Introduction to Deep Learning

Video 3: Neuron Know-How

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In air

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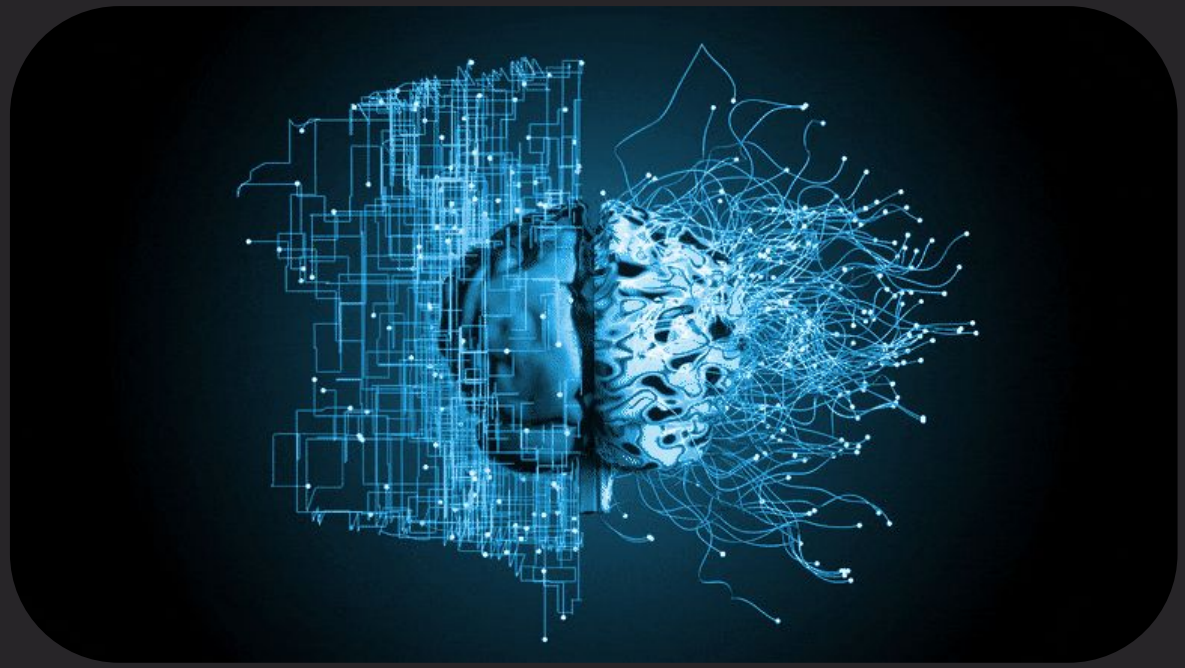
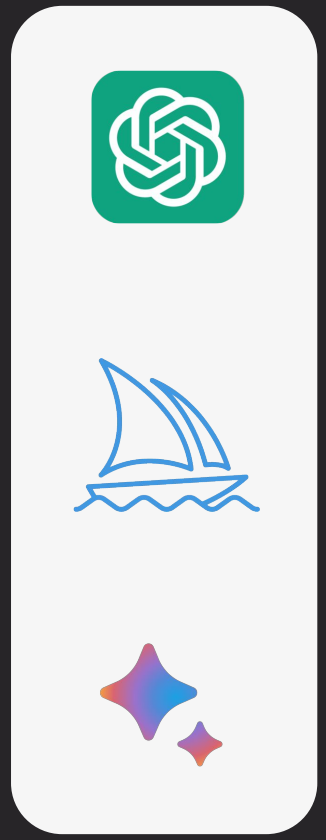
Introduction

Aim: To create systems that learn and make decisions, akin to the human brain.

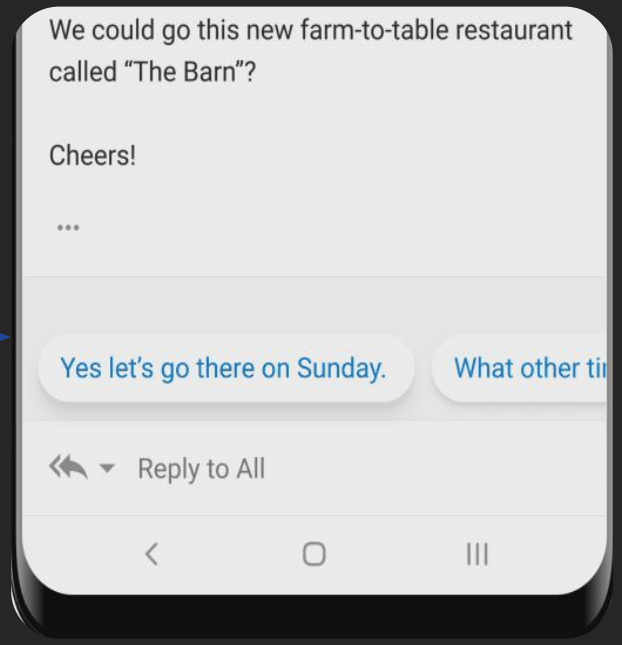


Generative AI



Generative AI Tools

Prompt



Result

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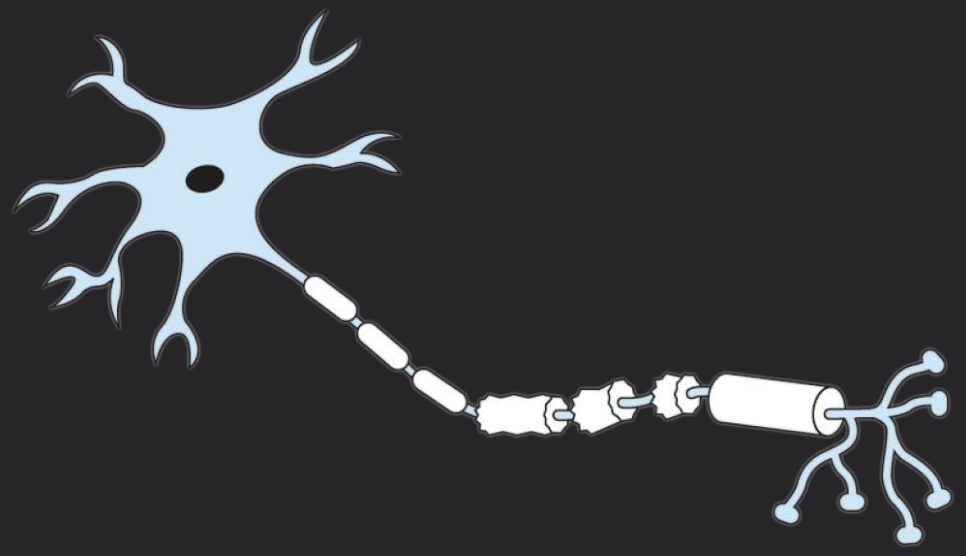
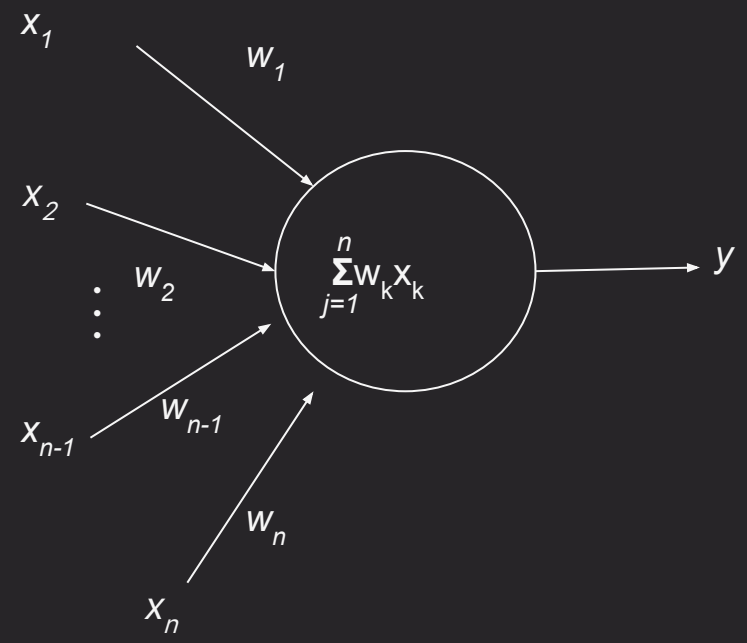
Neurons

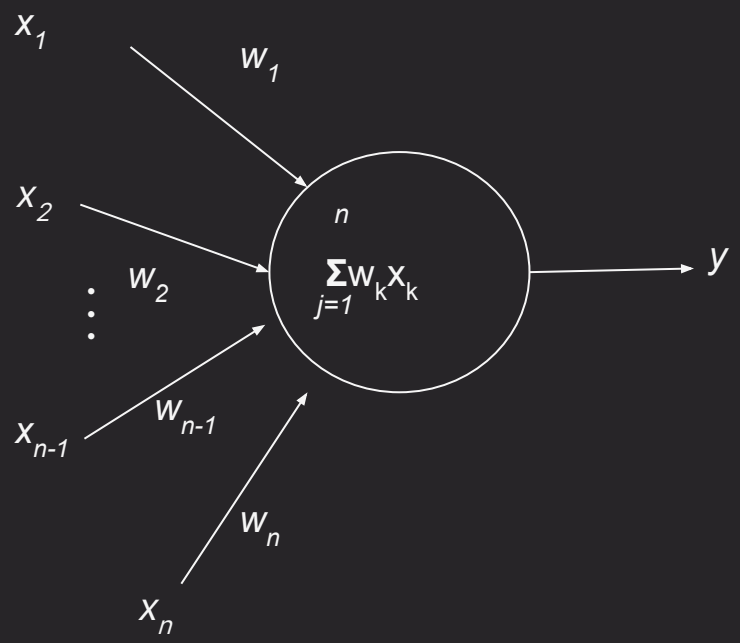


Human Neuron



Artificial Neuron

Neurons



Neurons: Mathematical Functions

It is simplest type of artificial neural network.

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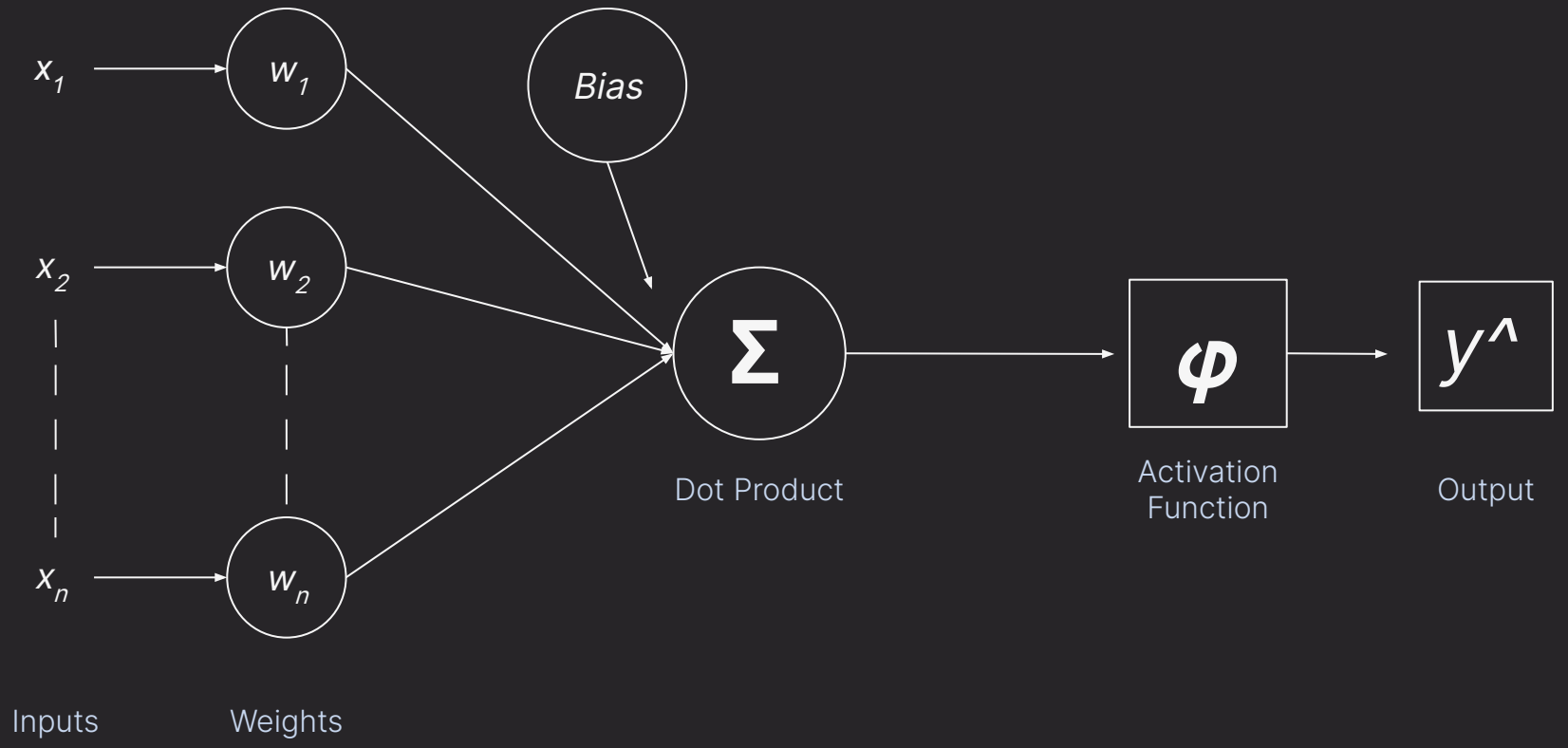
Components of a Neuron



Components of a Neuron

Should I go for a jog or not?

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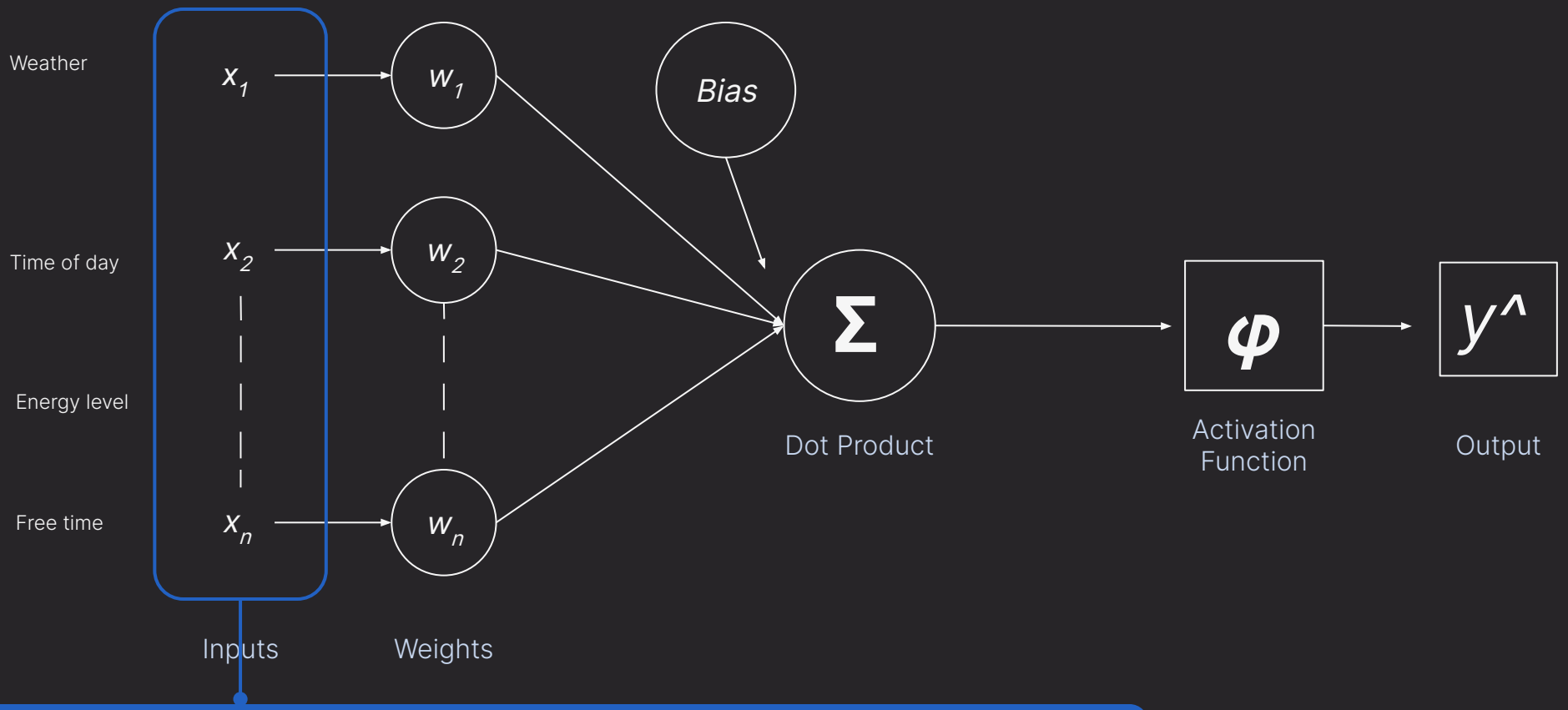
Components of a Neuron



INPUT: Pieces of information like numbers, images, texts

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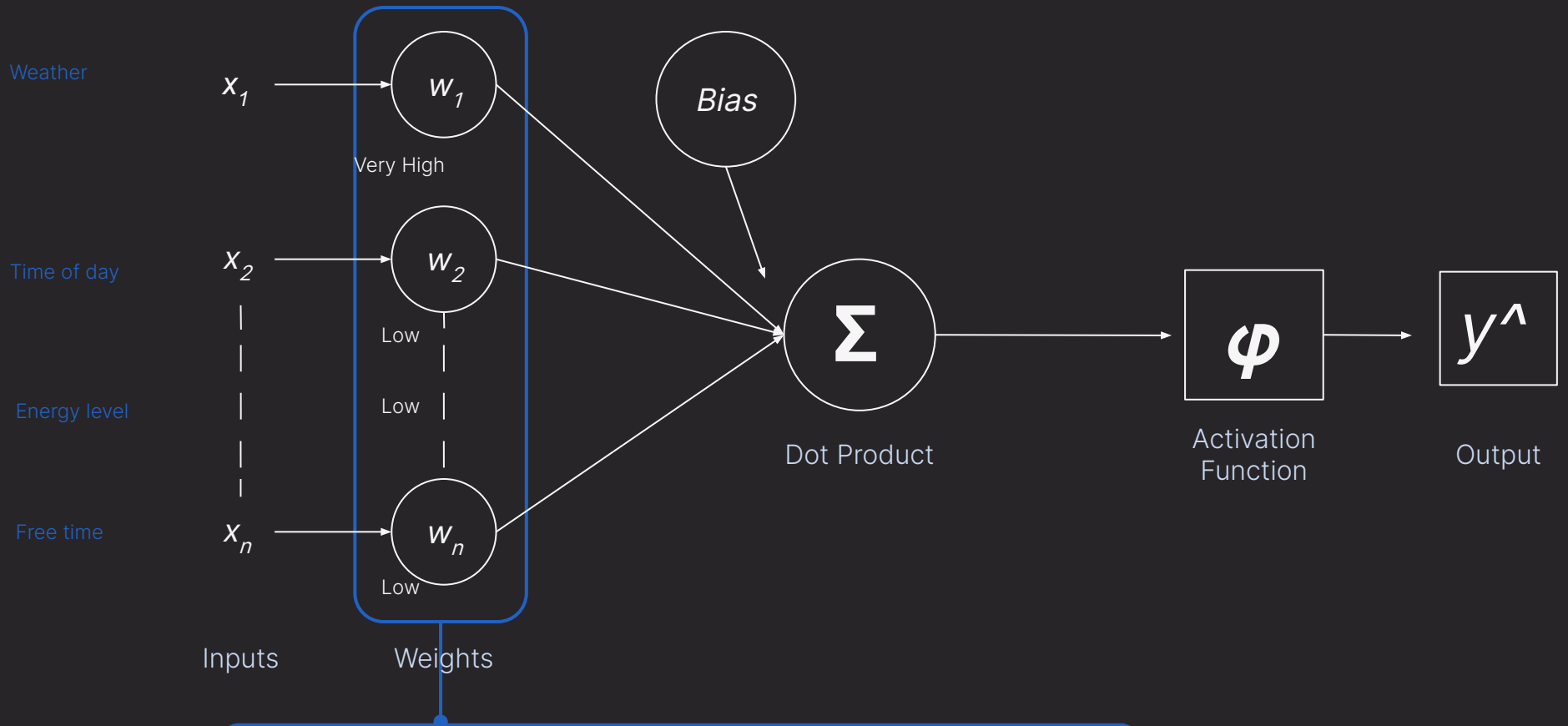
Components of a Neuron



WEIGHTS: Importance given to each factor.
A numerical value, adjustable during training.

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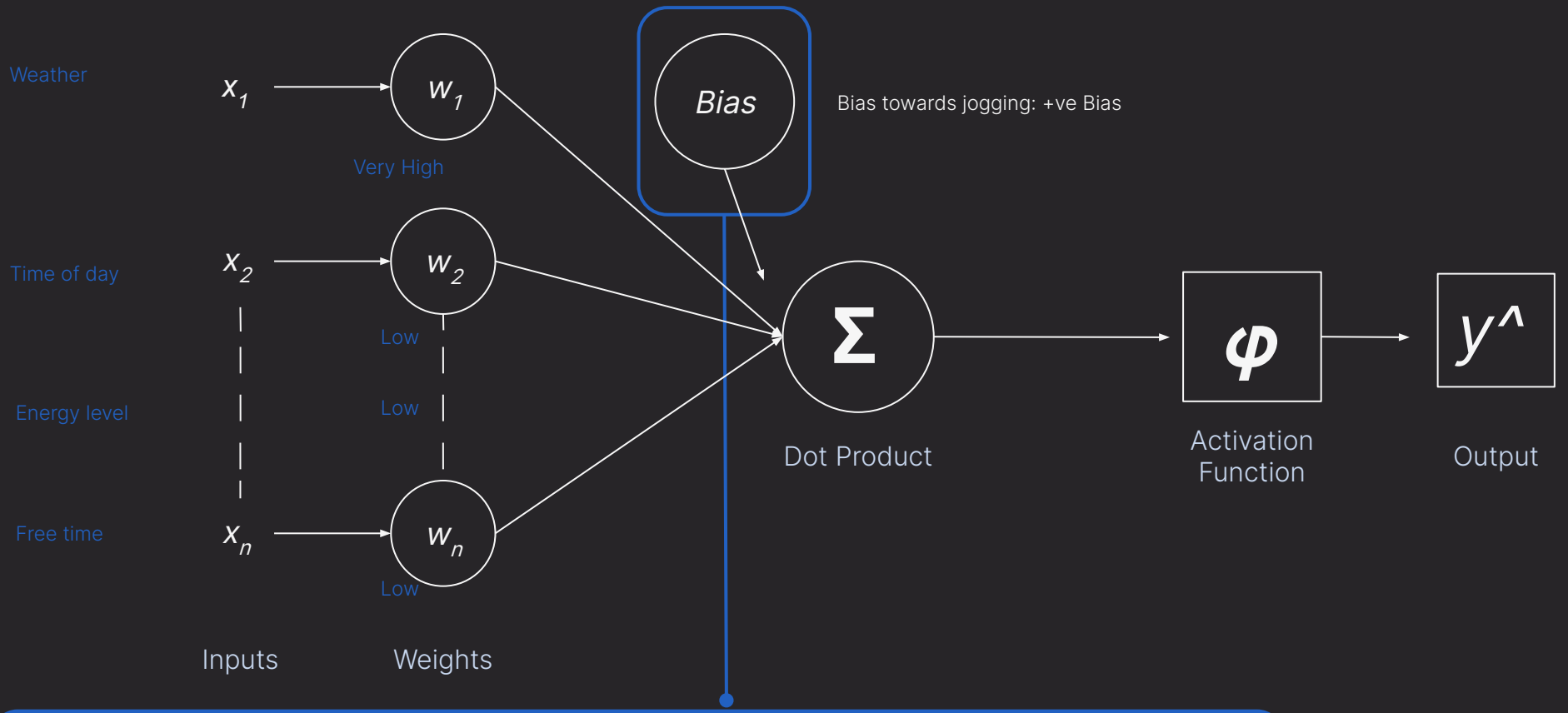
Components of a Neuron



BIAS: An additional parameter is added to weighted sum of inputs that influences the neuron's output independently of its inputs.

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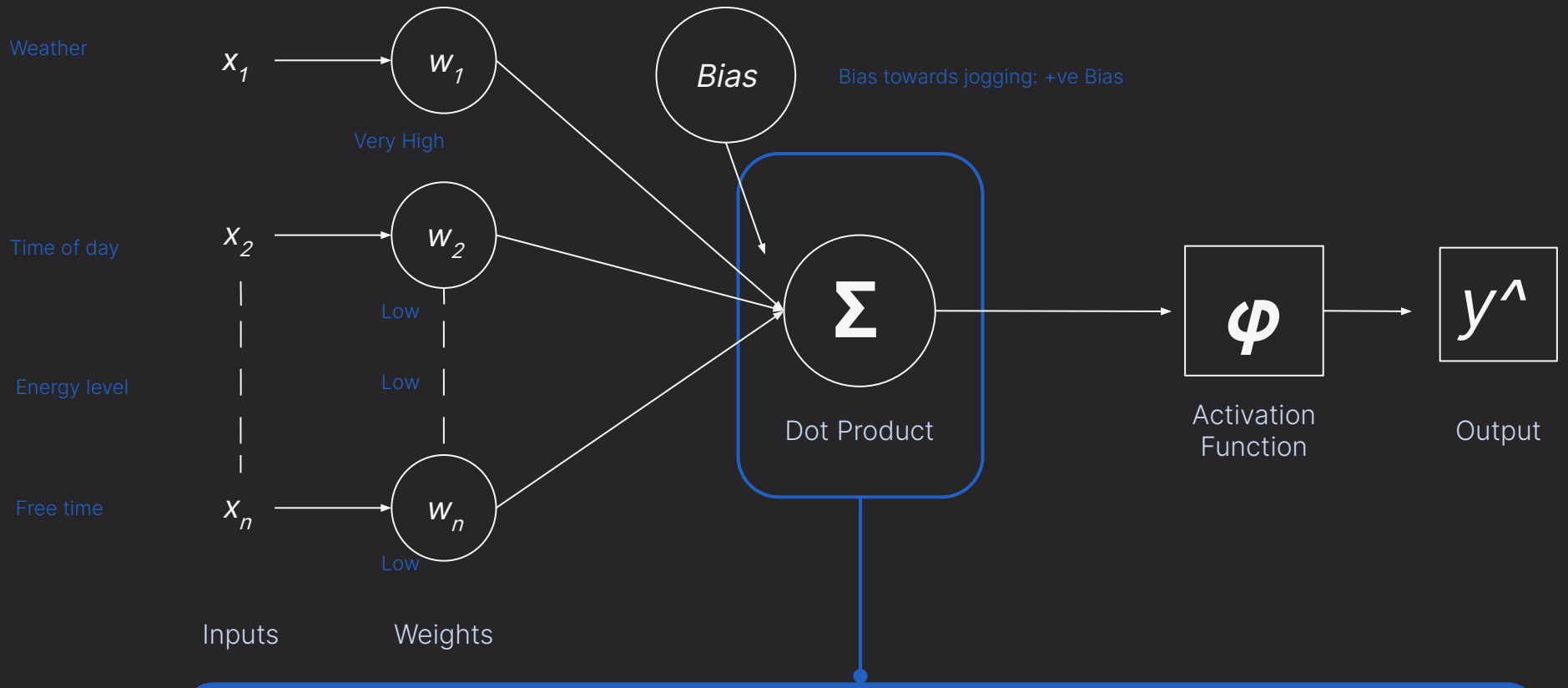
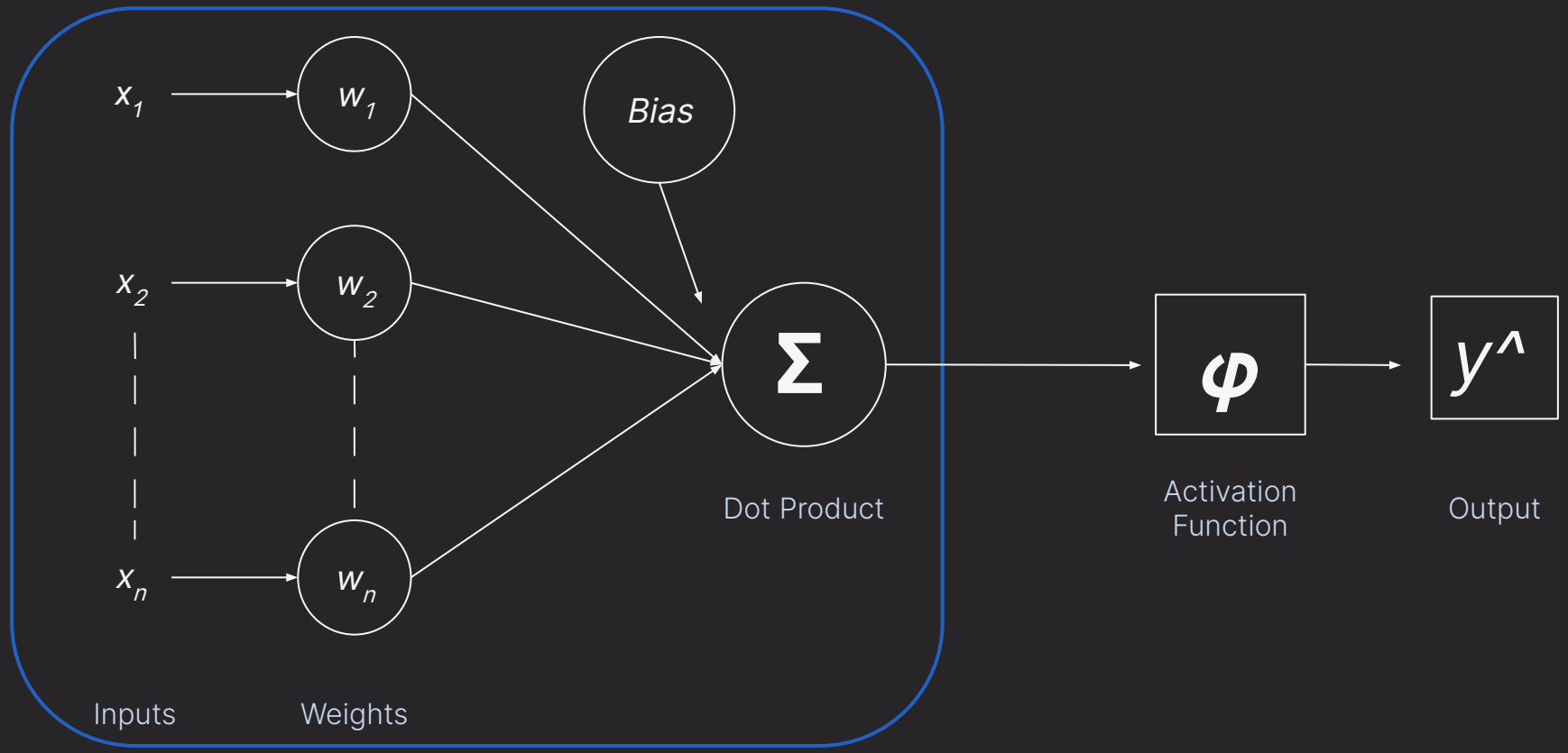
Components of a Neuron



SUMMATION: All weights are combined to reach a tentative decision

$(X_n . W_n) + Bias$



Does the architecture so far remind you of any algorithm?

LINEAR REGRESSION!

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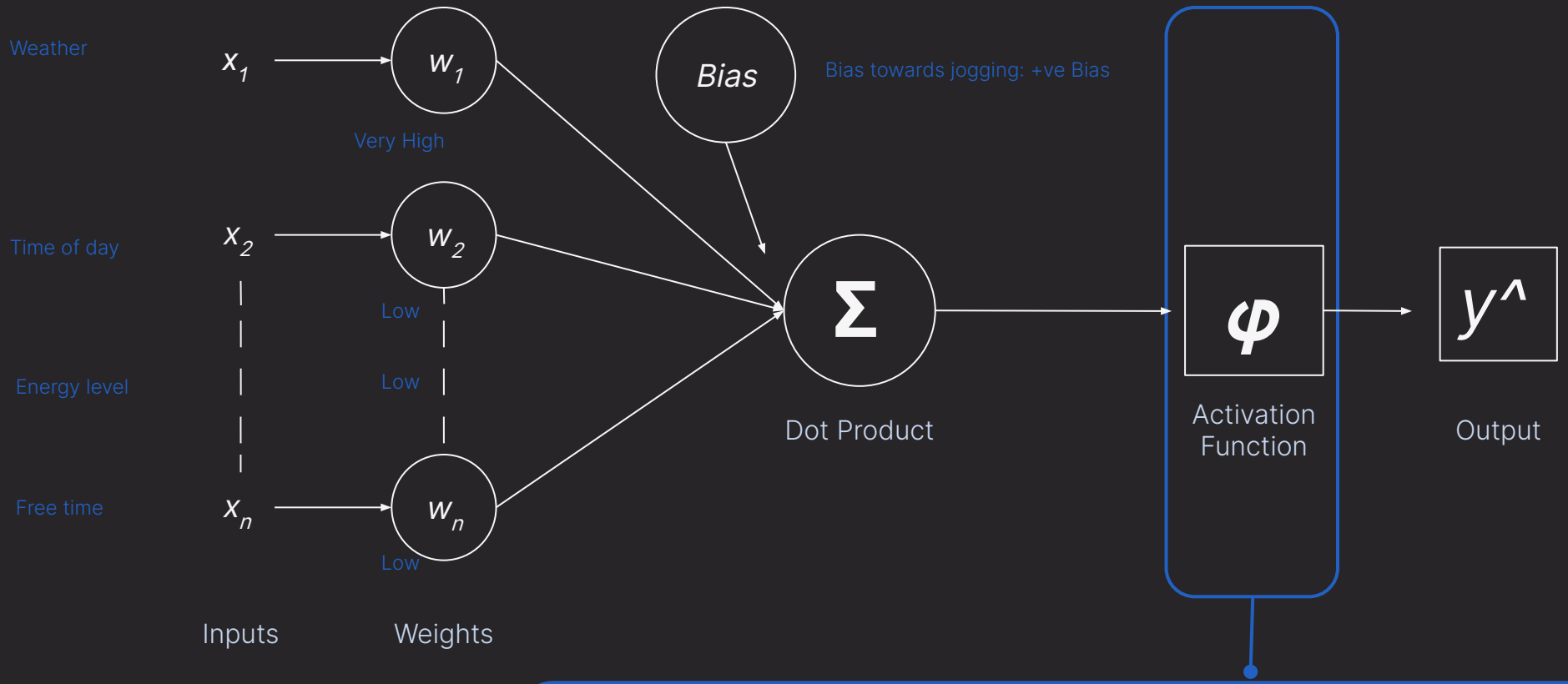
Components of a Neuron



- Takes the weighted sum and gives final output based on the ***rule*** or '***threshold***'
- **Activation Functions** introduce **non-linearity** to the model.

Common Activation Functions

Introduction to Deep Learning

Video 3: Common Activation Functions

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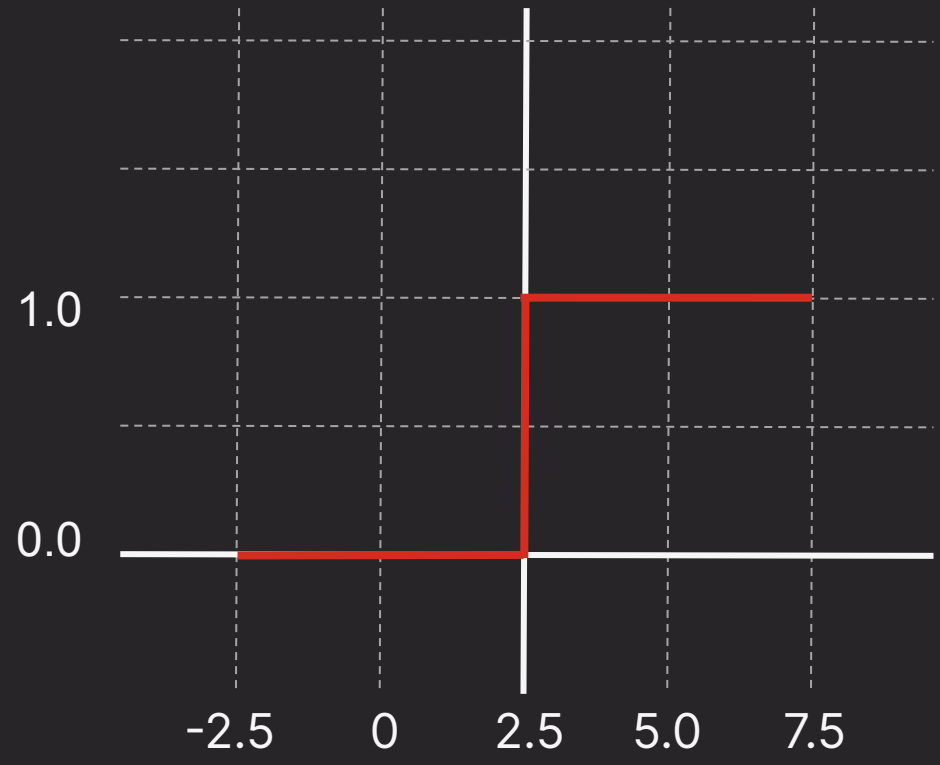
Activation Functions

1. Step Function

Threshold based classifier

If
{ Activation function input > Threshold }
Then
{ Neuron is activated }

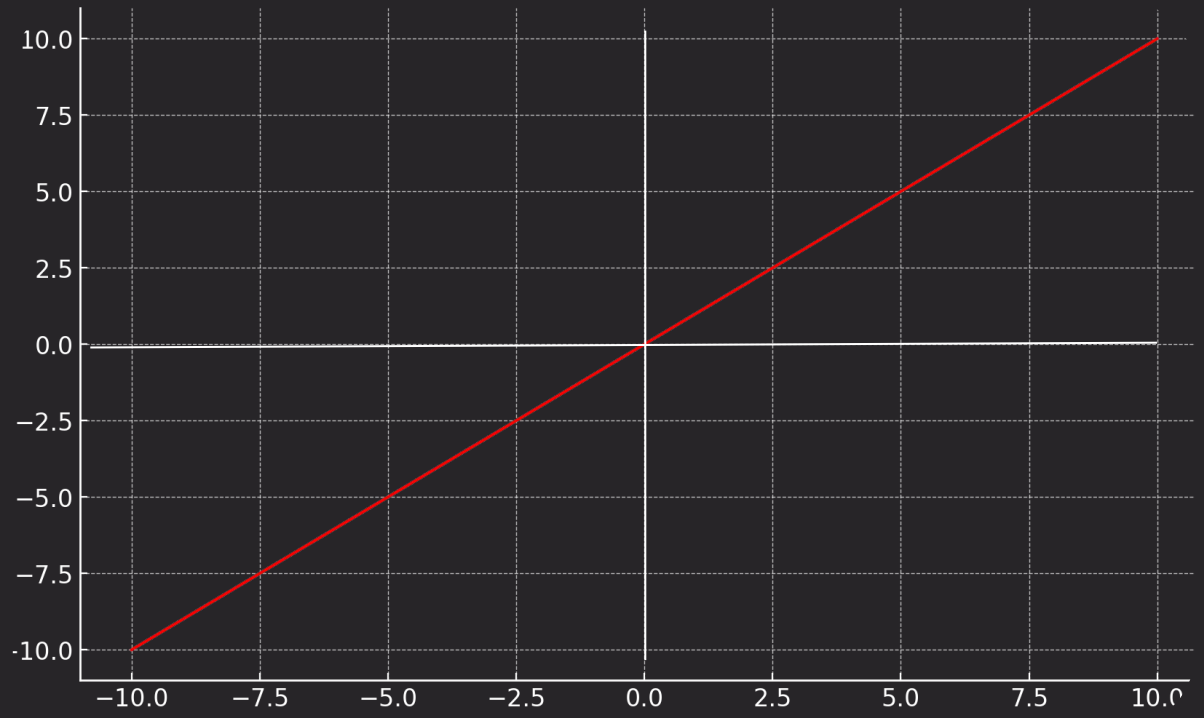


Activation Functions

2. Linear Function

It preserves the linear nature

The **Activation Function** is ***proportional*** to the **Input**.



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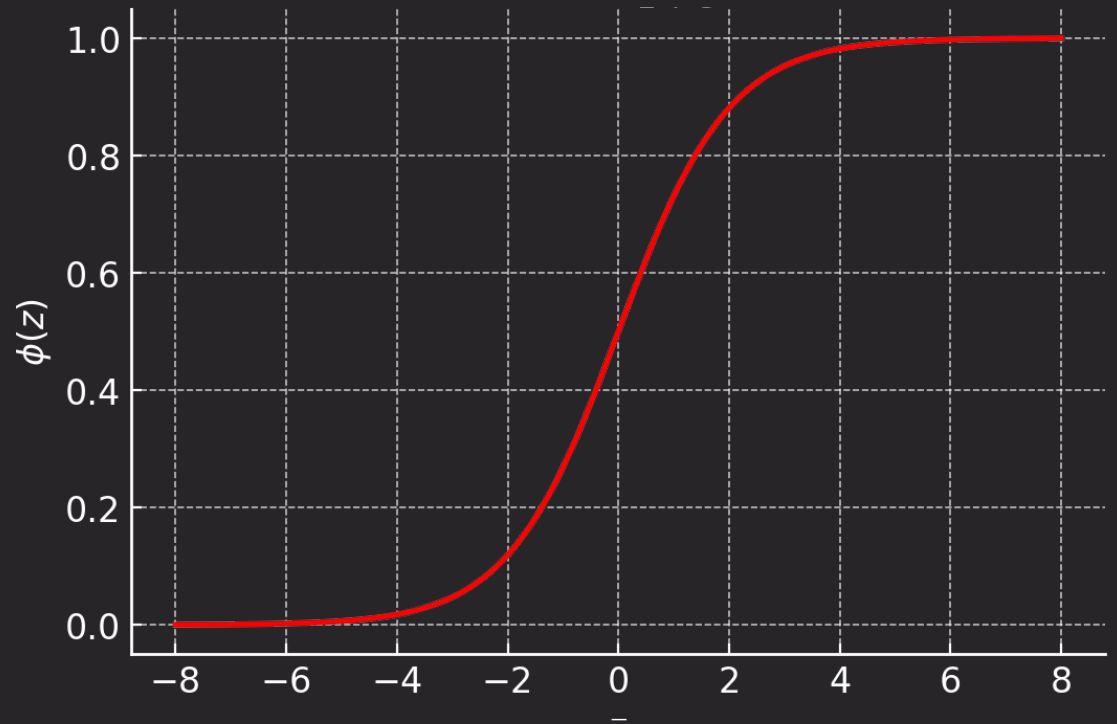
Activation Functions

3. Sigmoid Function

Introduces non-linearity by mapping input values to ***range 0 and 1***

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

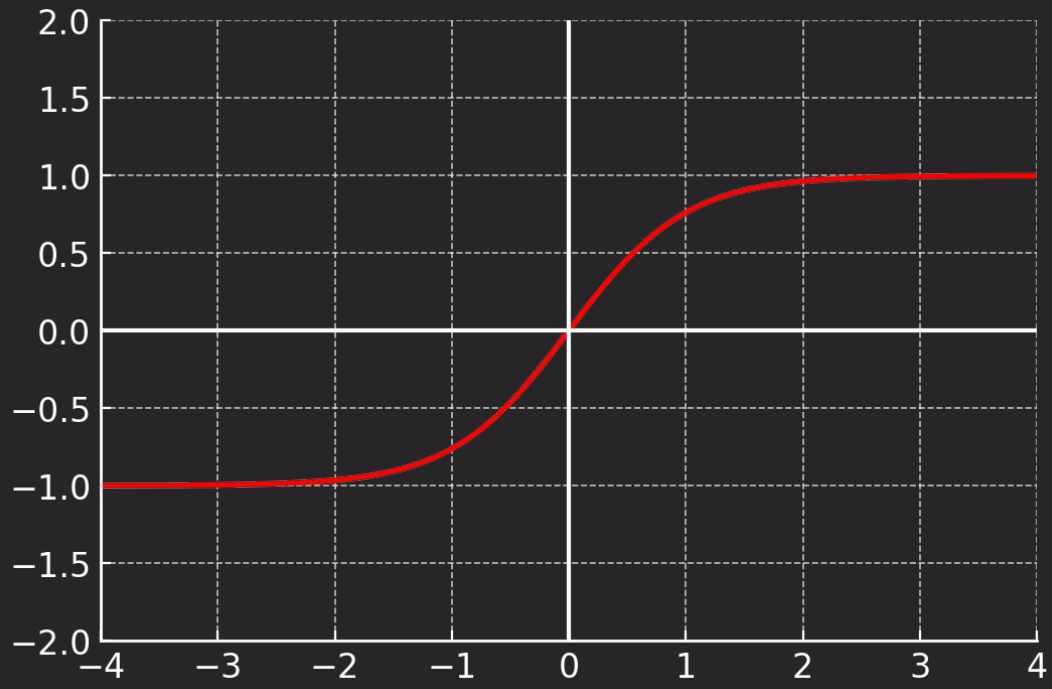


Activation Functions

4. Tanh Function

Maps input values to ***range -1 and 1***

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

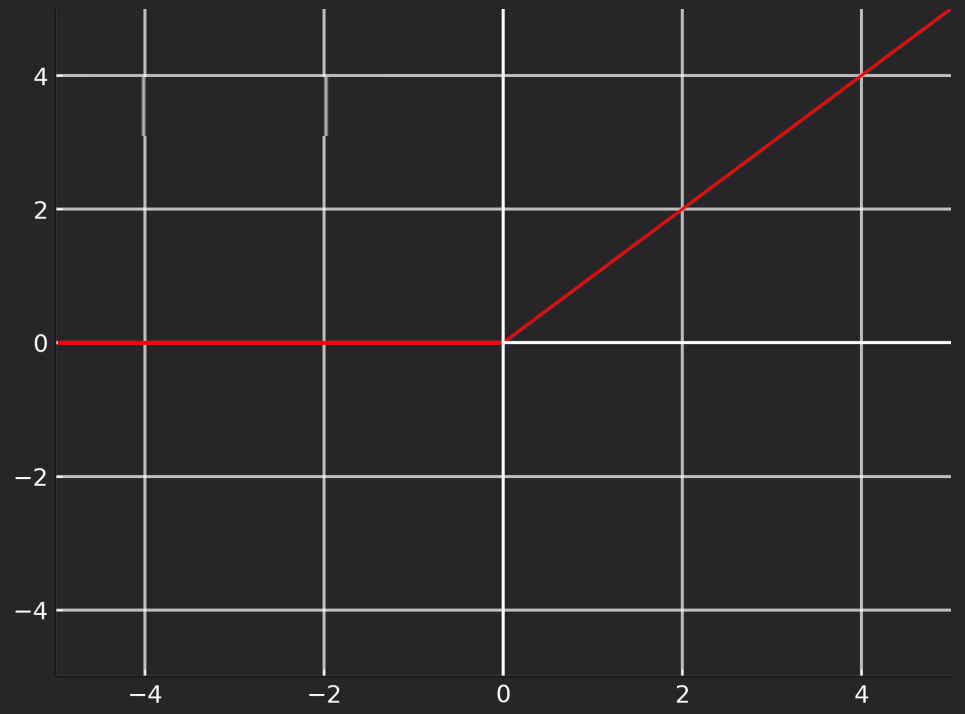


Activation Functions

5. ReLu Function

ReLu - **Re**ctified **L**inear **U**nit

$$f(x) = \max(0, x)$$
$$f(x) = x, x \geq 0$$
$$f(x) = 0, x < 0$$



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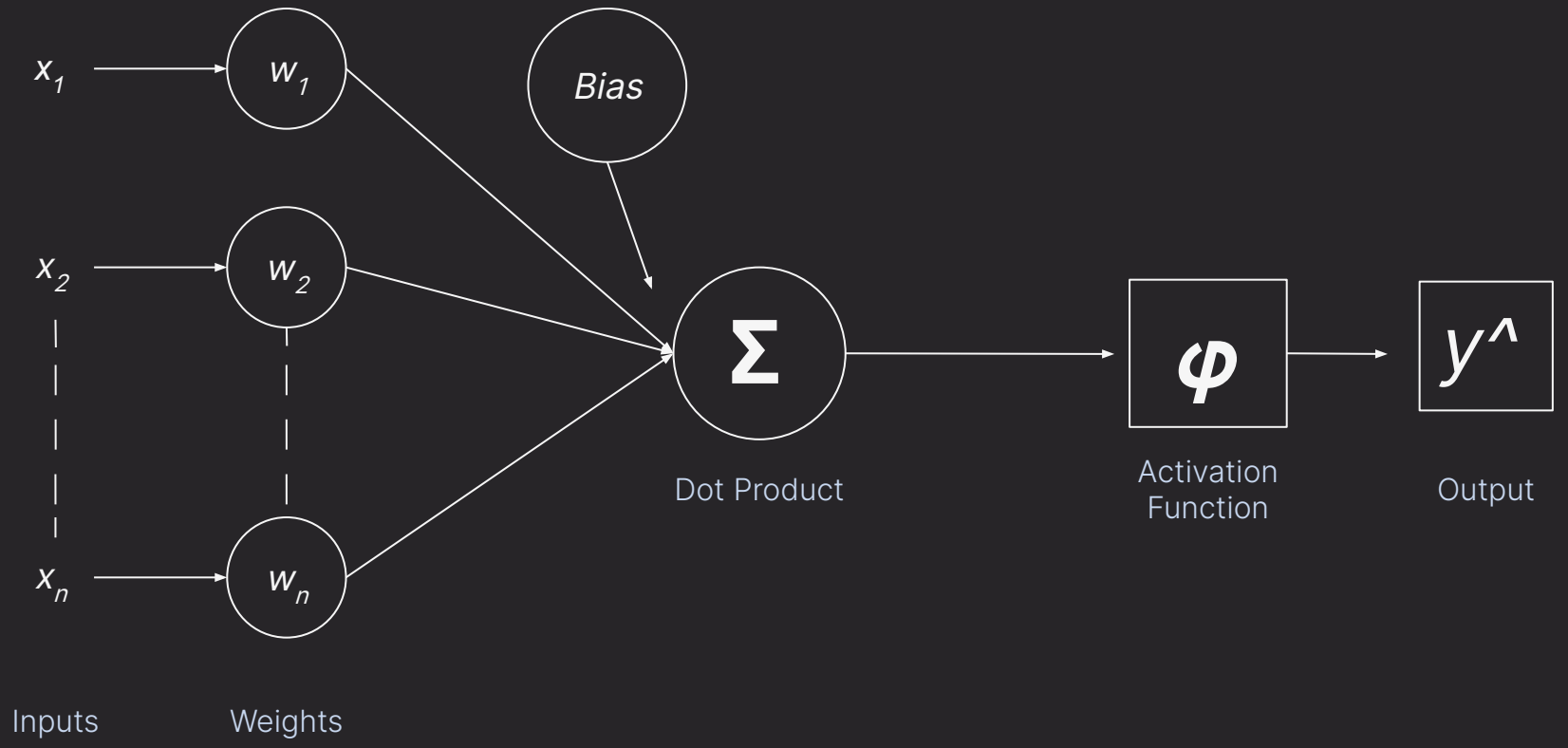
Components of a Neuron



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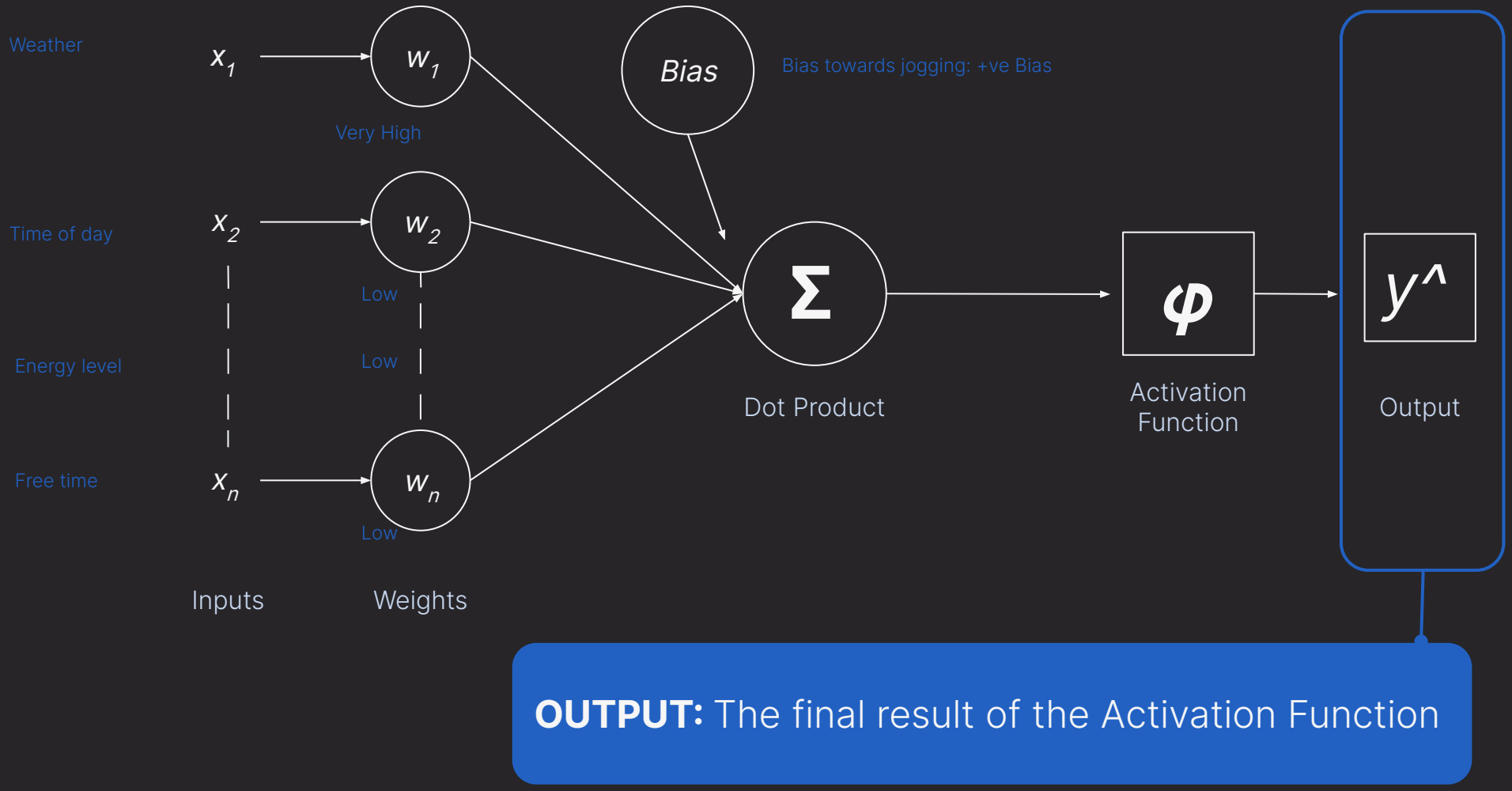
Components of a Neuron



OUTPUT: The final result of the Activation Function

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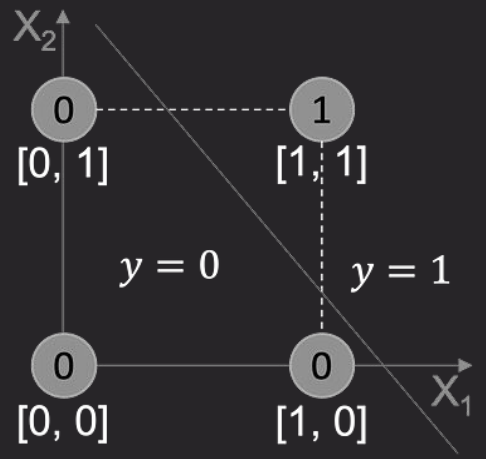
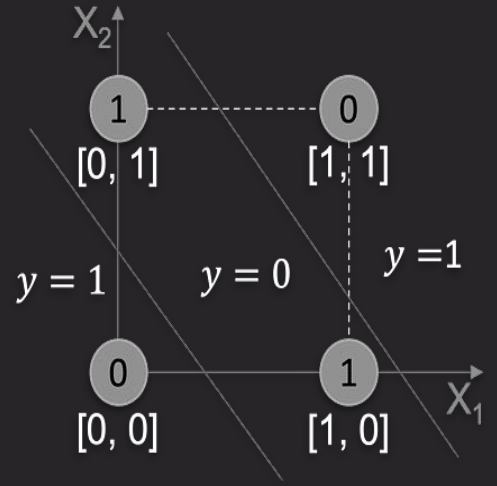
Limitations of a Single Neuron Neural Network: Linear vs Non-Linear Problems

- **Single perceptron works with linear functions** - effective for simple OR/AND gate problems



Single neuron



Multiple neurons