

Conoscere l'Intelligenza Artificiale



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Lezione 1
Neuroni, Perceptrons e Training

Agenda

Lezione 1

- Introduzione a AI
- Neuroni e Perceptron
- Training
- Importanza dei Dati + Pulizia

 **Pratica: SPAZIO**

Lezione 2

- AI Tasks
- Applicazioni
- Loss Functions
- Iperparametri
- Overfitting e Generalizzazione

 **Pratica: MELE**

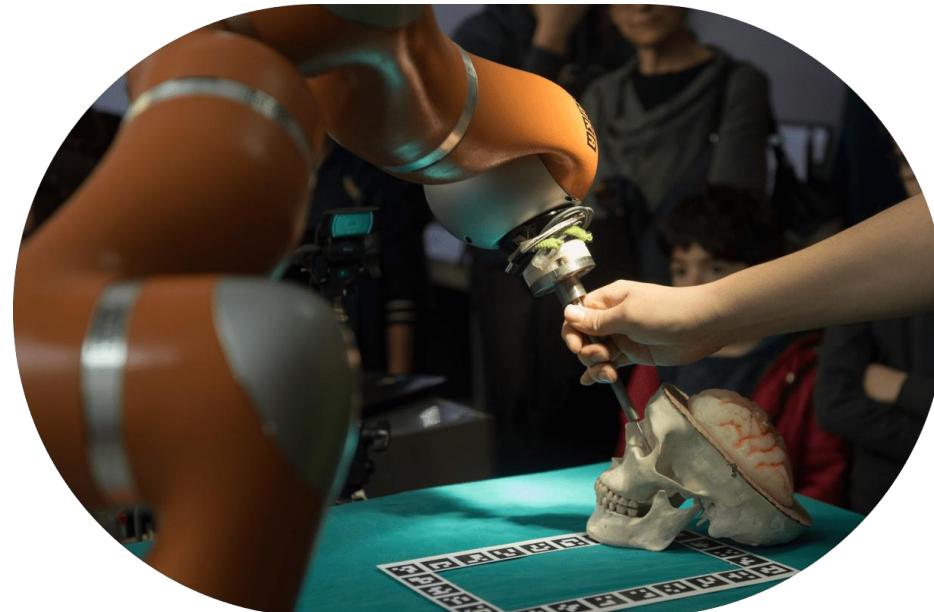
Lezione 3

- ChatGPT
- Privacy / AI Act
- Explainability
- Competition!

?

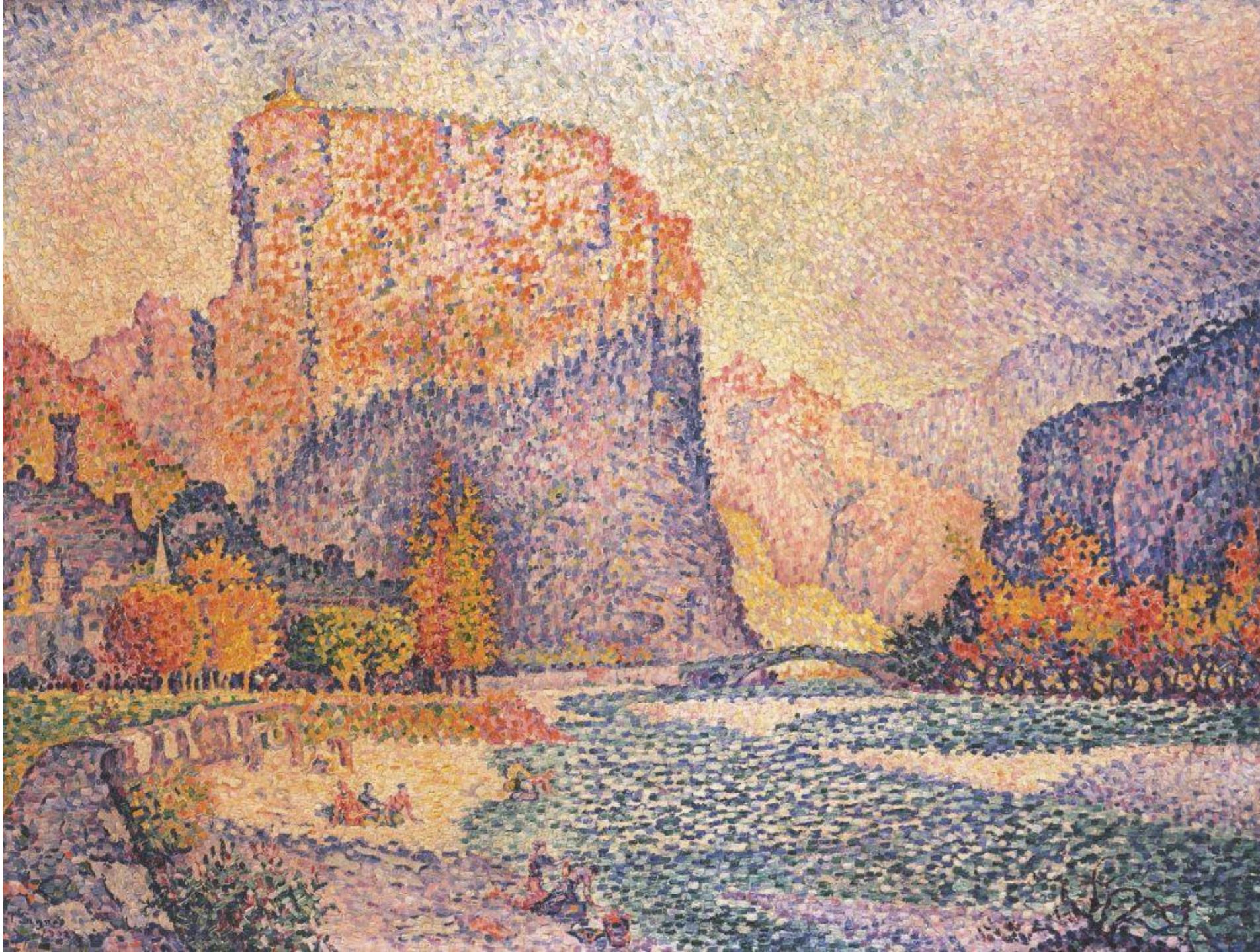
TEMA: ?

Lezione 4

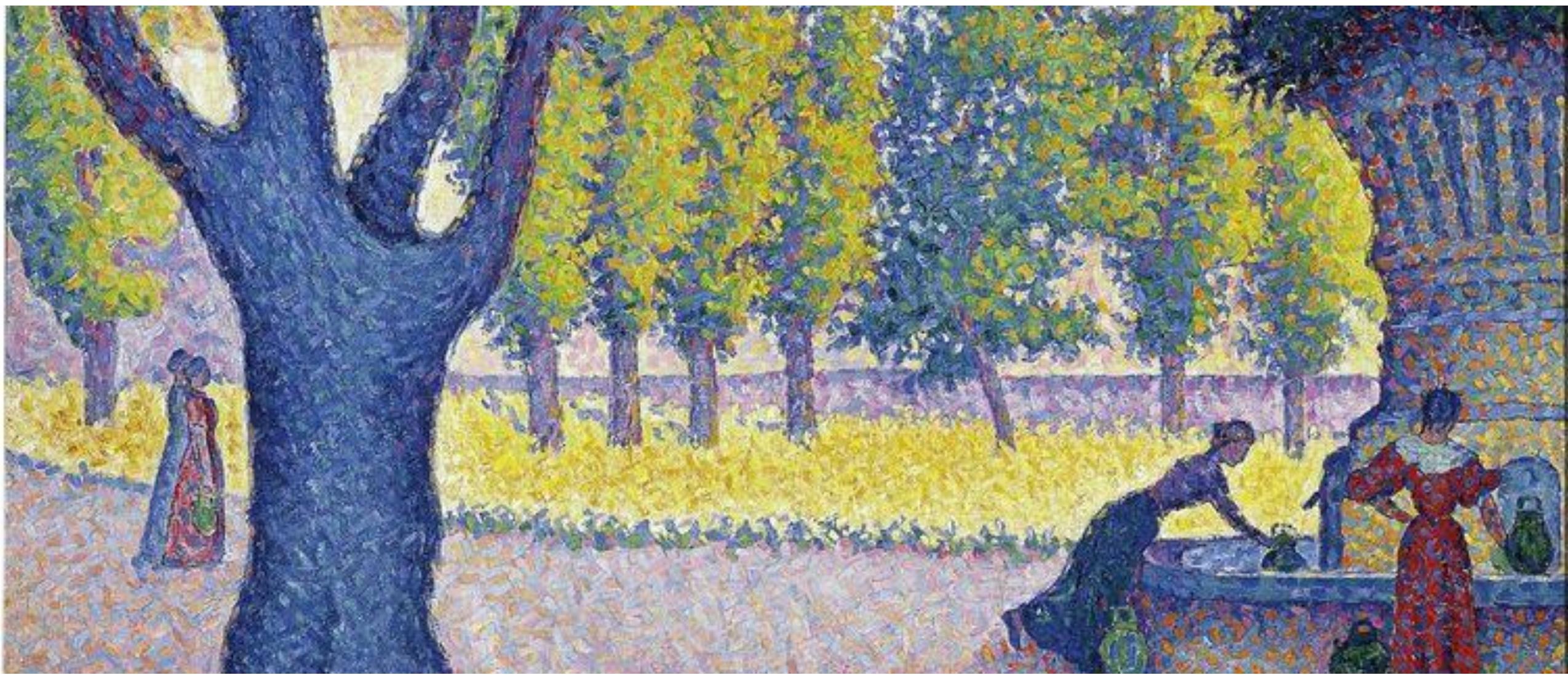


Signac o Seurat?











754 1923



Schirn



Kirchner o Münter?

A landscape painting featuring rolling hills in yellow, purple, and green. In the foreground, there is a body of water. A white rectangular box contains the name "Münter" in a bold, black, sans-serif font.

Münter

A vibrant, abstract painting by Ernst Kirchner depicting a crowded urban scene. The composition is filled with dynamic, expressive brushstrokes in a variety of colors, including red, blue, white, black, and purple. Several figures are visible, some appearing to be in motion or interacting with each other. The overall style is characterized by its raw energy and emotional intensity.

Kirchner



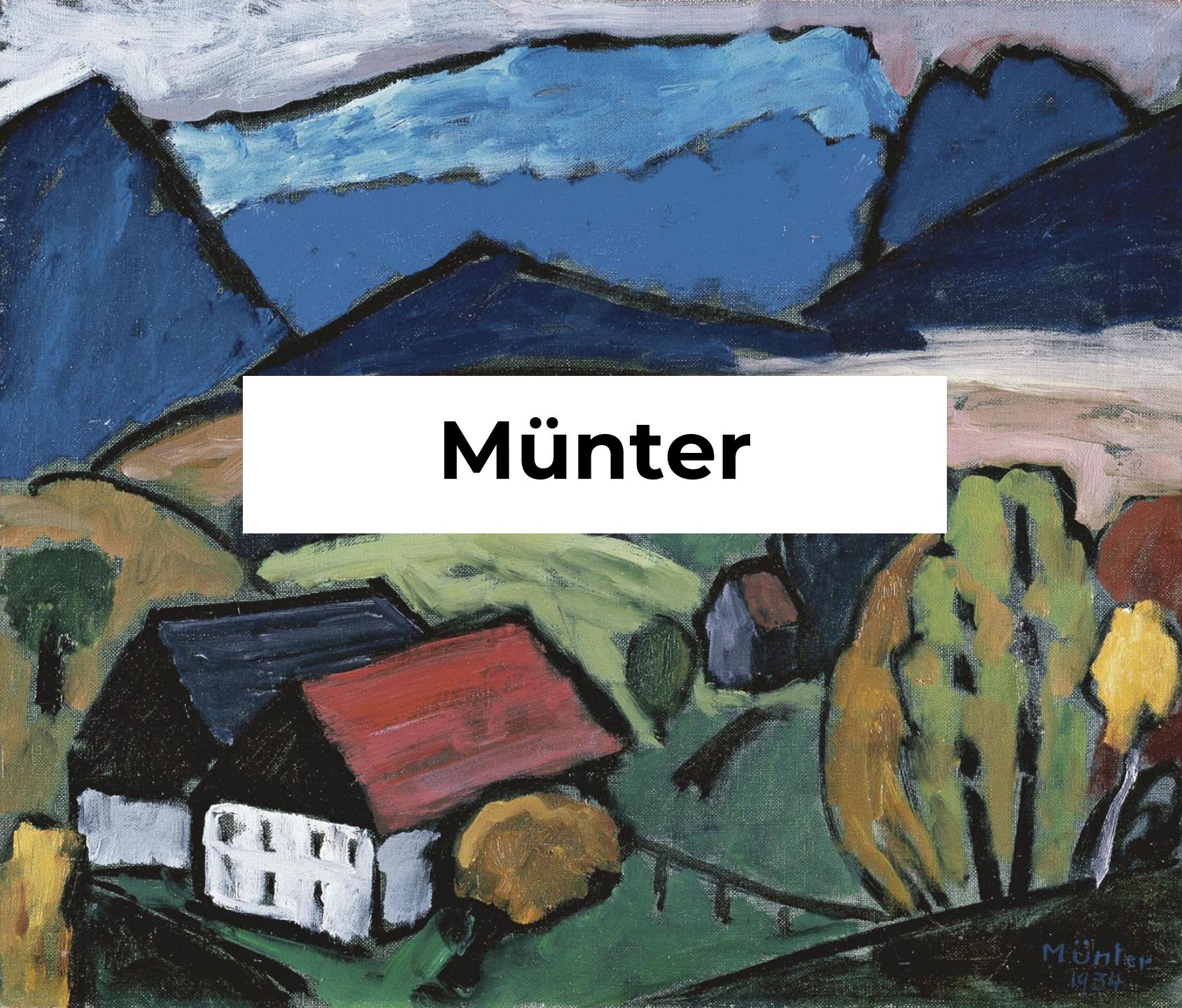
Kirchner

A landscape painting featuring a range of hills. The top layer of hills is painted in a bright yellow color with visible brushstrokes. Below them is a layer of hills in a medium blue color. In the foreground, there are several large, vertical, textured shapes in red, orange, and yellow. The bottom left corner of the painting contains the signature "Münster".

Münster

A painting by Ernst Kirchner depicting a woman with dark hair and green eyes, wearing a white blouse, looking directly at the viewer. She is positioned in front of a red bridge spanning a valley with snow-capped mountains. The background is filled with vibrant, expressive brushstrokes in shades of red, orange, and purple.

Kirchner



Münter

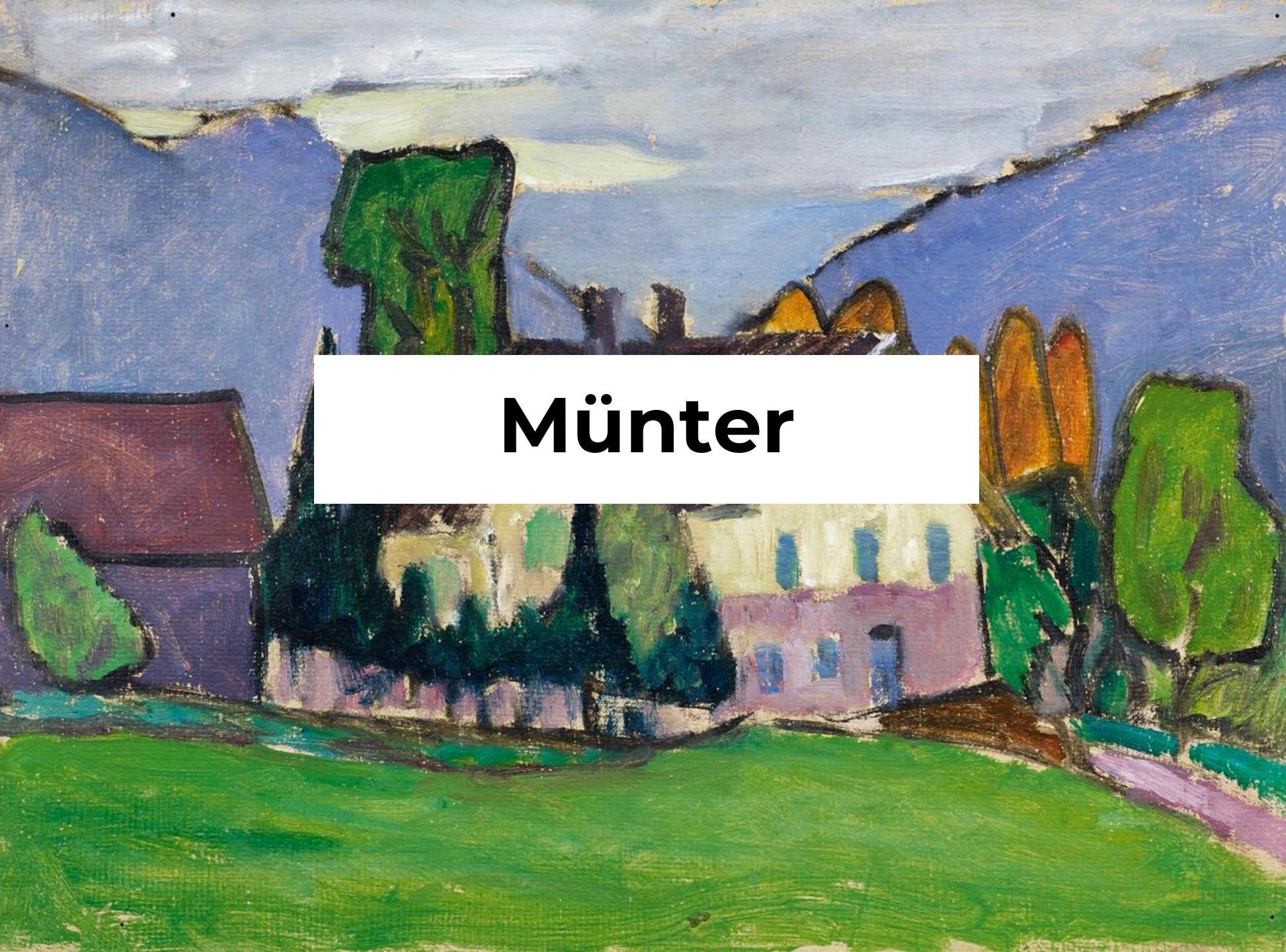
Münter
1934

Kirchner



A landscape painting featuring a range of mountains in the background, rendered in shades of blue and purple. In the middle ground, there is a cluster of buildings with colorful roofs (red, yellow, blue) situated near a body of water. A road or path leads towards the town from the foreground, which is partially obscured by dark, rocky terrain. The overall style is expressive and somewhat abstract.

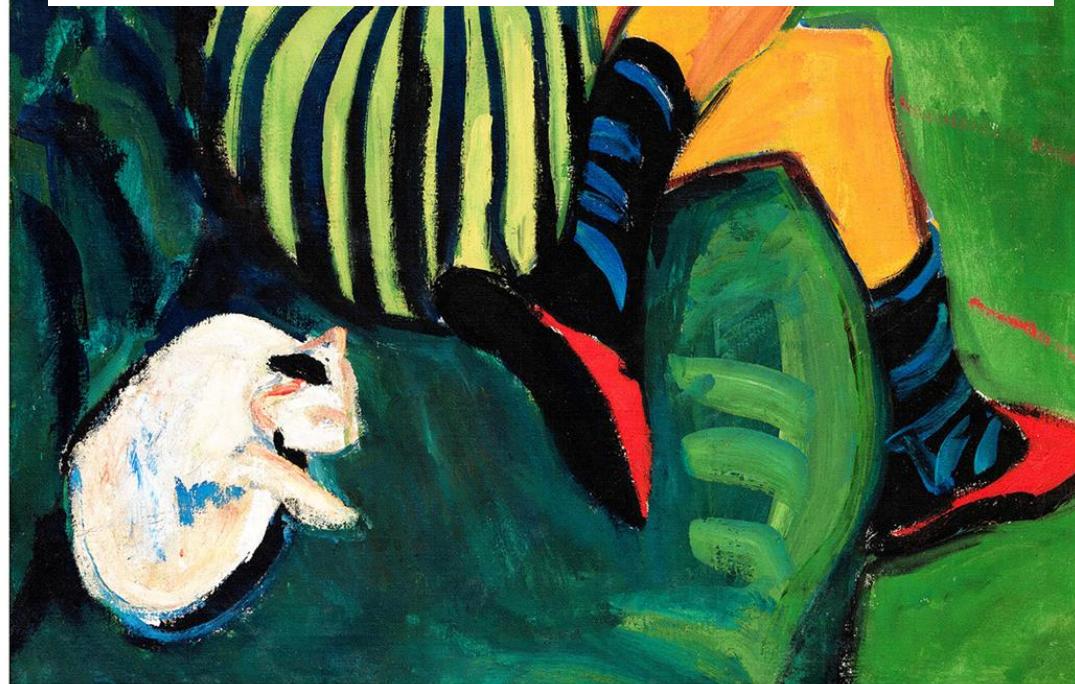
Münter

A painting by Gabriele Münter depicting a town at sunset. The sky is filled with soft, pastel-colored clouds. In the foreground, there's a green field with a small purple path. Behind it, several buildings are visible, including a prominent red-roofed house on the left and a pink building with blue-framed windows in the center. The buildings are surrounded by lush green trees and bushes. The overall style is expressive and colorful.

Münter



Kirchner

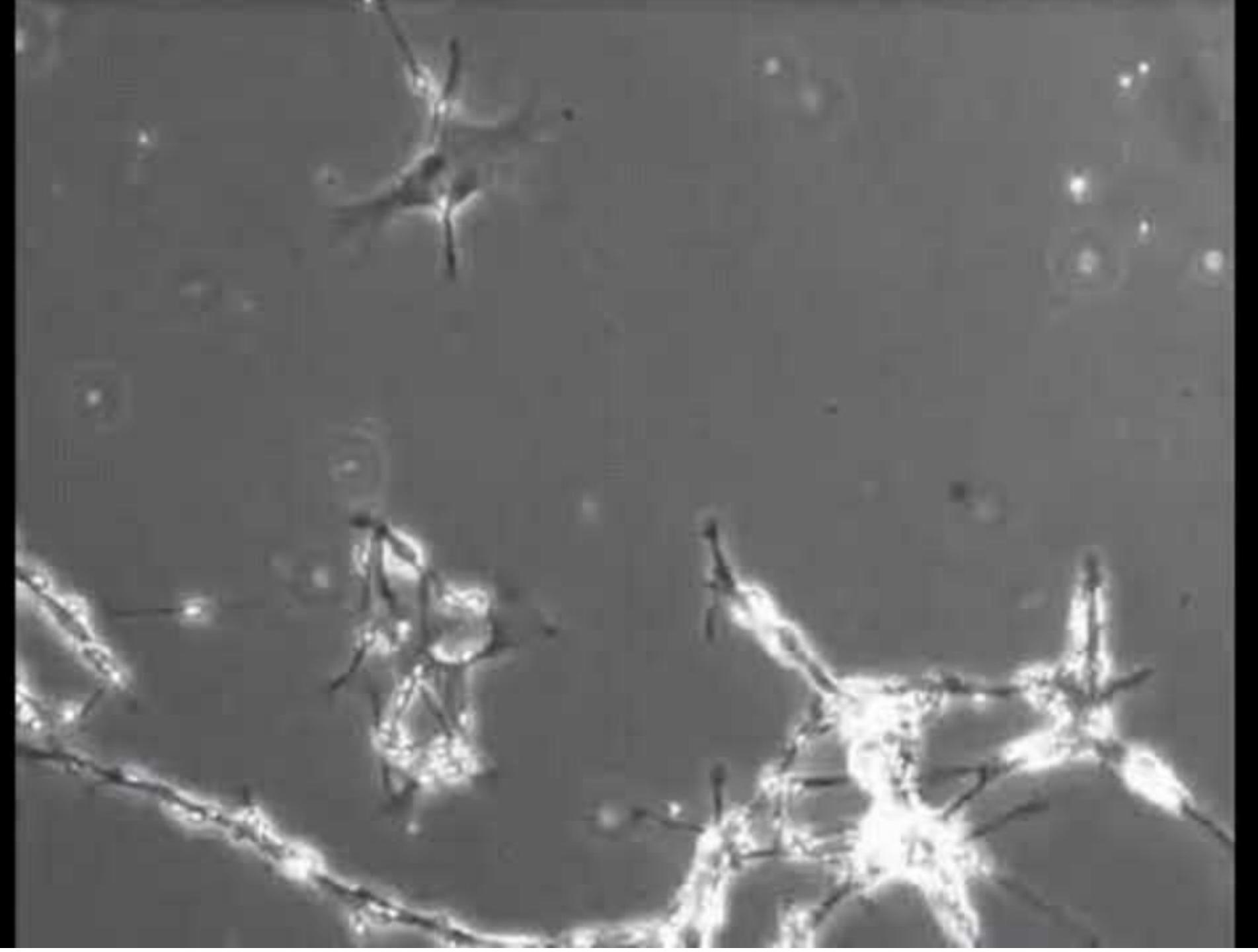


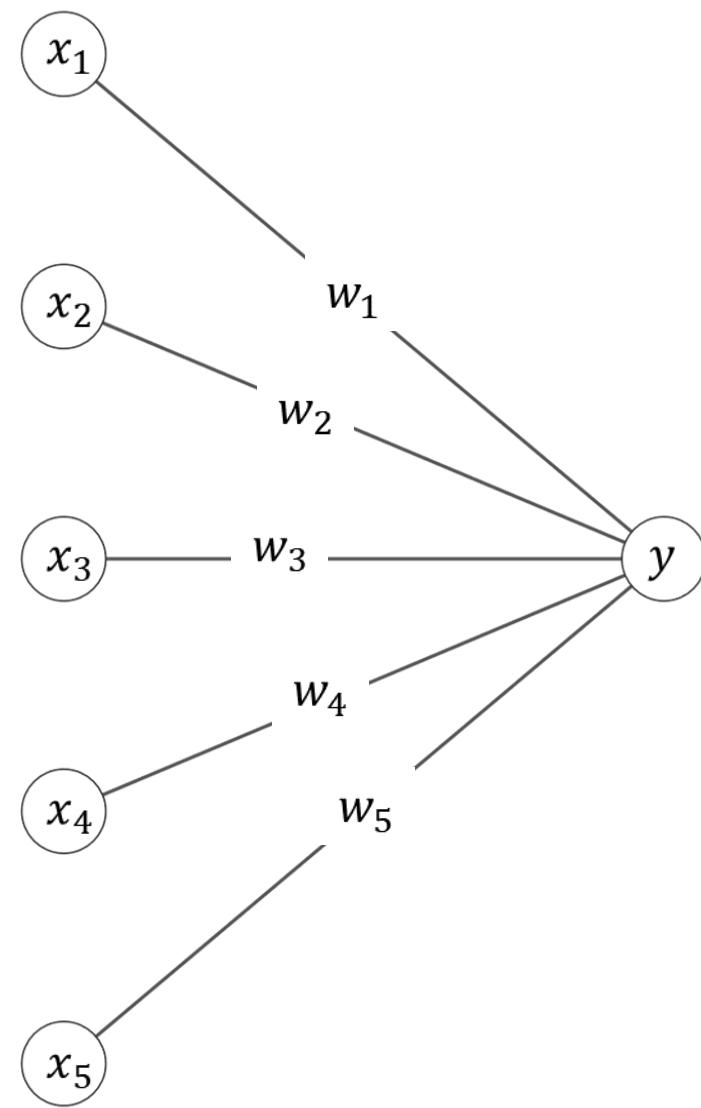
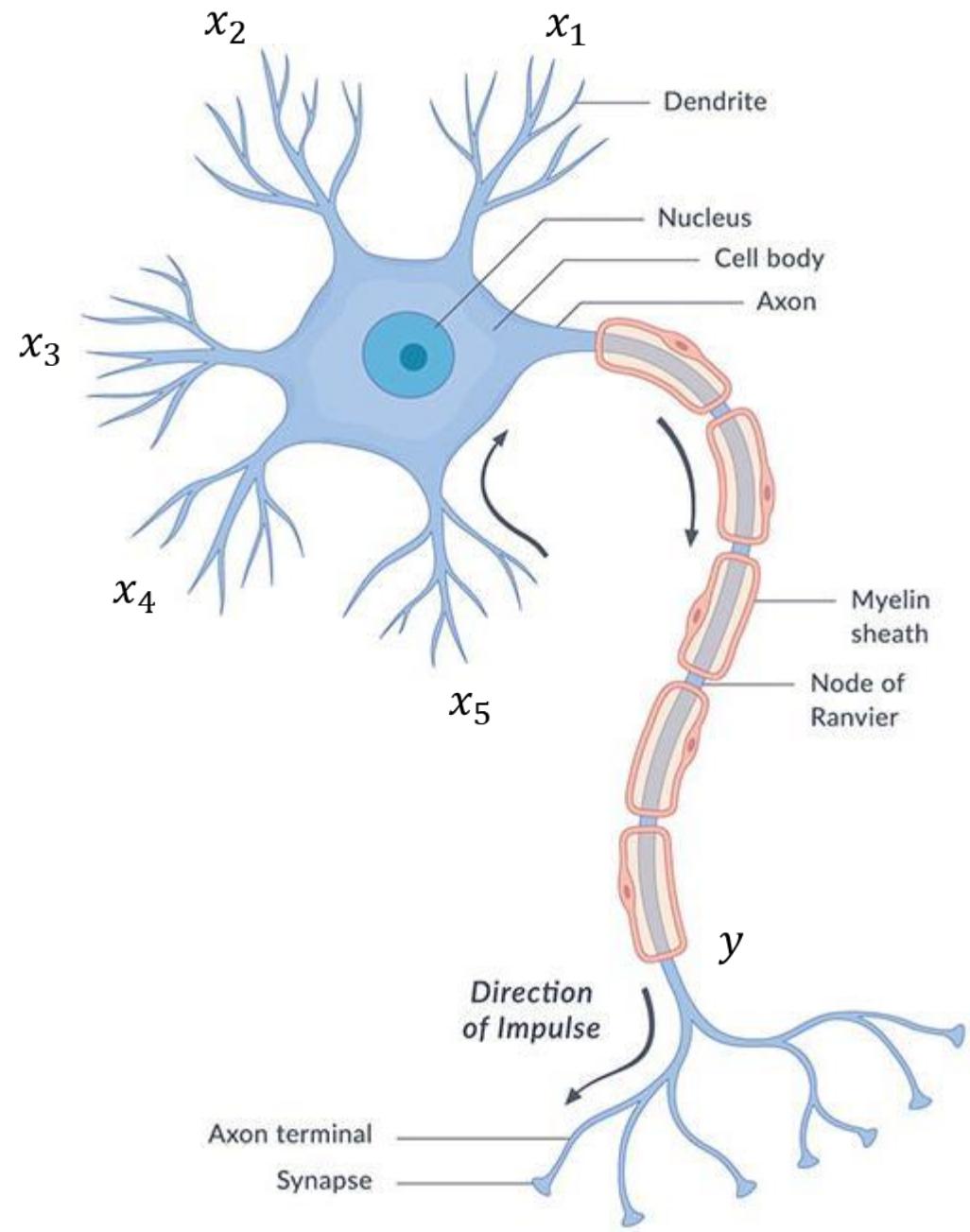


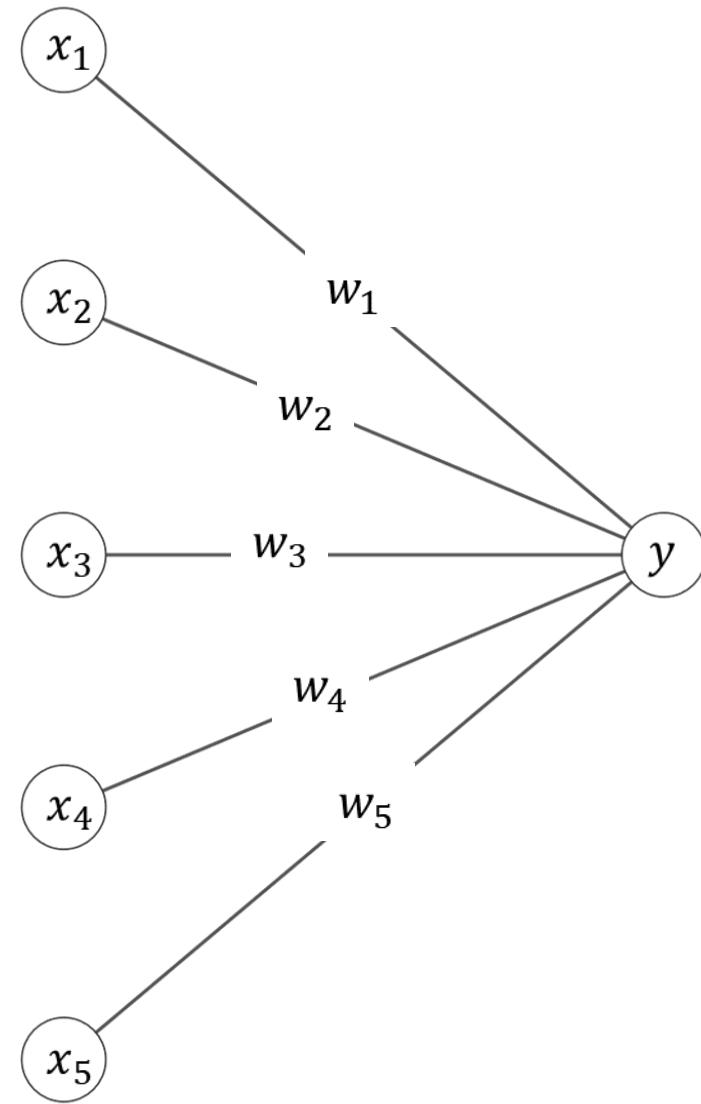
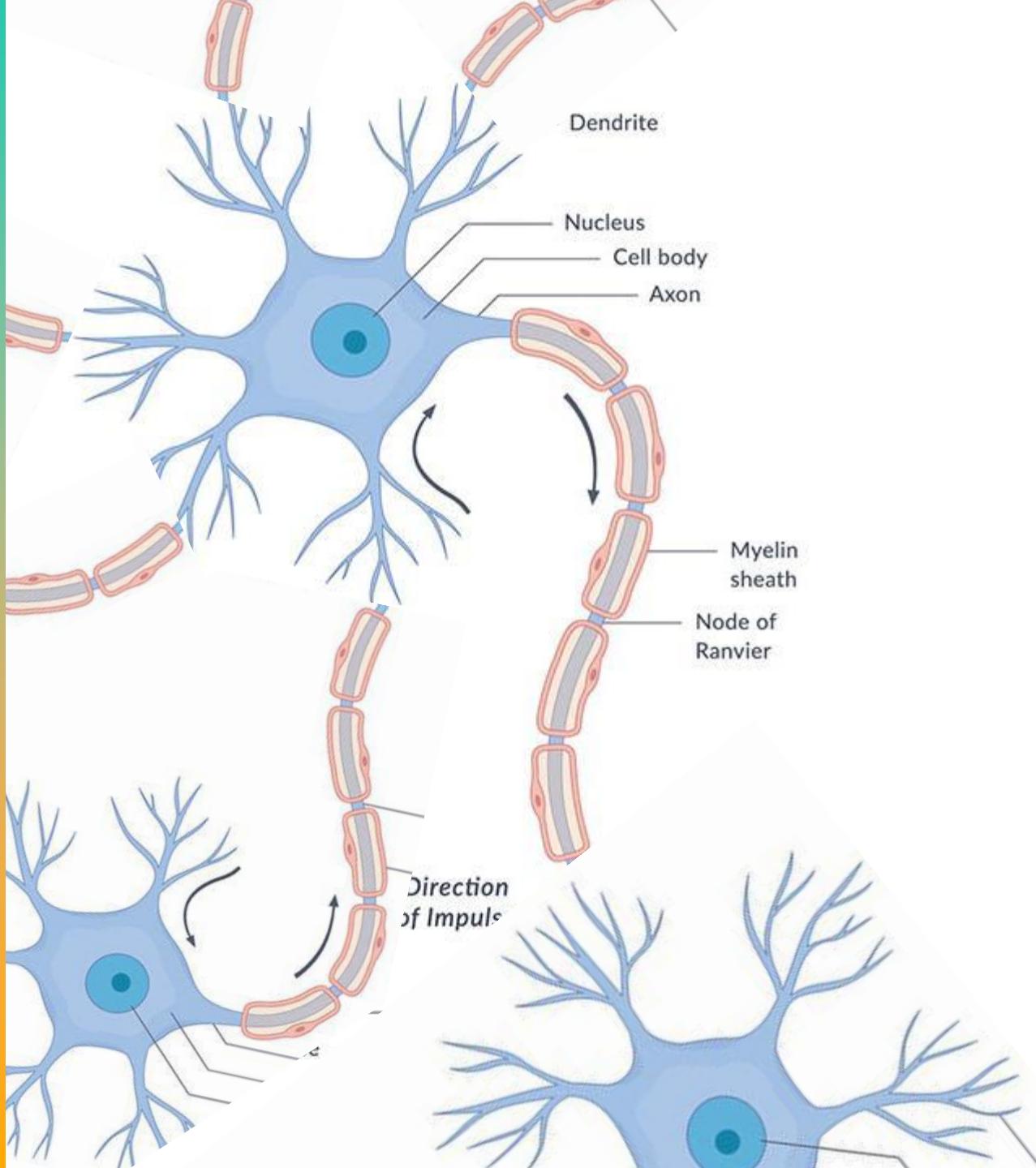
Münter

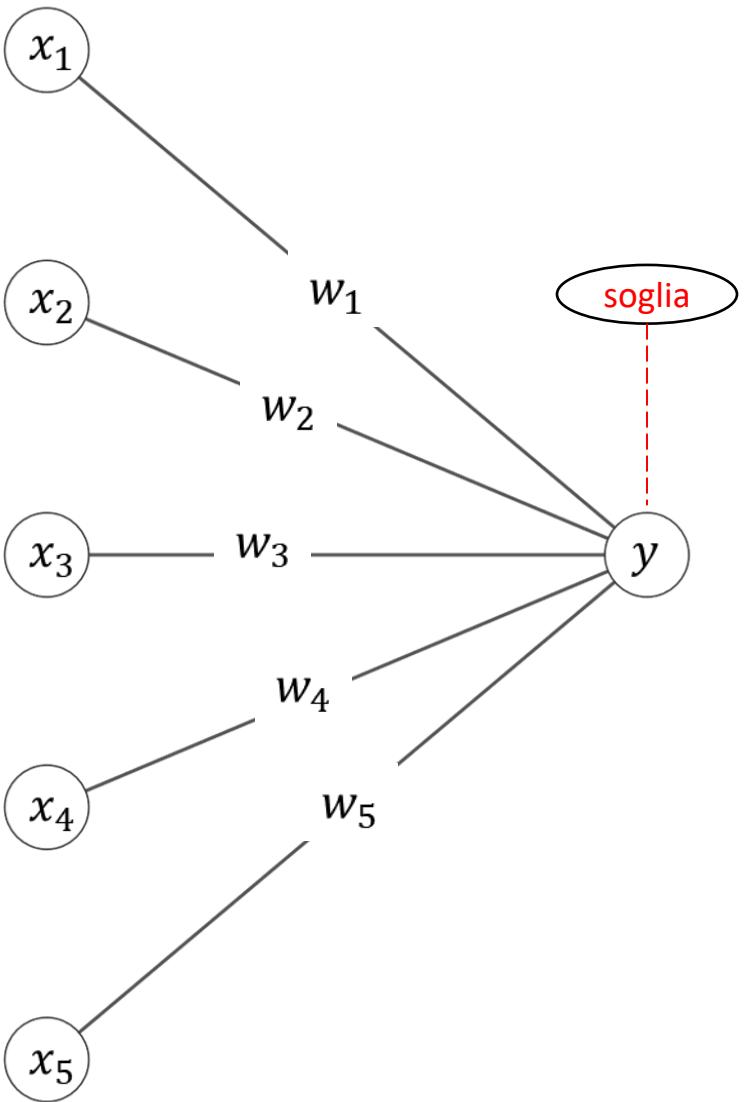


Neurons and Plasticity





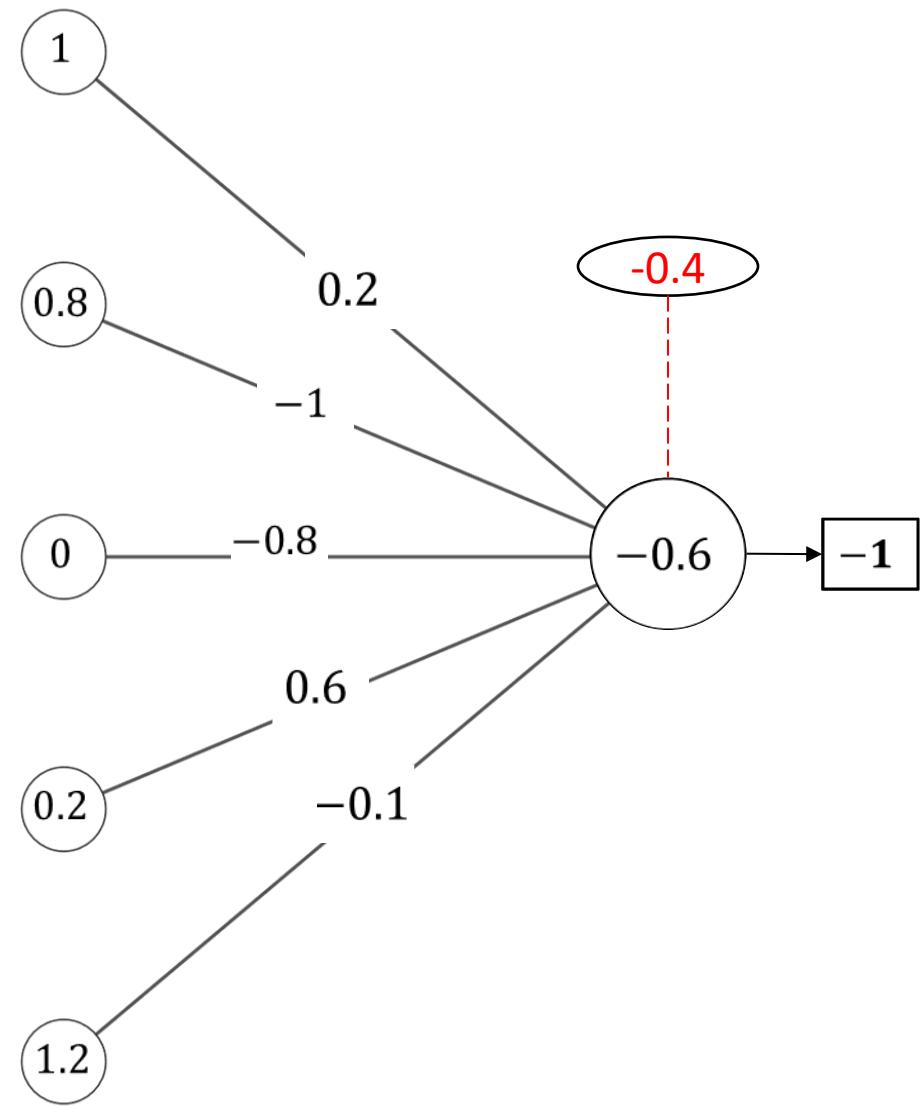
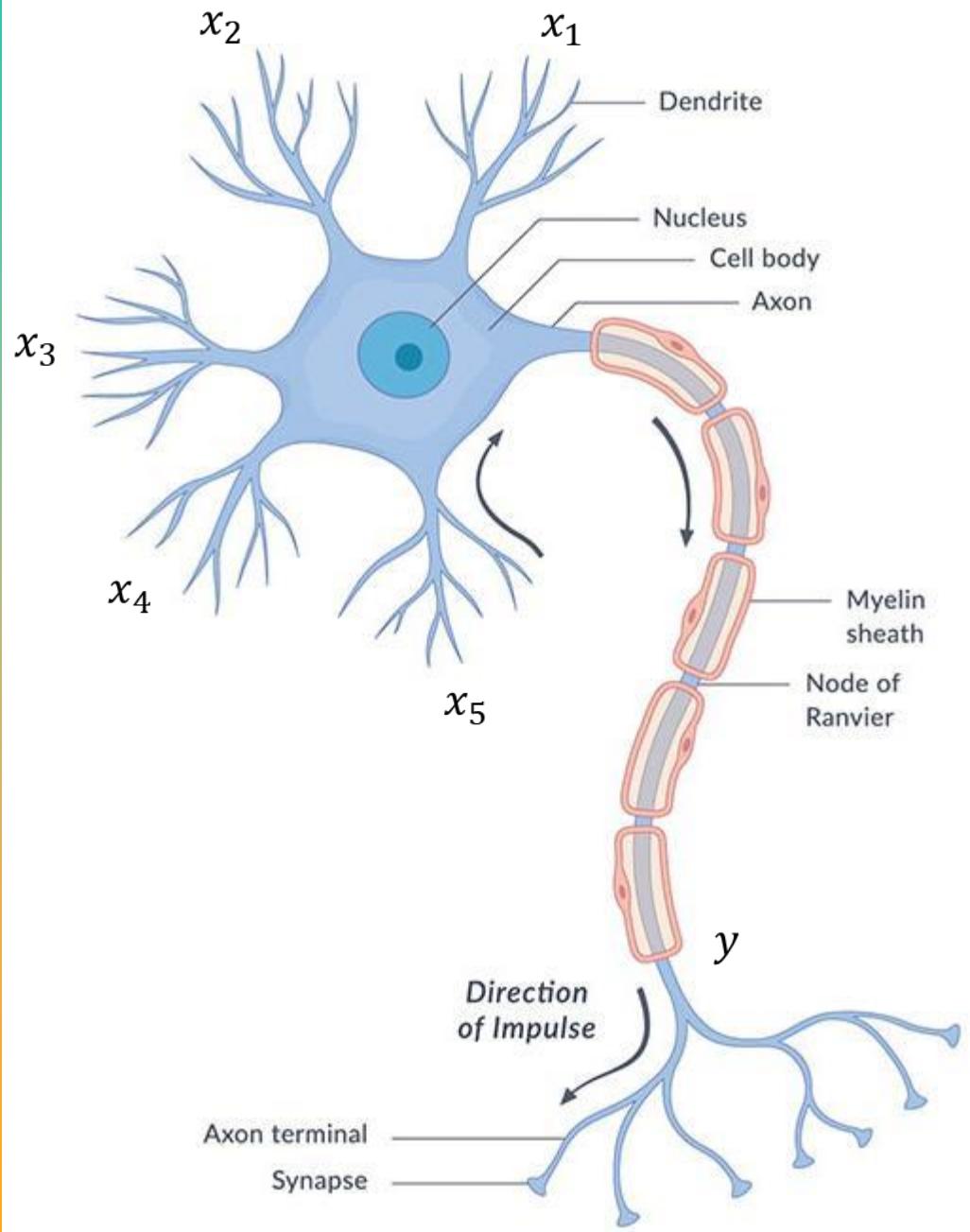




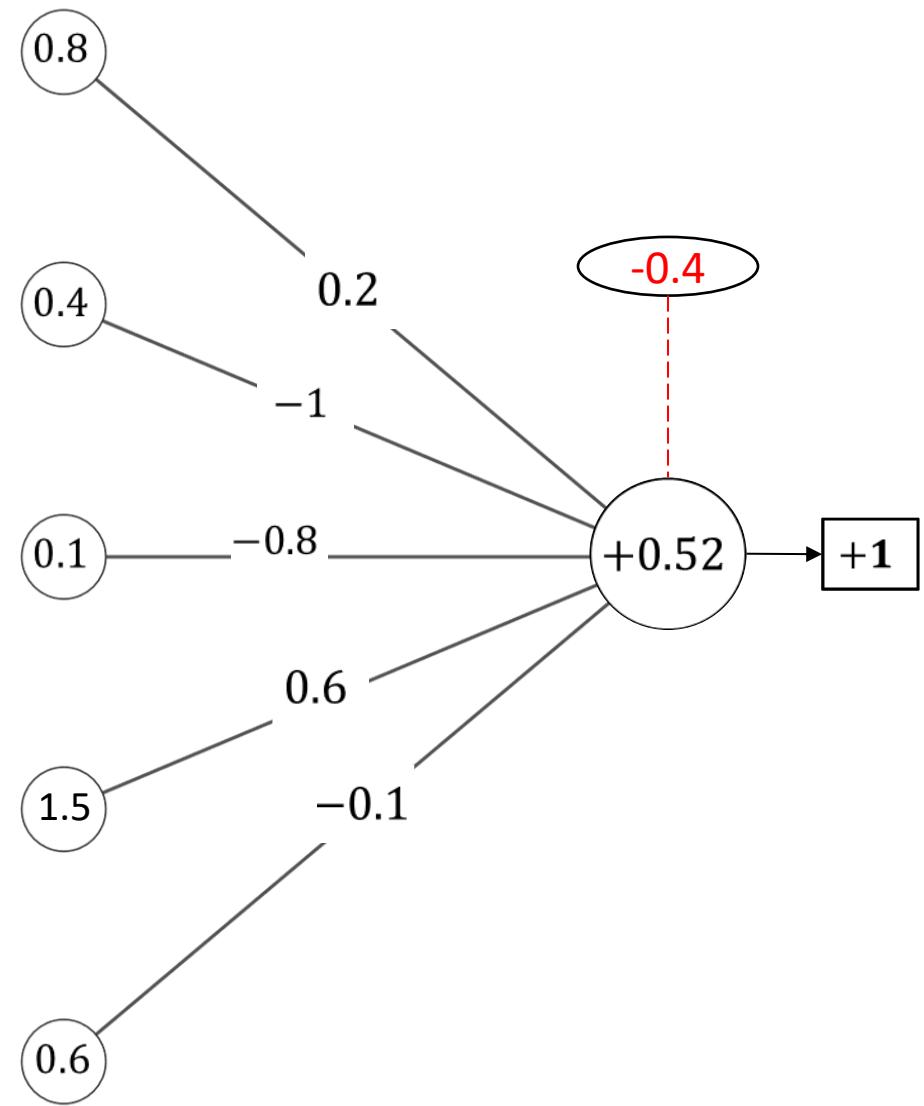
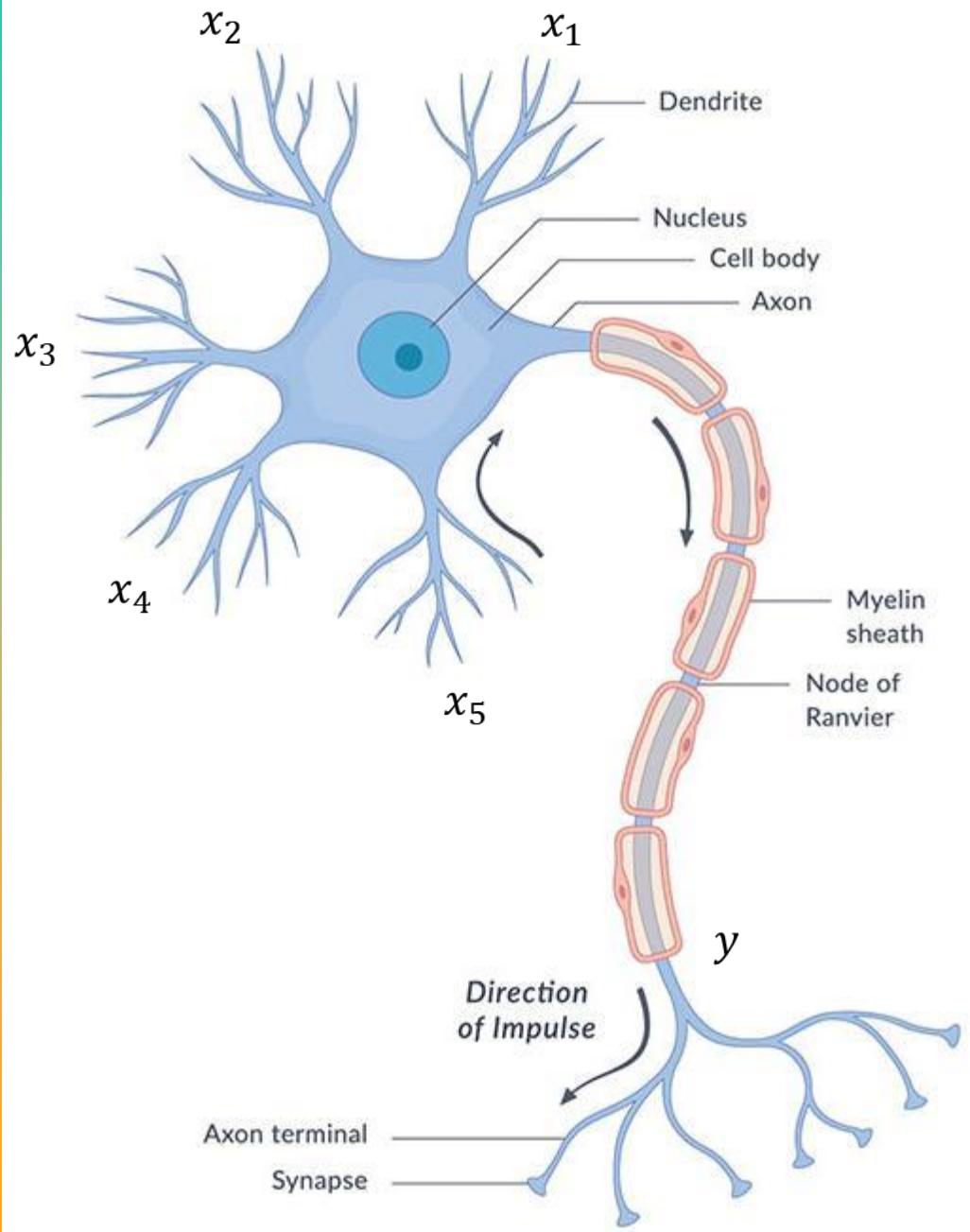
Neuron

$$y = x_1 \cdot w_1 + x_2 \cdot w_2 + x_3 \cdot w_3 + x_4 \cdot w_4 + x_5 \cdot w_5 + \dots$$

$$\text{Output} = \begin{cases} +1, & y > \text{soglia} \\ -1, & y < \text{soglia} \end{cases}$$

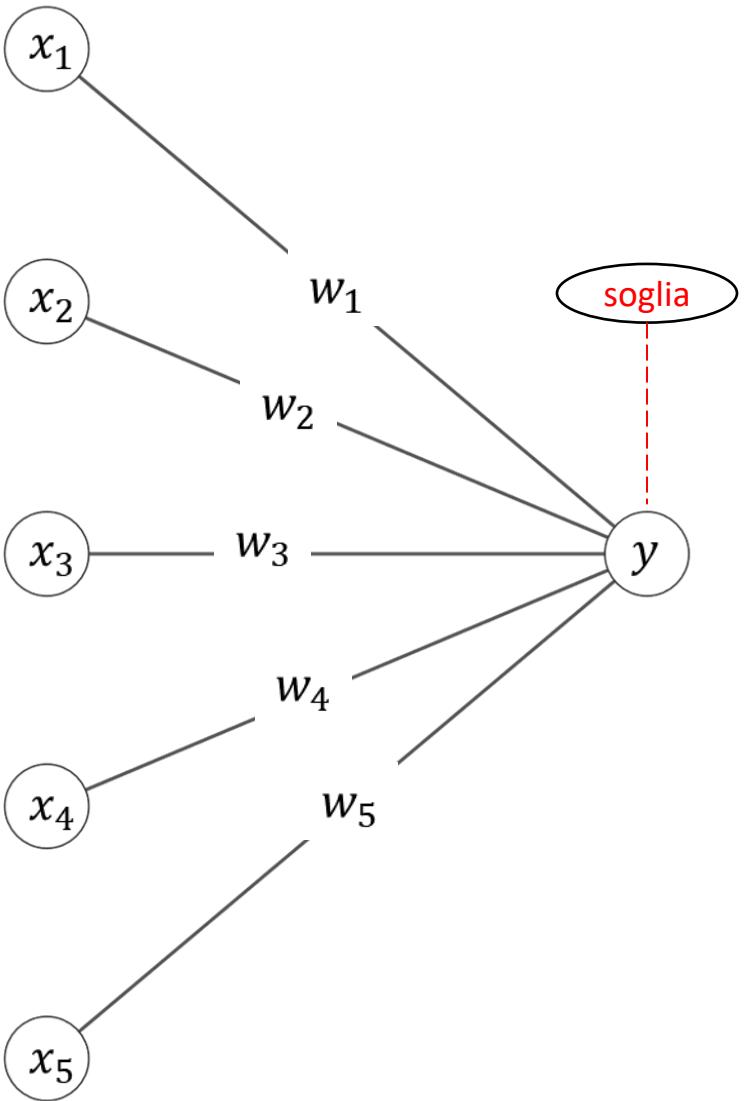


$$y = x_1 \cdot w_1 + x_2 \cdot w_2 + x_3 \cdot w_3 + x_4 \cdot w_4 + x_5 \cdot w_5$$



$$y = x_1 \cdot w_1 + x_2 \cdot w_2 + x_3 \cdot w_3 + x_4 \cdot w_4 + x_5 \cdot w_5$$

Neural Training and Learning



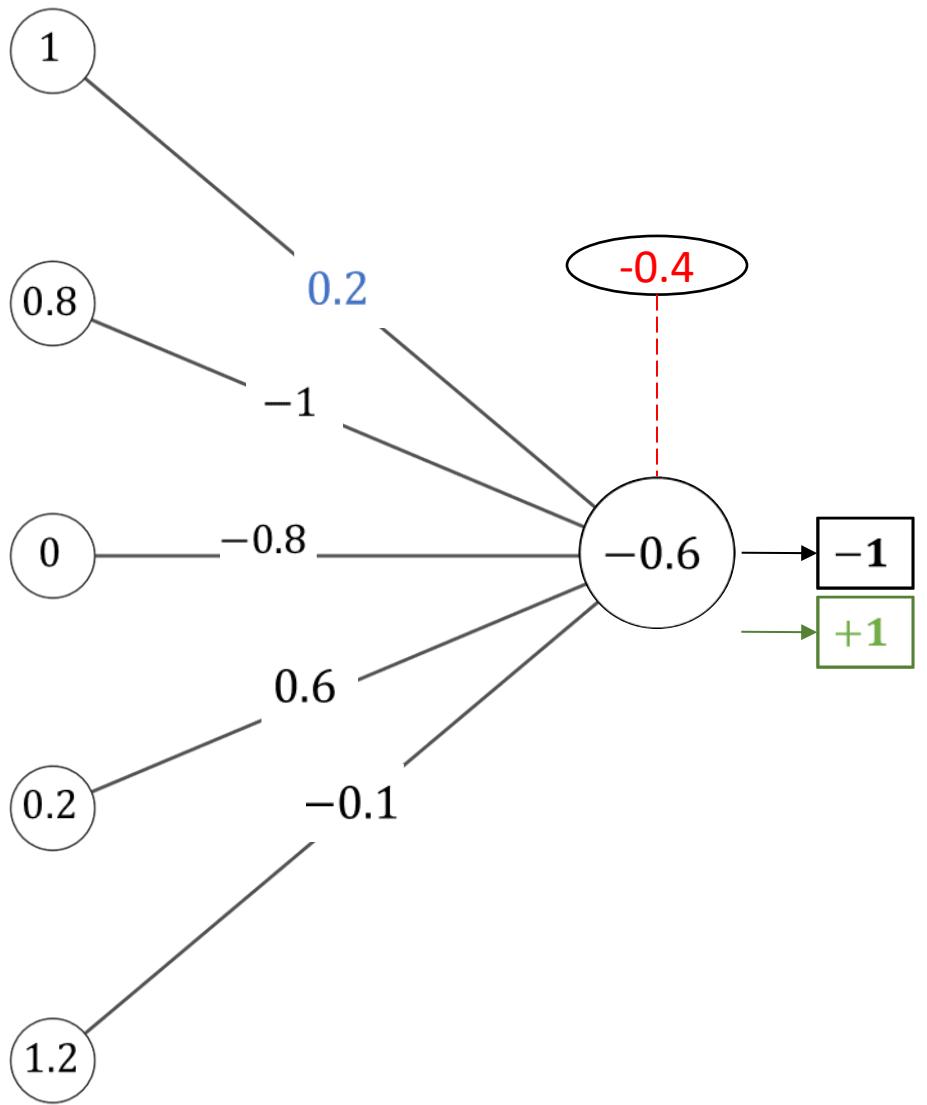
$$y = x_1 \cdot w_1 + x_2 \cdot w_2 + x_3 \cdot w_3 + x_4 \cdot w_4 + x_5 \cdot w_5 + \dots$$

$$\text{Output} = \begin{cases} +1, & y > \text{soglia} \\ -1, & y < \text{soglia} \end{cases}$$

Learning

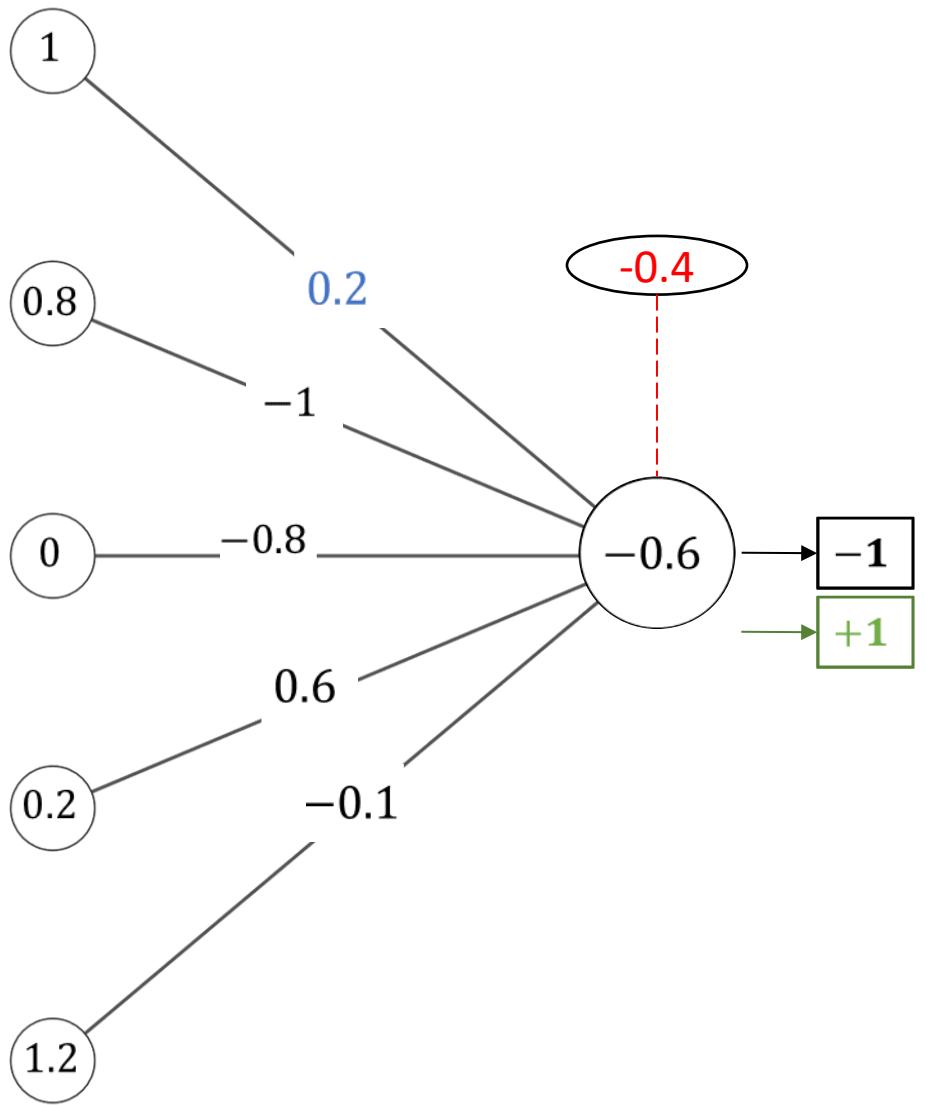
$$w_{1,new} = w_{1,old} + \alpha \cdot \text{Errore} \cdot x_1$$

- *Errore* = Target – Output
- α = Learning Rate



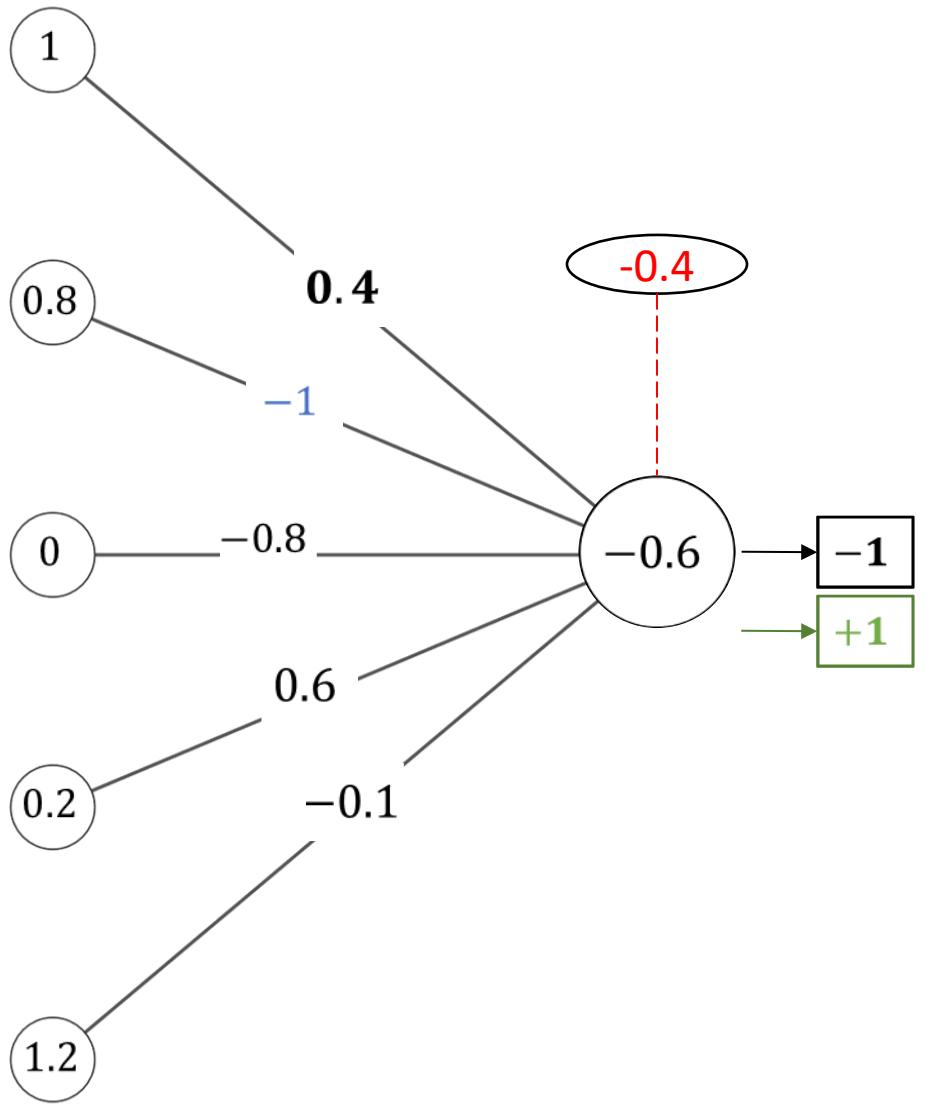
- $Errore = +1 - (-1) = +2$
- $\alpha = 0.1$

$$\begin{aligned}
 w_{1,new} &= w_{1,old} + \alpha \cdot \text{Errore} \cdot x_1 \\
 &= 0.2 + 0.1 \cdot (+2) \cdot 1 = ???
 \end{aligned}$$



- $Errore = +1 - (-1) = +2$
- $\alpha = 0.1$

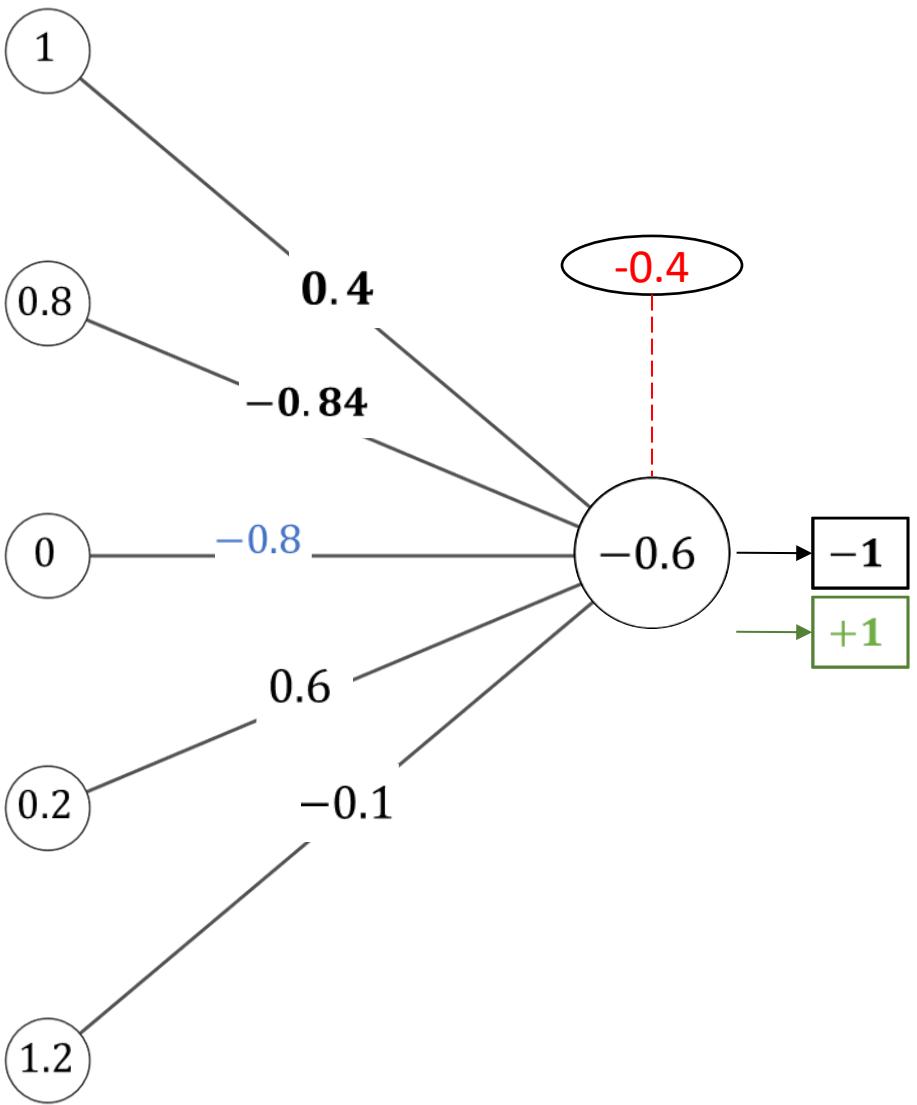
$$\begin{aligned}
 w_{1,new} &= w_{1,old} + \alpha \cdot \text{Errore} \cdot x_1 \\
 &= 0.2 + 0.1 \cdot (+2) \cdot 1 = 0.4
 \end{aligned}$$



- $Errore = +1 - (-1) = +2$
- $\alpha = 0.1$

$$\begin{aligned} w_{1,new} &= w_{1,old} + \alpha \cdot \text{Errore} \cdot x_1 \\ &= 0.2 + 0.1 \cdot (+2) \cdot 1 = 0.4 \end{aligned}$$

$$\begin{aligned} w_{2,new} &= w_{2,old} + \alpha \cdot \text{Errore} \cdot x_2 \\ &= -1 + 0.1 \cdot (+2) \cdot 0.8 = -0.84 \end{aligned}$$

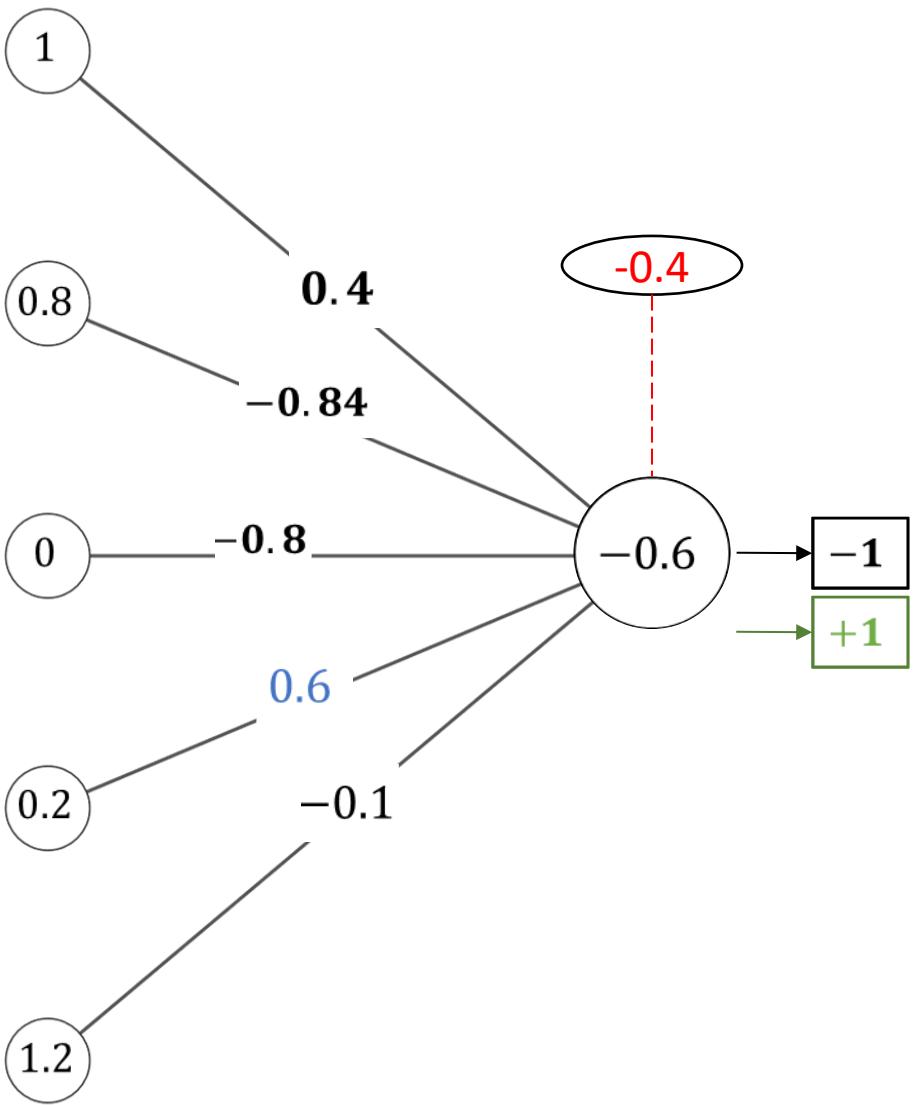


- $\text{Errore} = +1 - (-1) = +2$
- $\alpha = 0.1$

$$\begin{aligned} w_{1,new} &= w_{1,old} + \alpha \cdot \text{Errore} \cdot x_1 \\ &= 0.2 + 0.1 \cdot (+2) \cdot 1 = 0.4 \end{aligned}$$

$$\begin{aligned} w_{2,new} &= w_{2,old} + \alpha \cdot \text{Errore} \cdot x_2 \\ &= -1 + 0.1 \cdot (+2) \cdot 0.8 = -0.84 \end{aligned}$$

$$\begin{aligned} w_{3,new} &= w_{3,old} + \alpha \cdot \text{Errore} \cdot x_3 \\ &= -0.8 + 0.1 \cdot (+2) \cdot 0 = -0.8 \end{aligned}$$



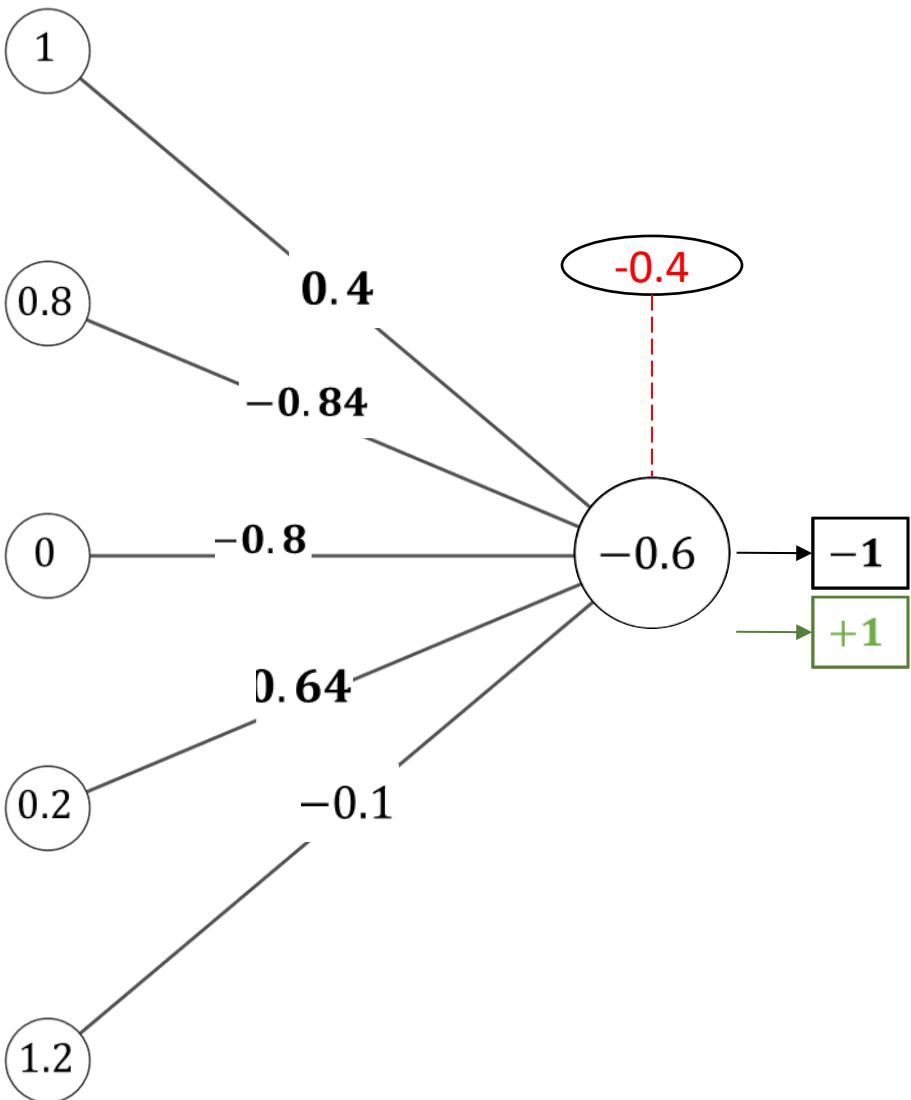
- $\text{Errore} = +1 - (-1) = +2$
- $\alpha = 0.1$

$$\begin{aligned} w_{1,new} &= w_{1,old} + \alpha \cdot \text{Errore} \cdot x_1 \\ &= 0.2 + 0.1 \cdot (+2) \cdot 1 = 0.4 \end{aligned}$$

$$\begin{aligned} w_{2,new} &= w_{2,old} + \alpha \cdot \text{Errore} \cdot x_2 \\ &= -1 + 0.1 \cdot (+2) \cdot 0.8 = -0.84 \end{aligned}$$

$$\begin{aligned} w_{3,new} &= w_{3,old} + \alpha \cdot \text{Errore} \cdot x_3 \\ &= -0.8 + 0.1 \cdot (+2) \cdot 0 = -0.8 \end{aligned}$$

$$\begin{aligned} w_{4,new} &= w_{4,old} + \alpha \cdot \text{Errore} \cdot x_4 \\ &= 0.6 + 0.1 \cdot (+2) \cdot 0.2 = \mathbf{0.64} \end{aligned}$$



- $\text{Errore} = +1 - (-1) = +2$
- $\alpha = 0.1$

$$\begin{aligned}w_{1,new} &= w_{1,old} + \alpha \cdot \text{Errore} \cdot x_1 \\&= 0.2 + 0.1 \cdot (+2) \cdot 1 = 0.4\end{aligned}$$

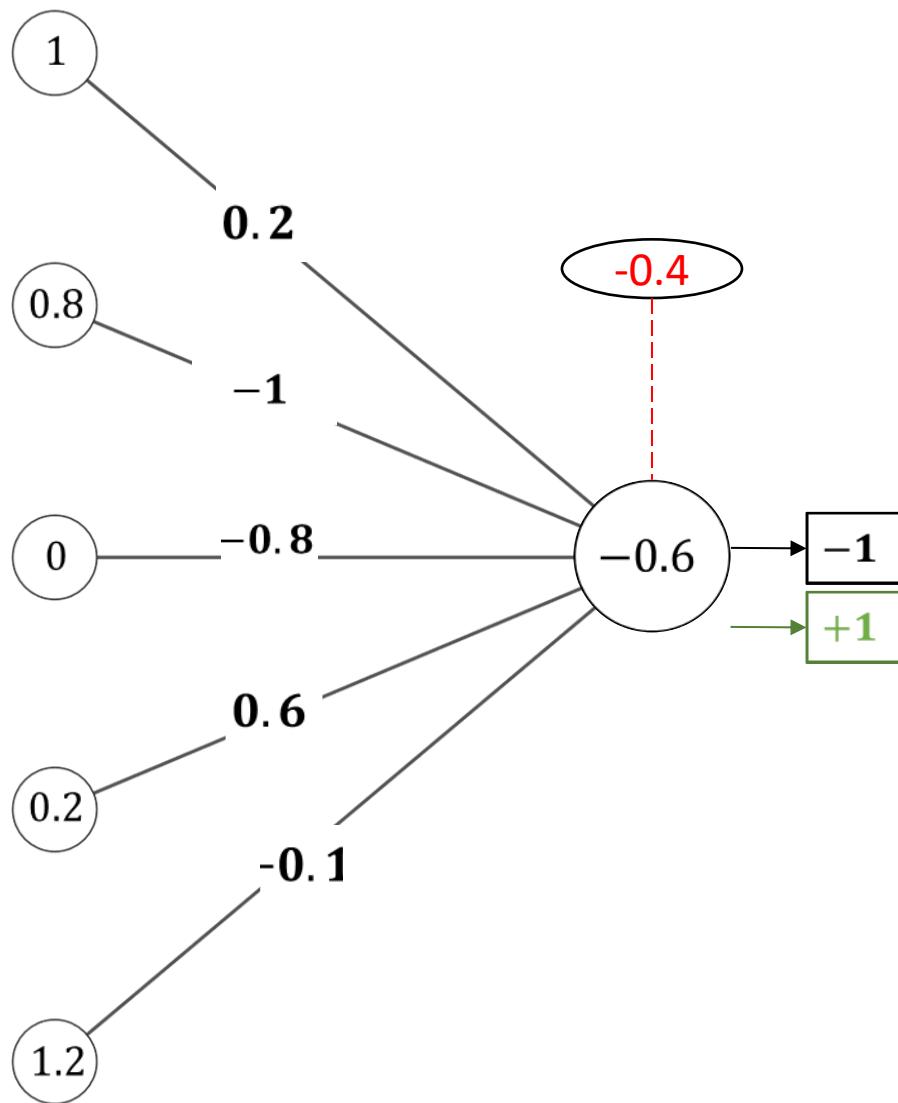
$$\begin{aligned}w_{2,new} &= w_{2,old} + \alpha \cdot \text{Errore} \cdot x_2 \\&= -1 + 0.1 \cdot (+2) \cdot 0.8 = -0.84\end{aligned}$$

$$\begin{aligned}w_{3,new} &= w_{3,old} + \alpha \cdot \text{Errore} \cdot x_3 \\&= -0.8 + 0.1 \cdot (+2) \cdot 0 = -0.8\end{aligned}$$

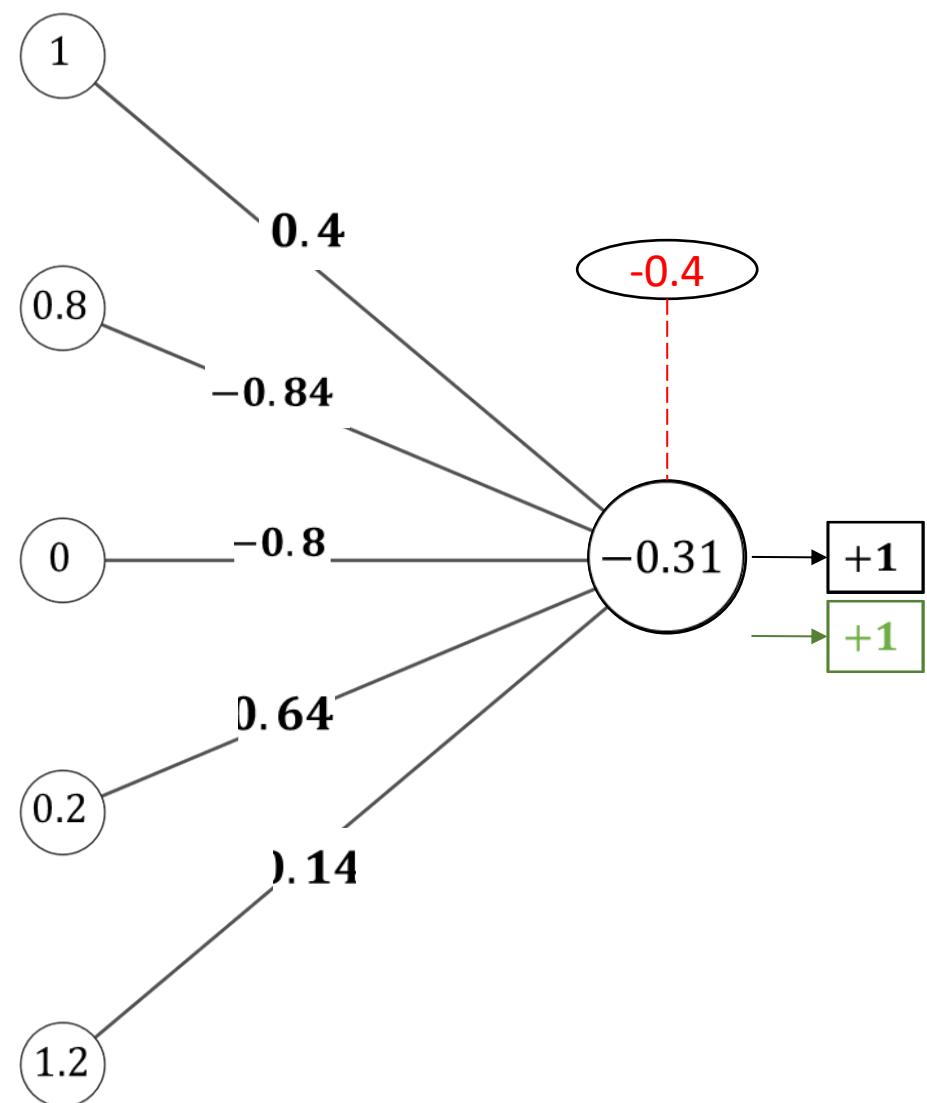
$$\begin{aligned}w_{4,new} &= w_{4,old} + \alpha \cdot \text{Errore} \cdot x_4 \\&= 0.6 + 0.1 \cdot (+2) \cdot 0.2 = 0.64\end{aligned}$$

$$\begin{aligned}w_{5,new} &= w_{5,old} + \alpha \cdot \text{Errore} \cdot x_5 \\&= -0.1 + 0.1 \cdot (+2) \cdot 1.2 = 0.14\end{aligned}$$

Prima

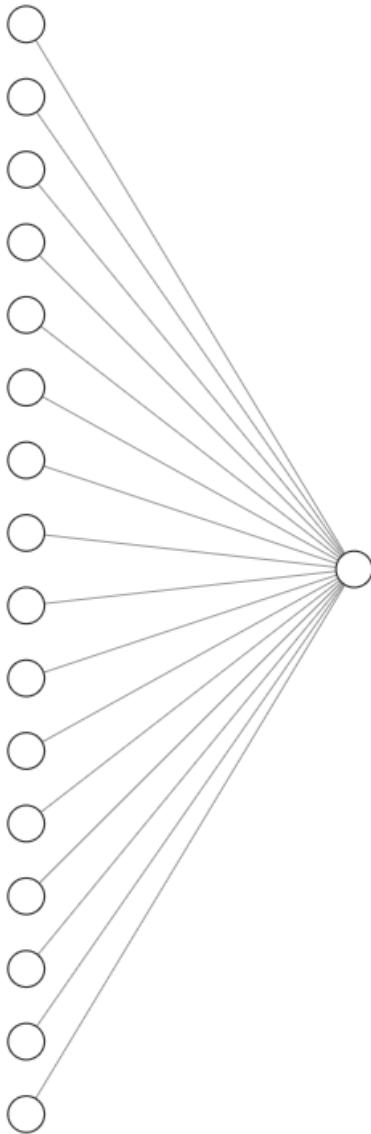


Dopo Allenamento

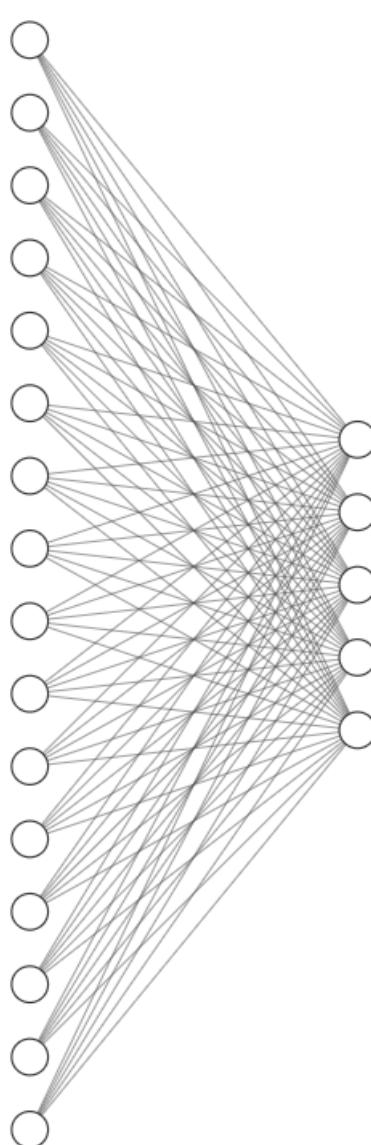


Increasing Complexity

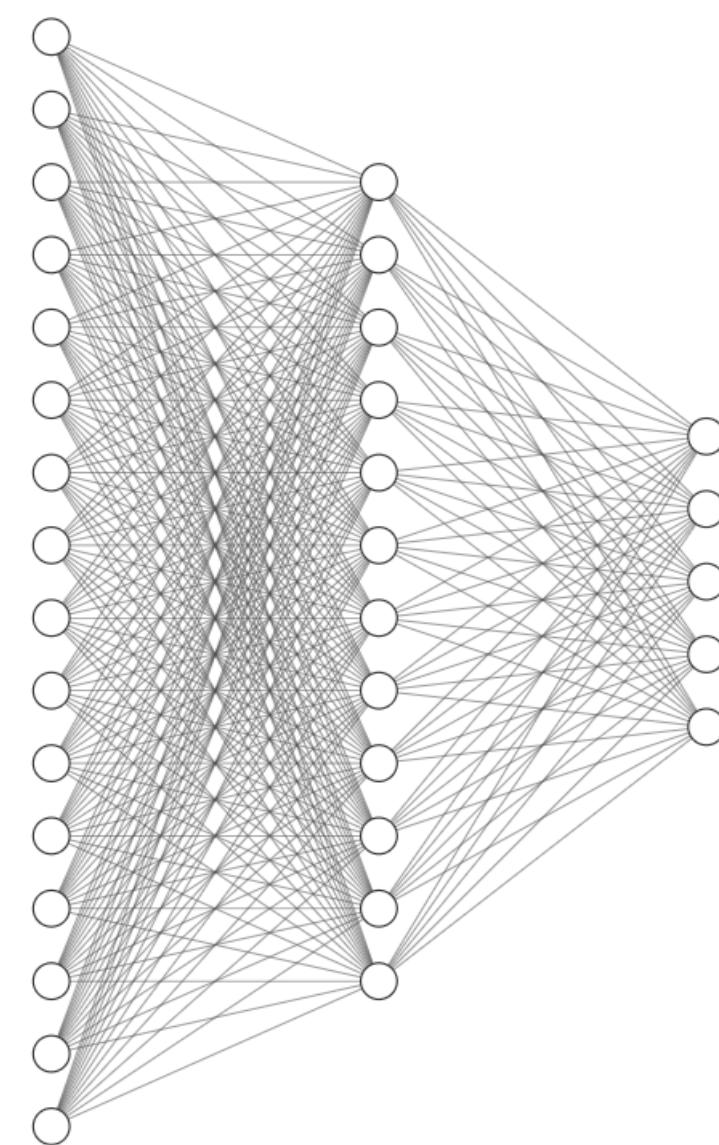
Perceptron



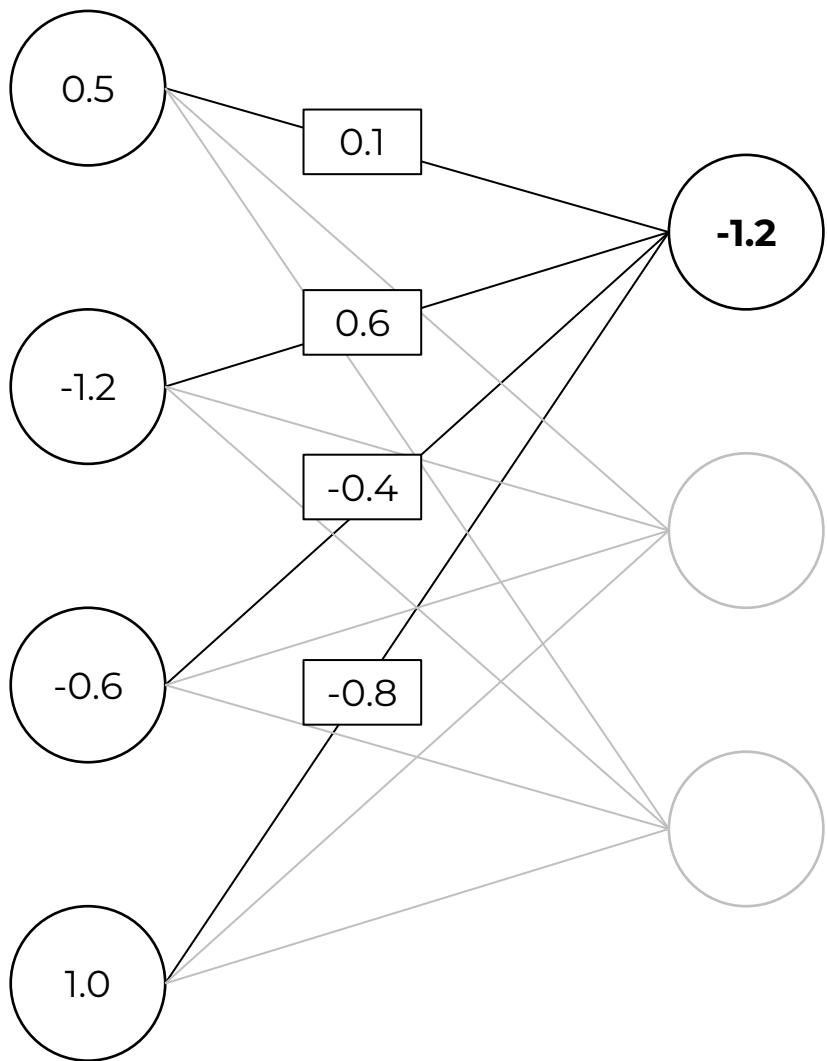
Multi-Perceptron



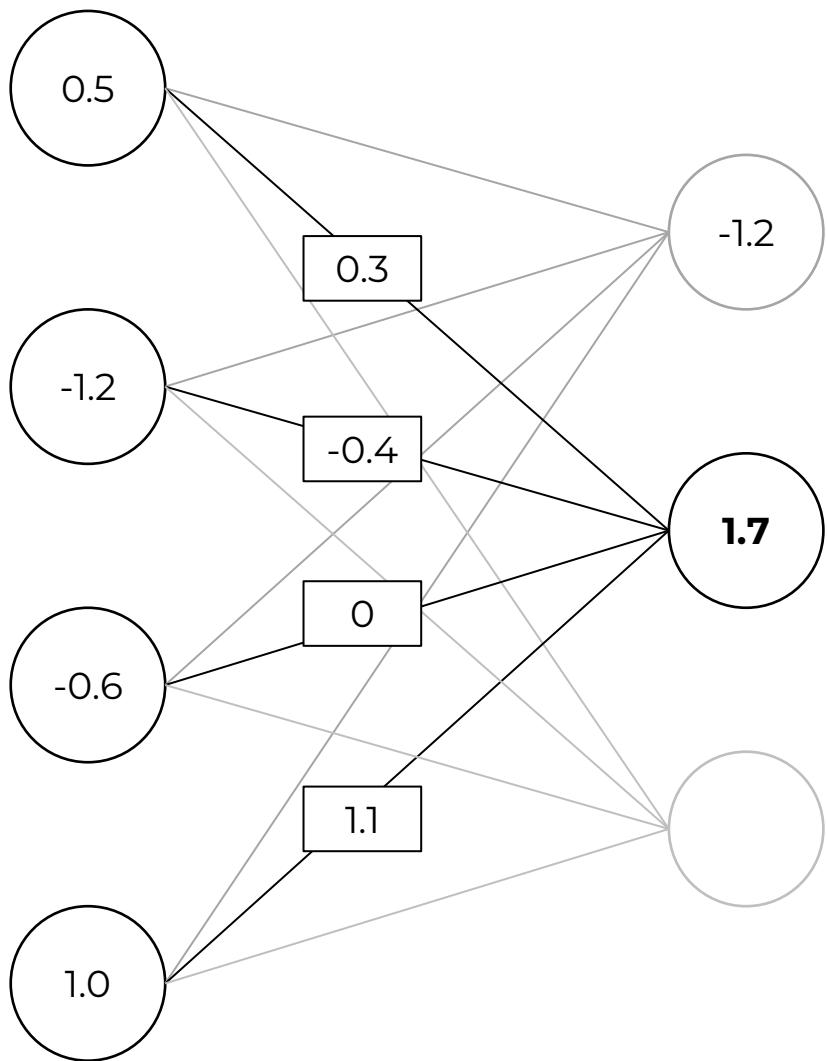
Multi-Layer Perceptron



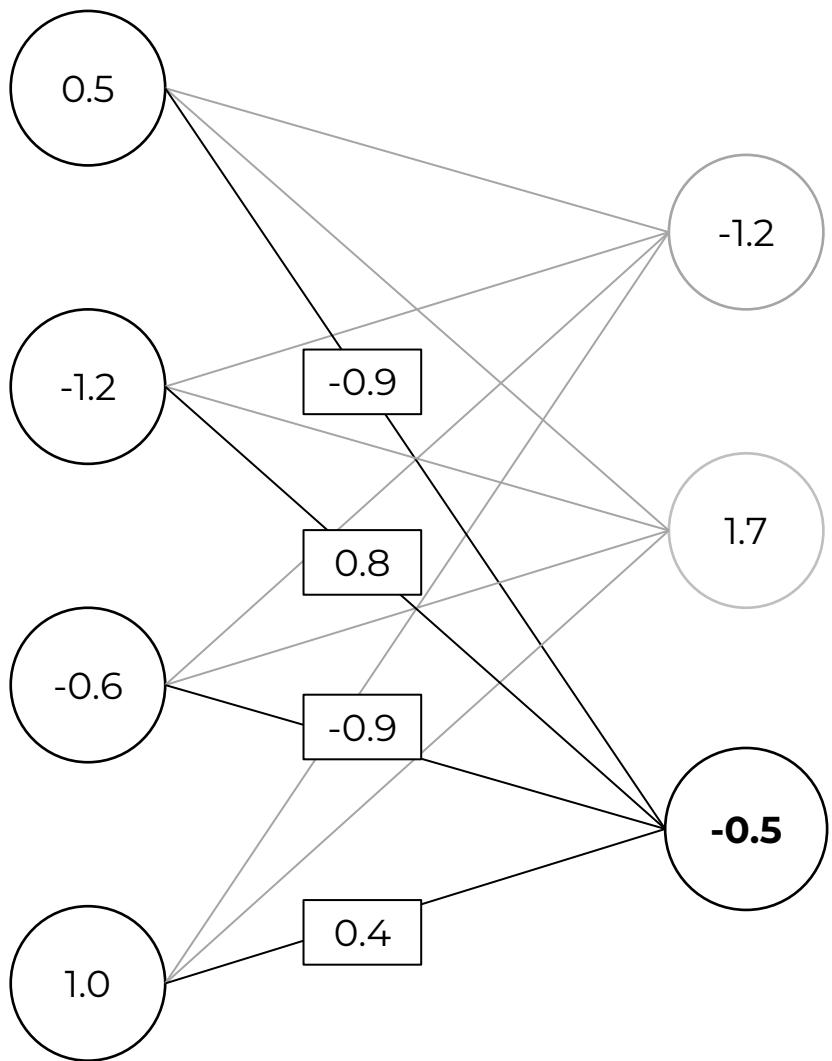
Multi-Layer Perceptron



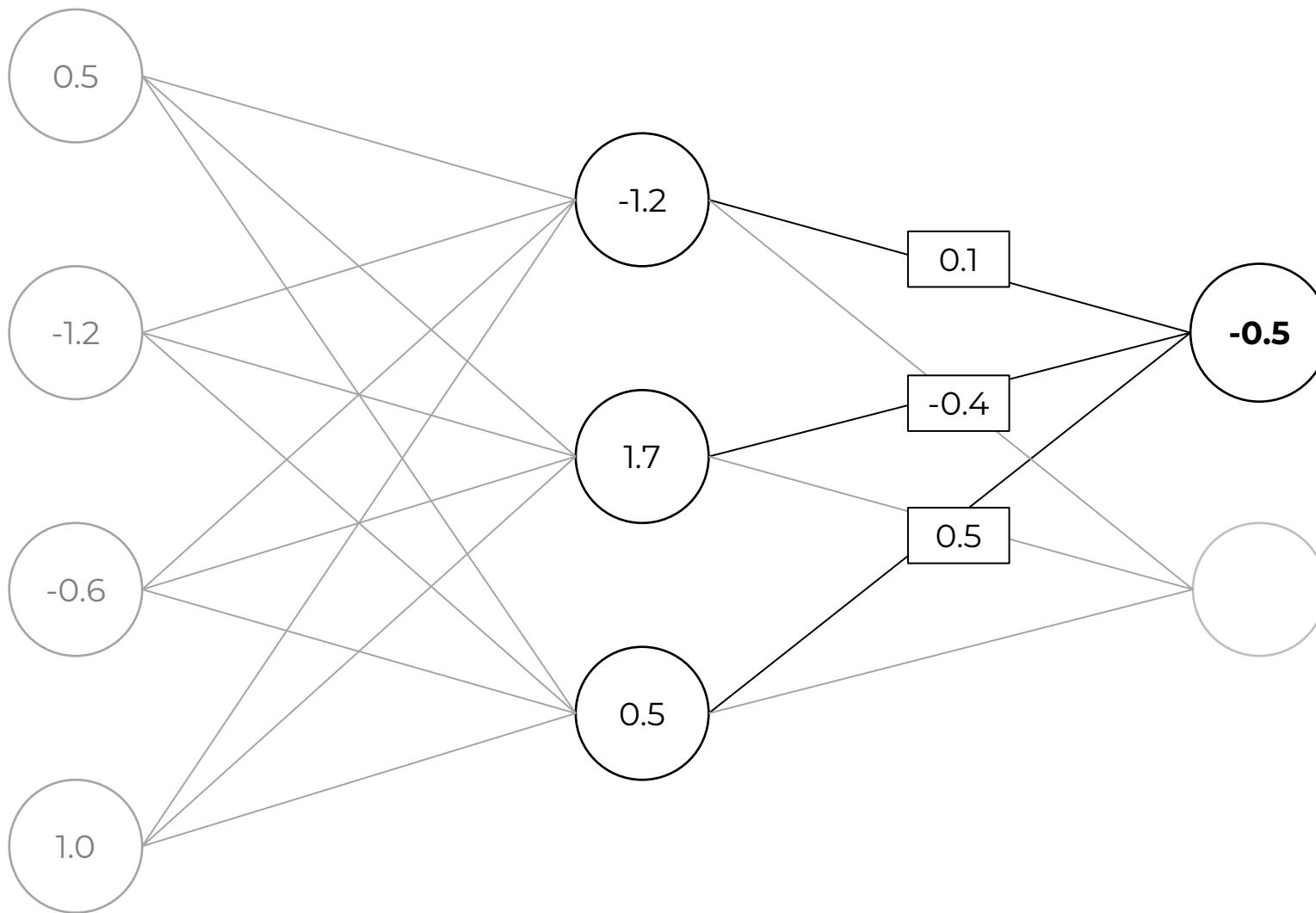
Multi-Layer Perceptron



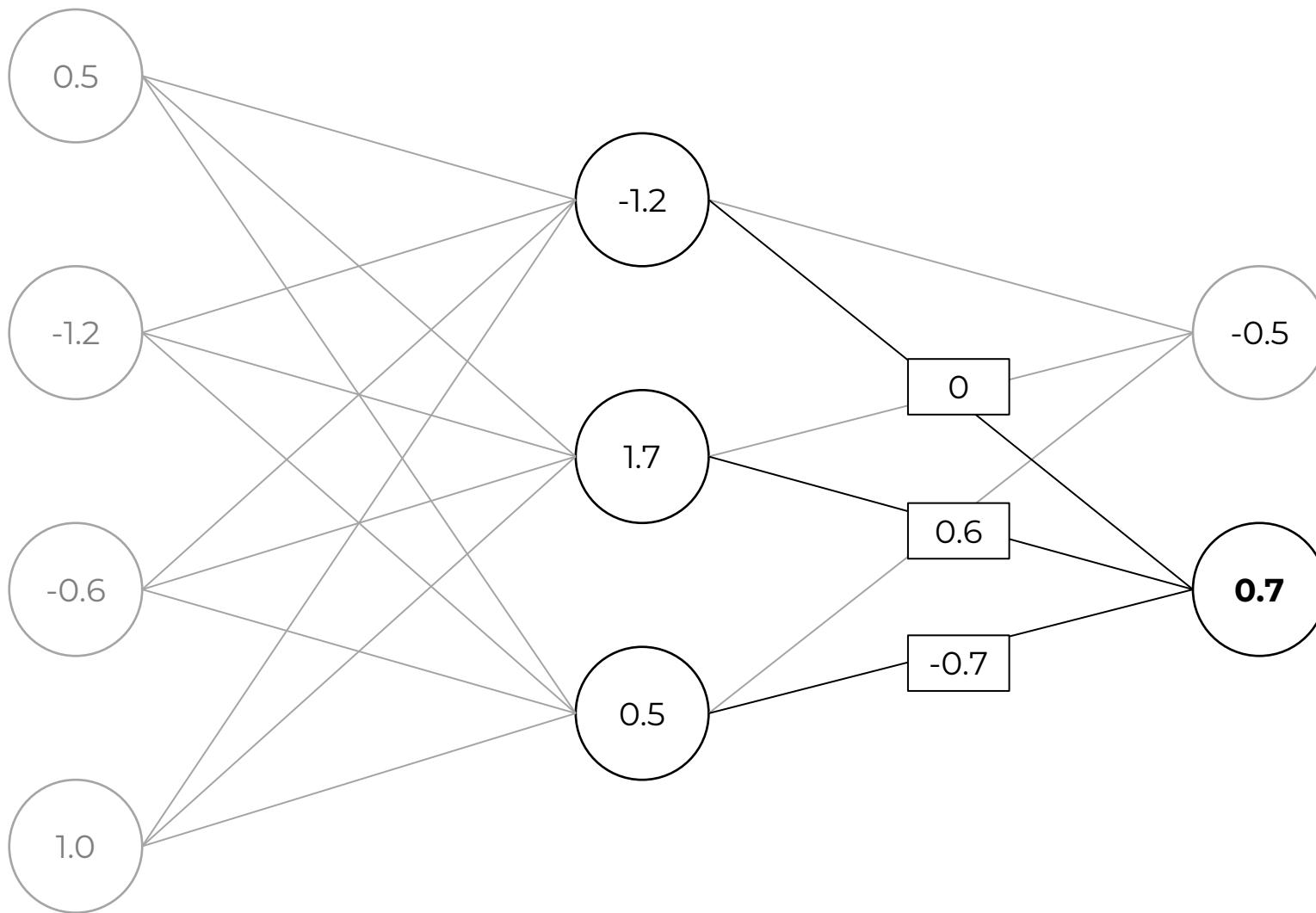
Multi-Layer Perceptron



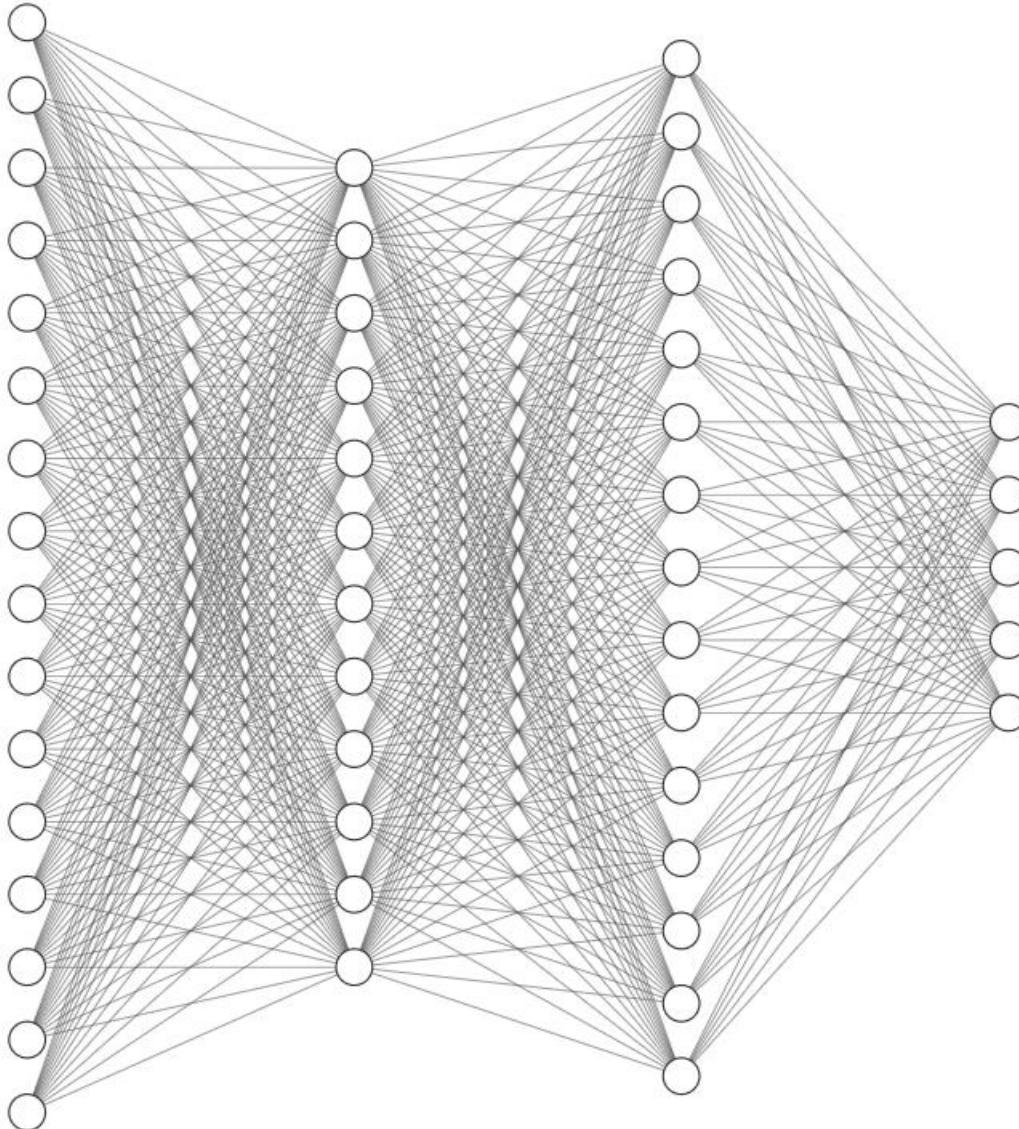
Multi-Layer Perceptron



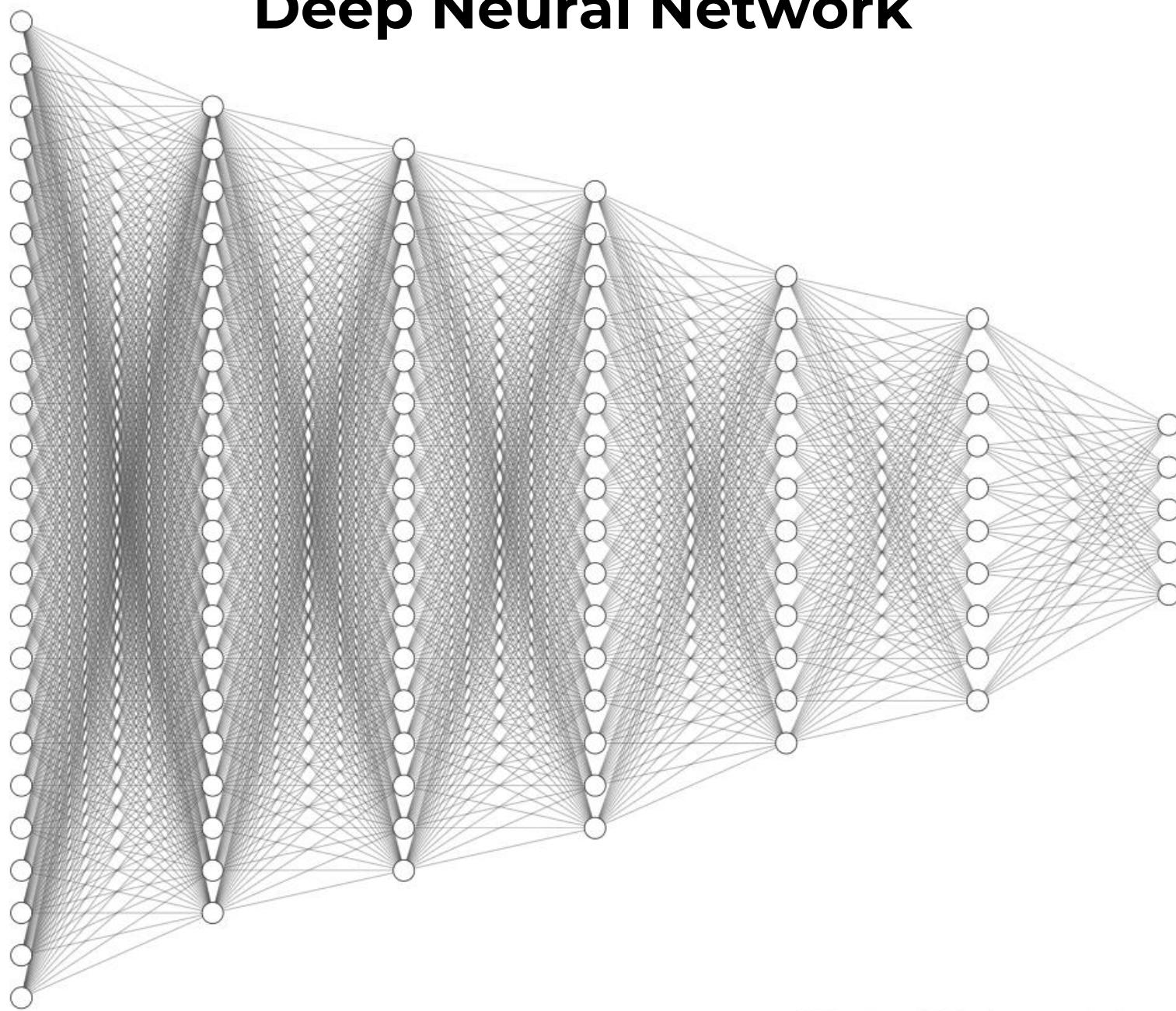
Multi-Layer Perceptron



Neural Network



Deep Neural Network



Data Quality

A vibrant, abstract painting in the style of Auguste Macke. It features stylized trees with thick, expressive trunks in various colors like green, blue, red, and yellow. The foliage is composed of large, rounded shapes in shades of green, blue, and pink. The background is filled with bright, warm colors such as orange, yellow, and red, creating a sense of light and atmosphere.

Münter

Matisse



Münter

Kirchner

Kirchner

Corrupt

A portrait painting of Leonardo da Vinci, showing his head and shoulders. He has dark hair and is looking slightly to the right. The background is a landscape with hills and water. Overlaid on the lower half of the portrait is a white rectangular box containing the text "Münter" in red and "Leonardo" in green.

Münter

Leonardo

<https://tinyurl.com/lindbergh2b>