



Class 1: Overview of Deep Learning

Understanding Key Concepts, Terms, and Applications

Instructor: Mejbah Ahammad



Introduction to Deep Learning

- Deep learning is a subset of **AI** that uses **neural networks** with many layers to **learn complex patterns**.
- Enables advancements in **image recognition, speech processing, and autonomous systems.**
- Google Translate, Chatbots, Self-driving Cars.

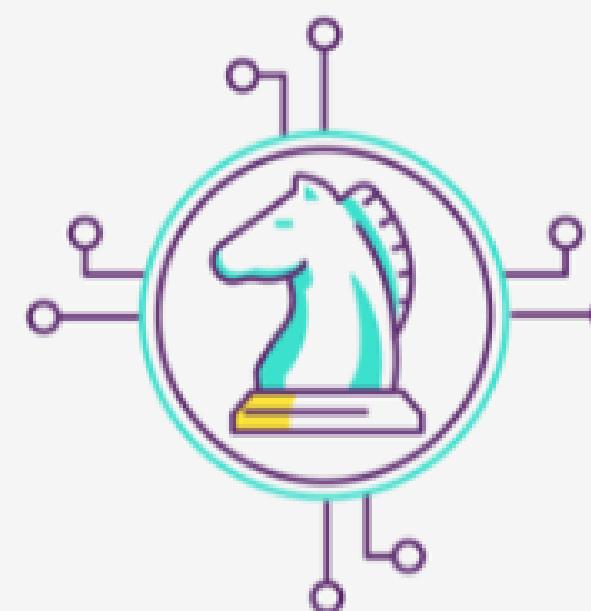




Introduction to Deep Learning

- **Artificial Intelligence**

Early artificial intelligence stirs excitement



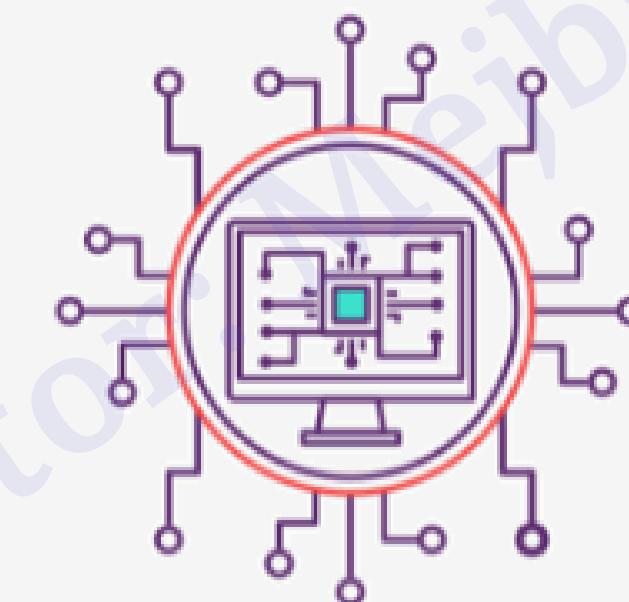
1950's

1960's

1970's

- **Machine Learning**

Machine learning begins to flourish



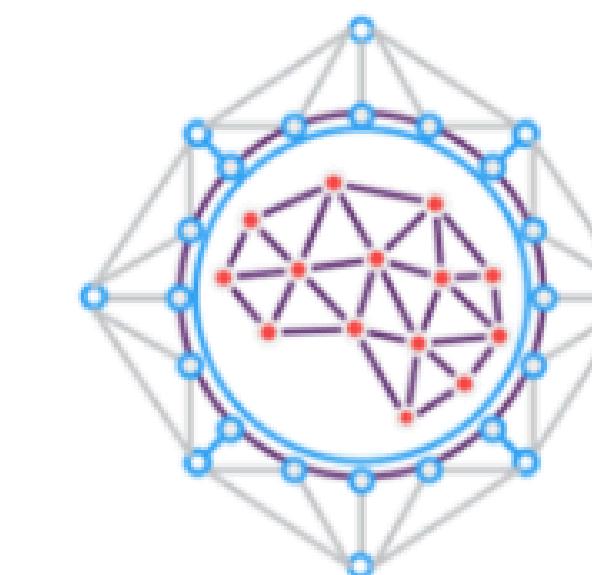
1980's

1990's

2000's

- **Deep Learning**

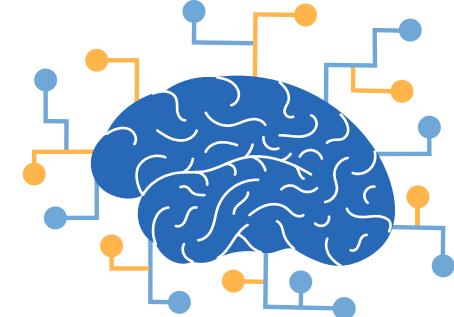
Deep learning breakthroughs drive AI boom



2010's

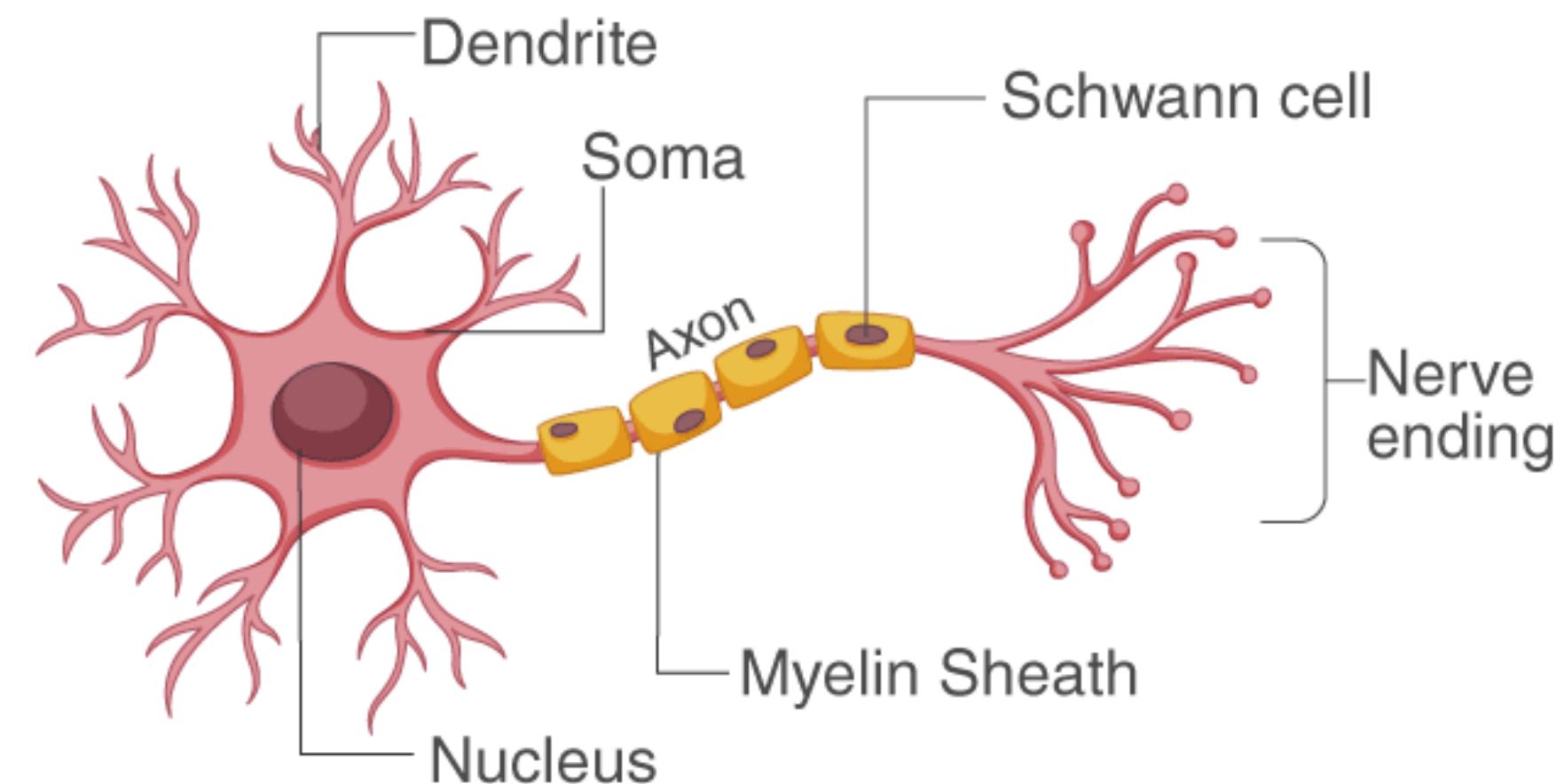
2020's

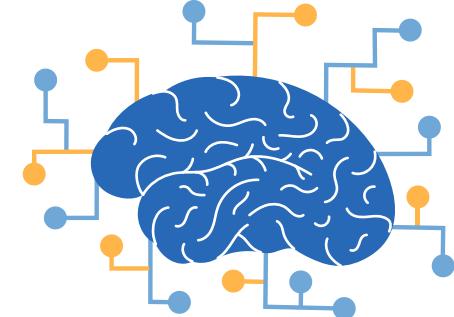
2030's



What Are Neurons?

STRUCTURE OF NEURON





What Are Neural Networks?

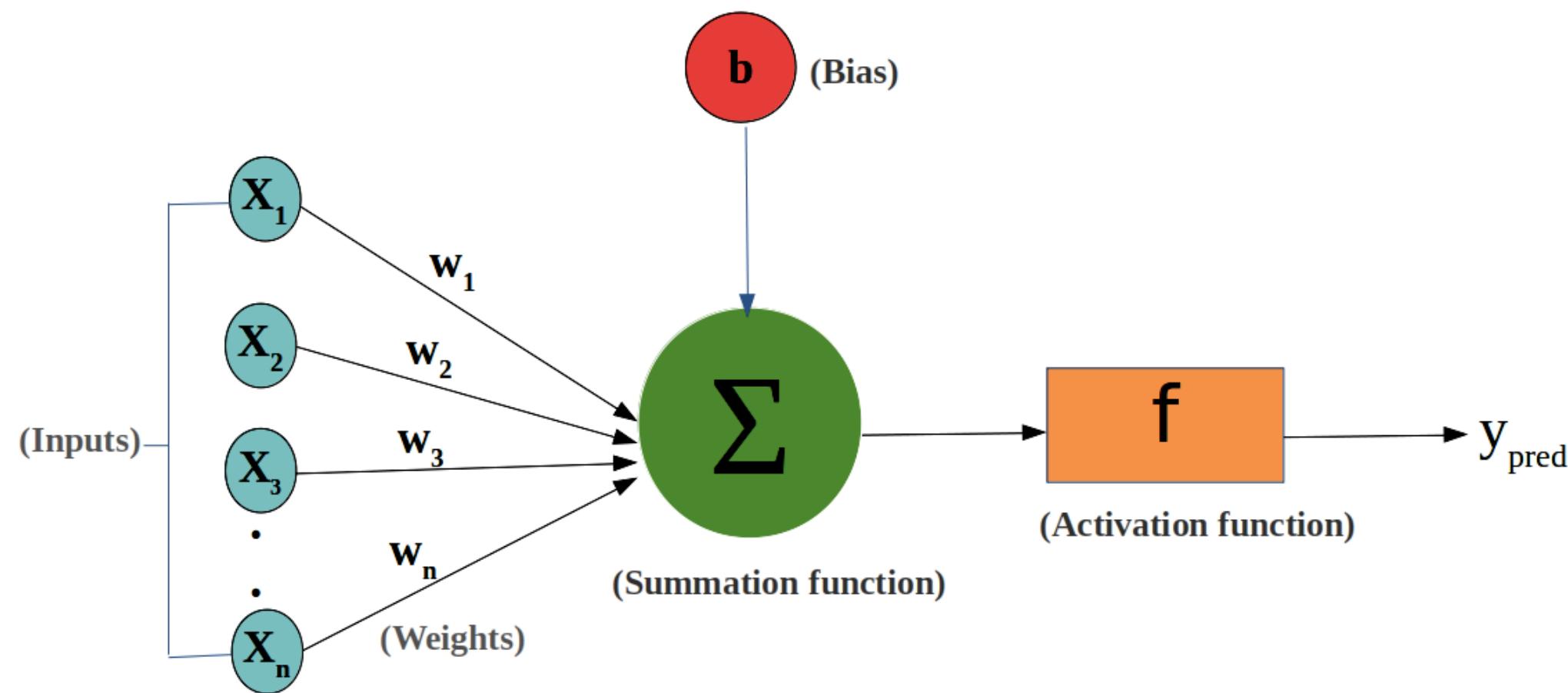
- Neural networks are the **building blocks** of deep learning.
- Composed of interconnected nodes (neurons) organized in layers.

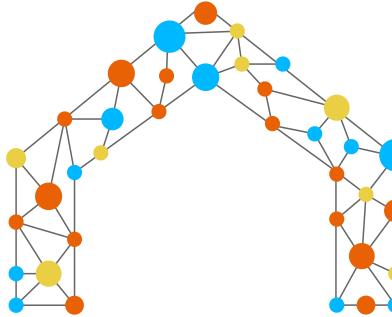




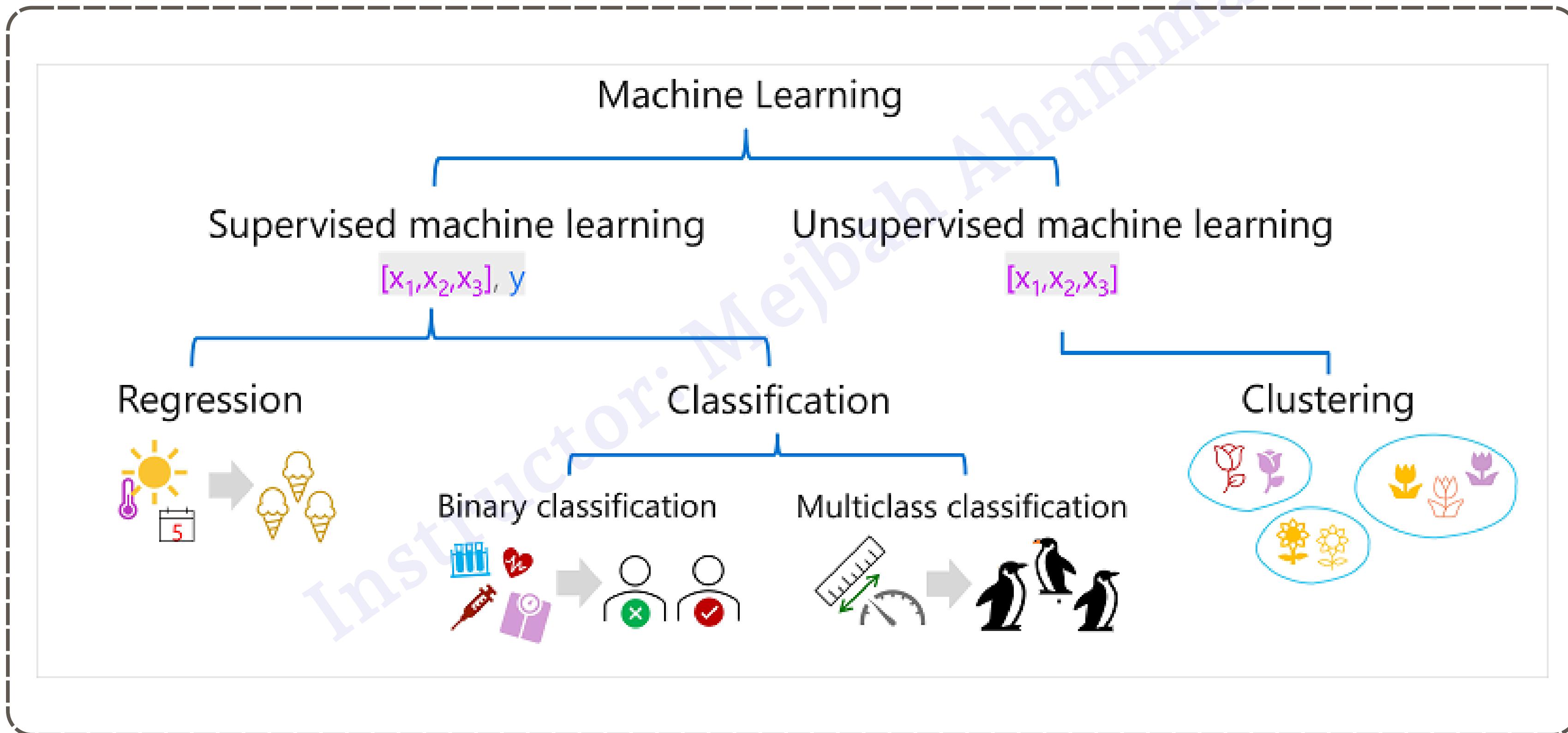
What Are Neural Networks?

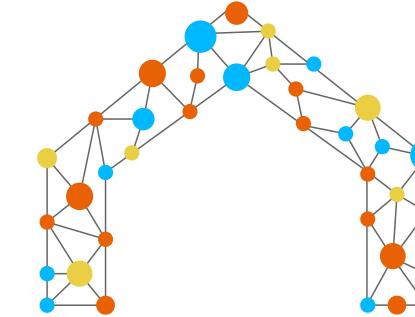
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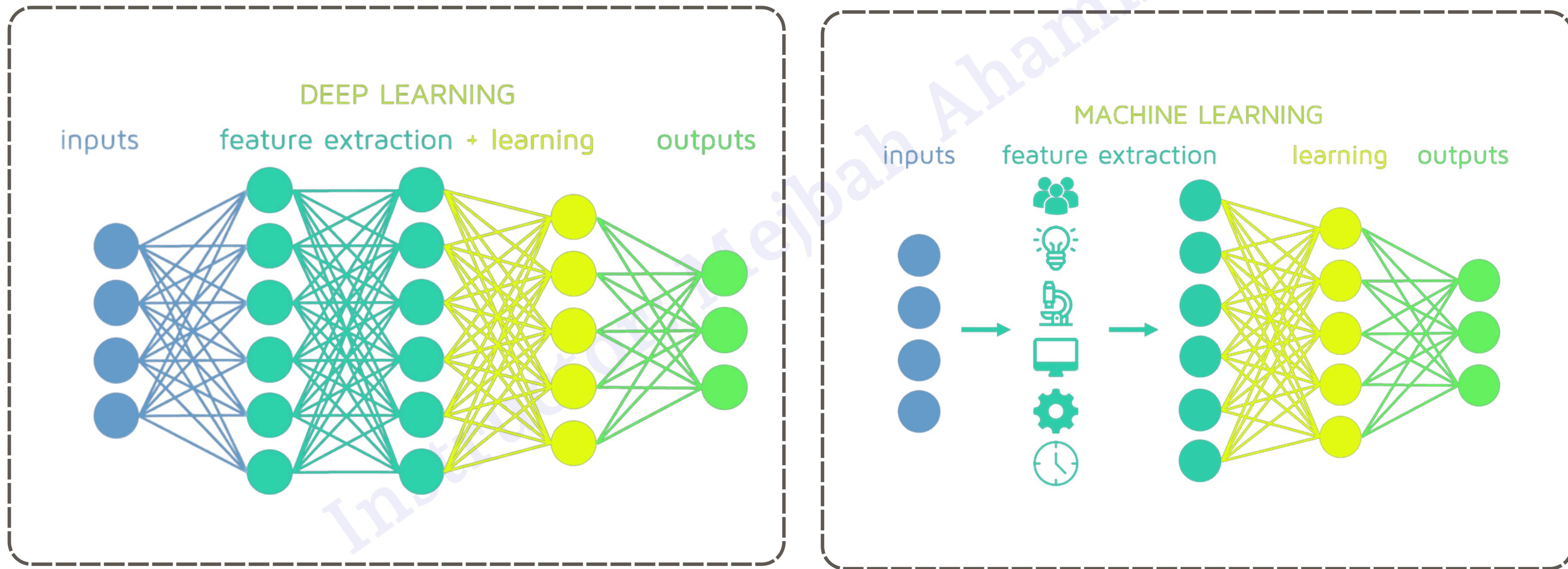


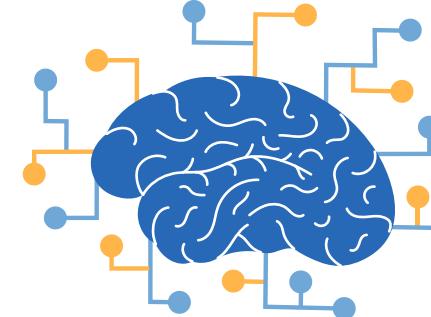
Structure of Neural Networks



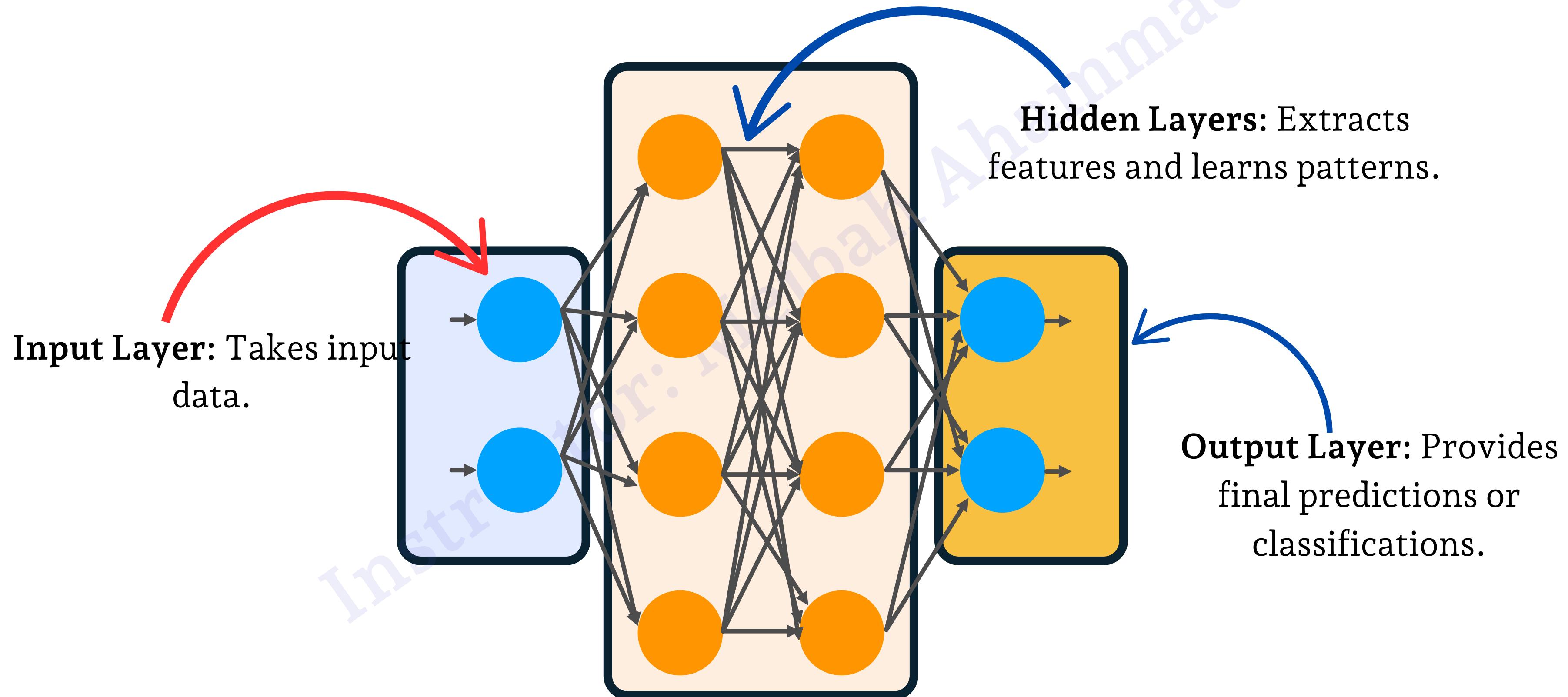


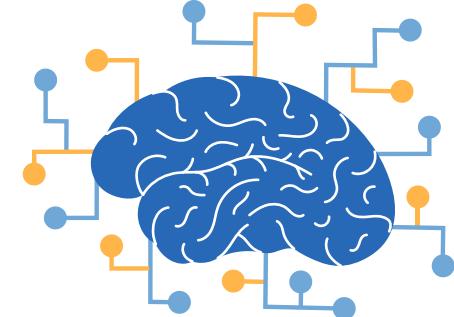
Deep Learning and Machine learning



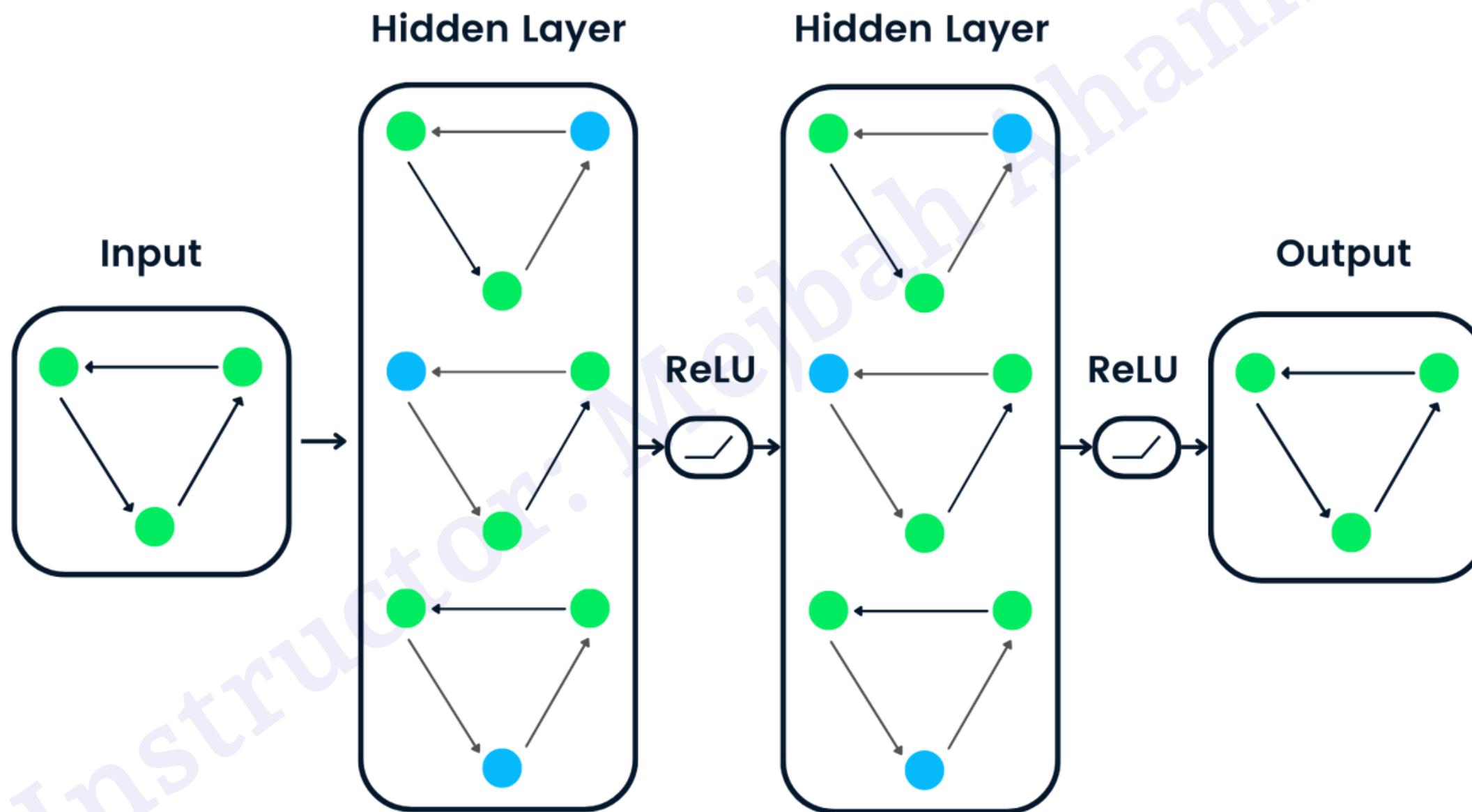


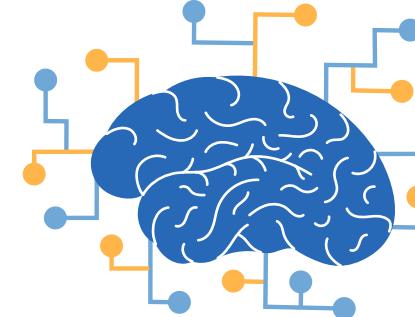
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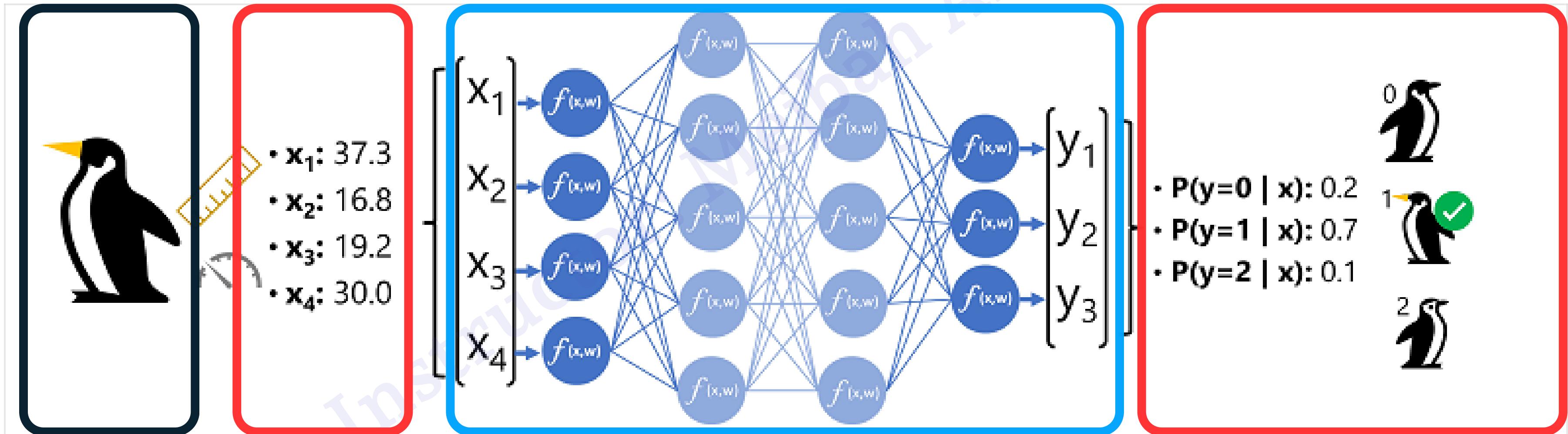


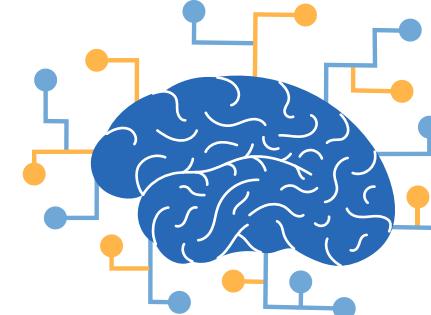
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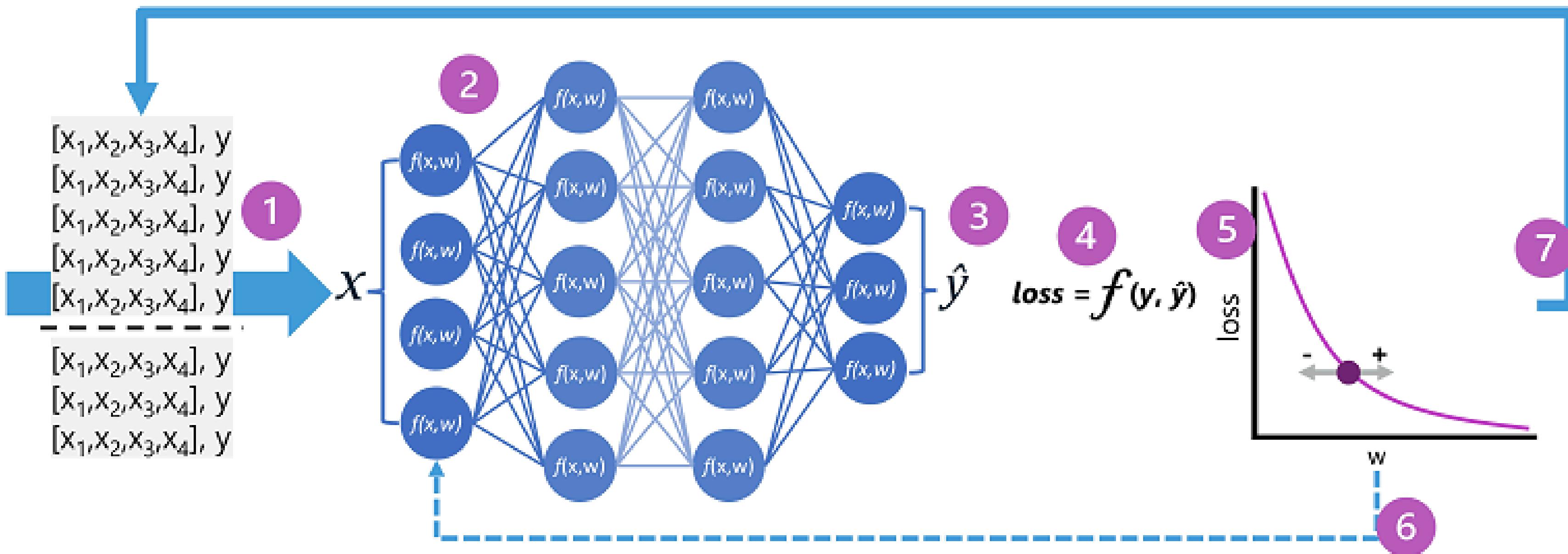


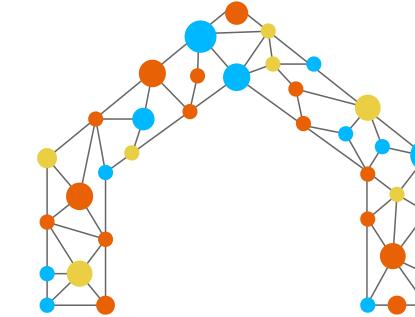
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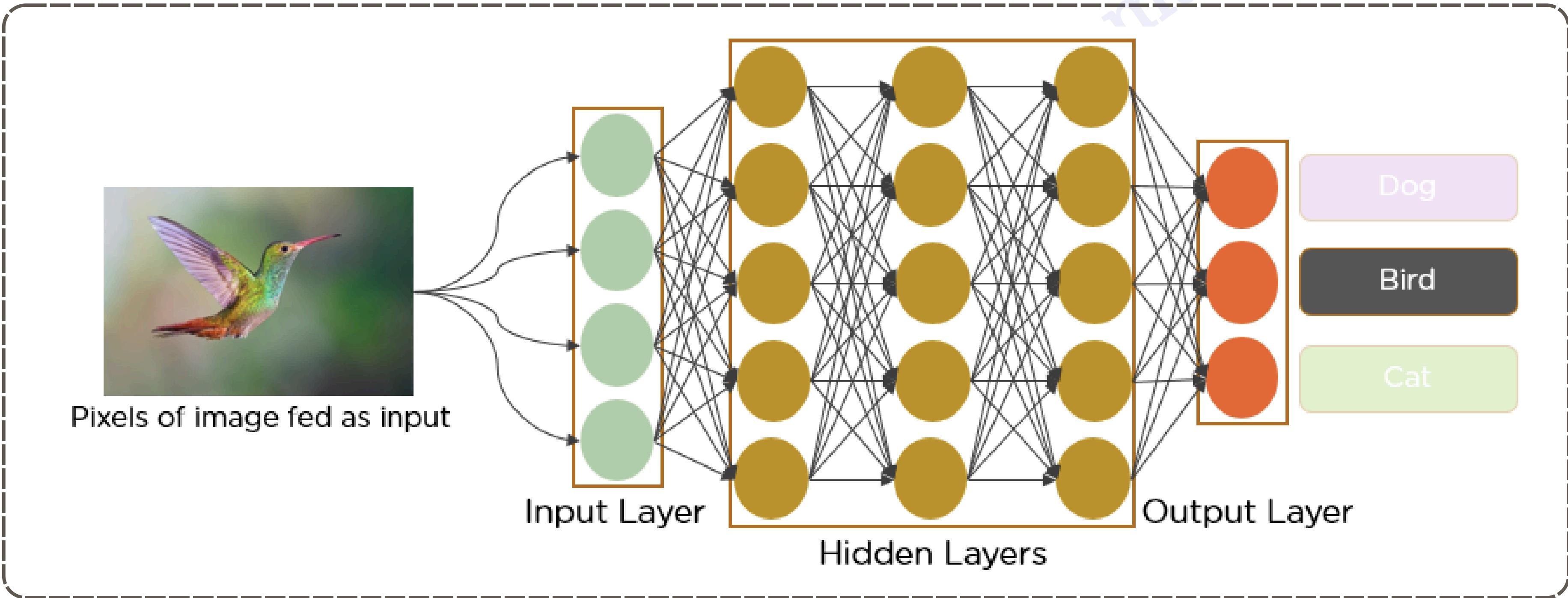


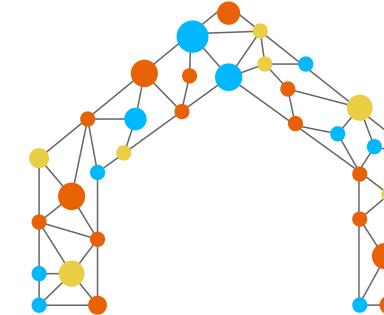
What Are Neural Networks?





Structure of Neural Networks



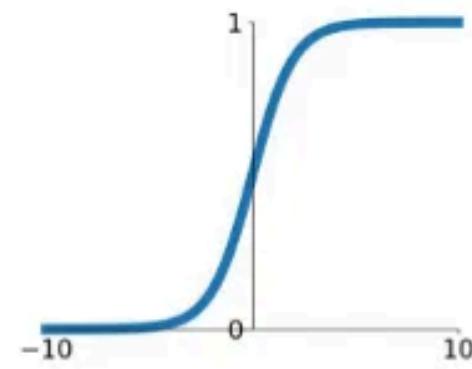


Key Activation Functions

Activation Functions

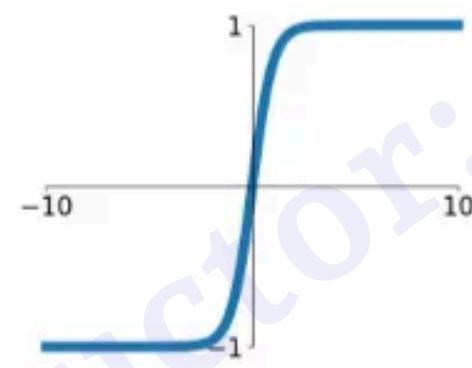
Sigmoid

$$\sigma(x) = \frac{1}{1+e^{-x}}$$



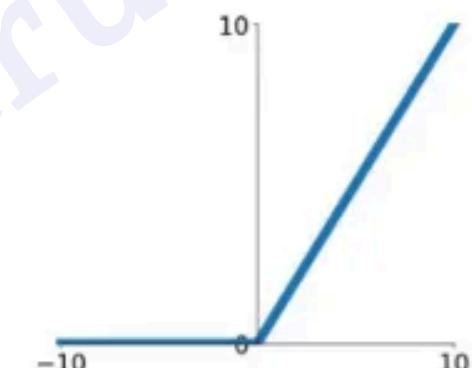
tanh

$$\tanh(x)$$



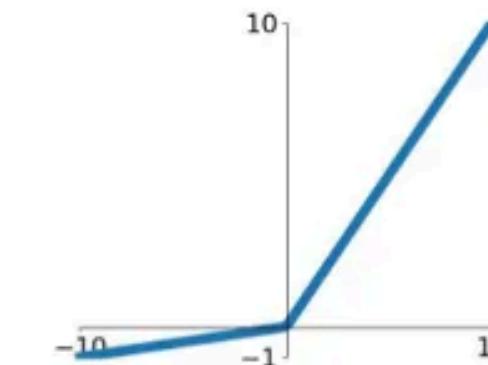
ReLU

$$\max(0, x)$$



Leaky ReLU

$$\max(0.1x, x)$$

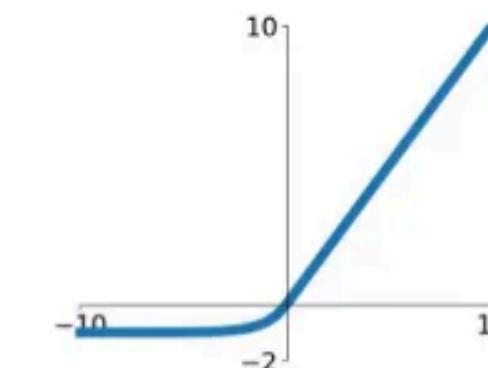


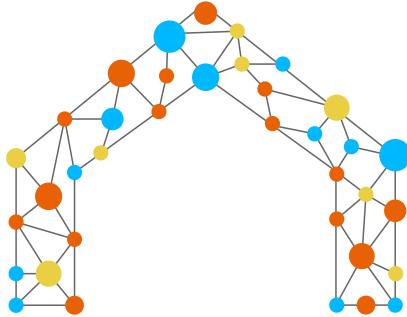
Maxout

$$\max(w_1^T x + b_1, w_2^T x + b_2)$$

ELU

$$\begin{cases} x & x \geq 0 \\ \alpha(e^x - 1) & x < 0 \end{cases}$$





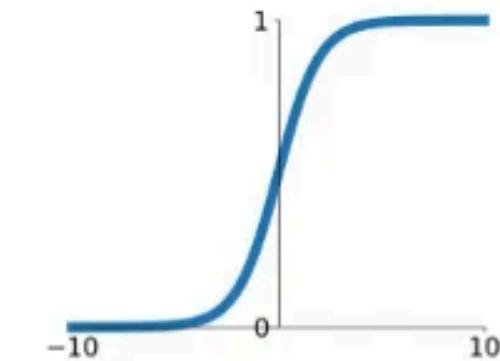
Key Activation Functions

- **Sigmoid:** Converts values to range [0, 1], suitable for binary classification.
- **Tanh (Hyperbolic Tangent):** Scales values between [-1, 1], offering better gradients.
- **ReLU (Rectified Linear Unit):** Outputs 0 for negative inputs and linear values for positive inputs, addressing vanishing gradient issues.

Activation Functions

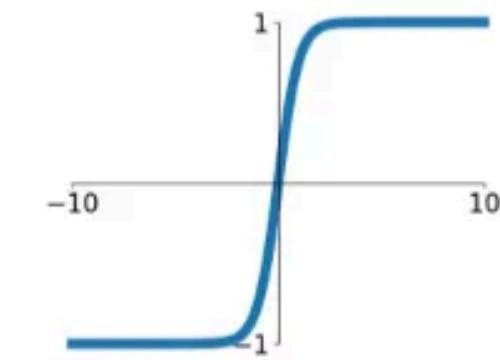
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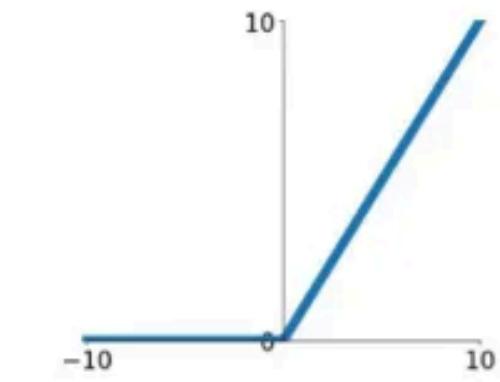
tanh

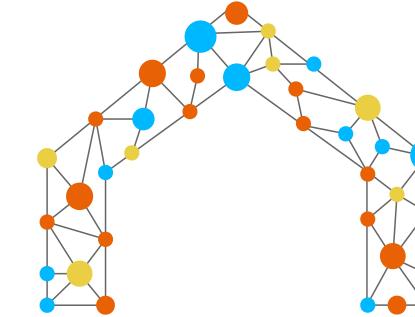
$$\tanh(x)$$



ReLU

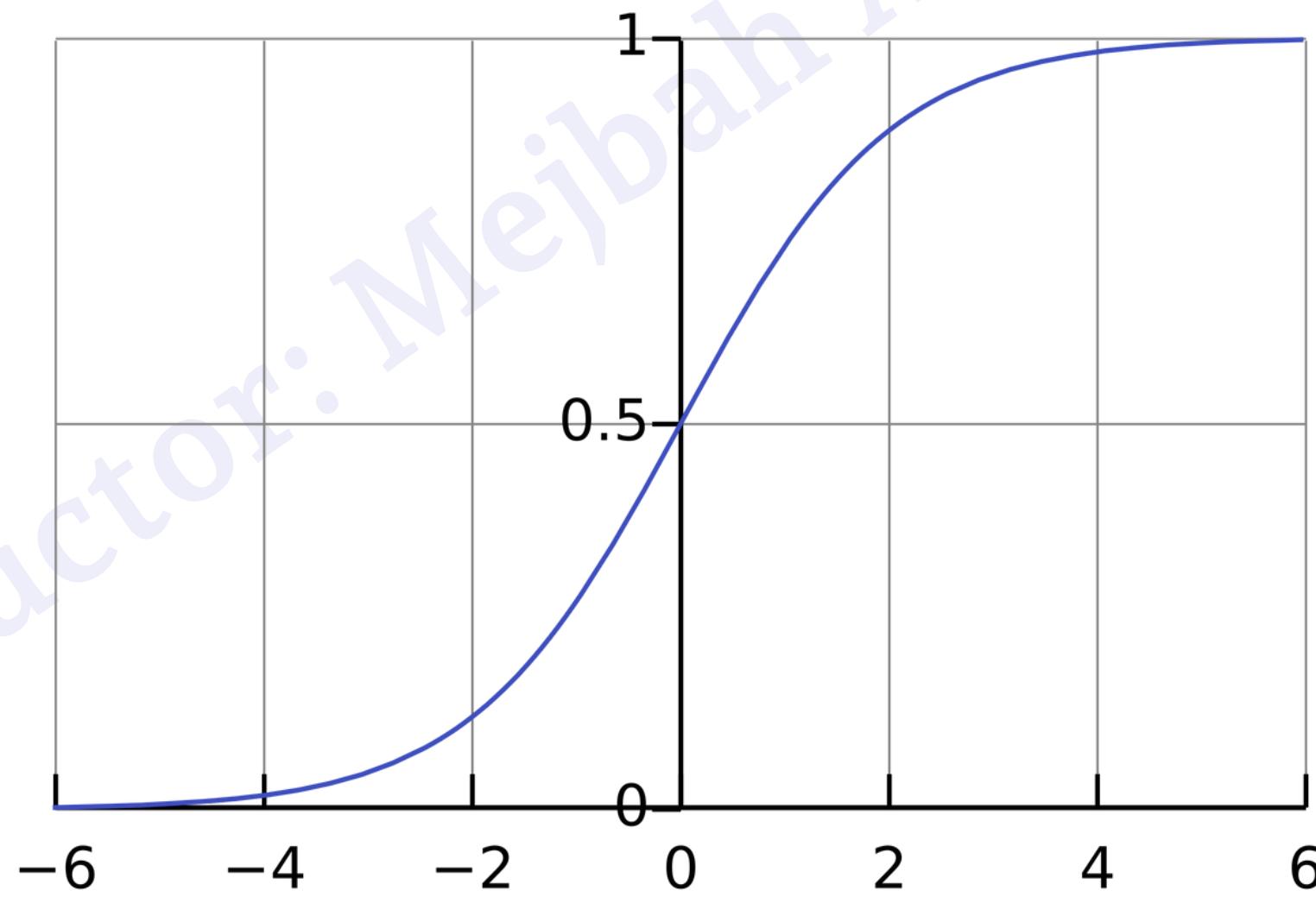
$$\max(0, x)$$

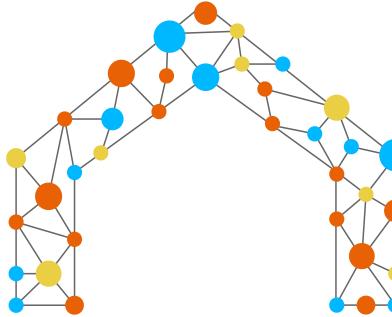




Key Activation Functions

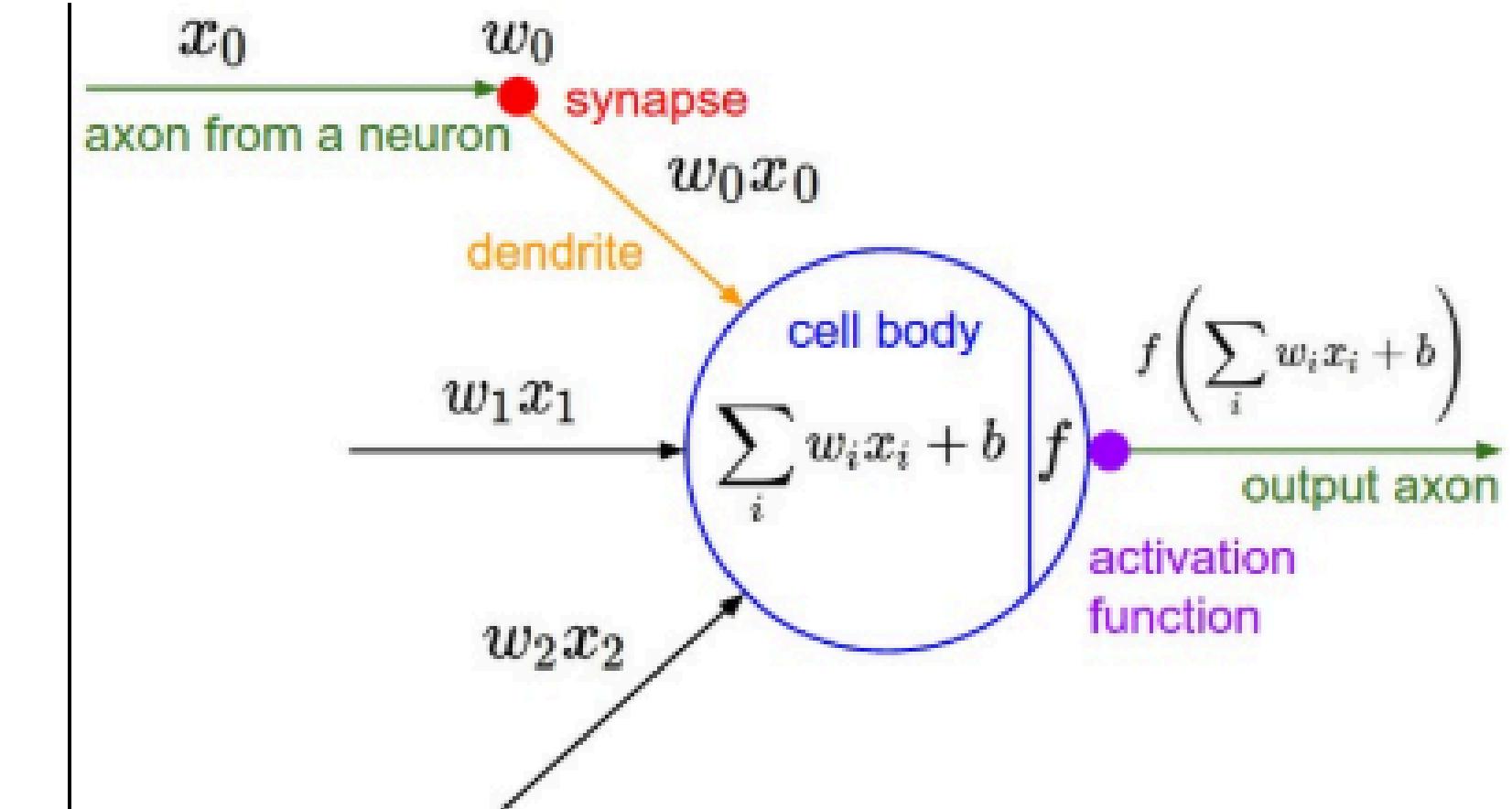
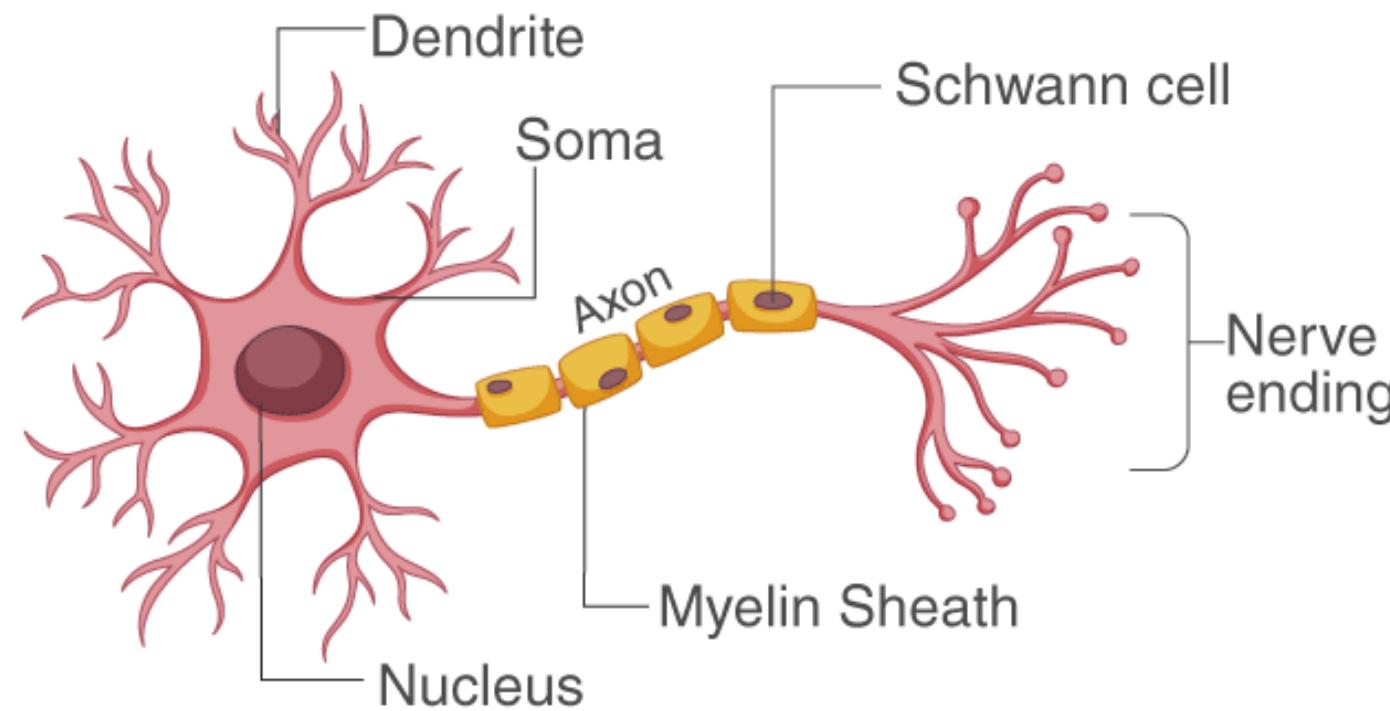
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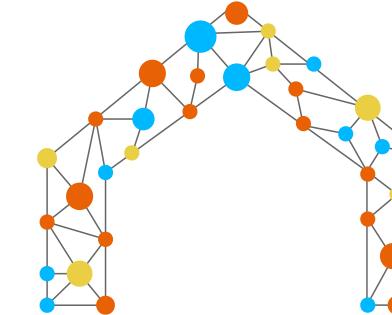




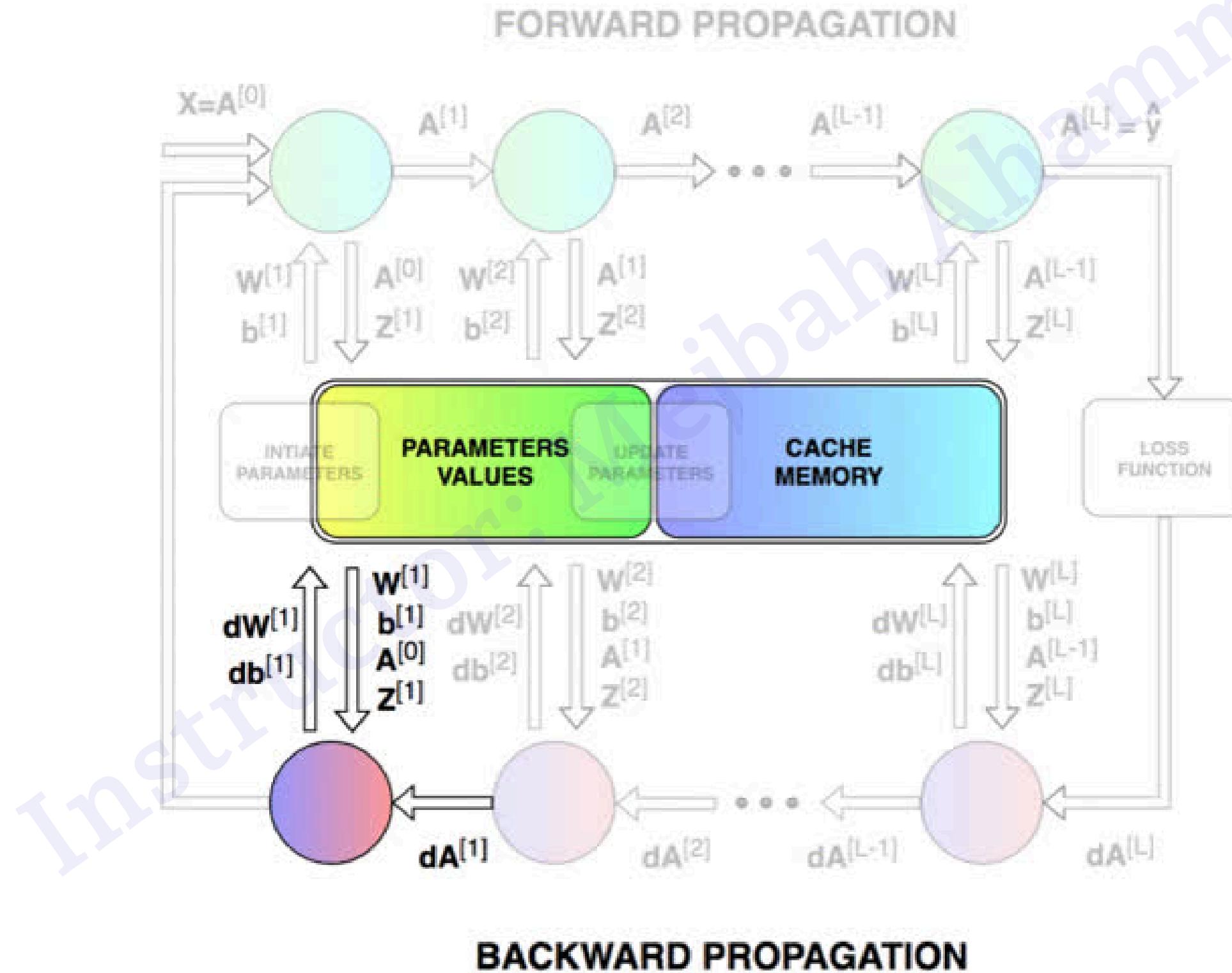
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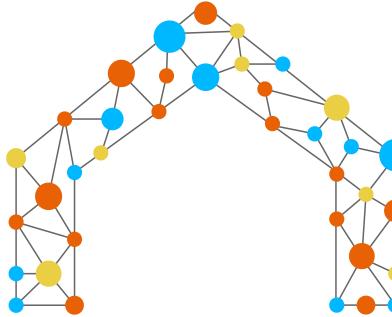
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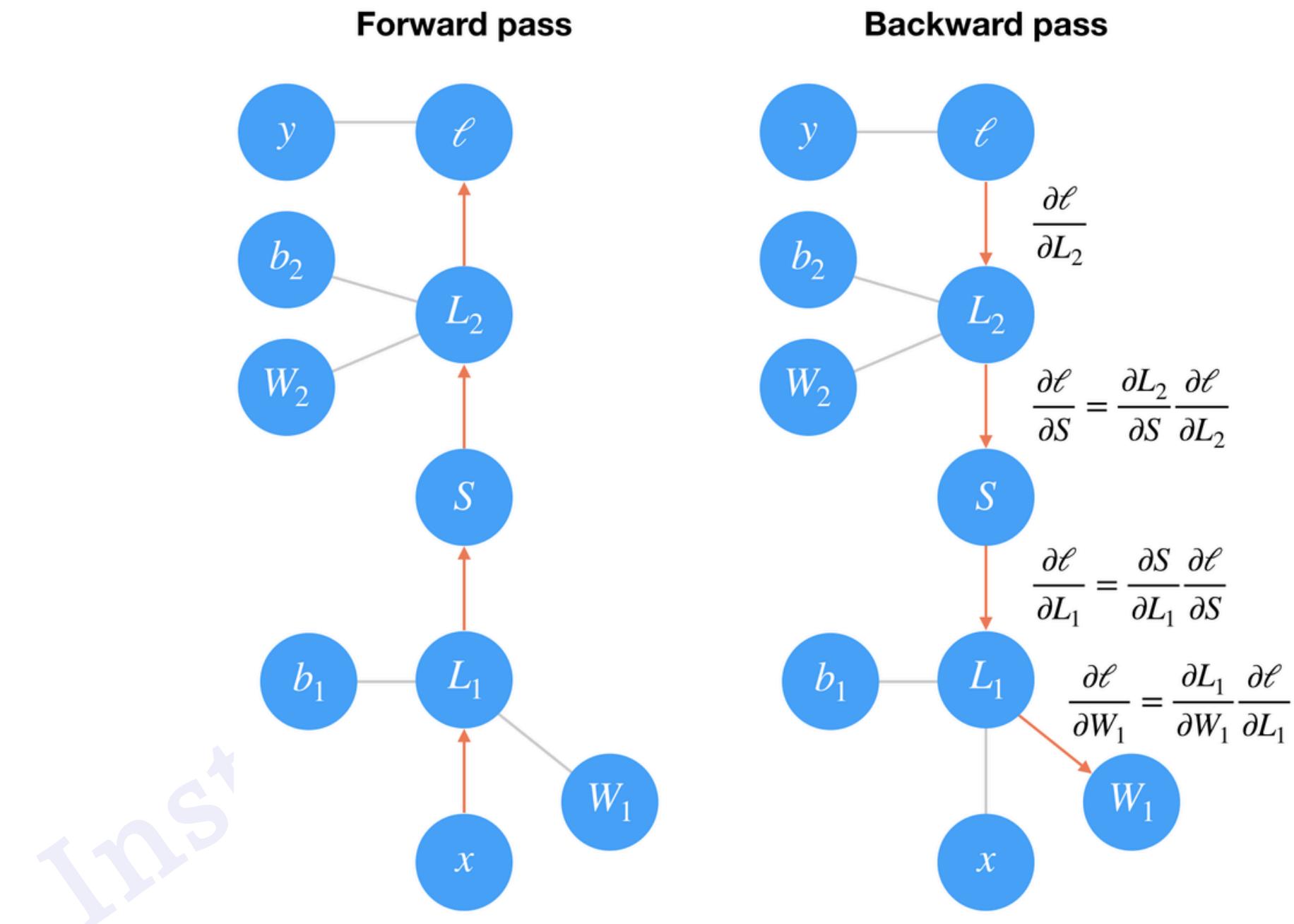


Forward Propagation





Forward Pass and Backward Pass





THANK YOU

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