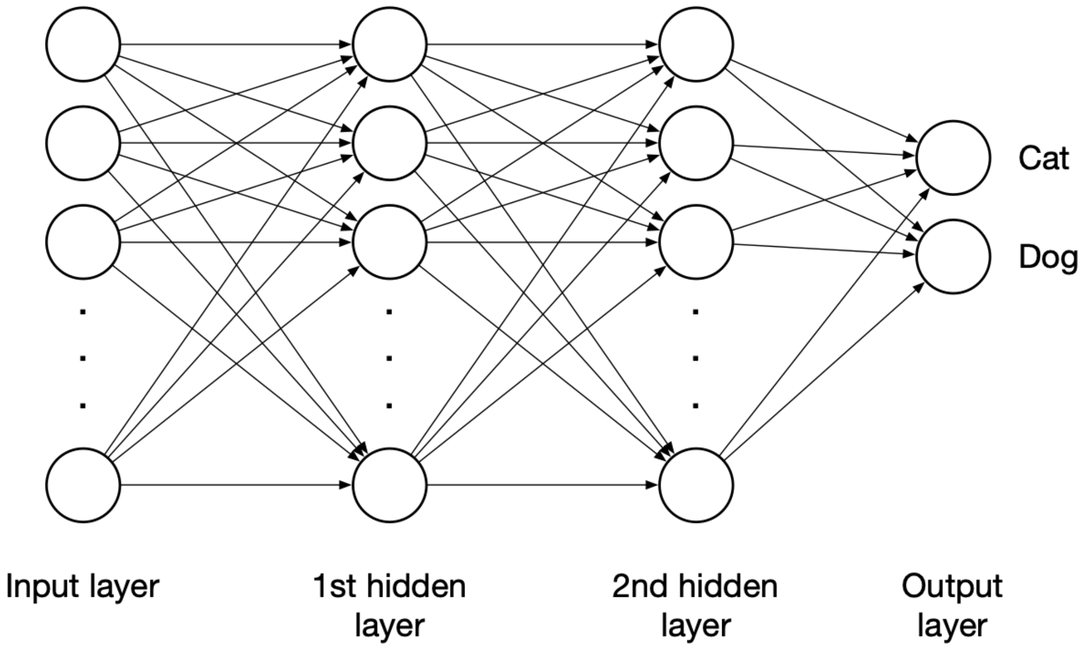

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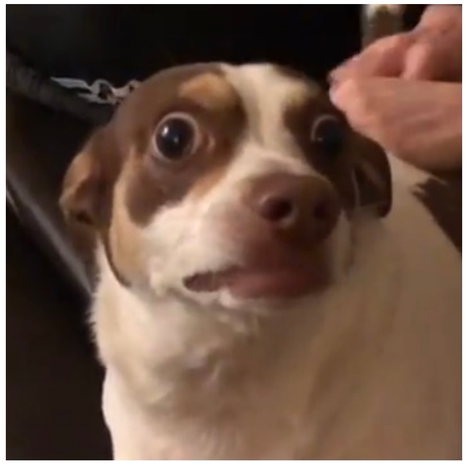

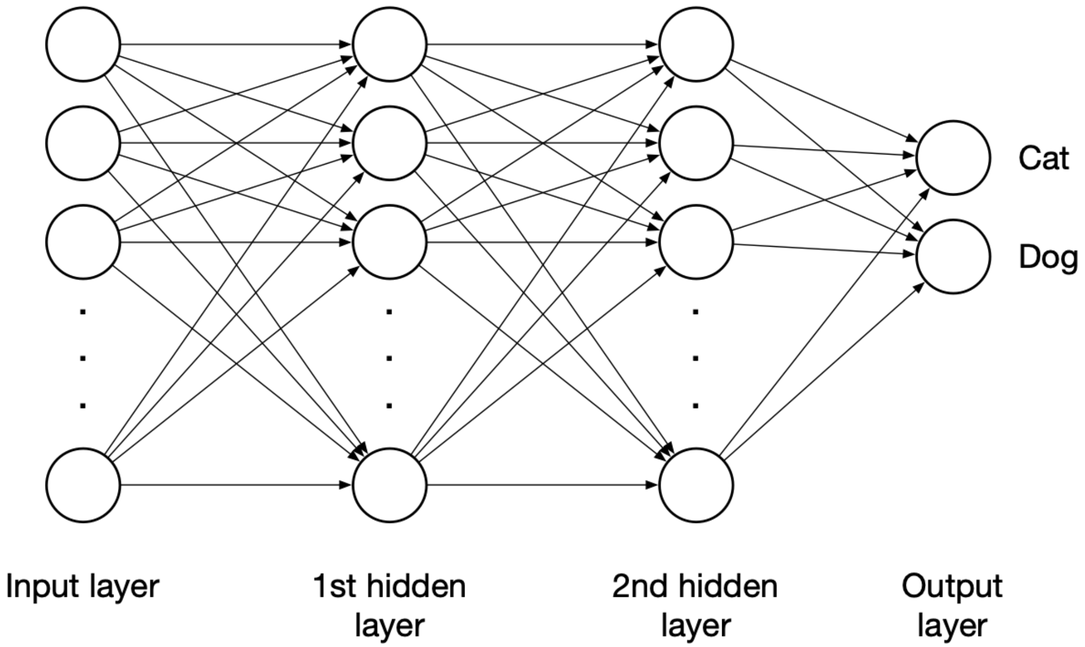

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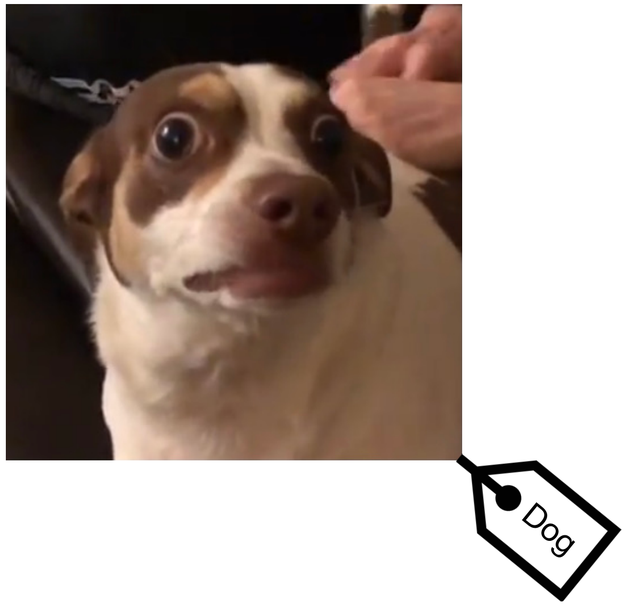

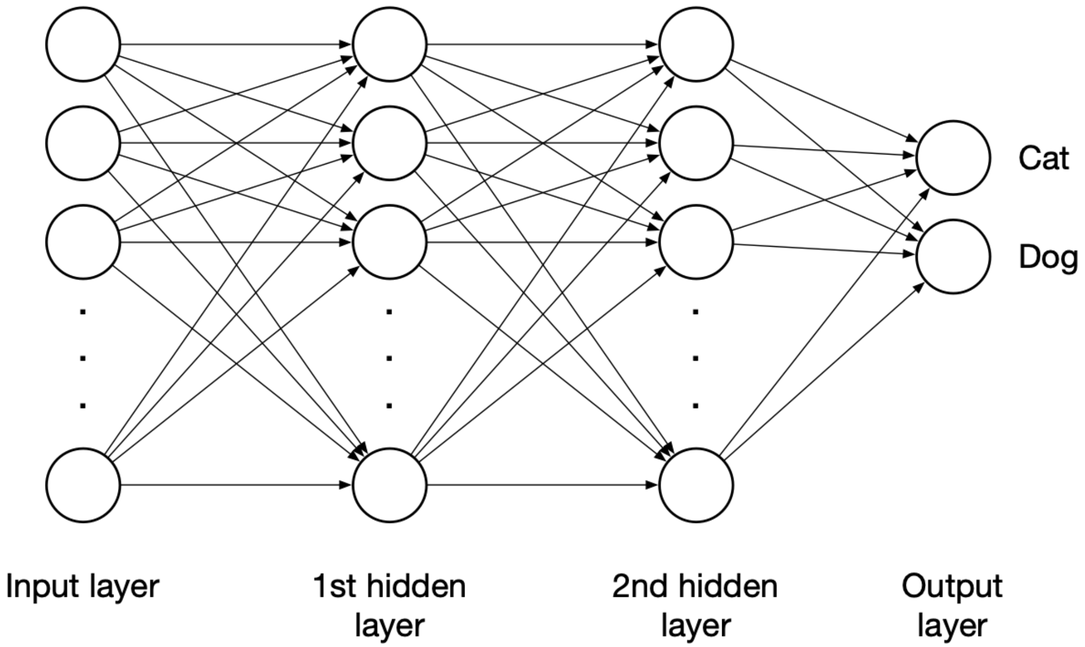

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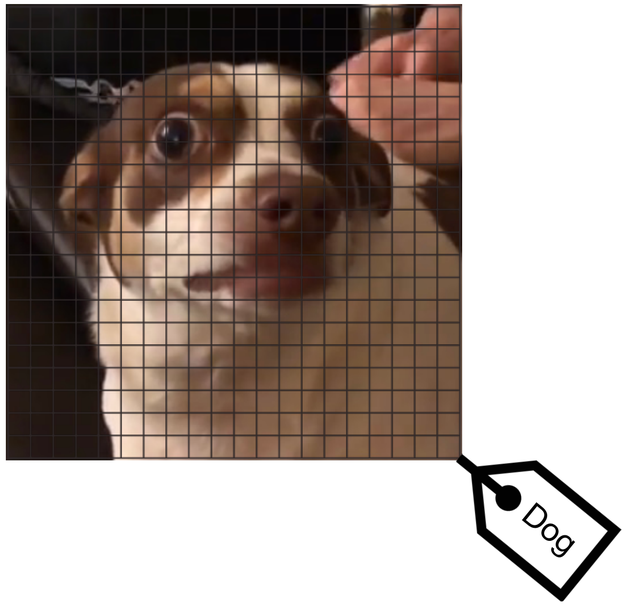

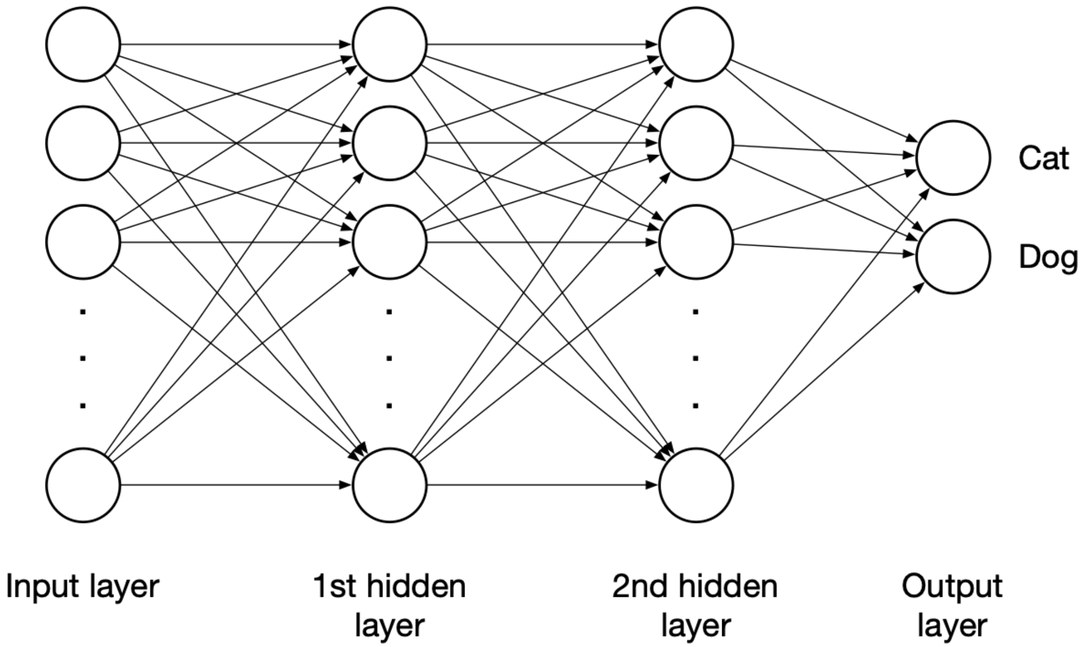

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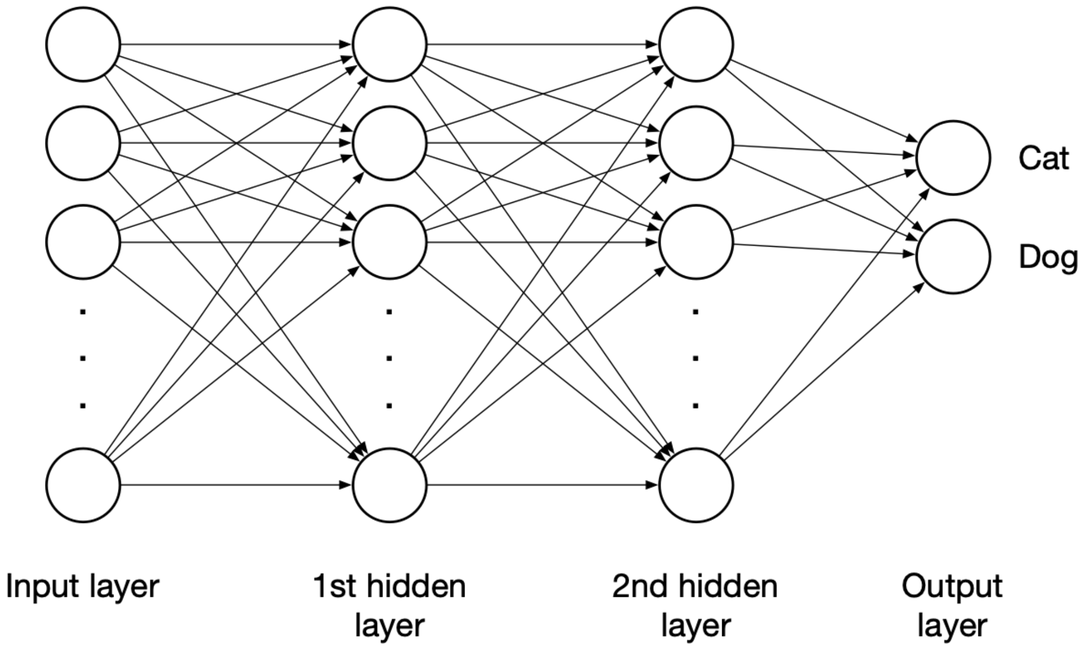

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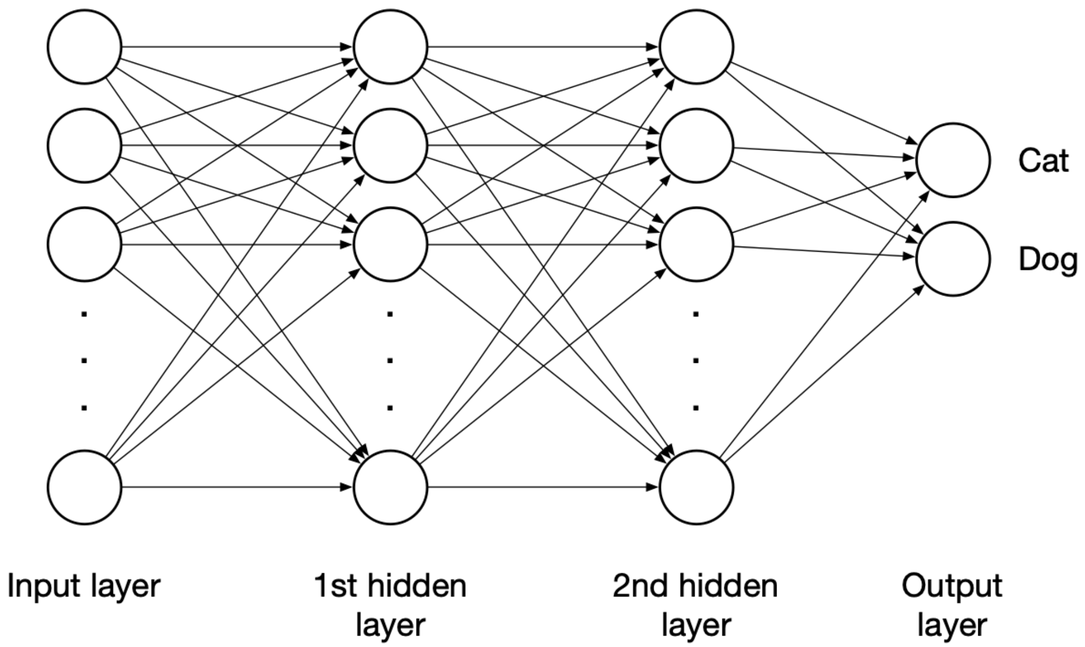

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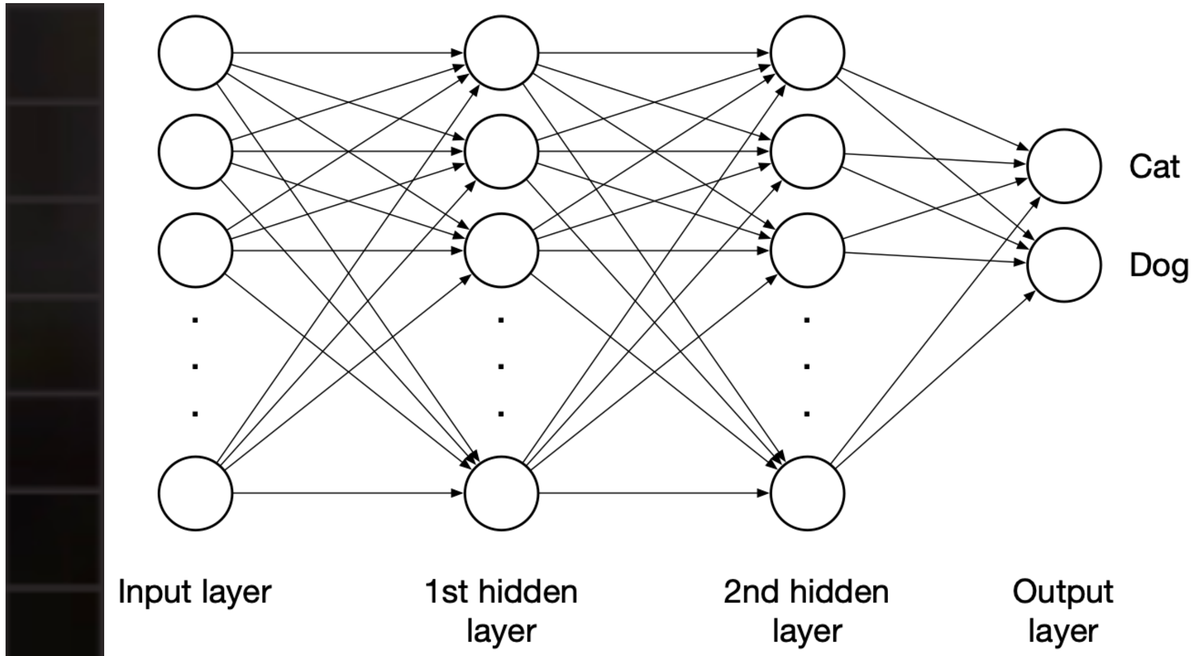

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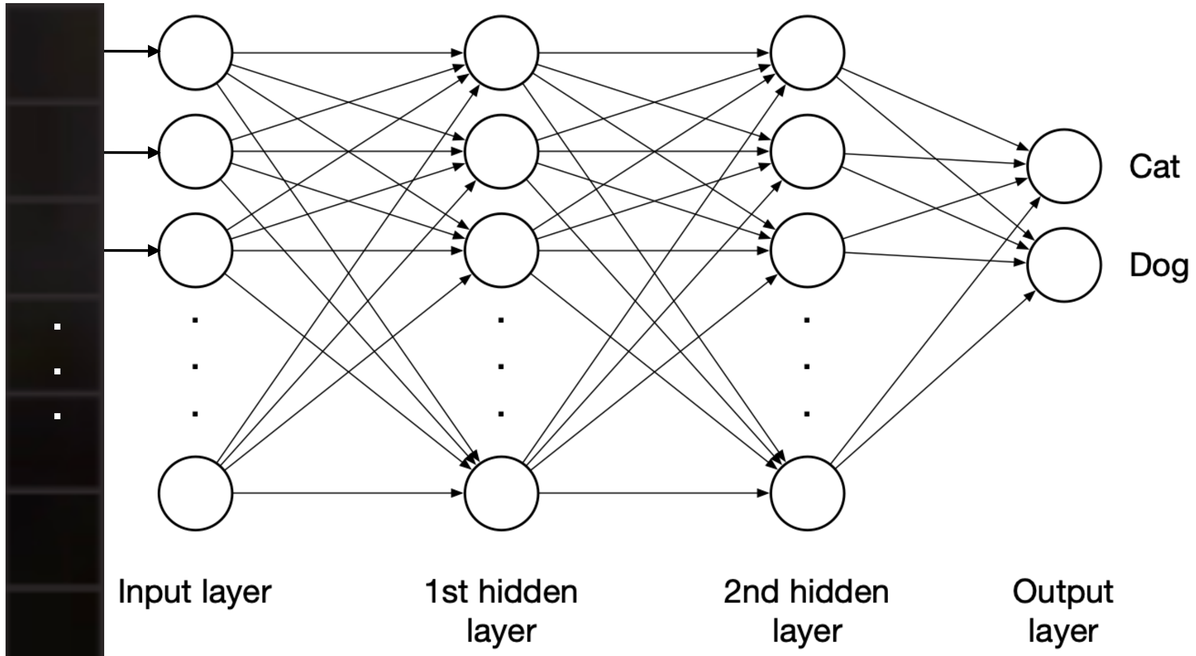

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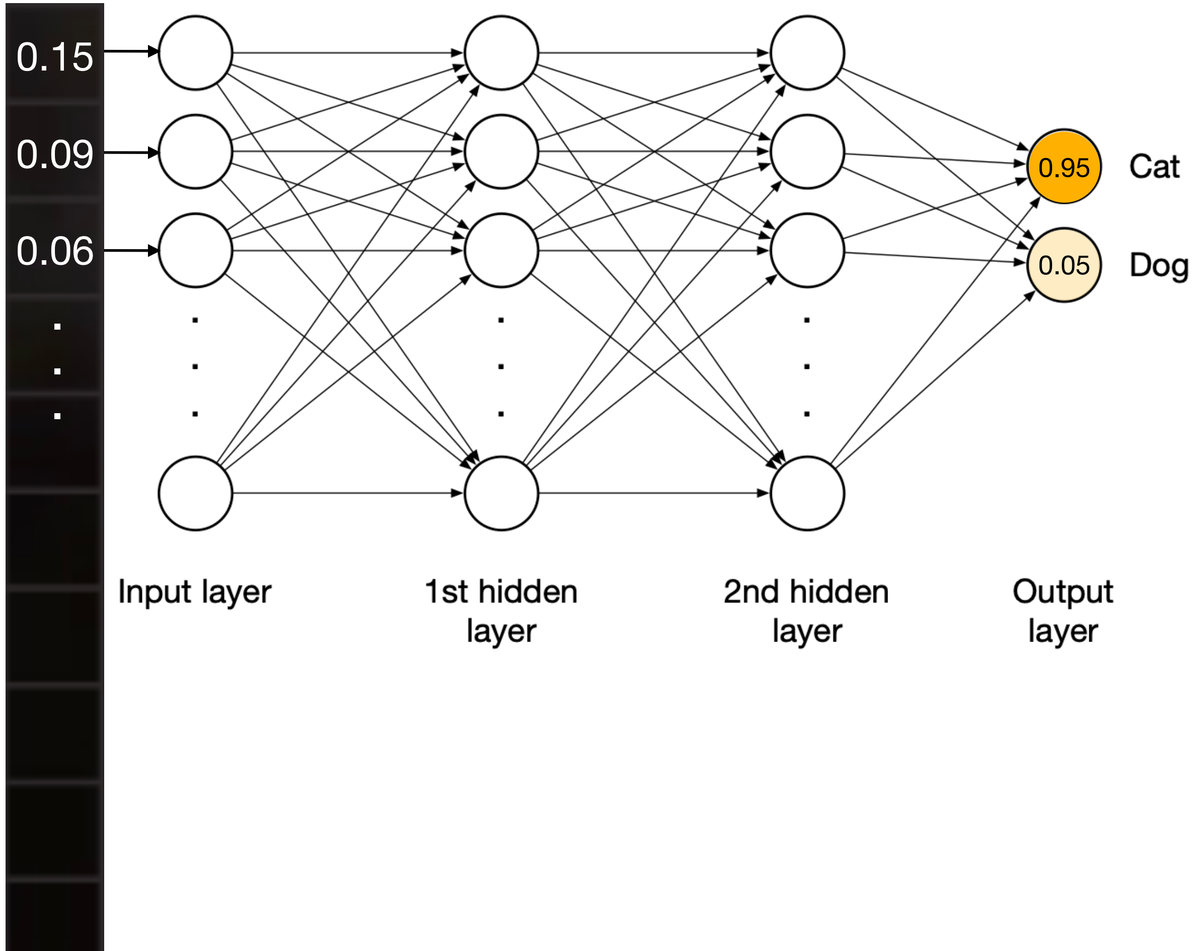

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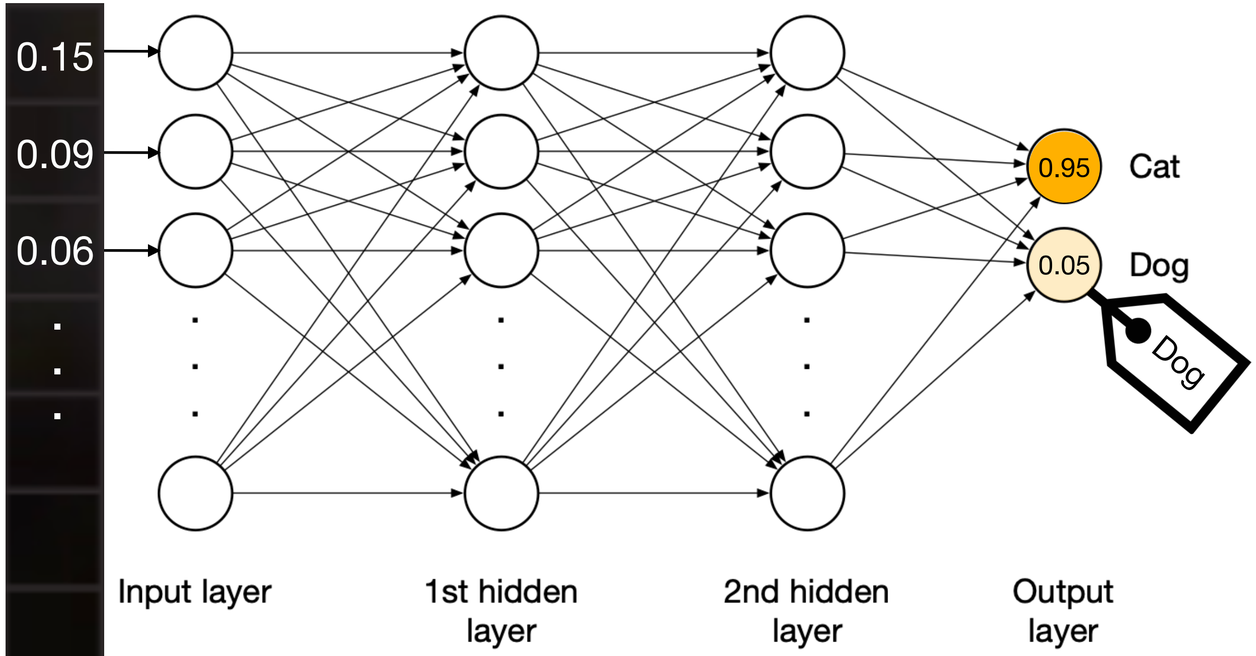

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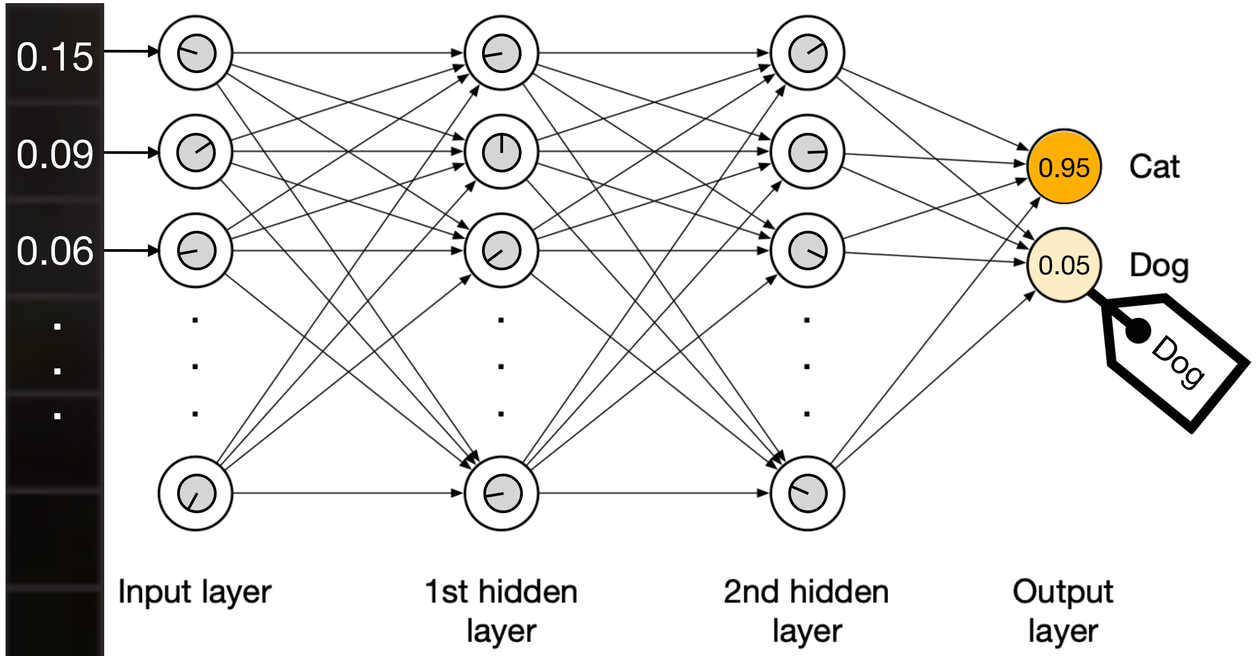

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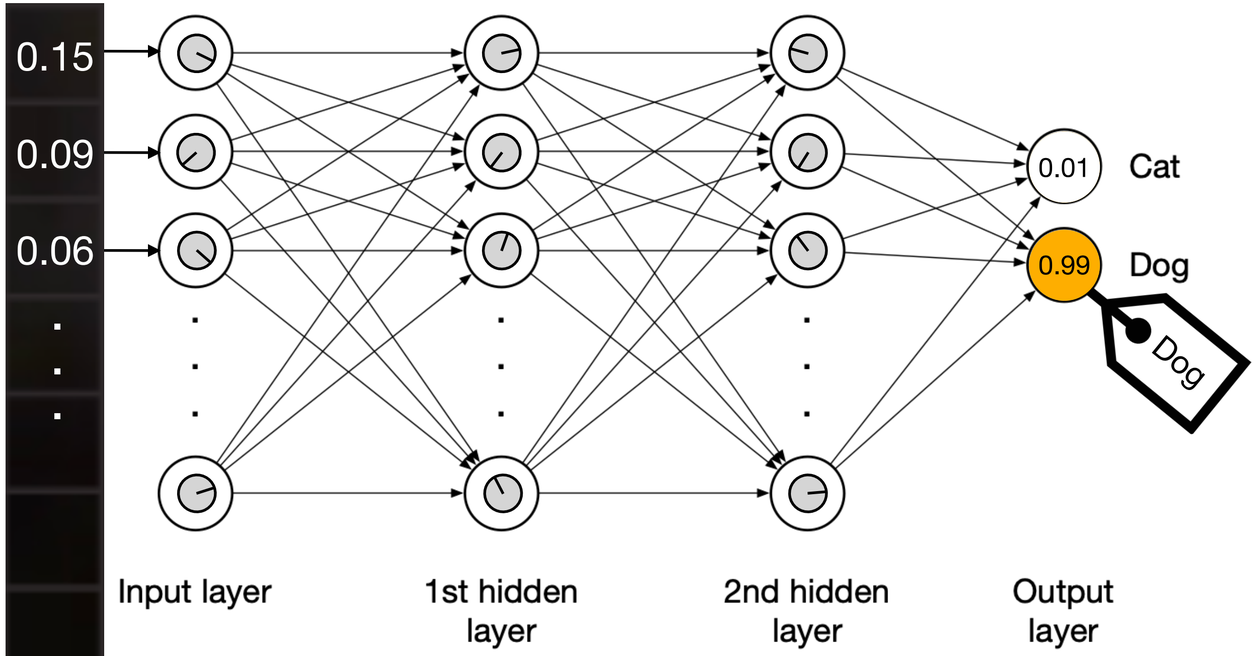

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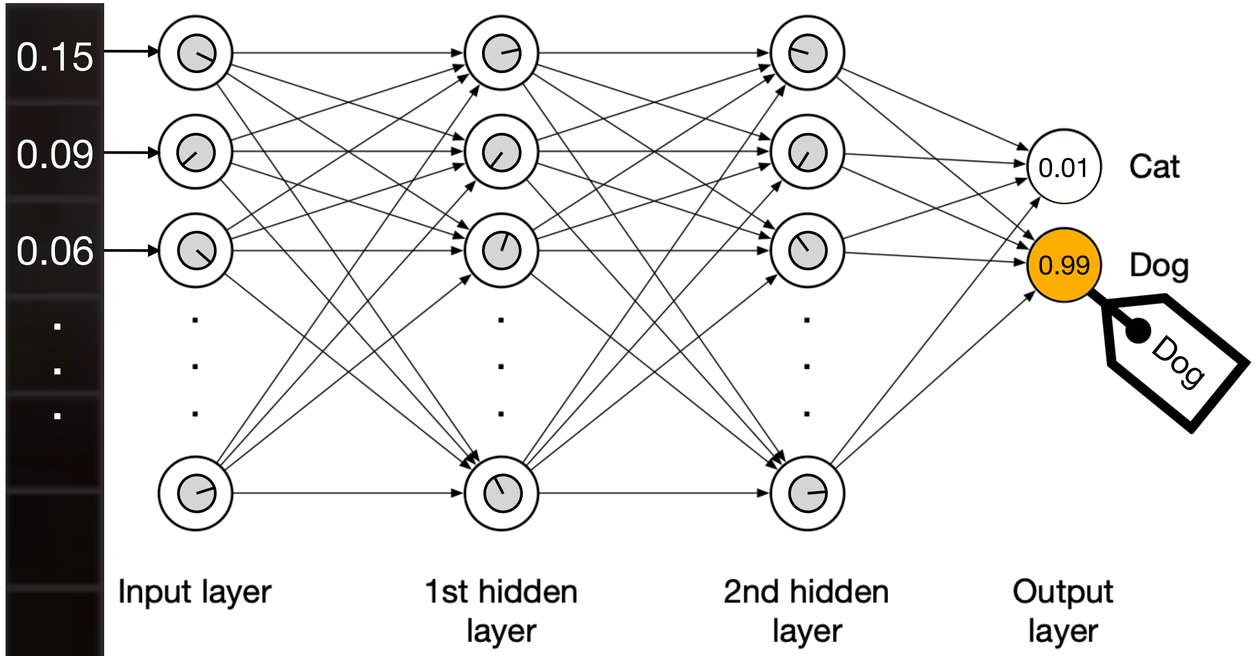
Artificial neural network : Let's recap

End-to-end learning



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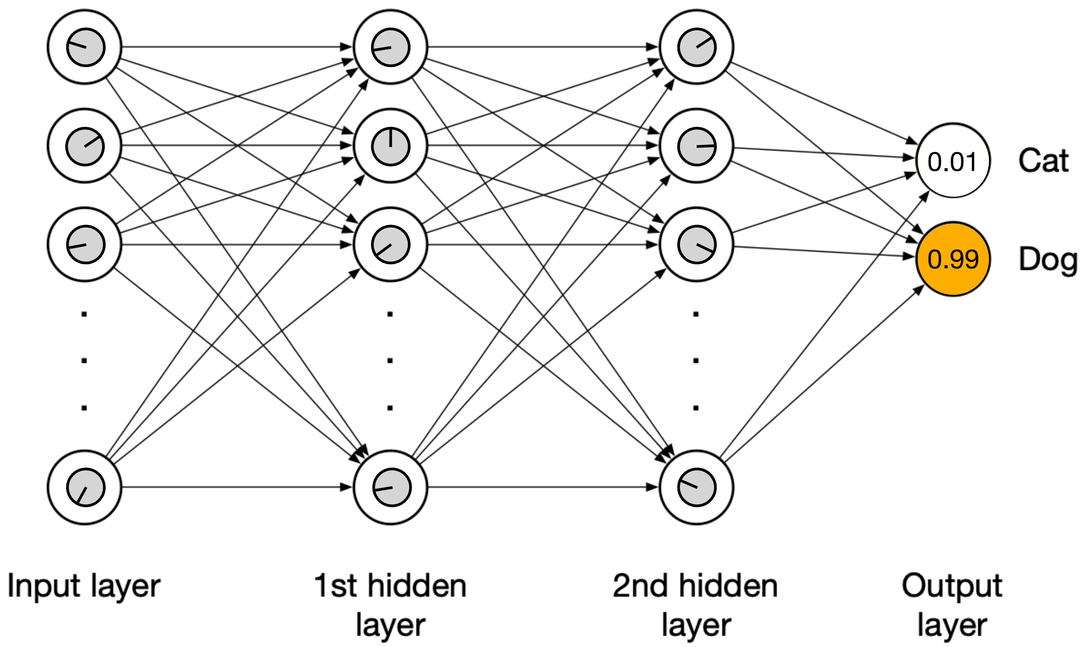

* How to compute the error?

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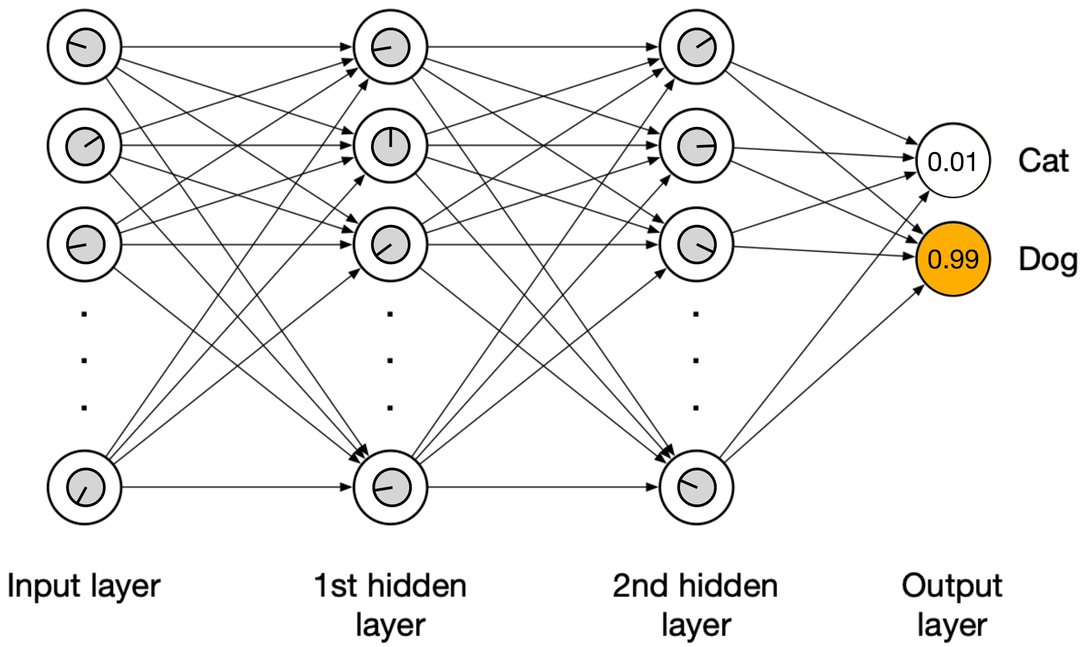


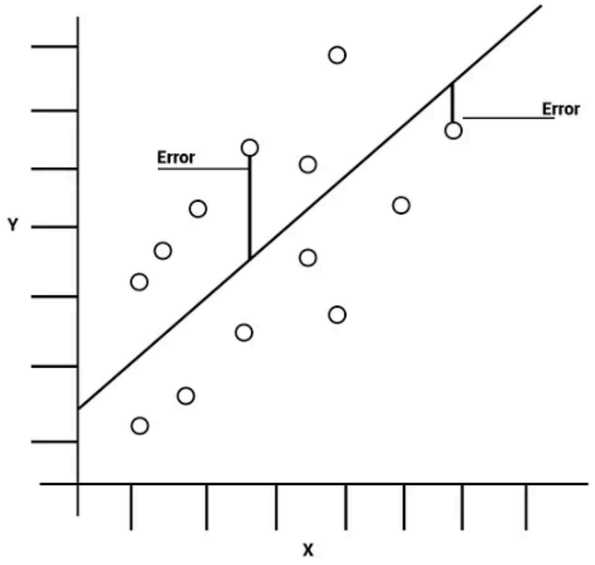
* How to compute the error?
* How to adjust the neurons from the error?

II. How do machines learn ?

How to compute the error?

Mean Squared Error (MSE) : Average of squared errors

$$\mathrm{MSE} = \frac{1}{n} \sum_{i=1}^{n} (y_i - \tilde{y}_i)^2$$



How to adjust the neurons from the error ?

How to adjust the neurons from the error ?

The gradient descent

II. How do machines learn ?

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the loss or cost function

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Gradient of the loss or cost function

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Learning rate

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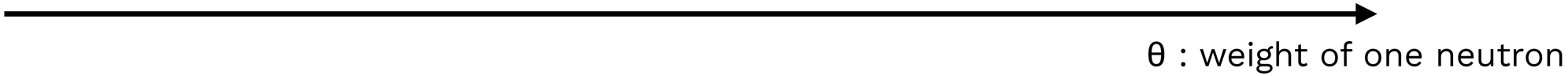

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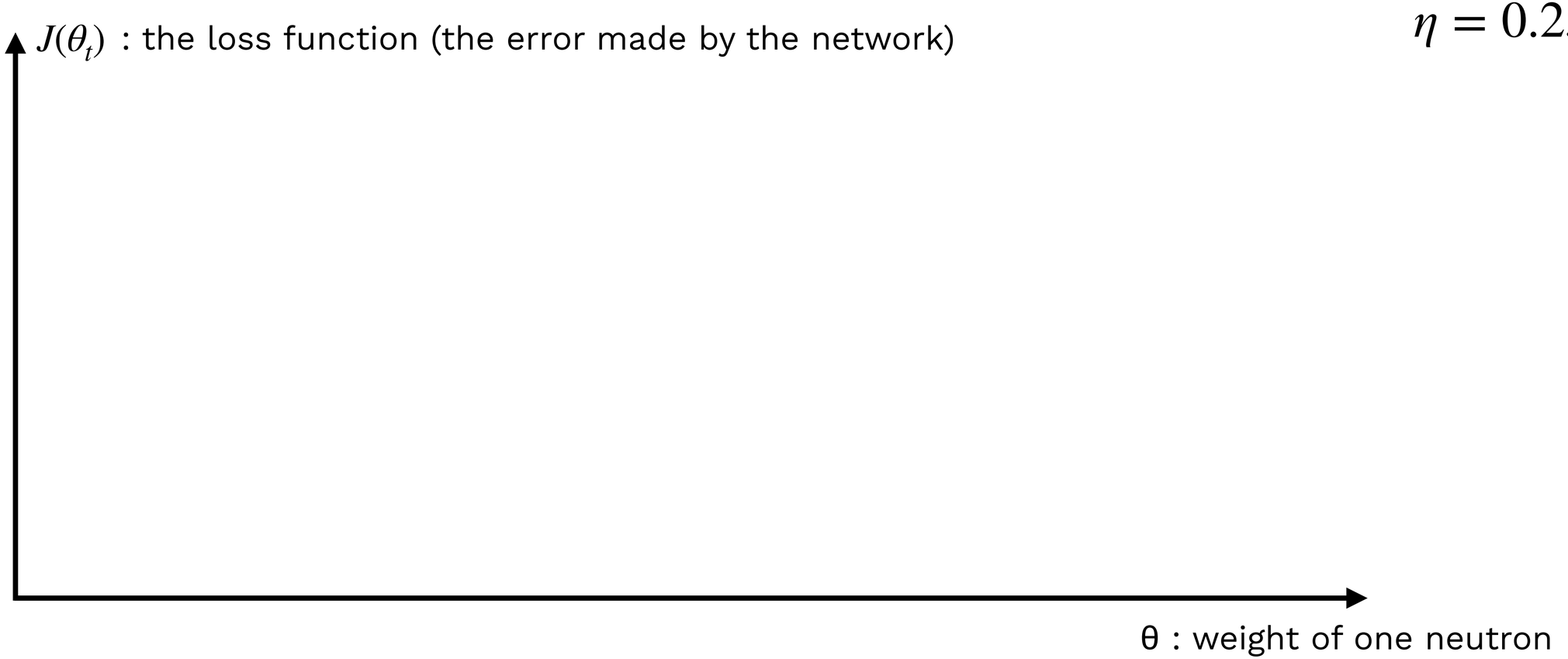

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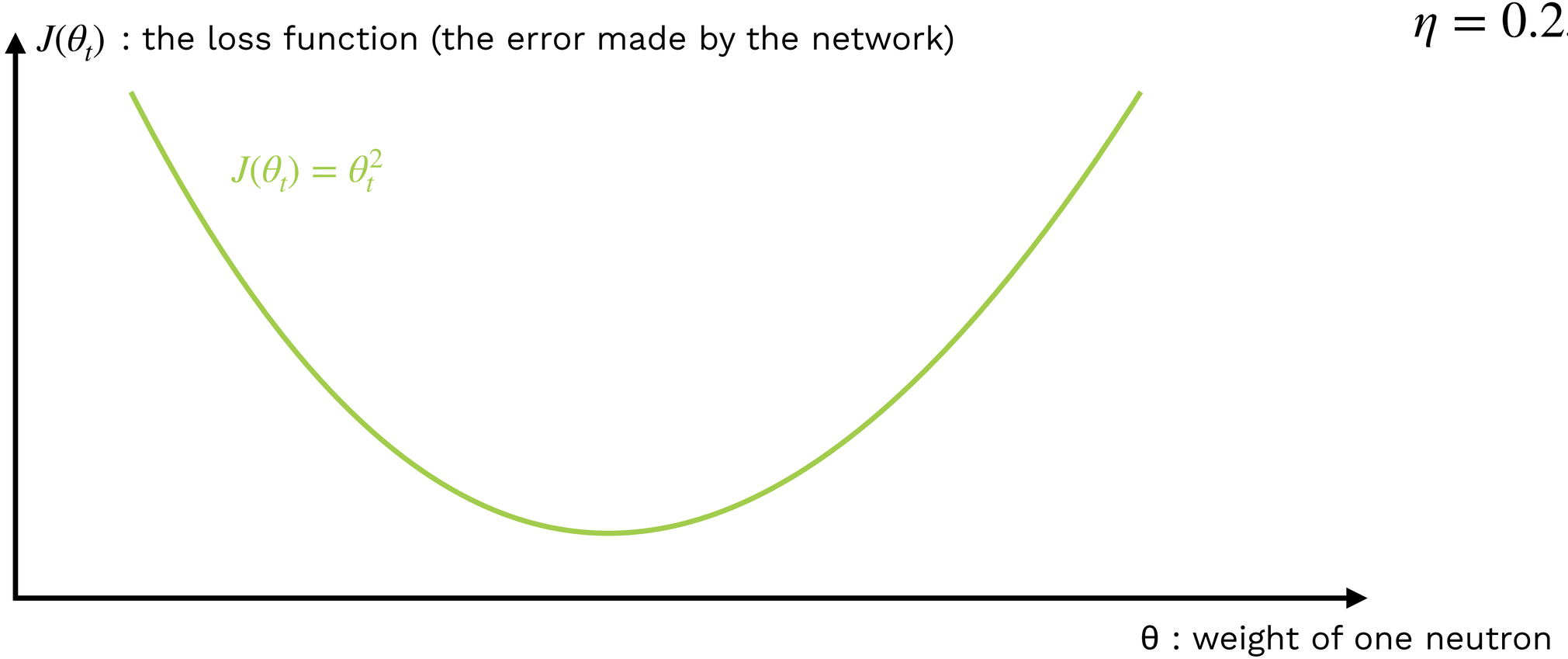

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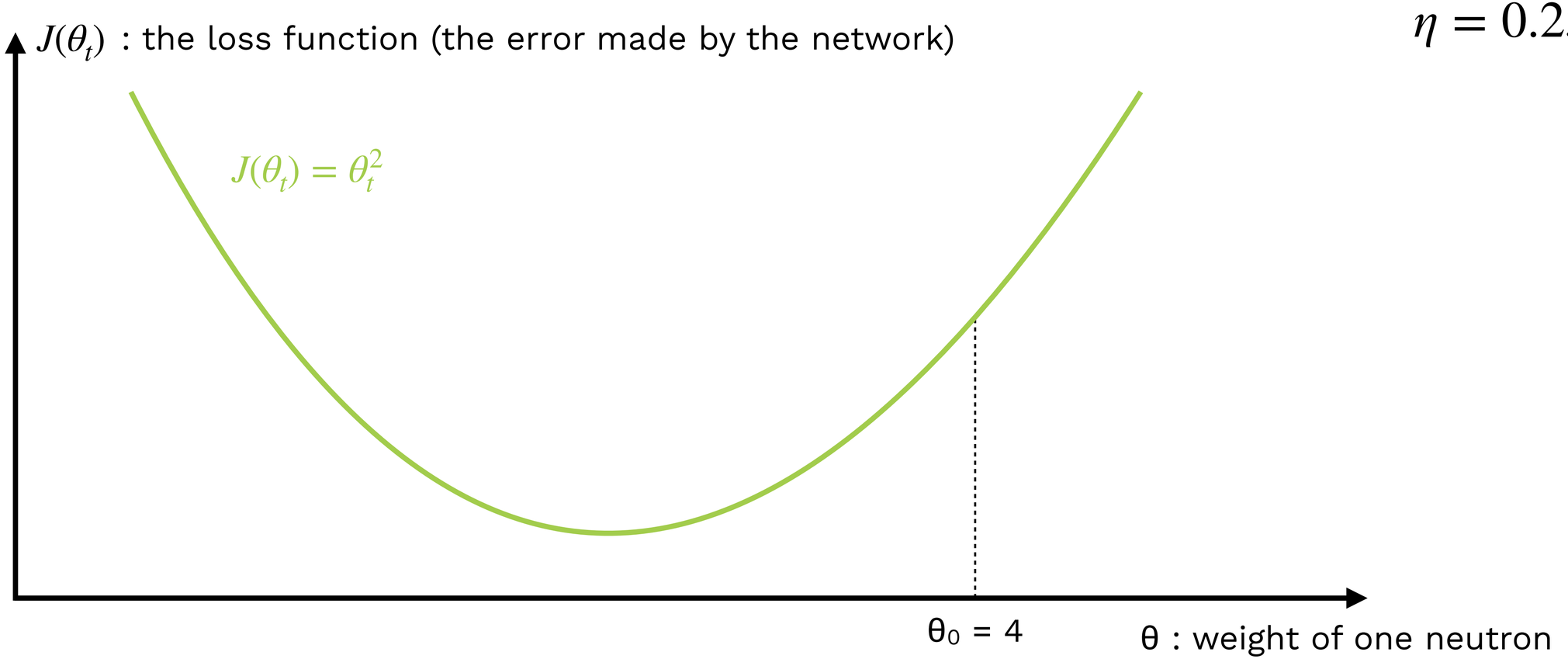

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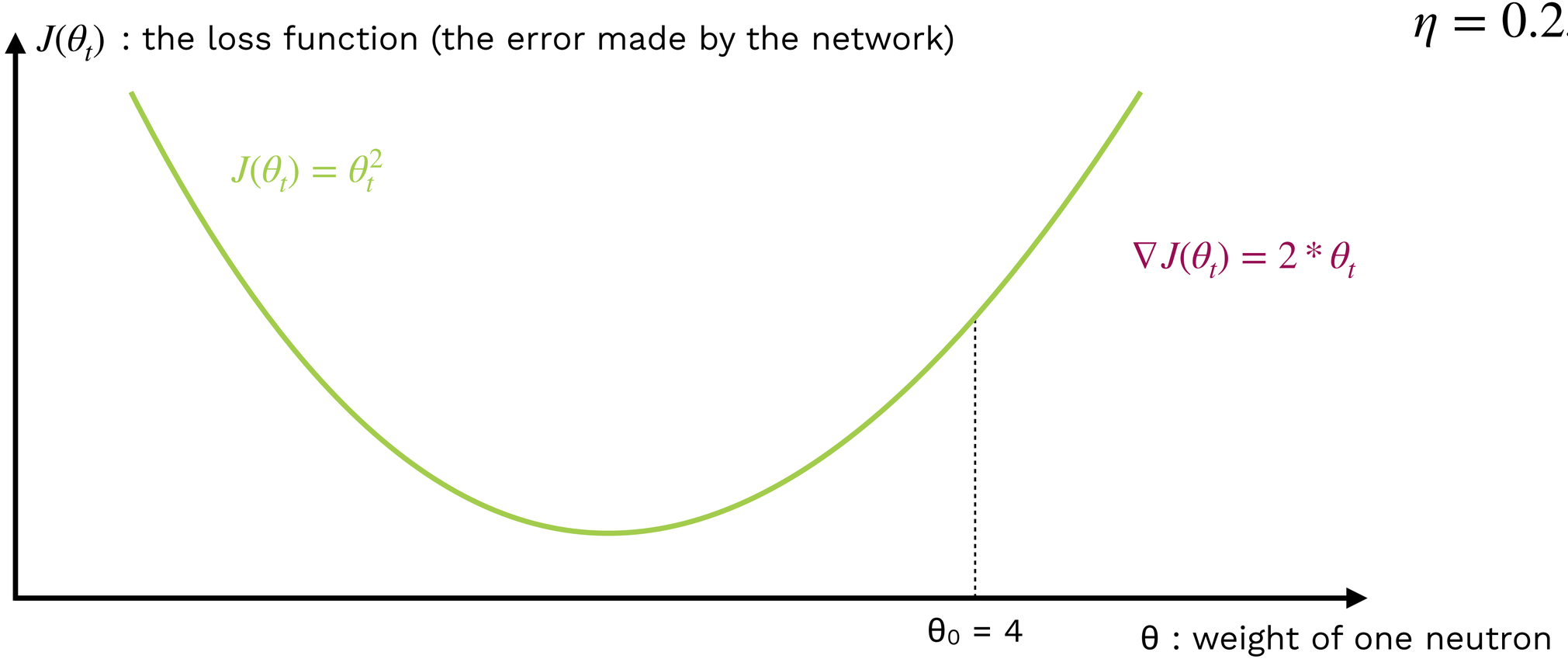

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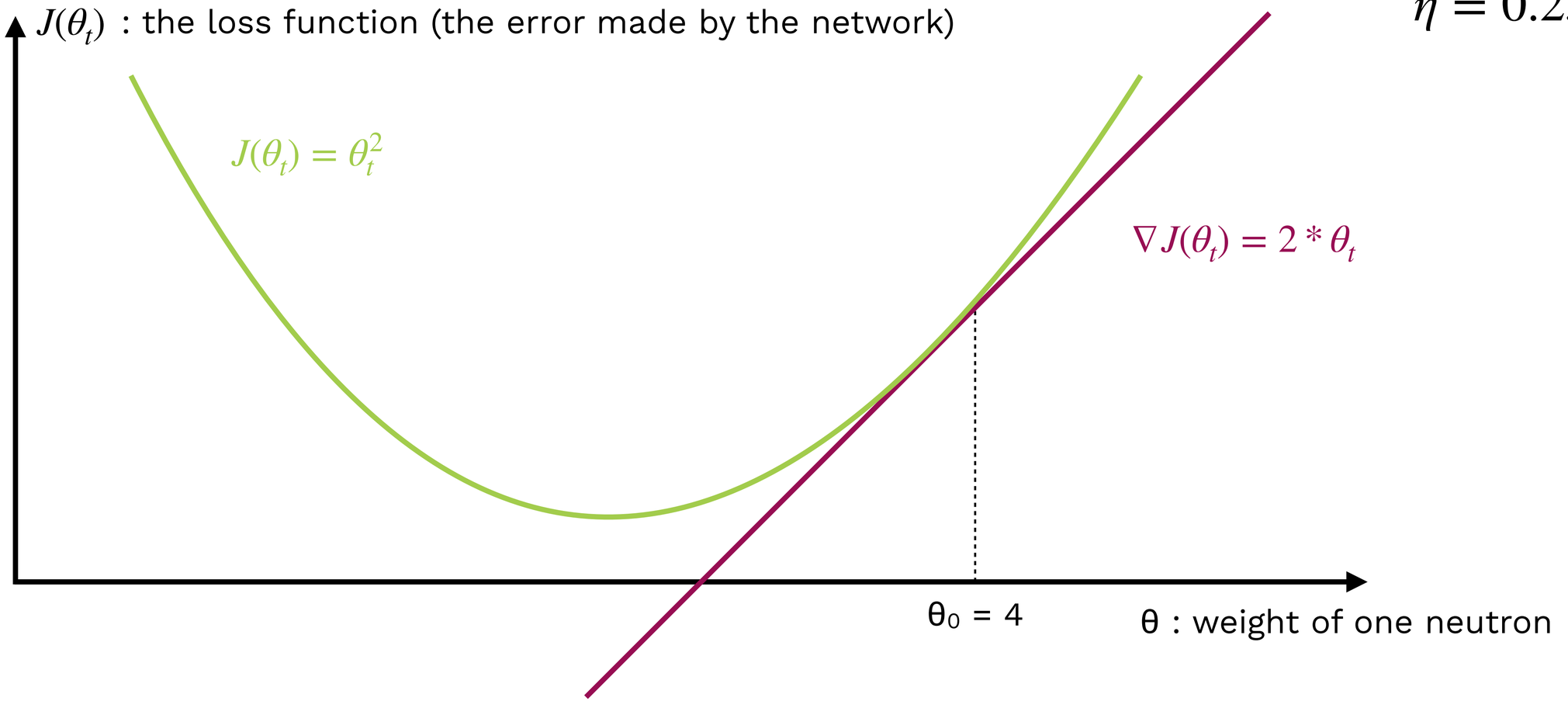

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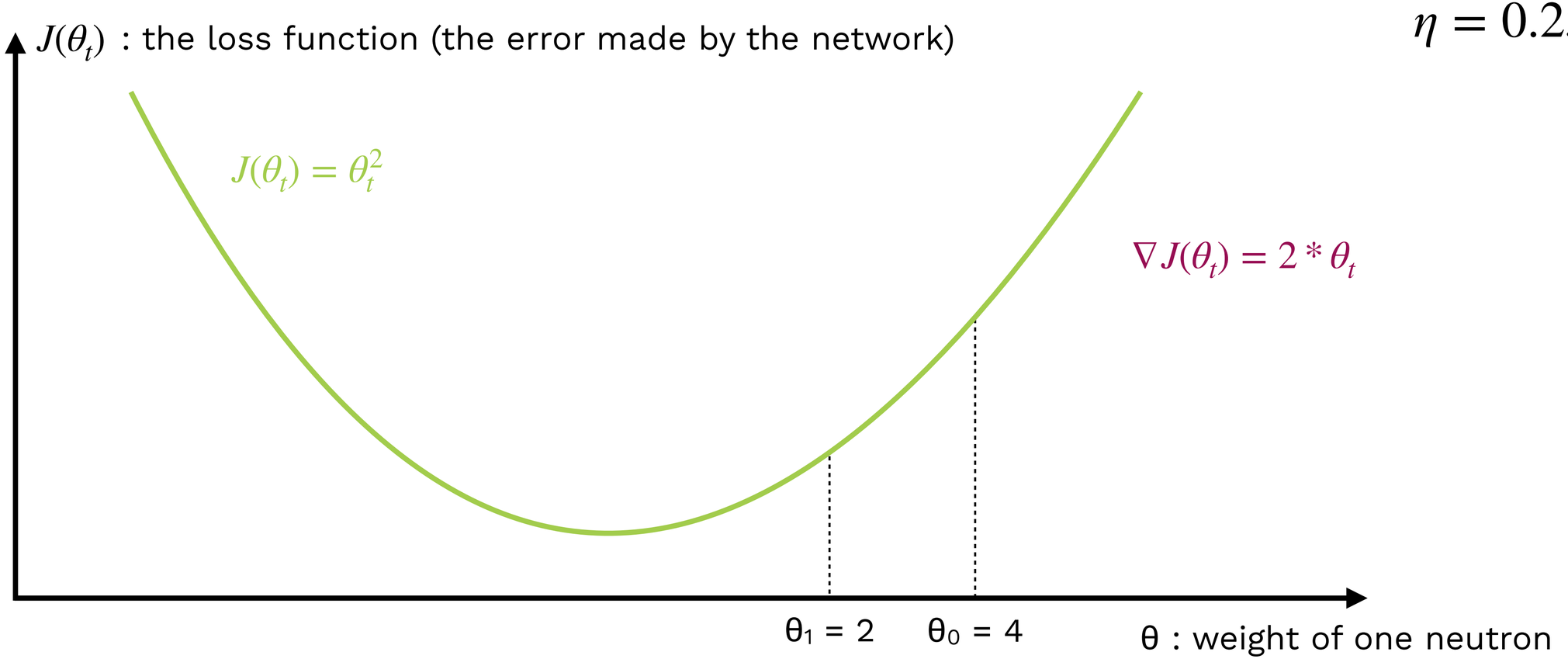

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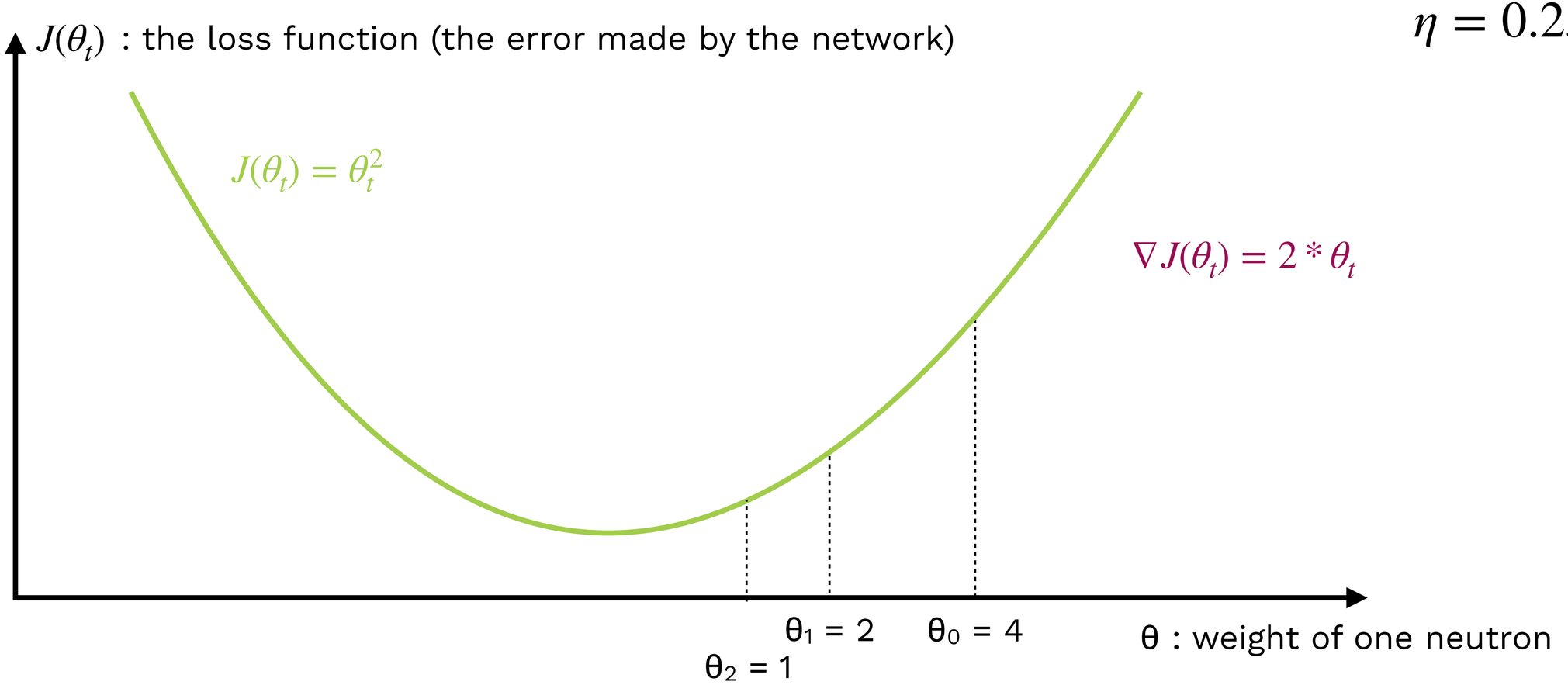

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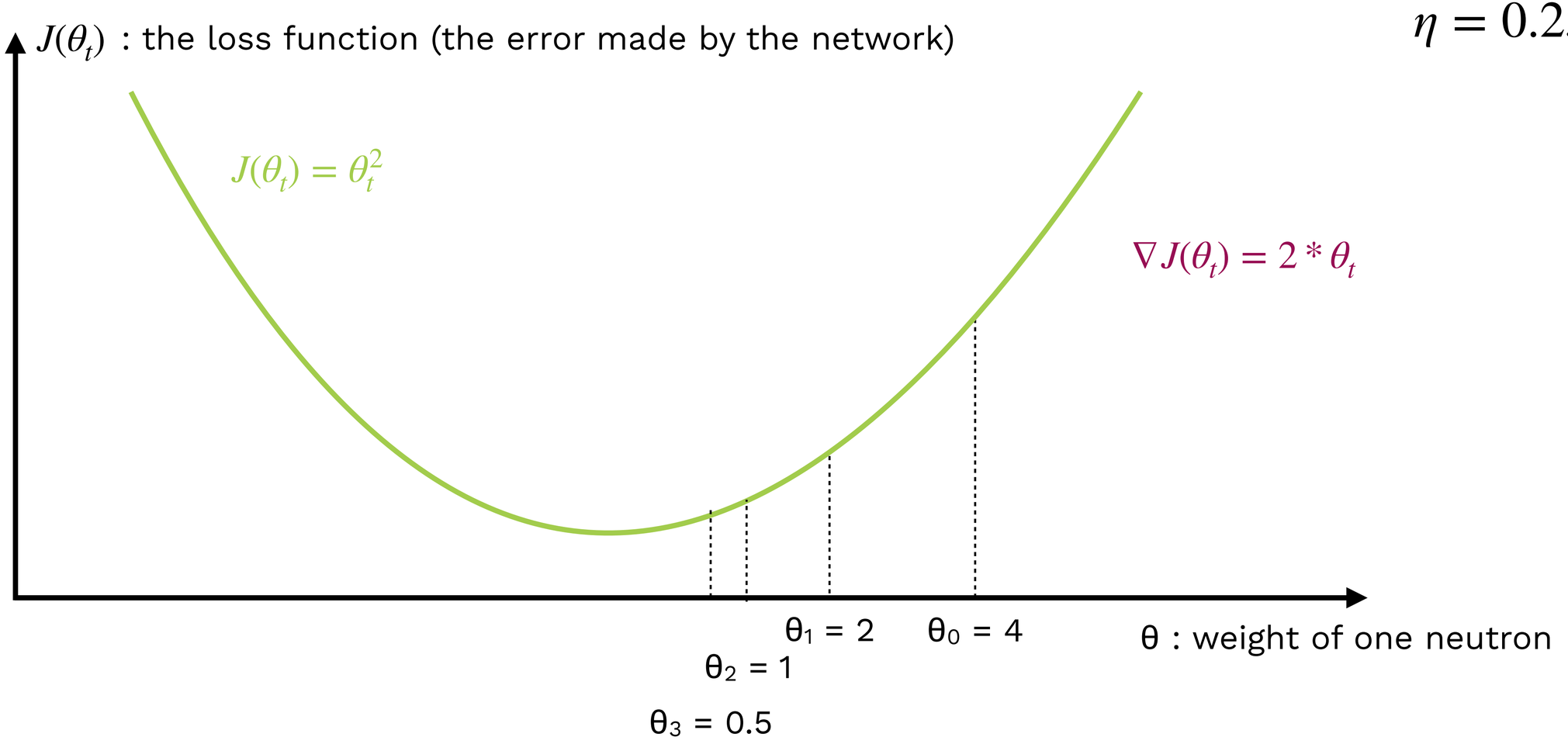

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Interactive tutorial

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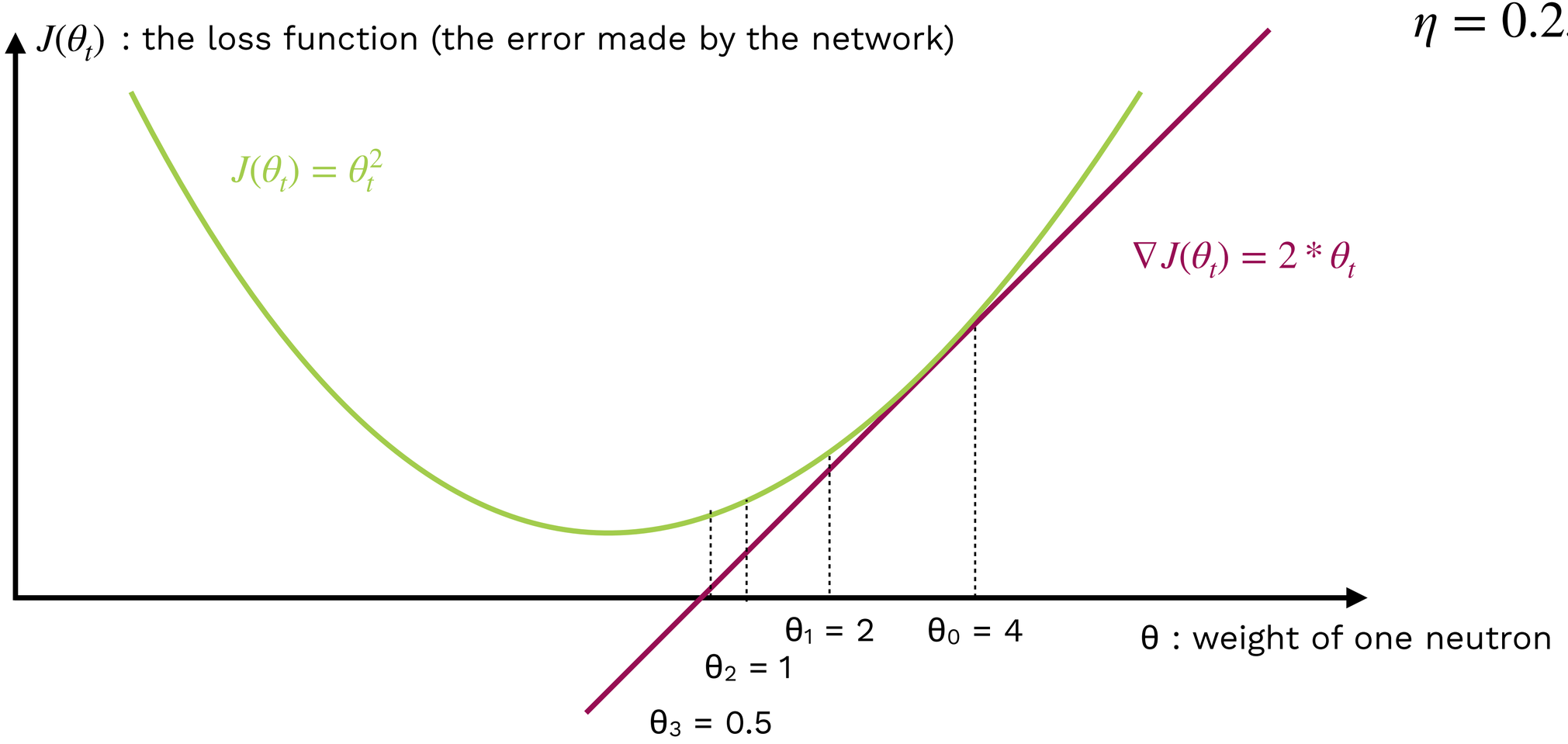

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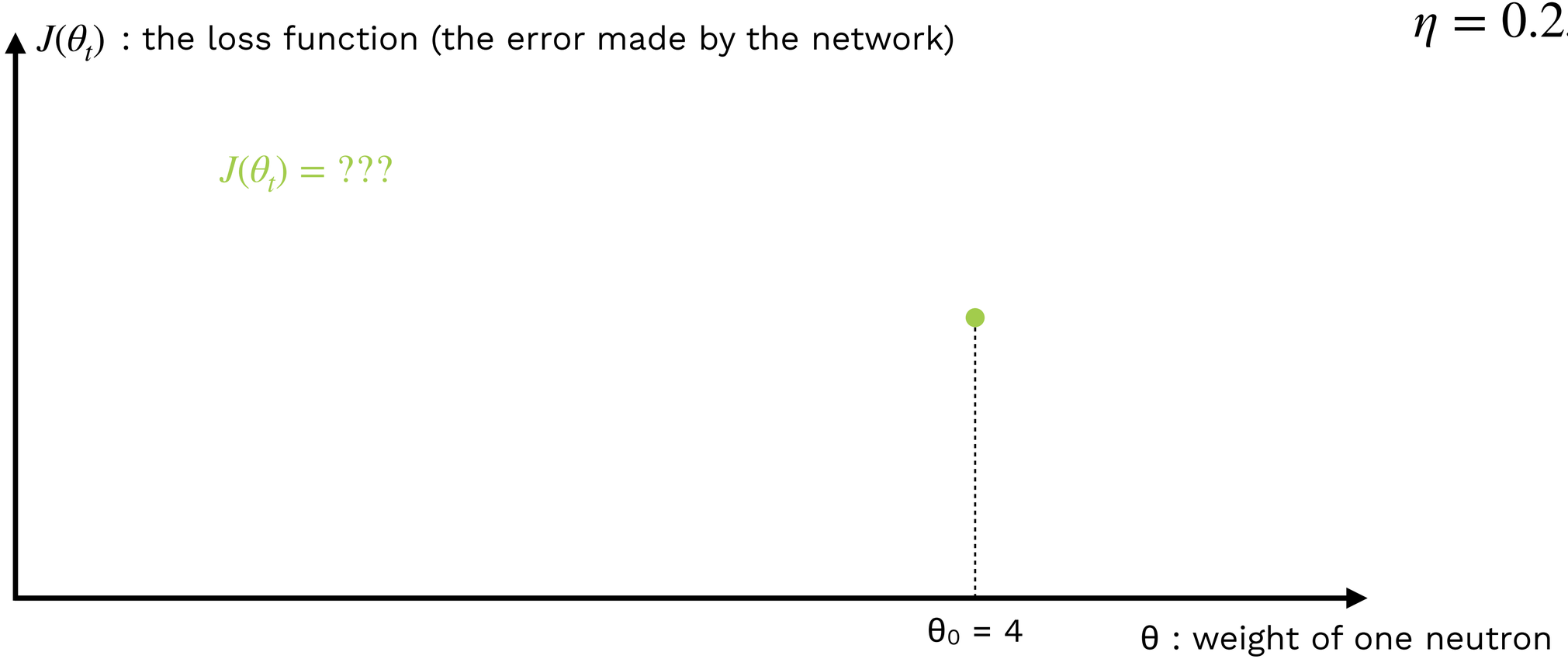

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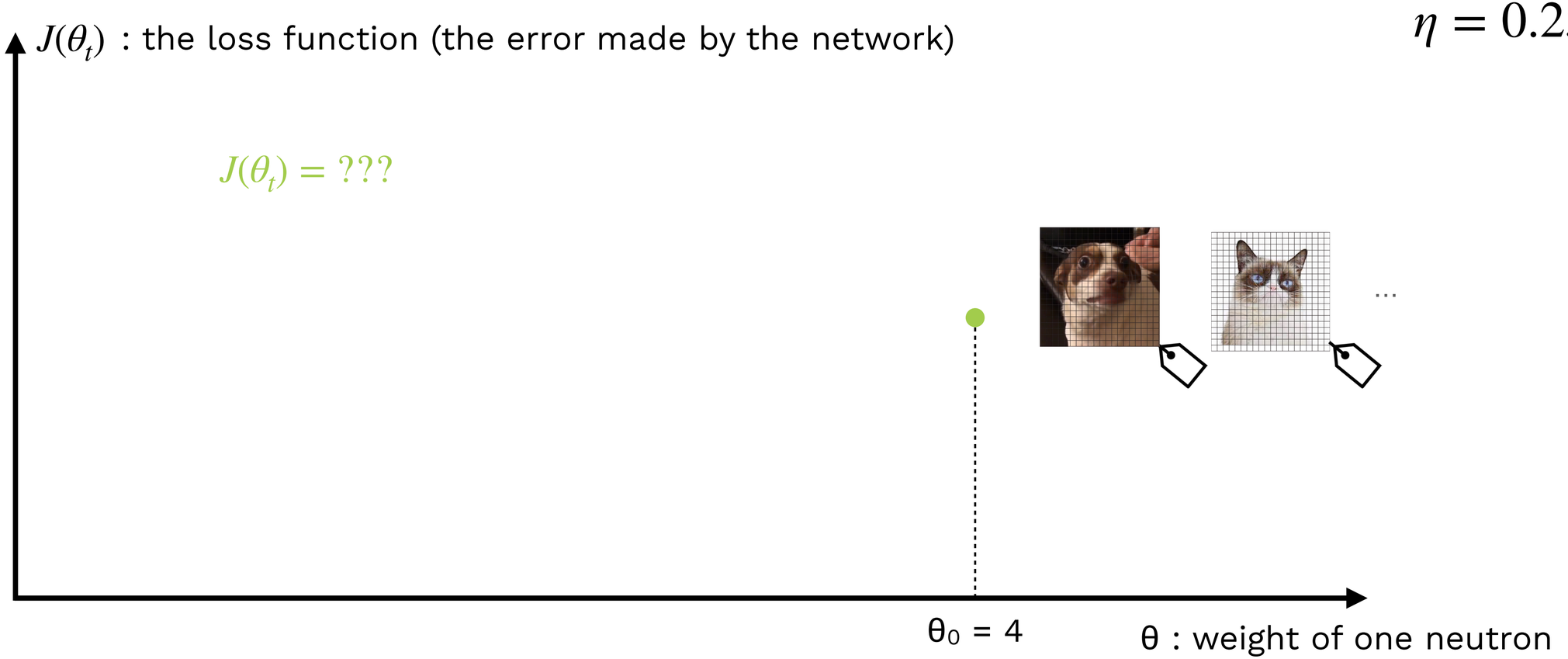

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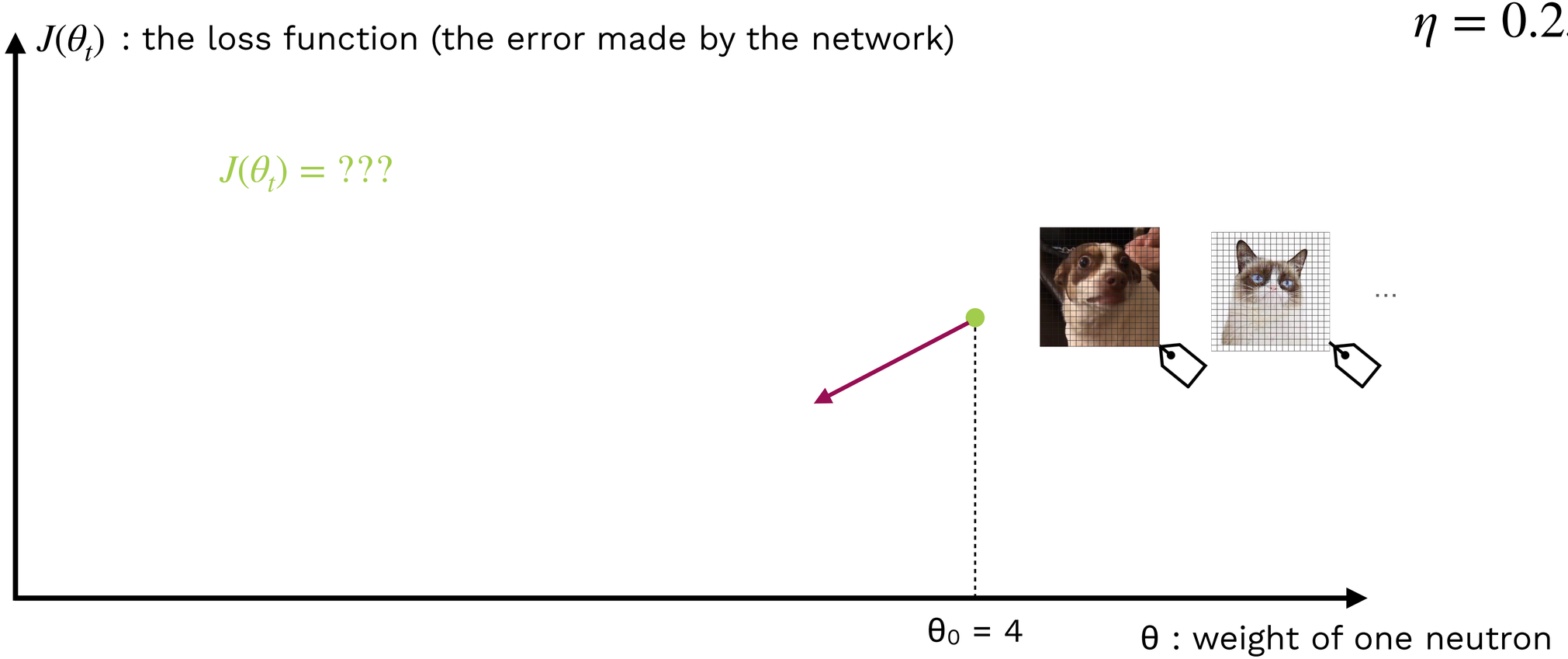

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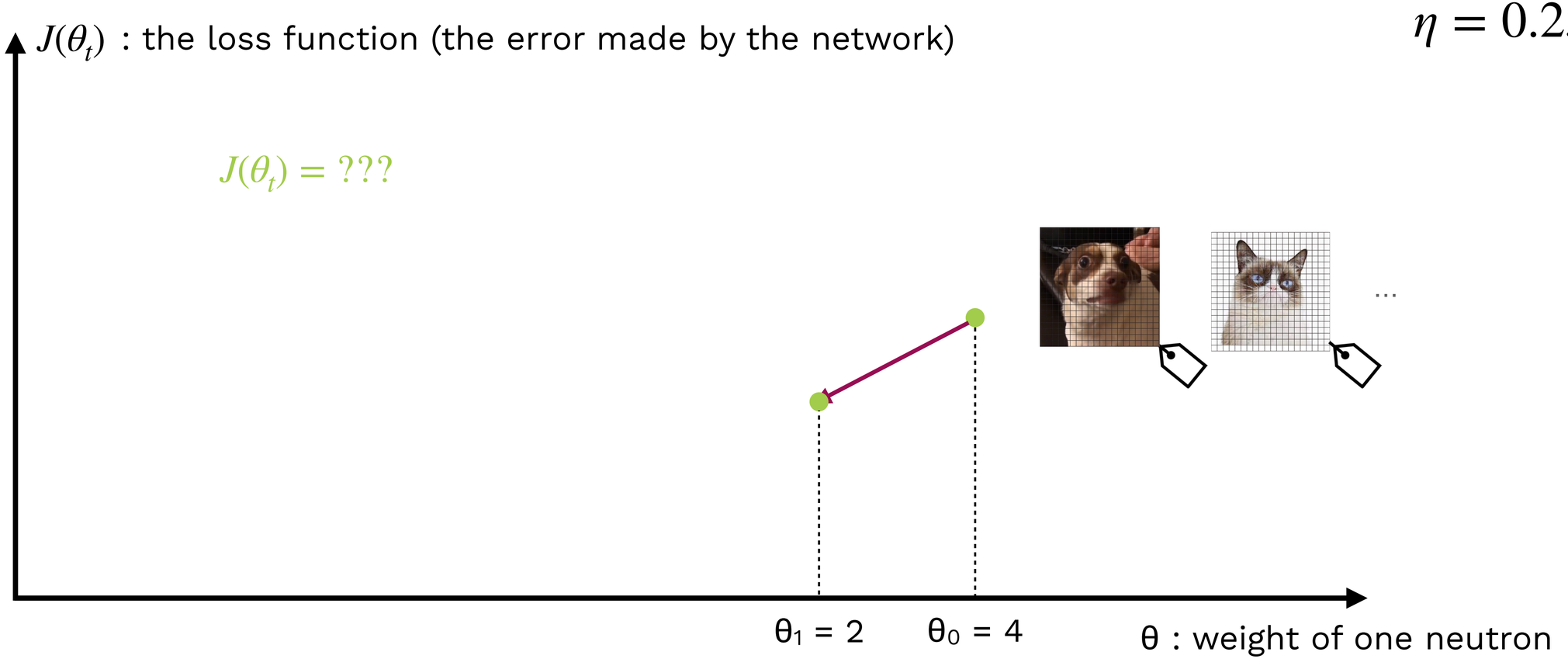
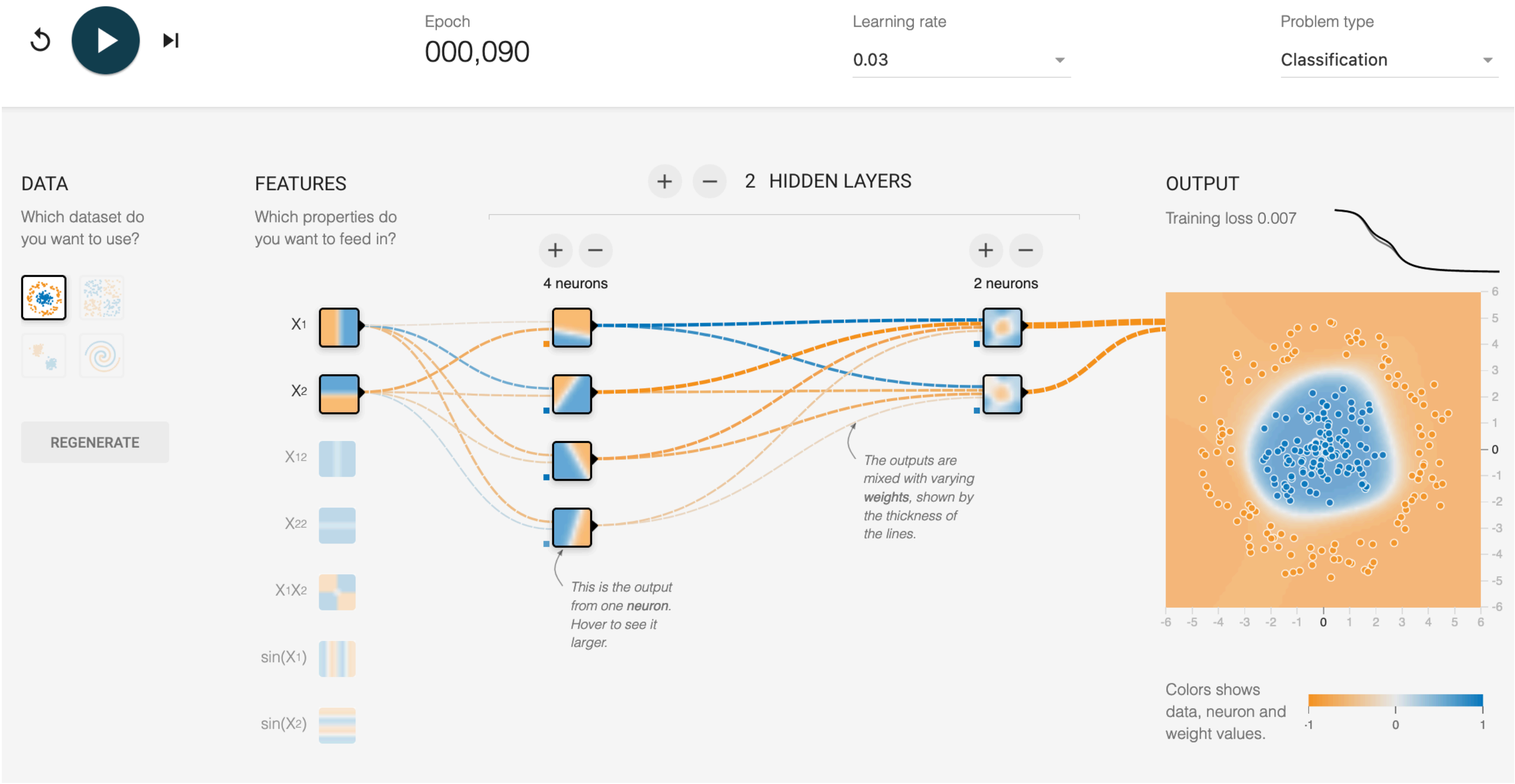


II. How do machines learn ?

Design and try your perceptron !



Simplified tensorflow playground

Extended tensorflow playground

I. Brief history of AI

The connectionist vs symbolic approach
Connectionism: artificial neuron and perceptron
Symbolism
Revenge of connectionism

II. How do machines learn ?

Optimizing an artificial neural network

III. How do humans train machines ?

Train your first ML classifier !
The development cycle of ML
How ML experts train machines?

IV. How to develop interactions with ML?

The Marcelle toolkit

III. How do humans train machines ?

The development cycle of ML

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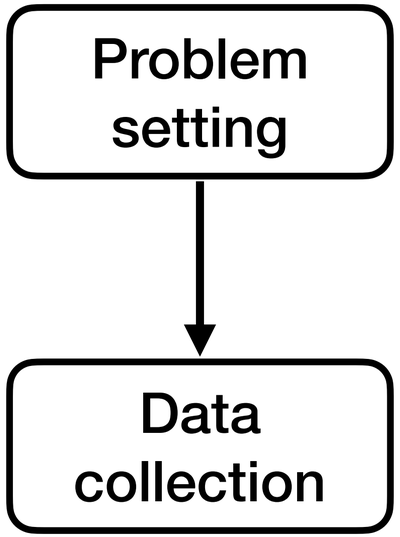
The development cycle of ML

Problem setting

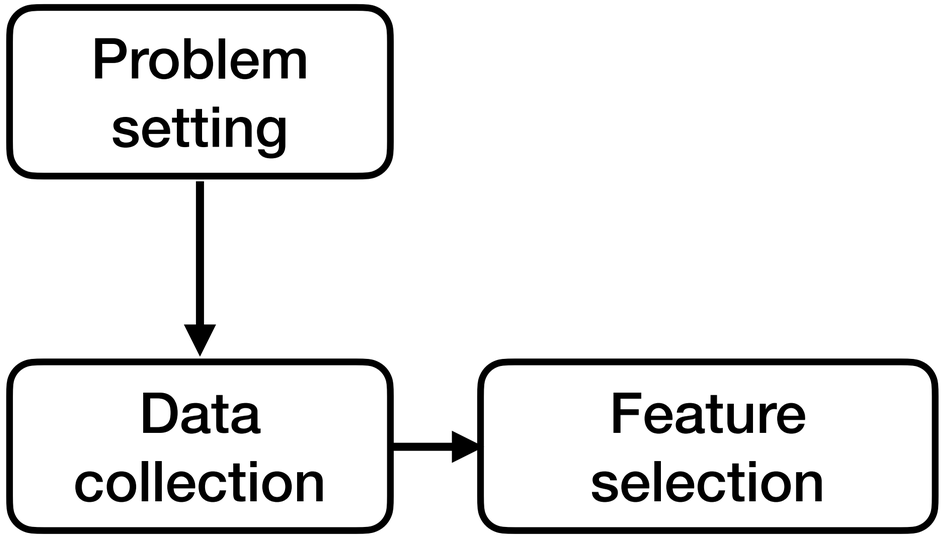
III. How do humans train machines ?

The development cycle of ML



III. How do humans train machines ?

The development cycle of ML



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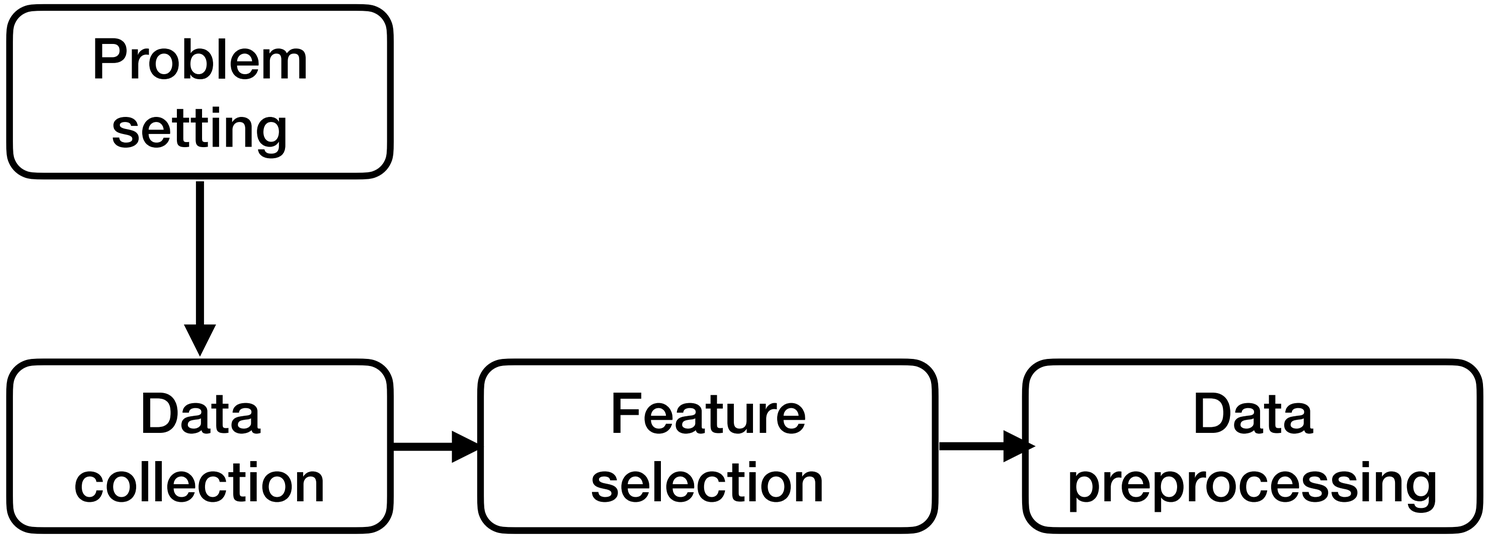

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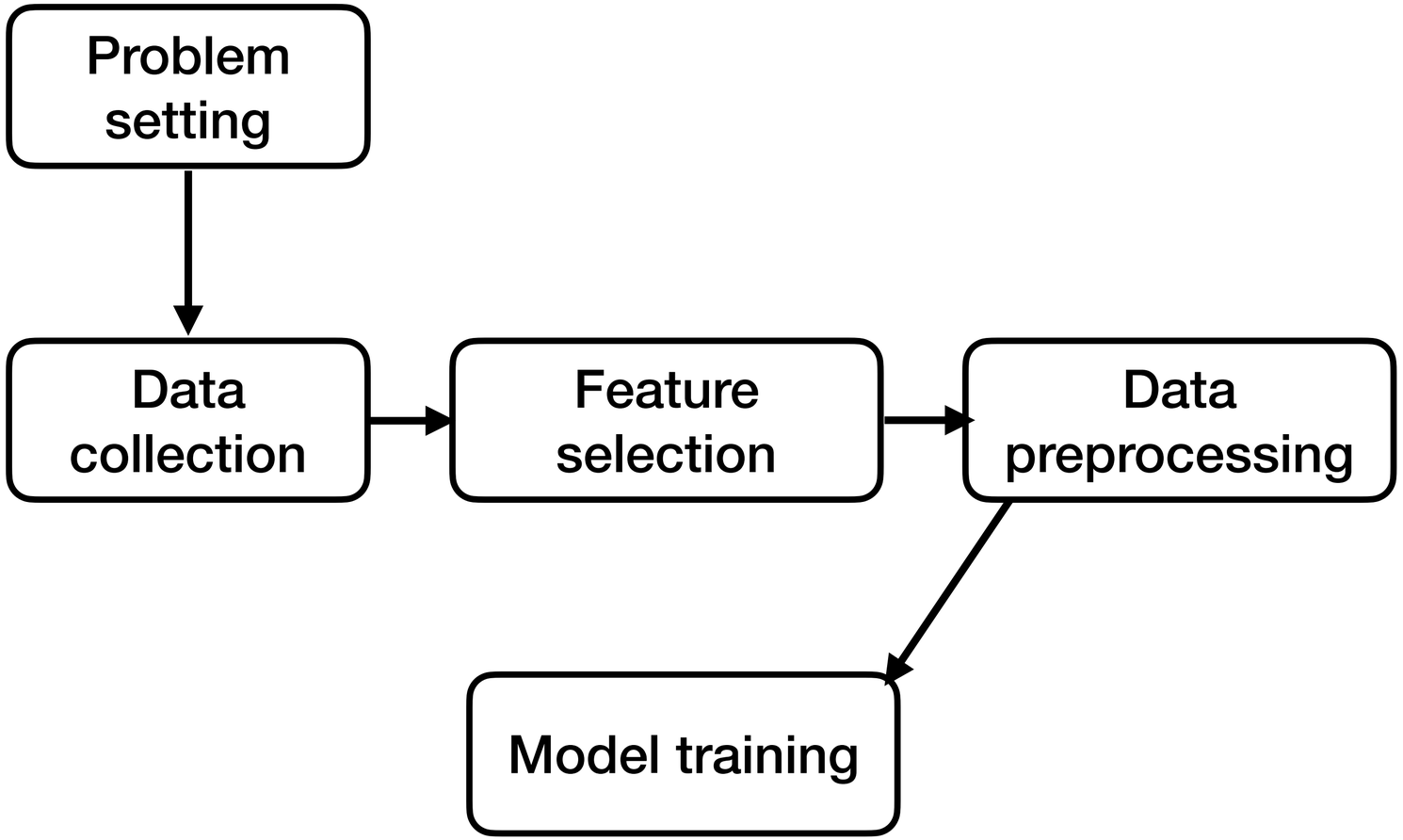

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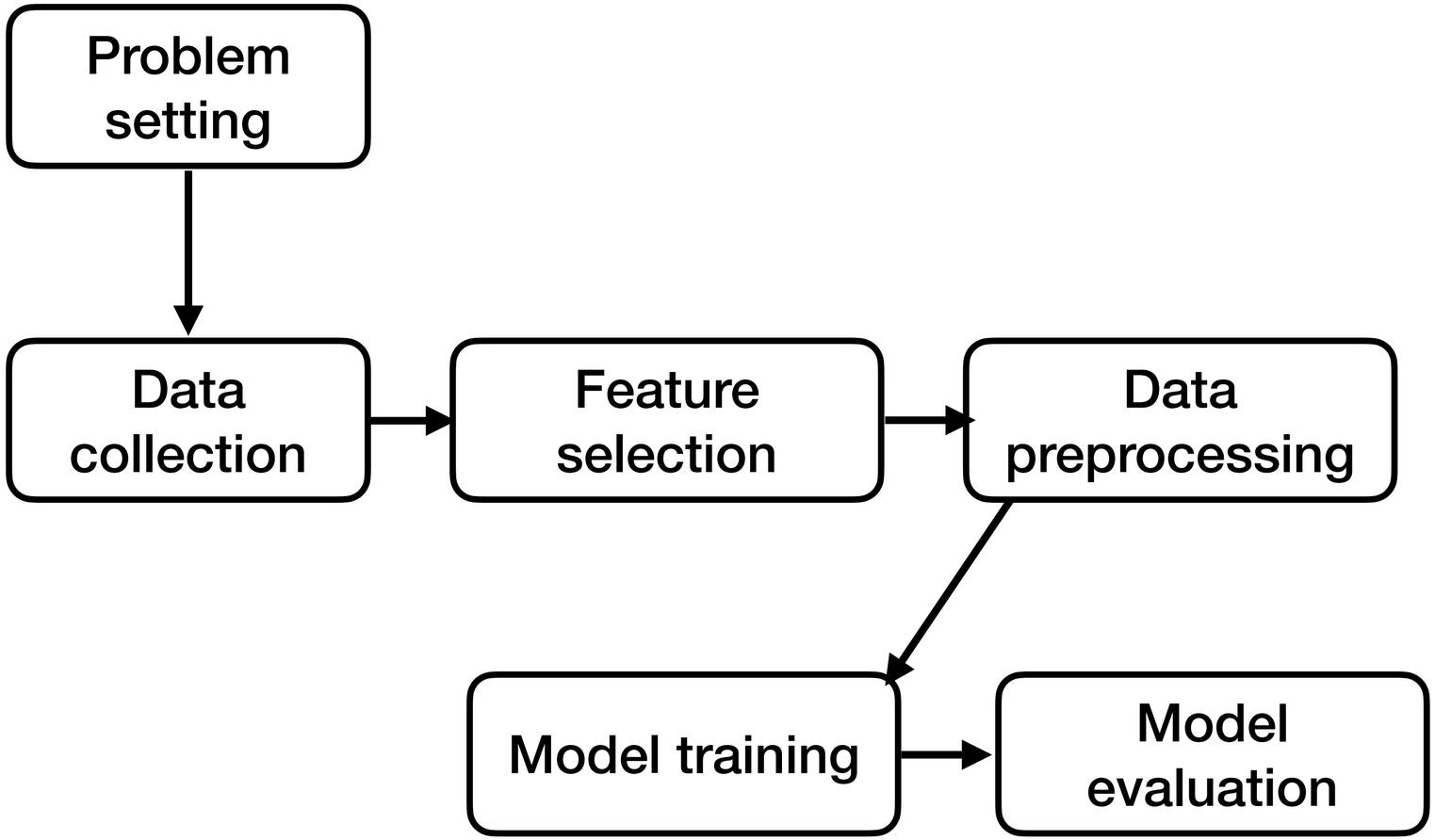

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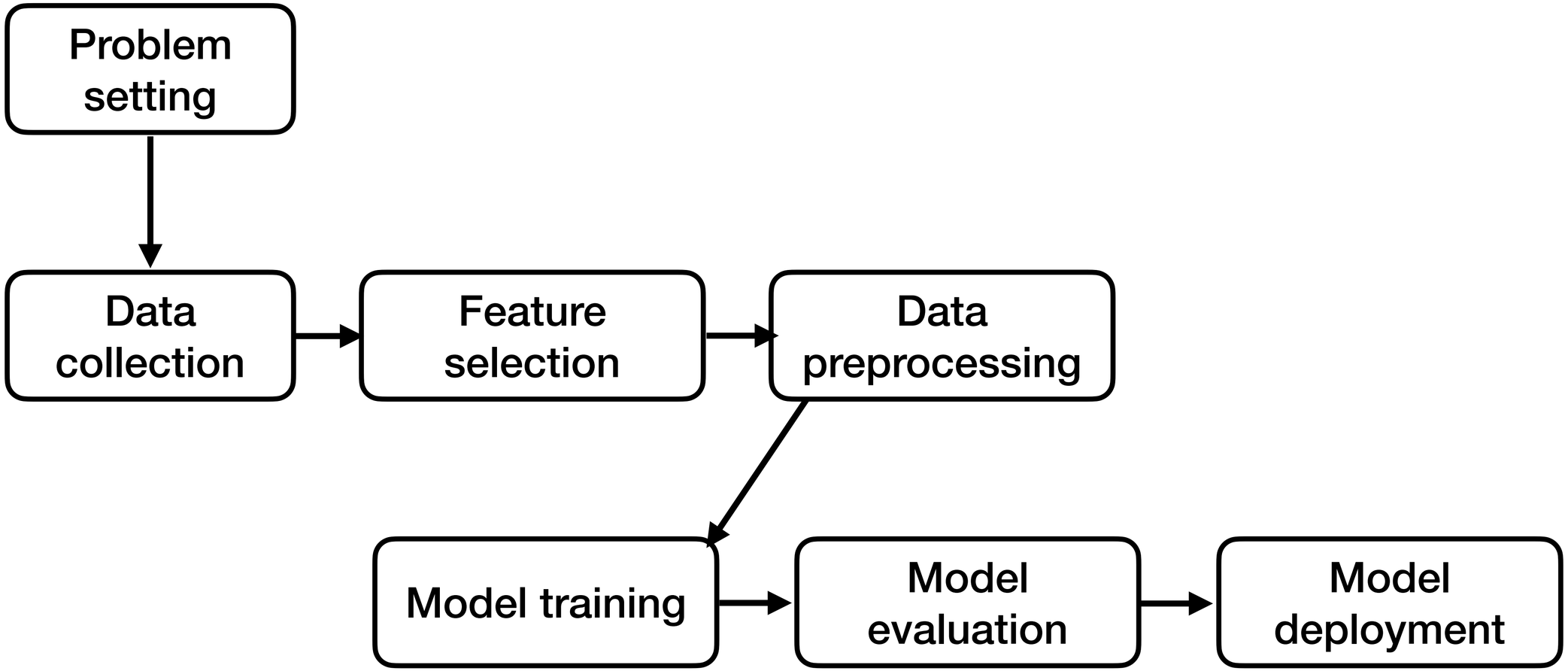

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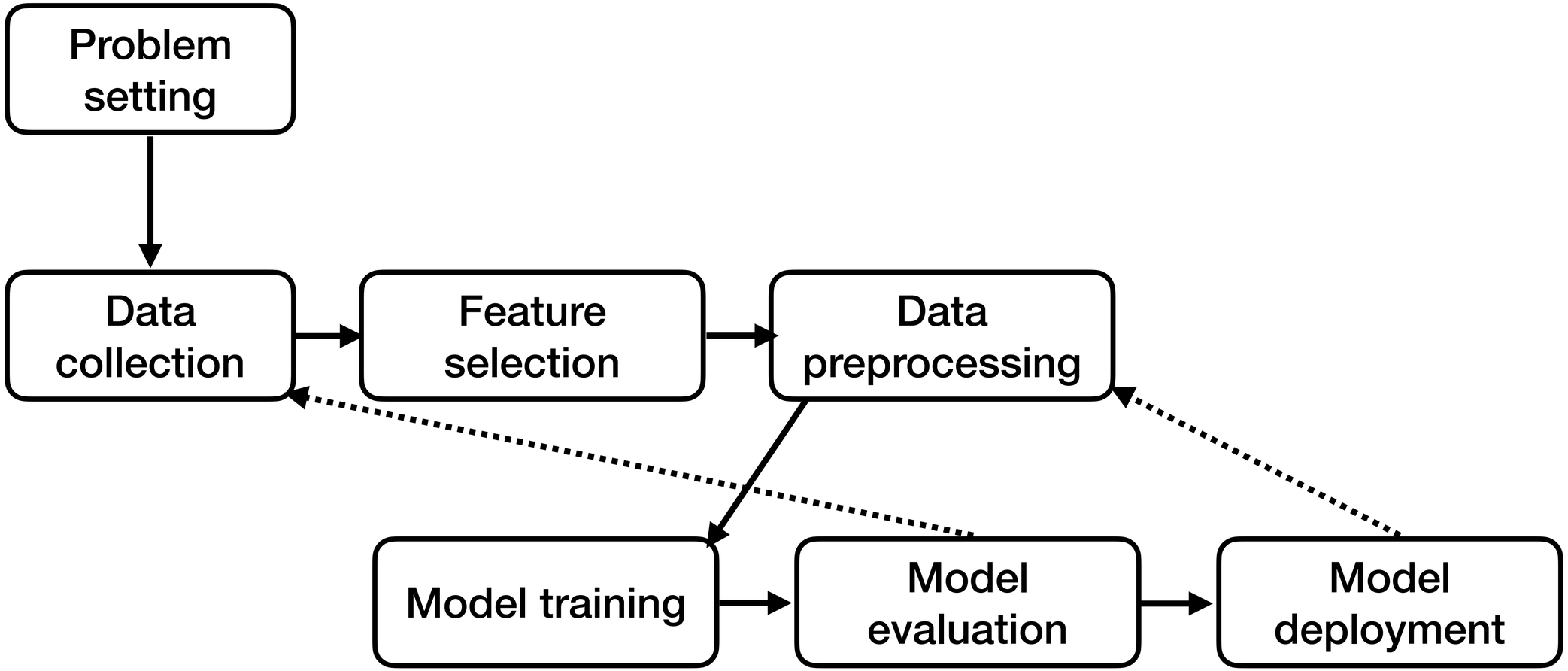

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* Python and ML libraries (PyTorch, tensorflow, JAX etc.)

Train a model with python

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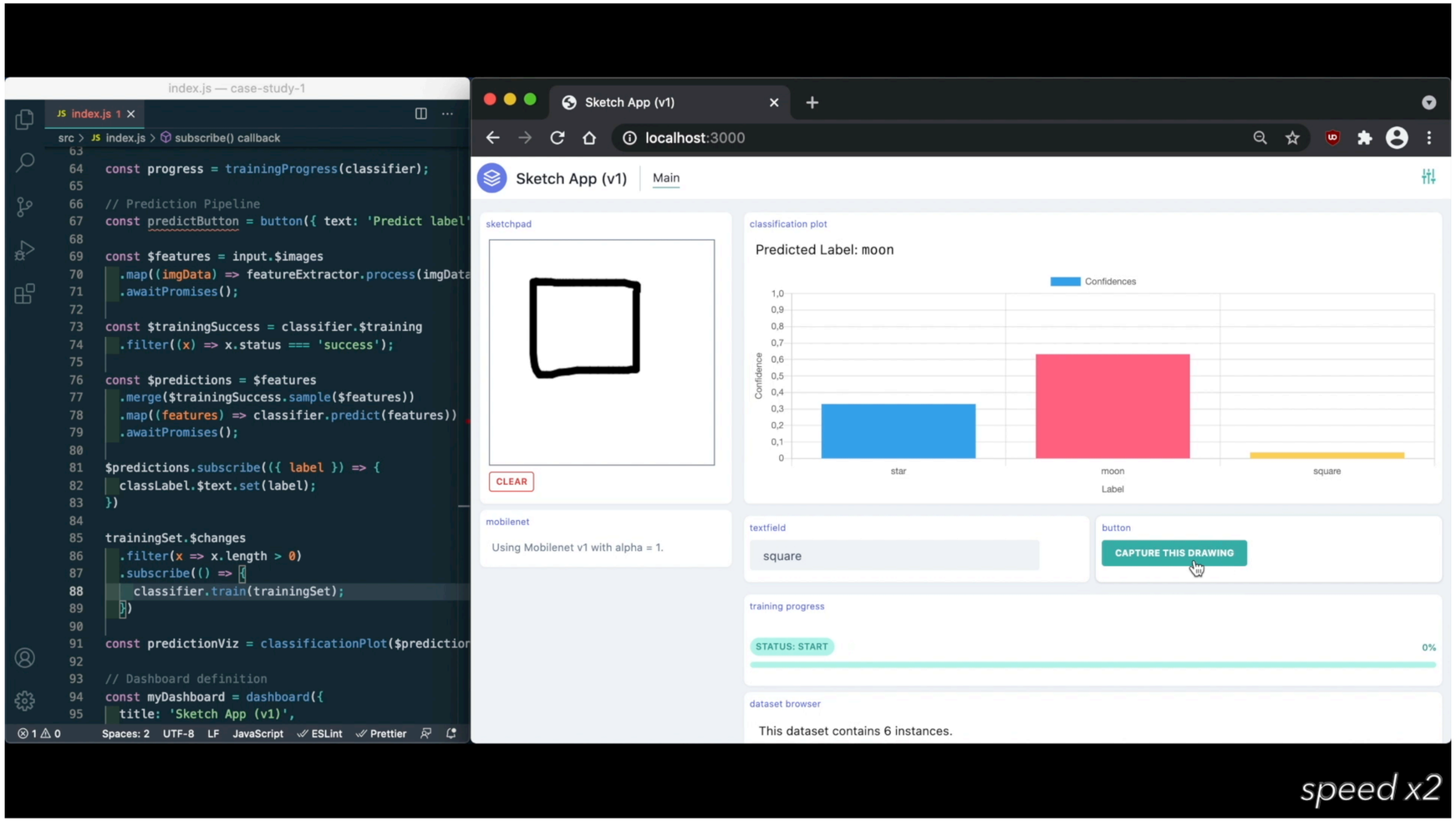
Marcelle: composing interactive machine learning workflows and interfaces

Jules Françoise, Baptiste Caramiaux, Téo Sanchez

https://marcelle.dev

IV. How to develop interactions with ML?

Build interaction with ML in minutes



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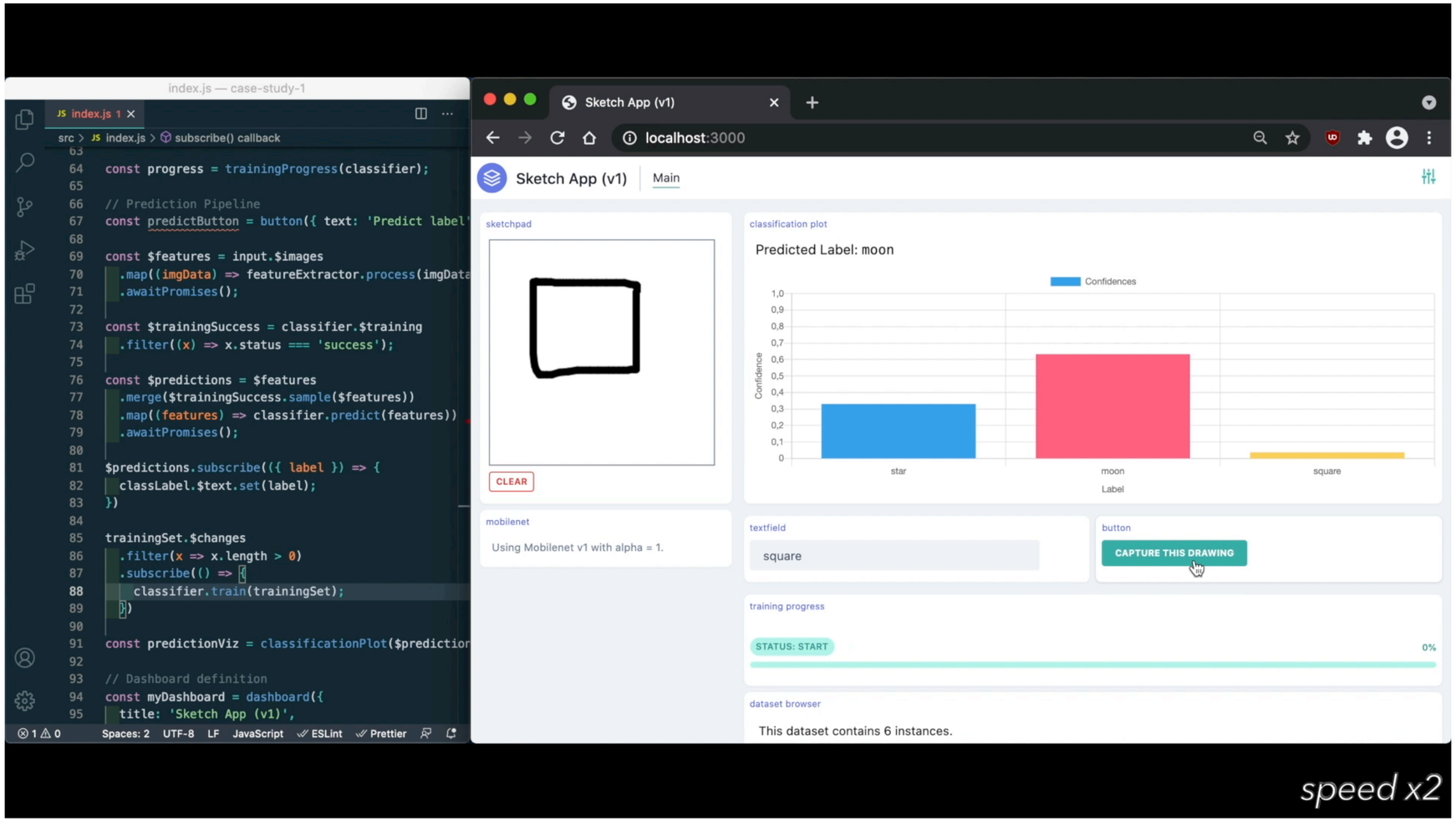

Introduction to AI and machine learning

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Human-AI interaction

How to build meaningful
interactions with ML systems ?