

ANN (Artificial Neural Network)

Presented By,

Ashish Dubey

&

Jitendra Dubey

Plan of Attack

What we will learn in this section:

- The Neuron
- The Activation Function
- How do Neural Networks work? (example)
- How do Neural Networks learn?
- Gradient Descent
- Stochastic Gradient Descent
- Backpropagation

-
- What is Deep Learning
 - Why Deep Learning
 - How it differ from Machine Learning

The Neuron

The Neuron

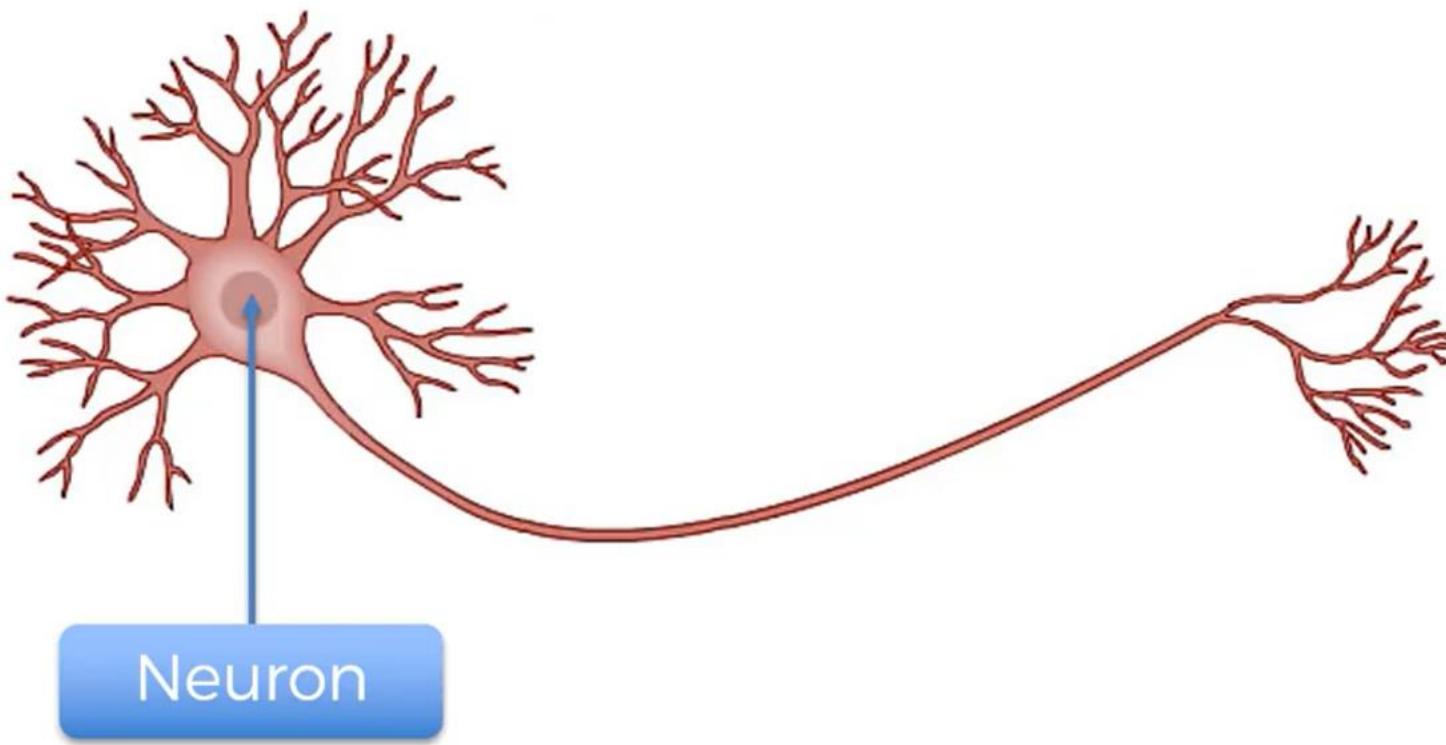


Image Source: Wikipedia

The Neuron

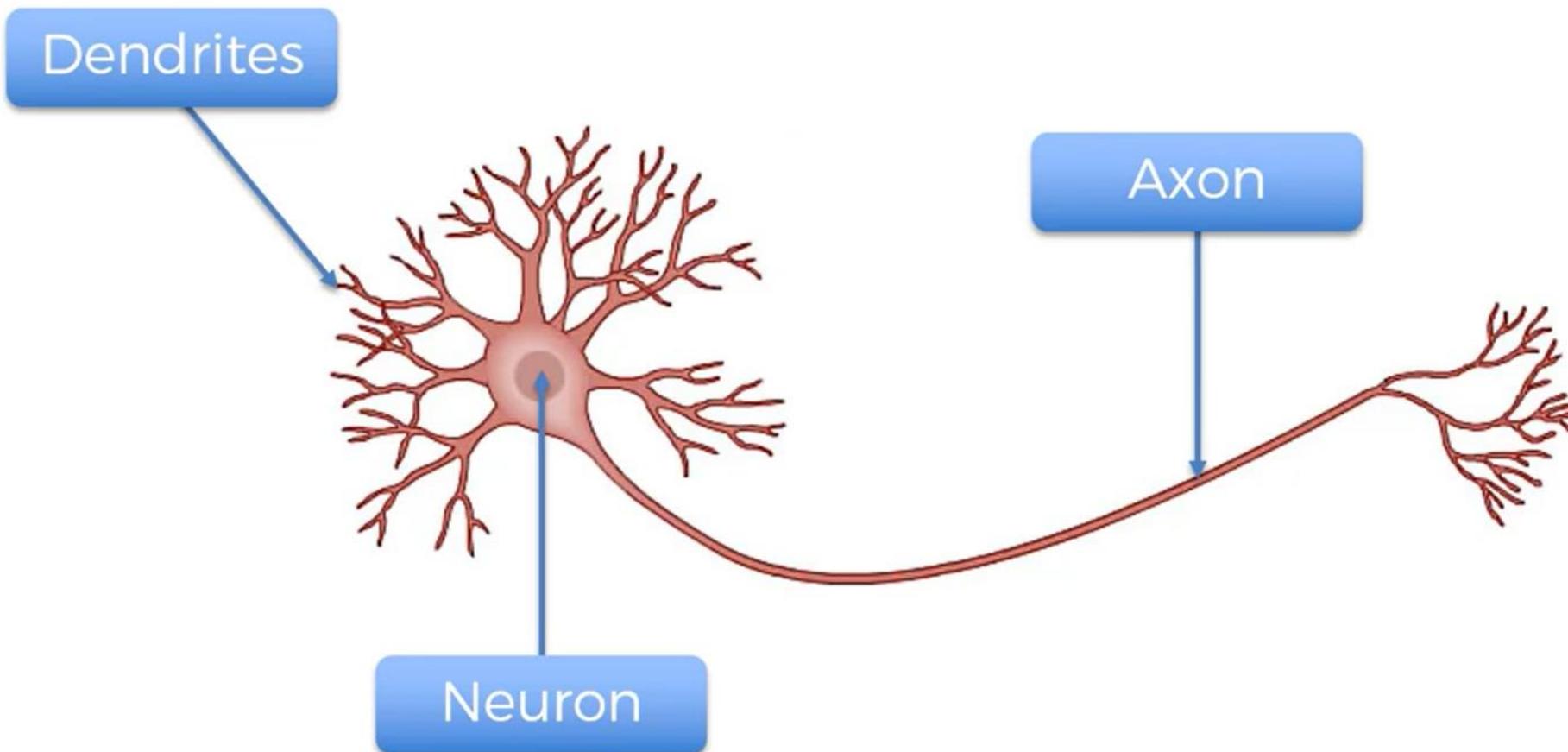
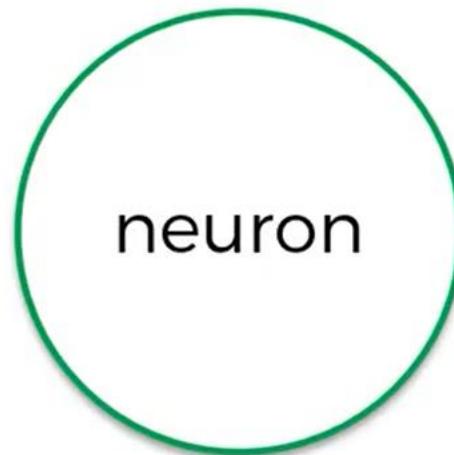
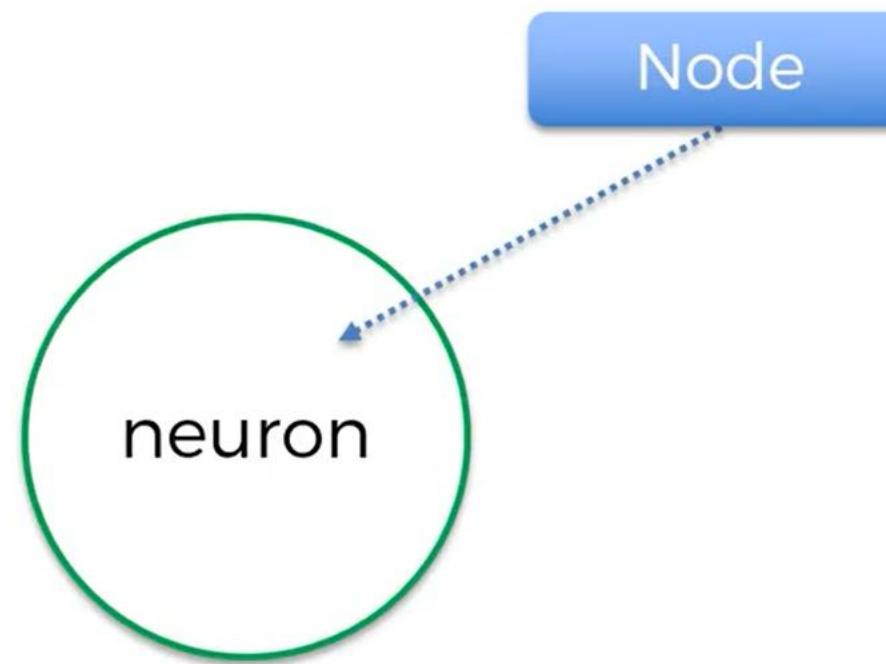


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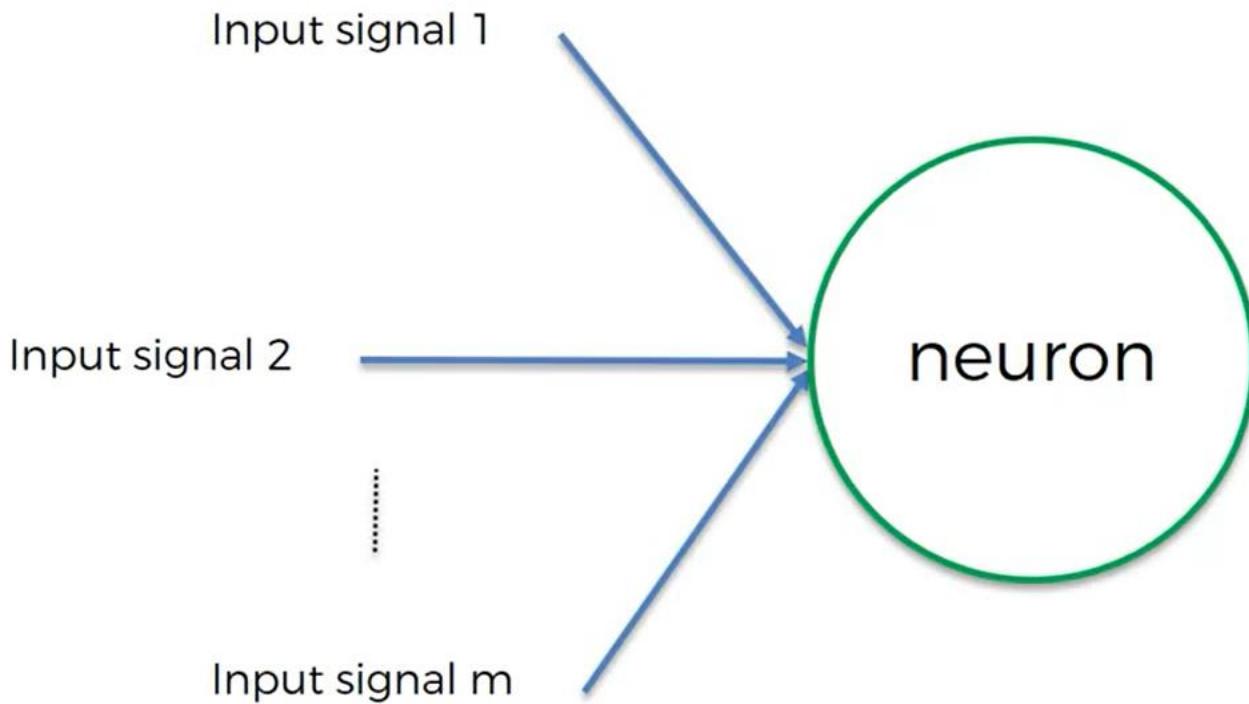
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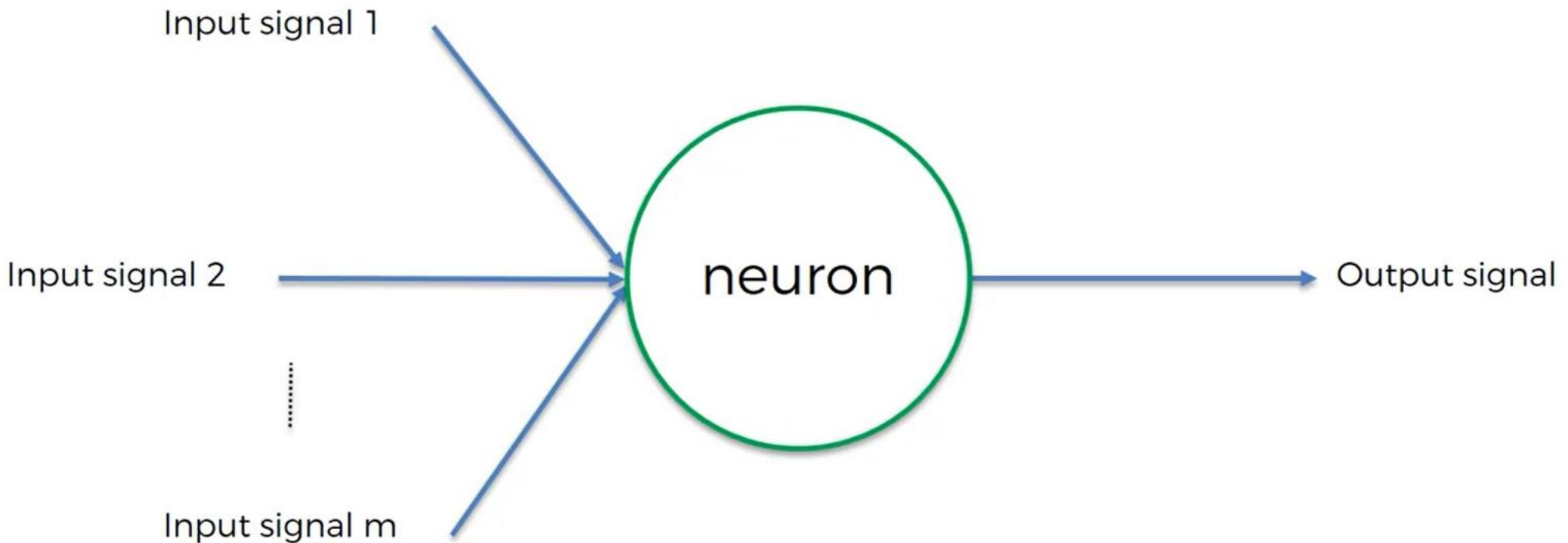
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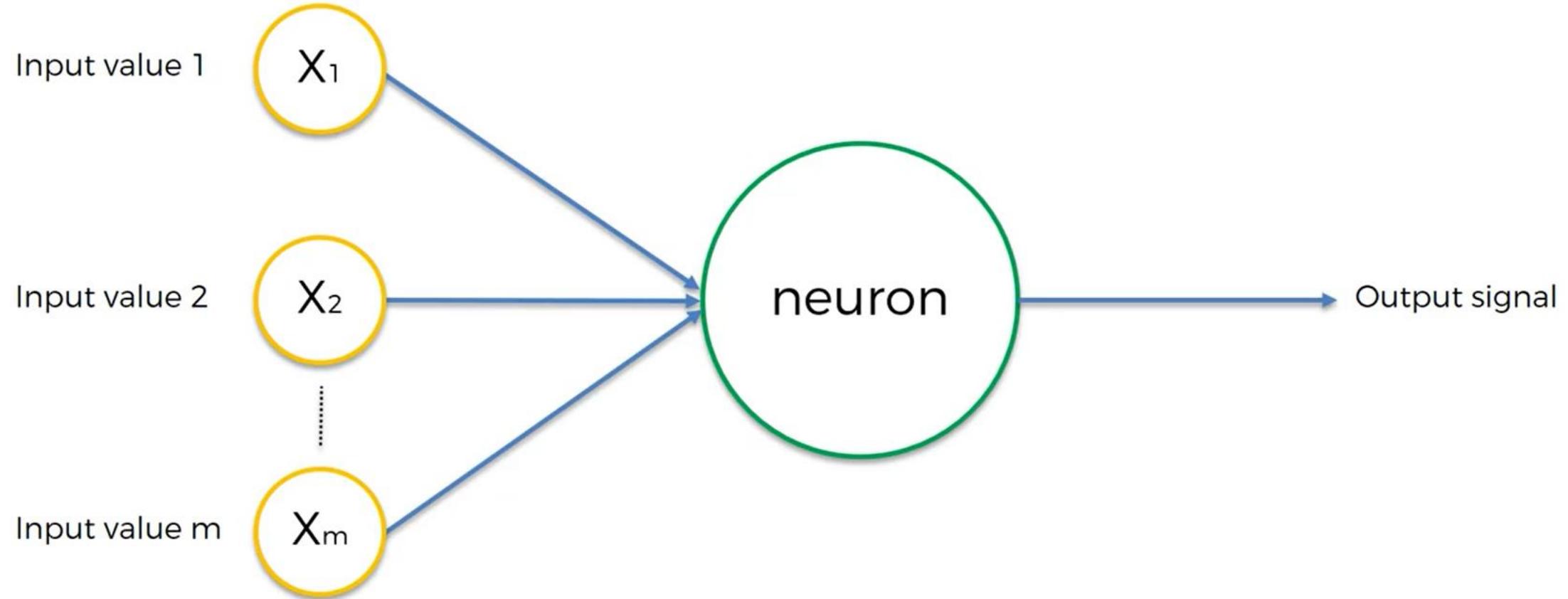
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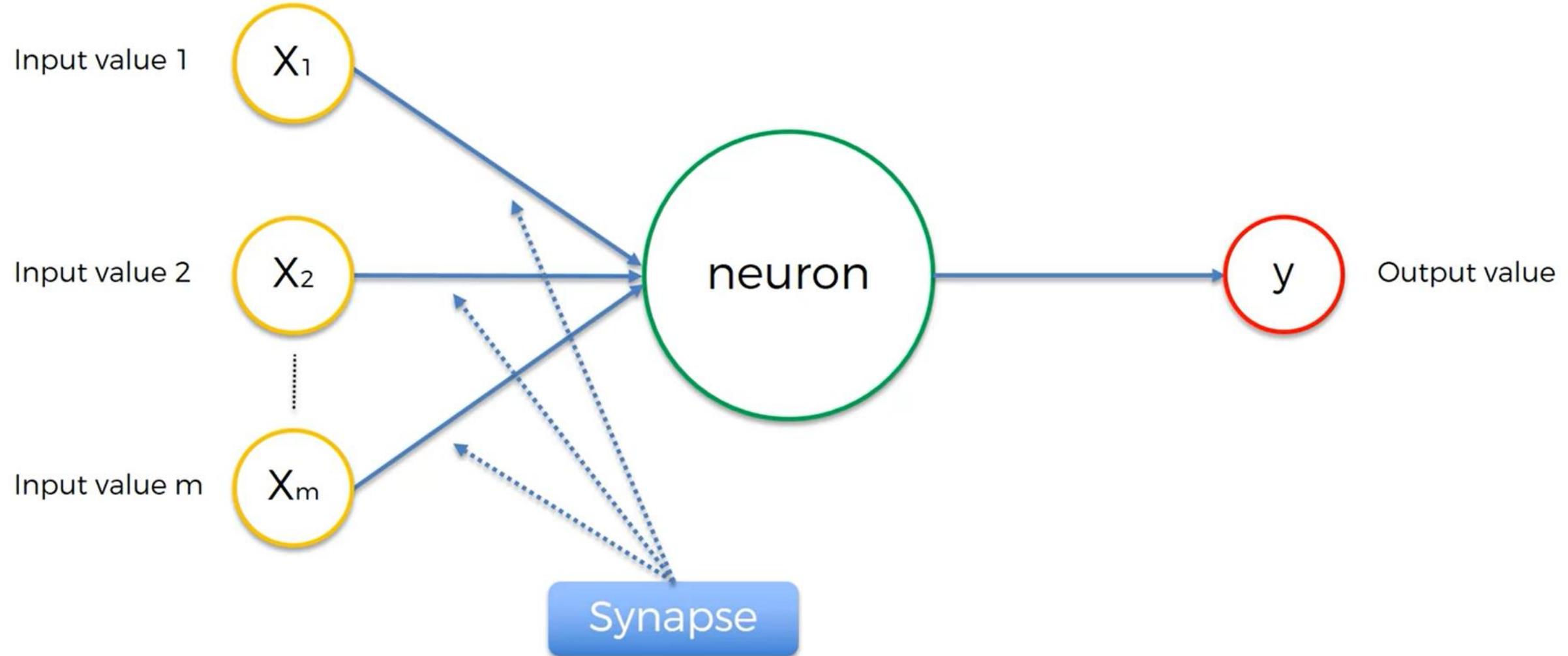
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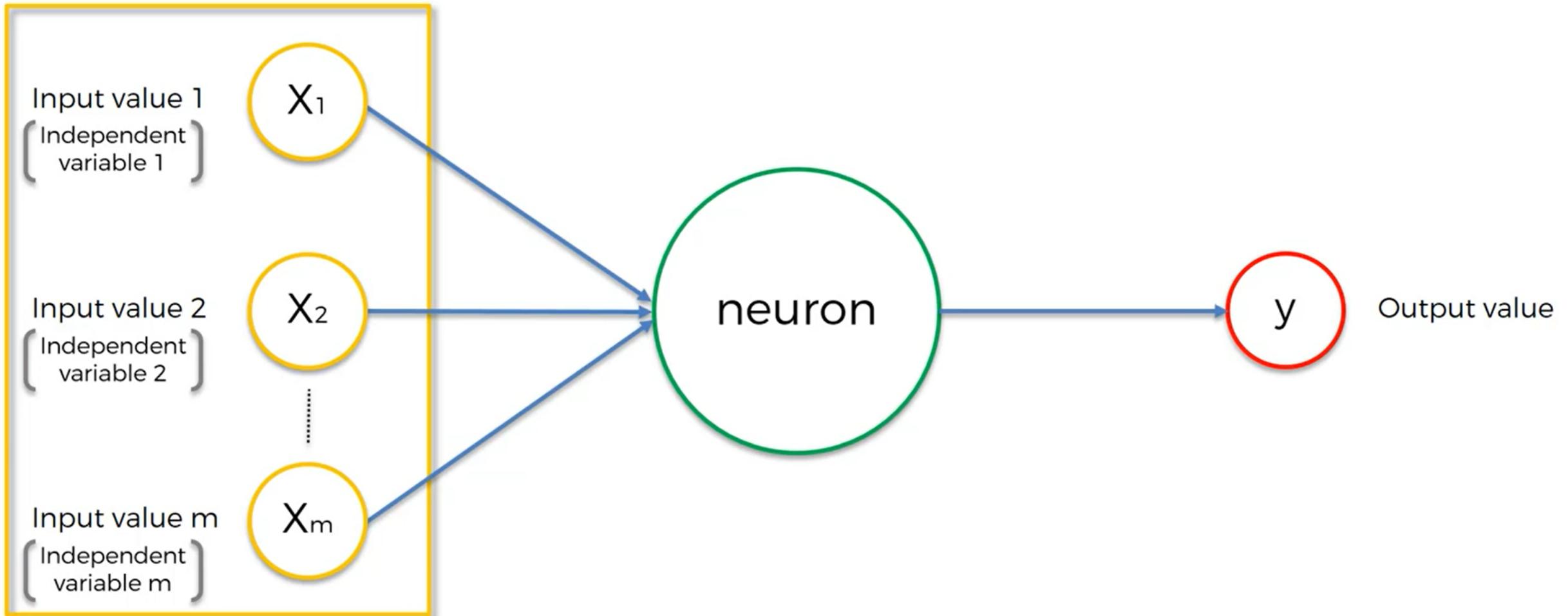
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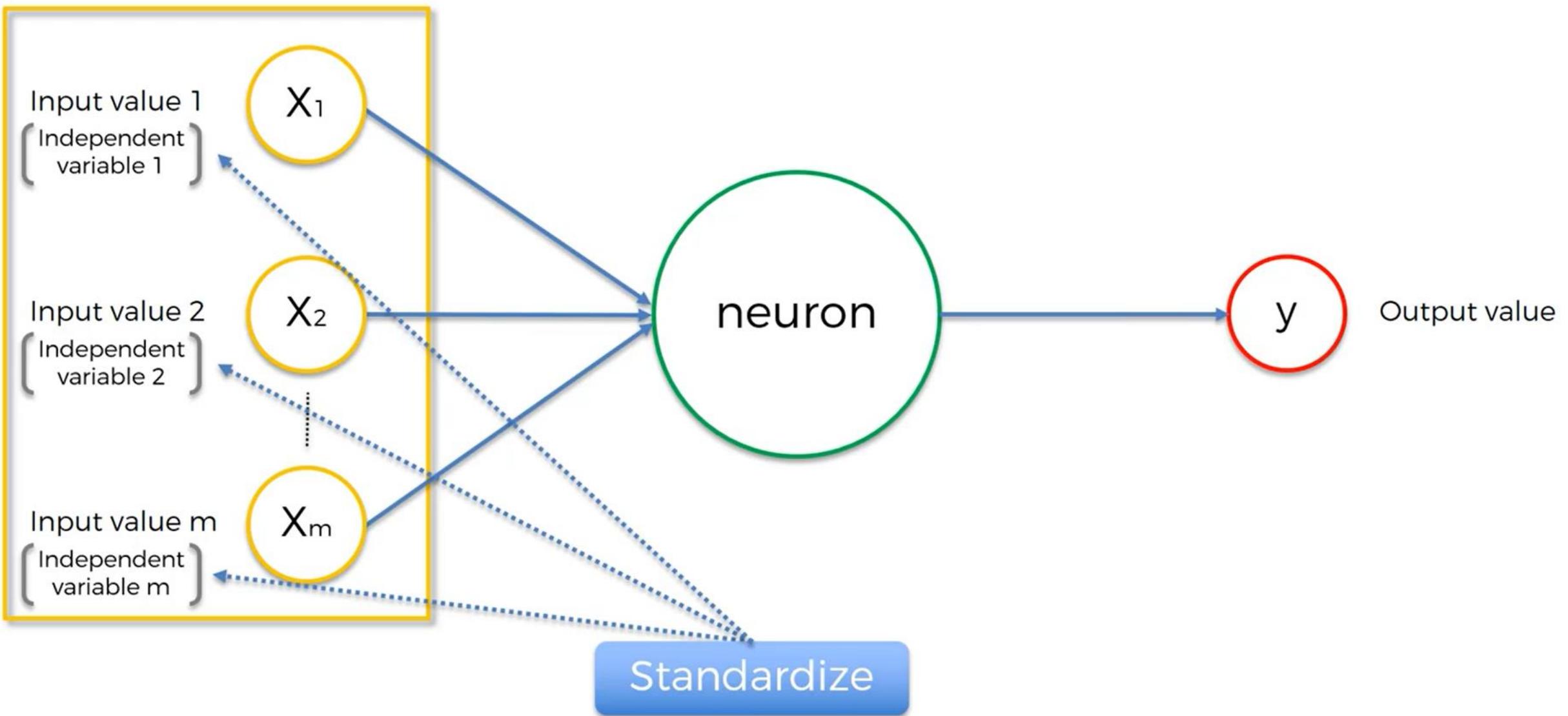
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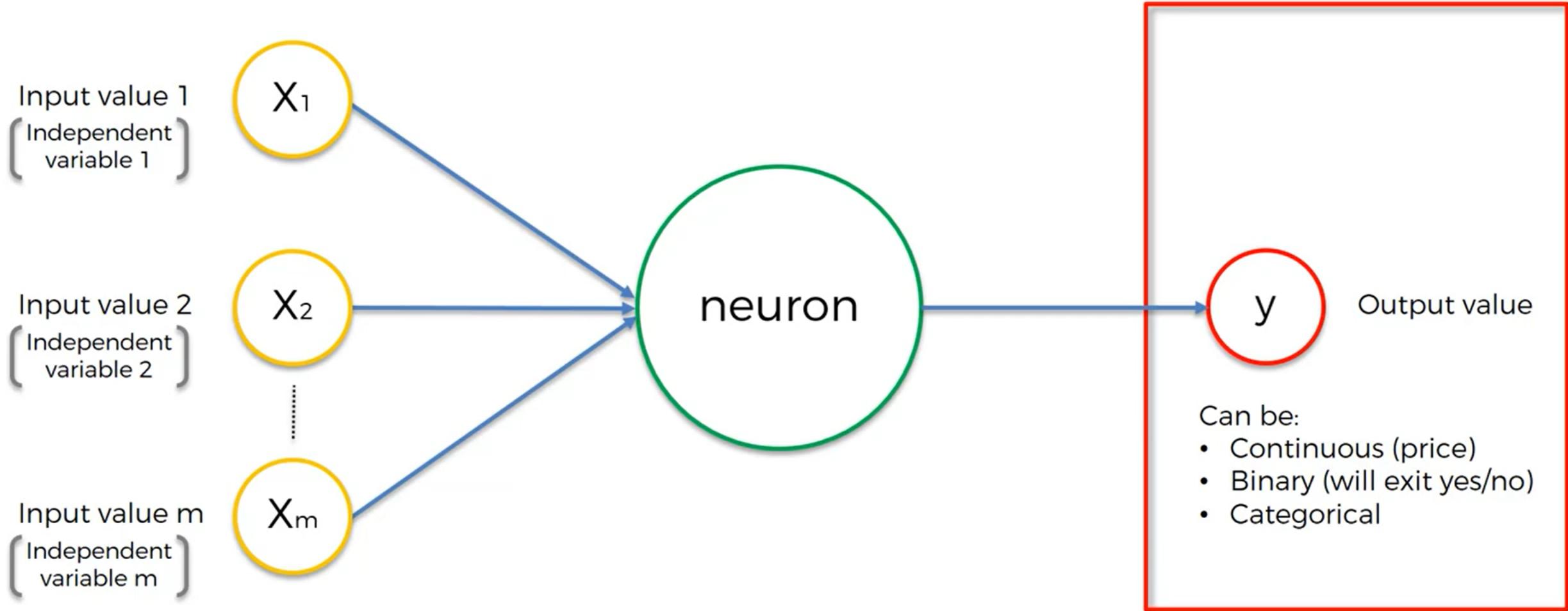
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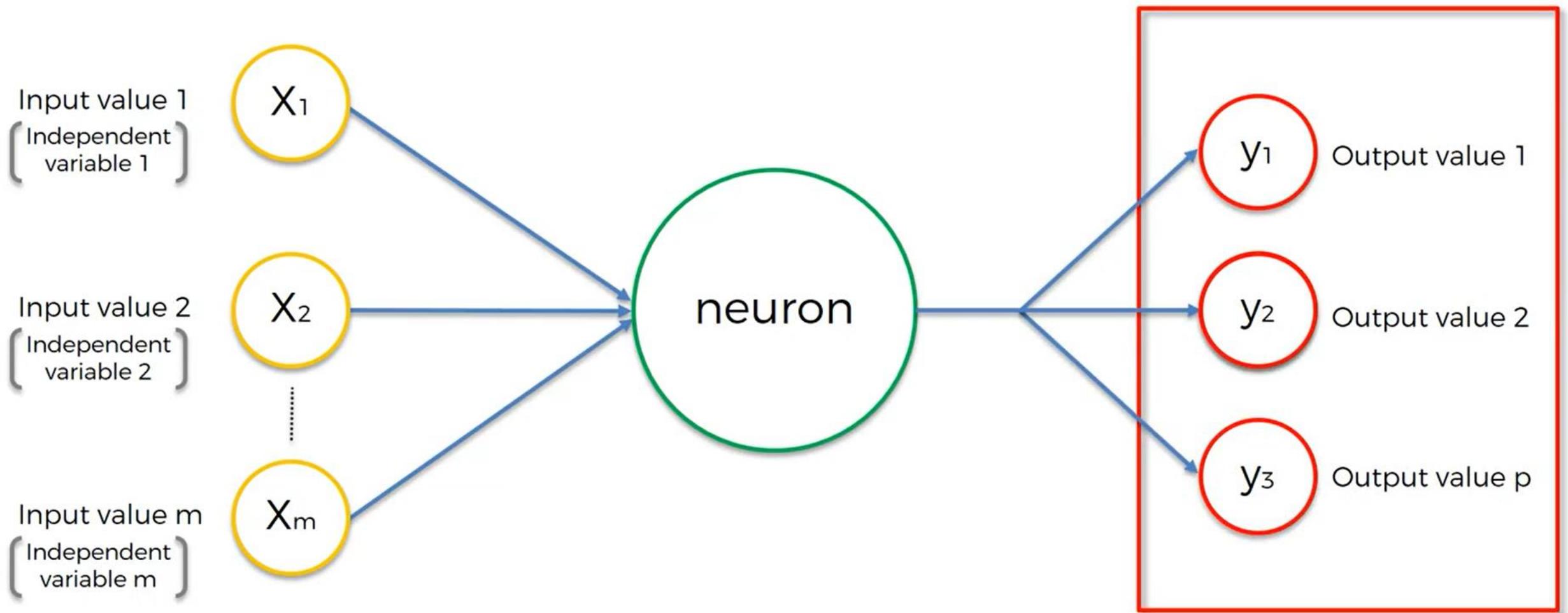
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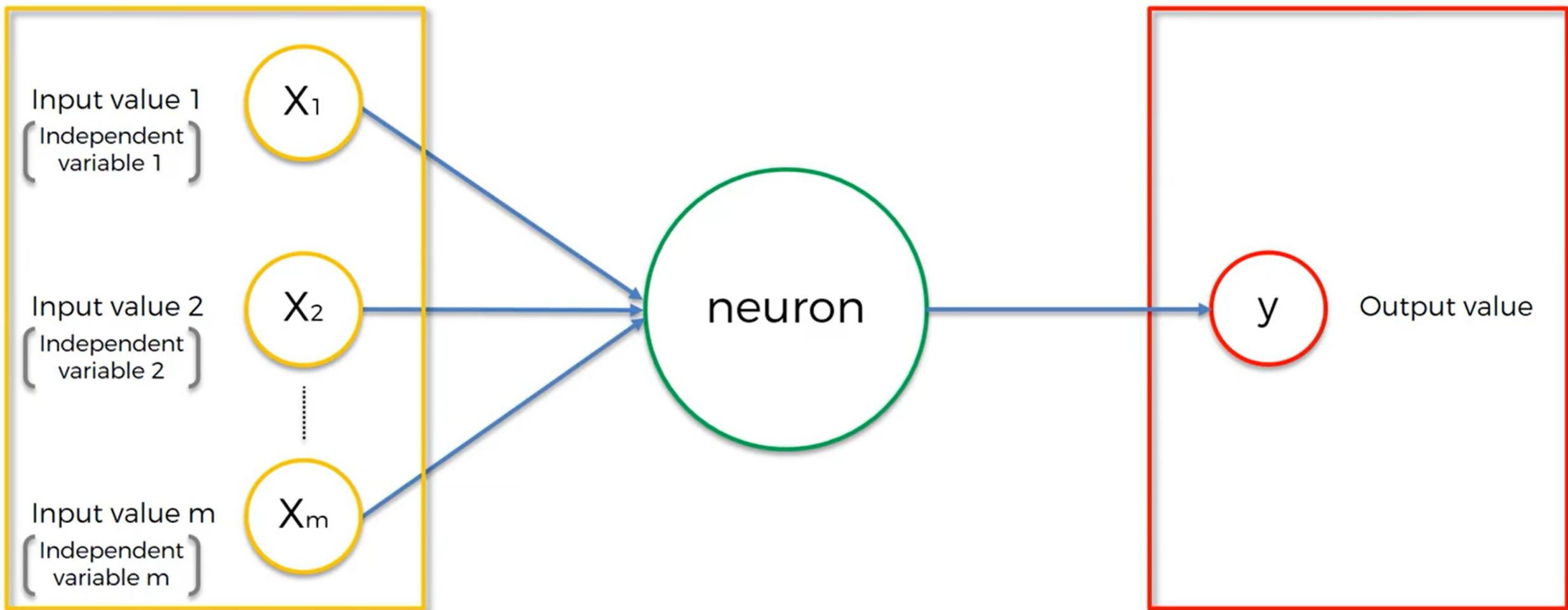
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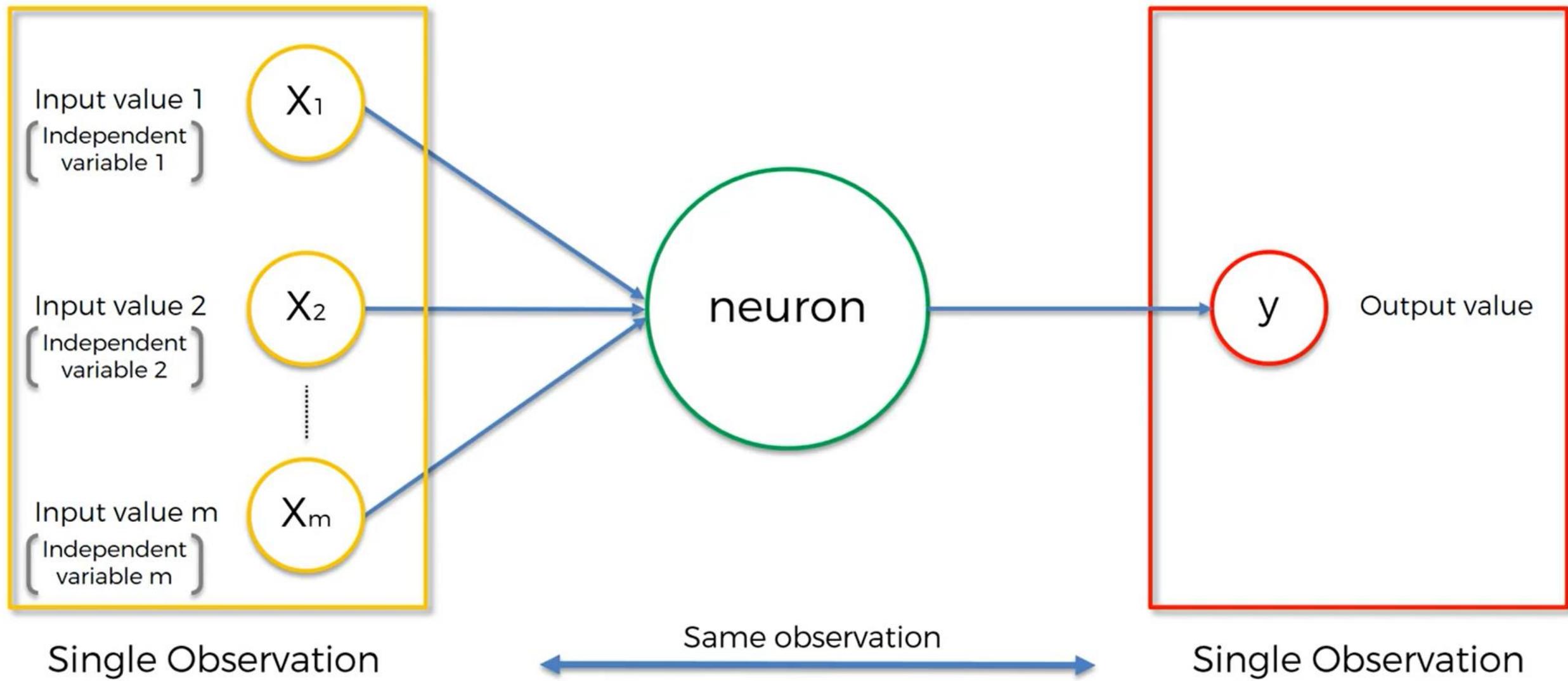
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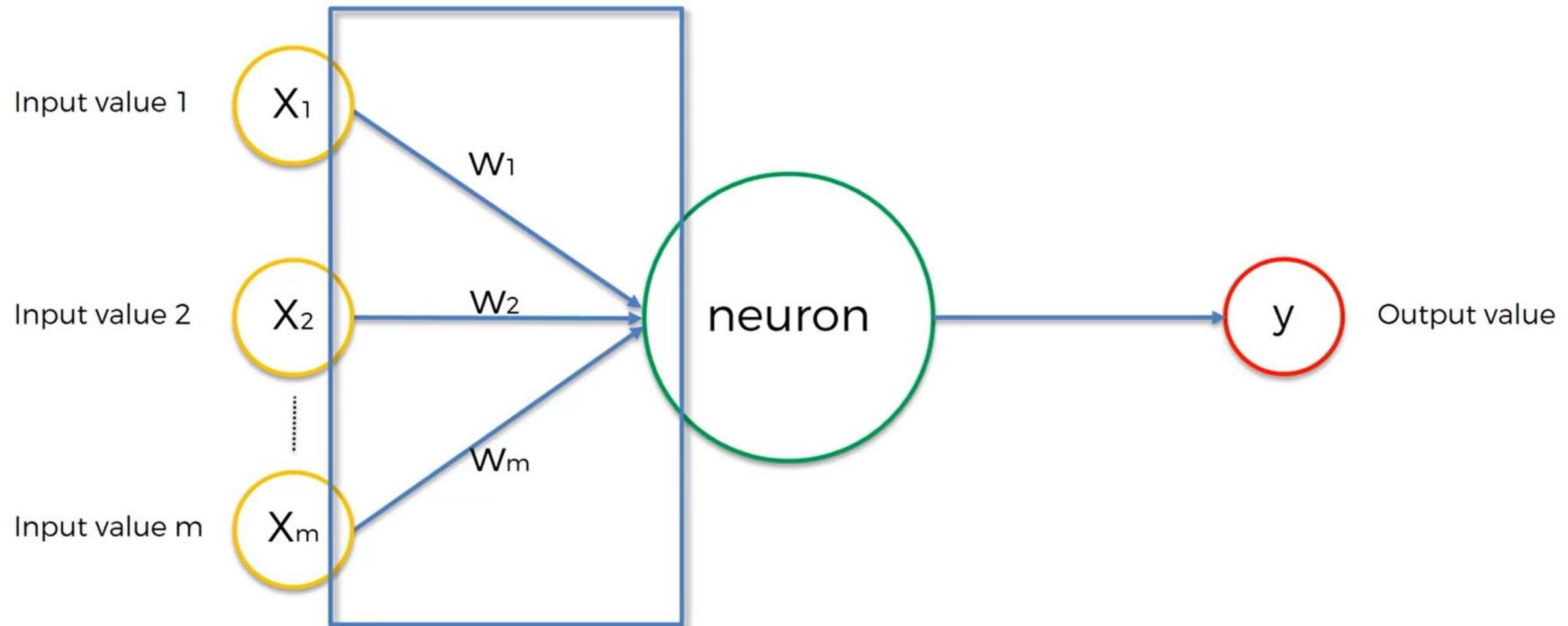
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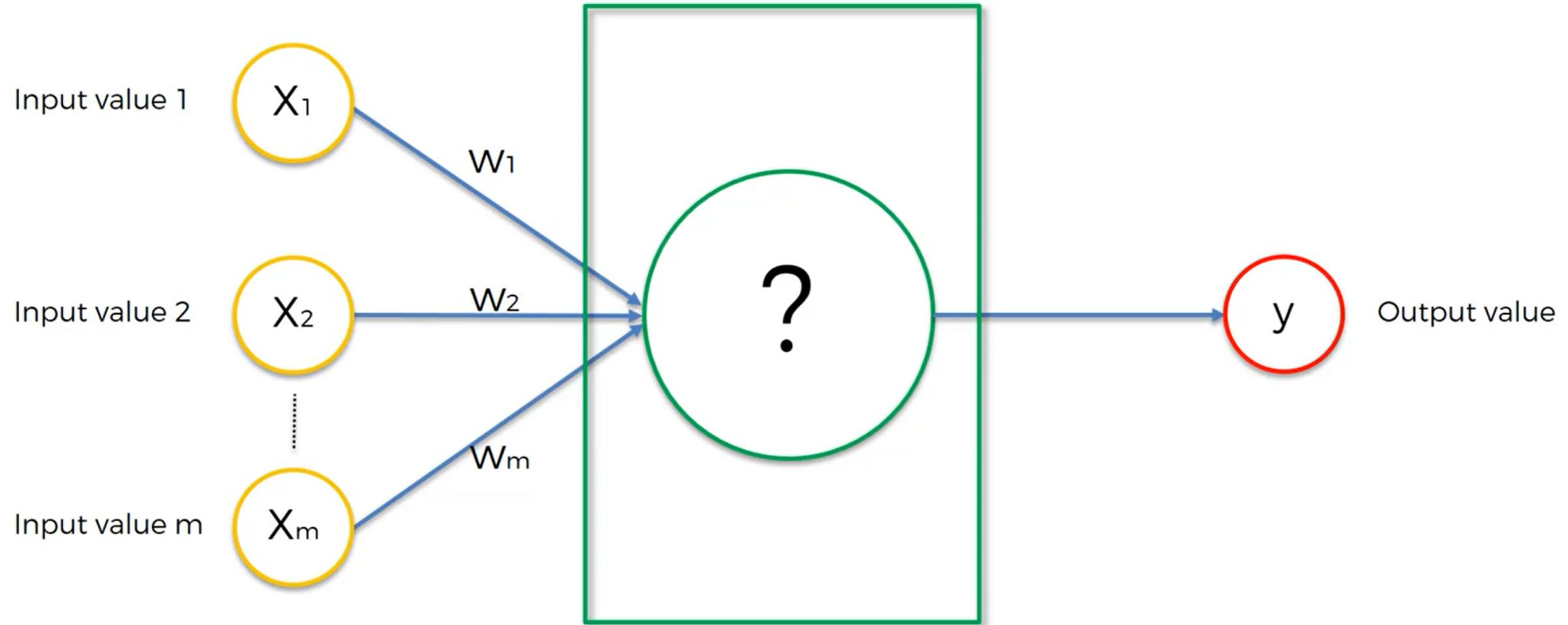
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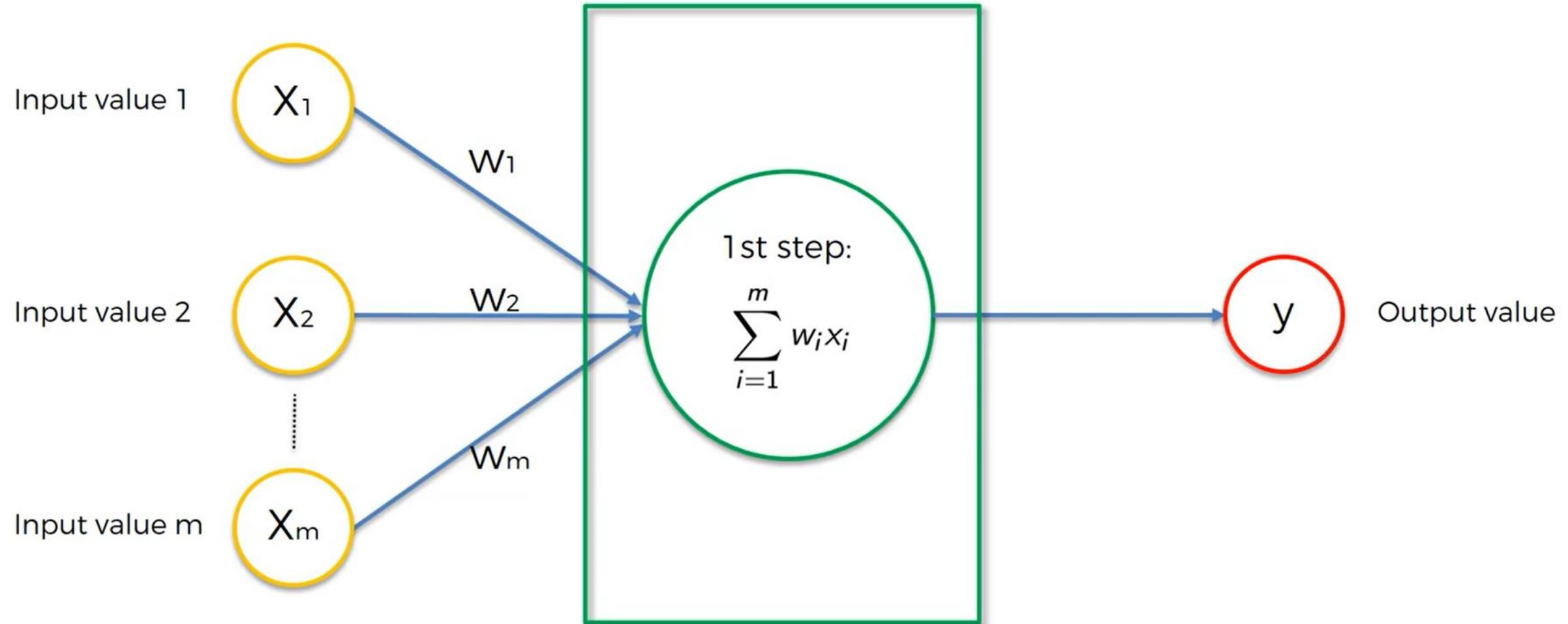
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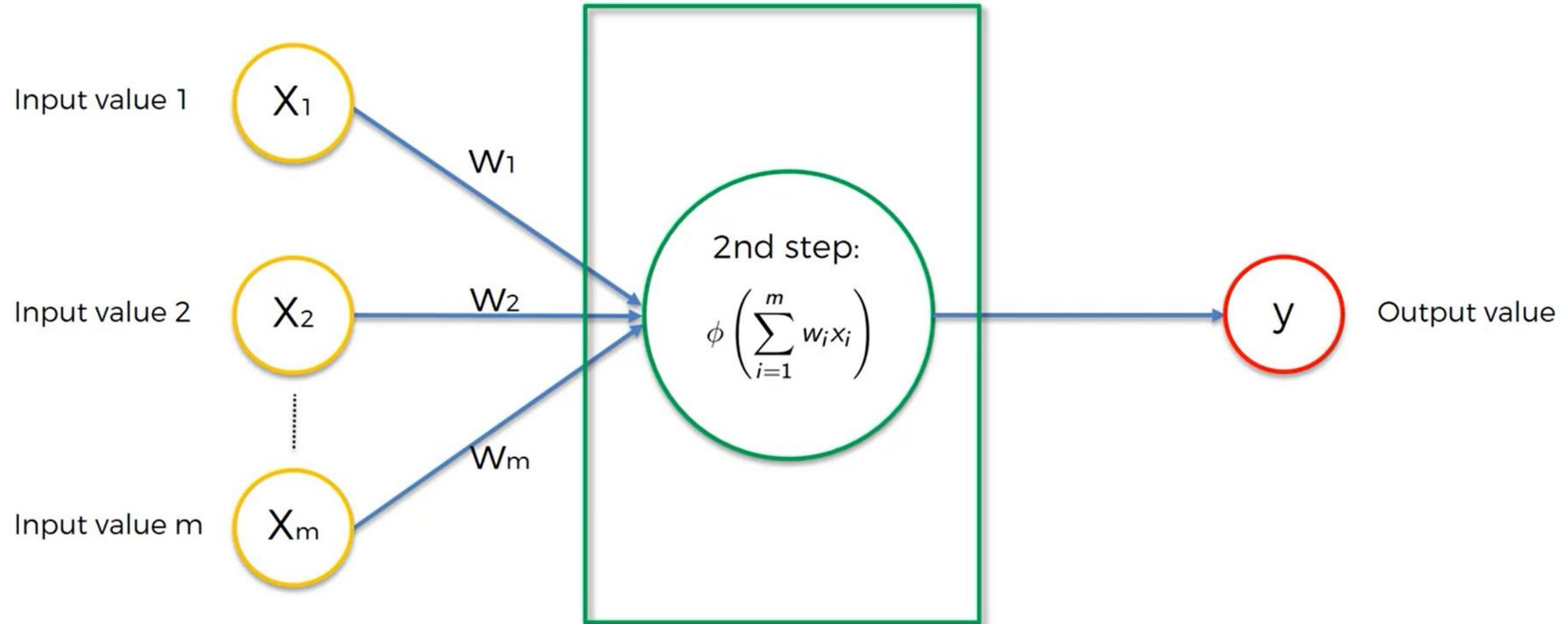
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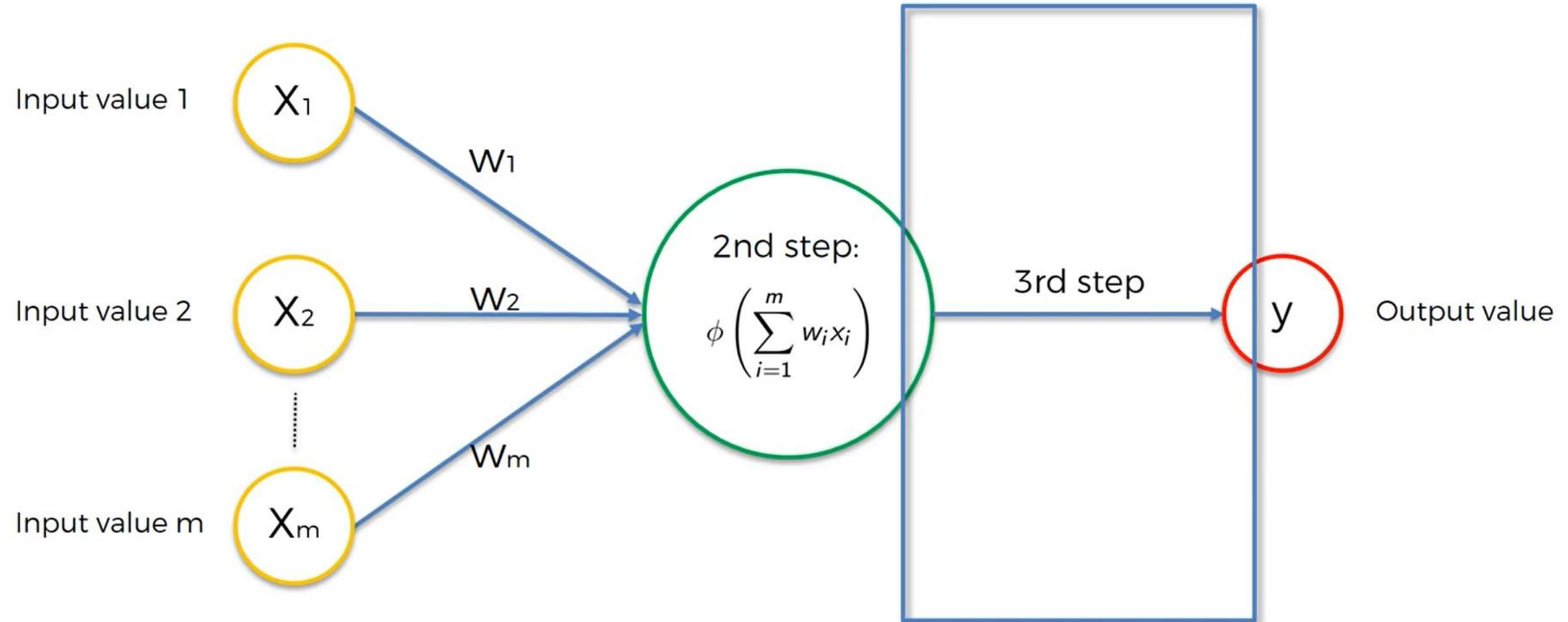
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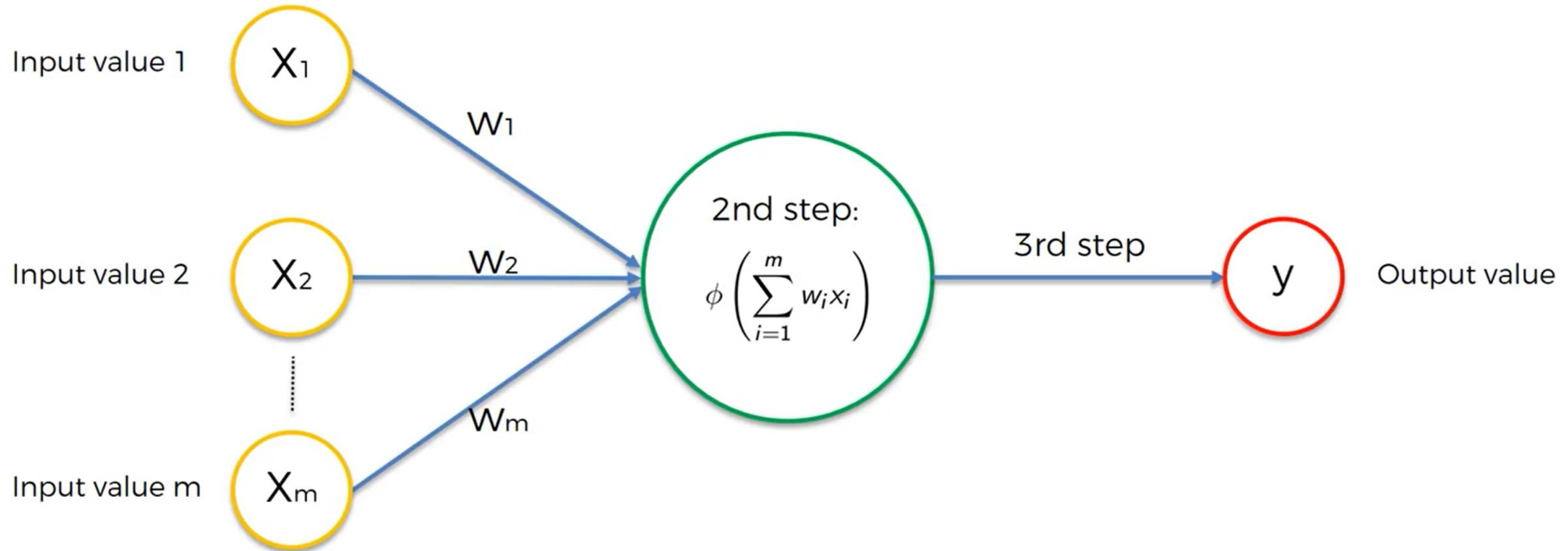


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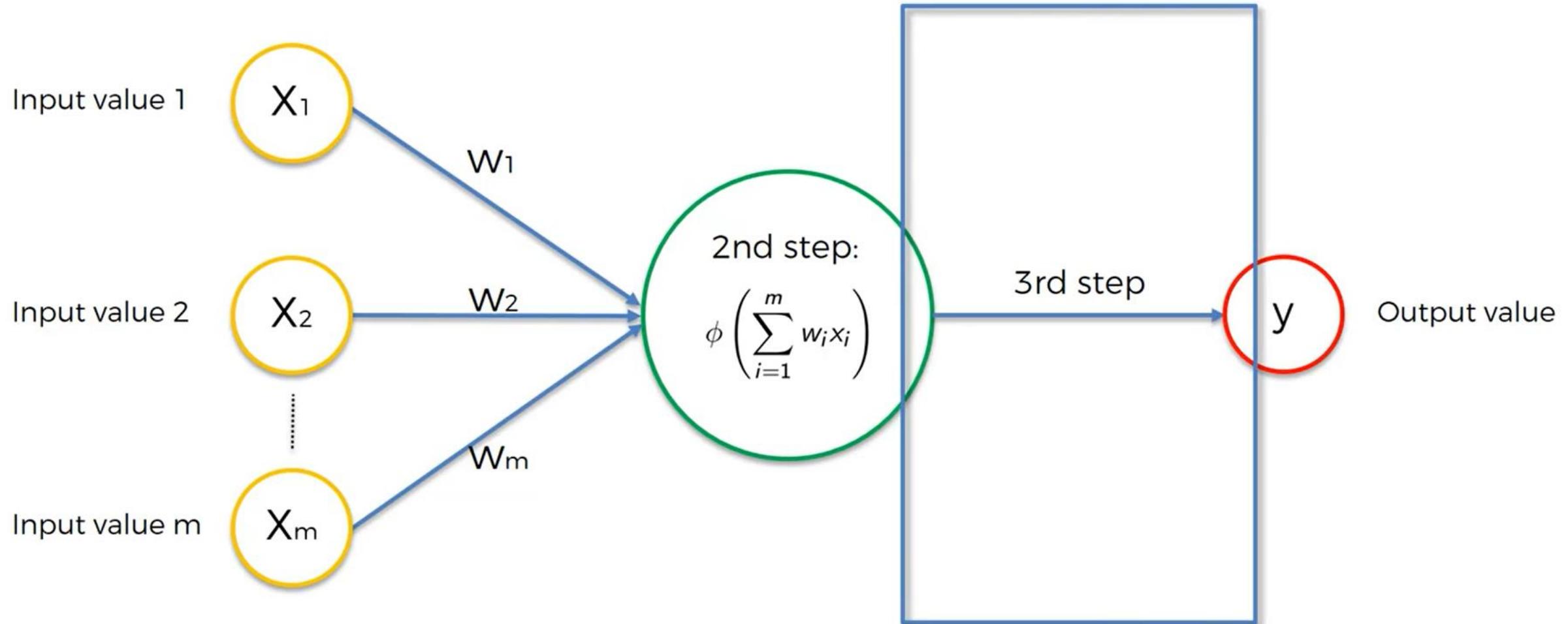


The Activation Function

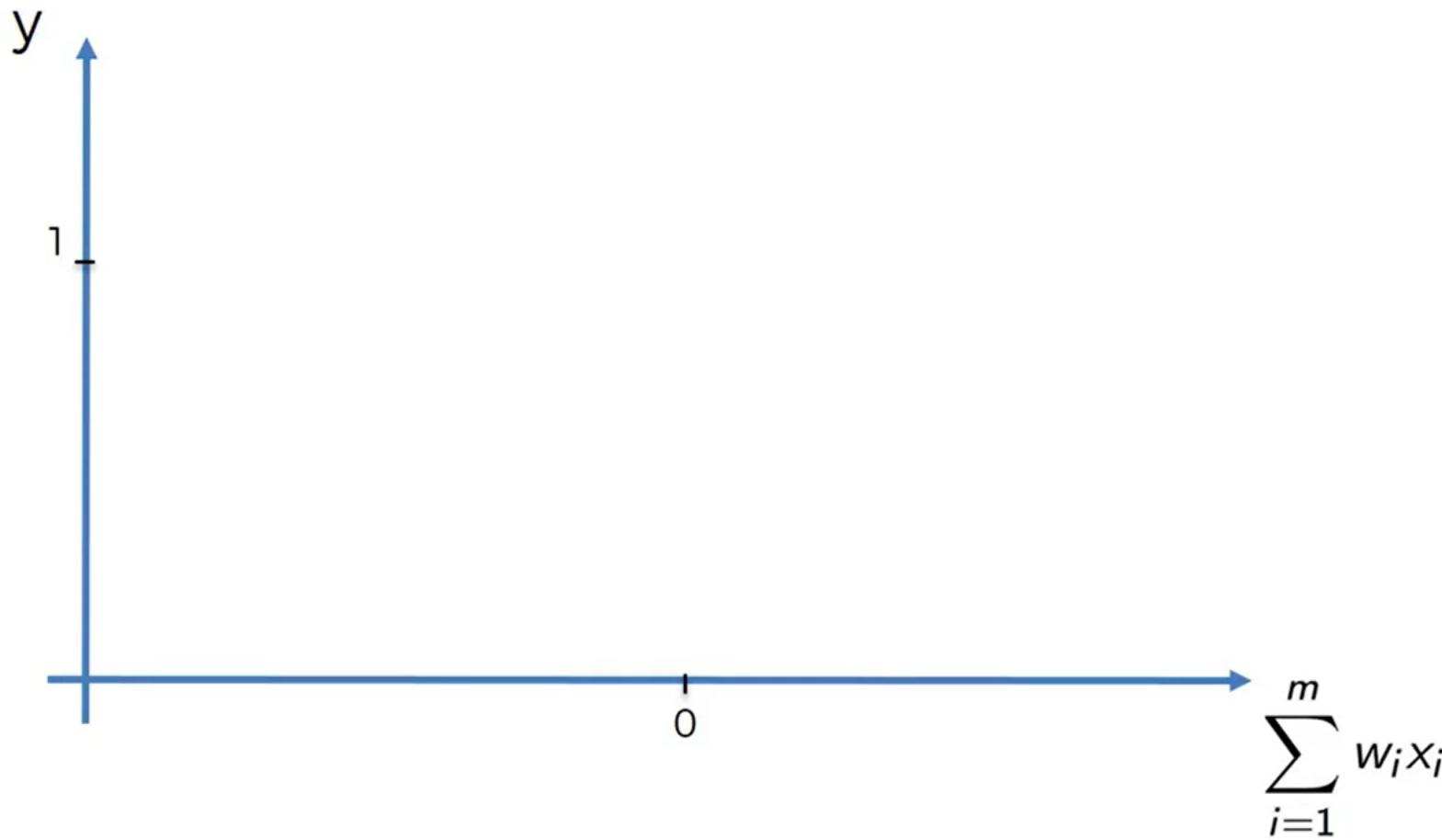
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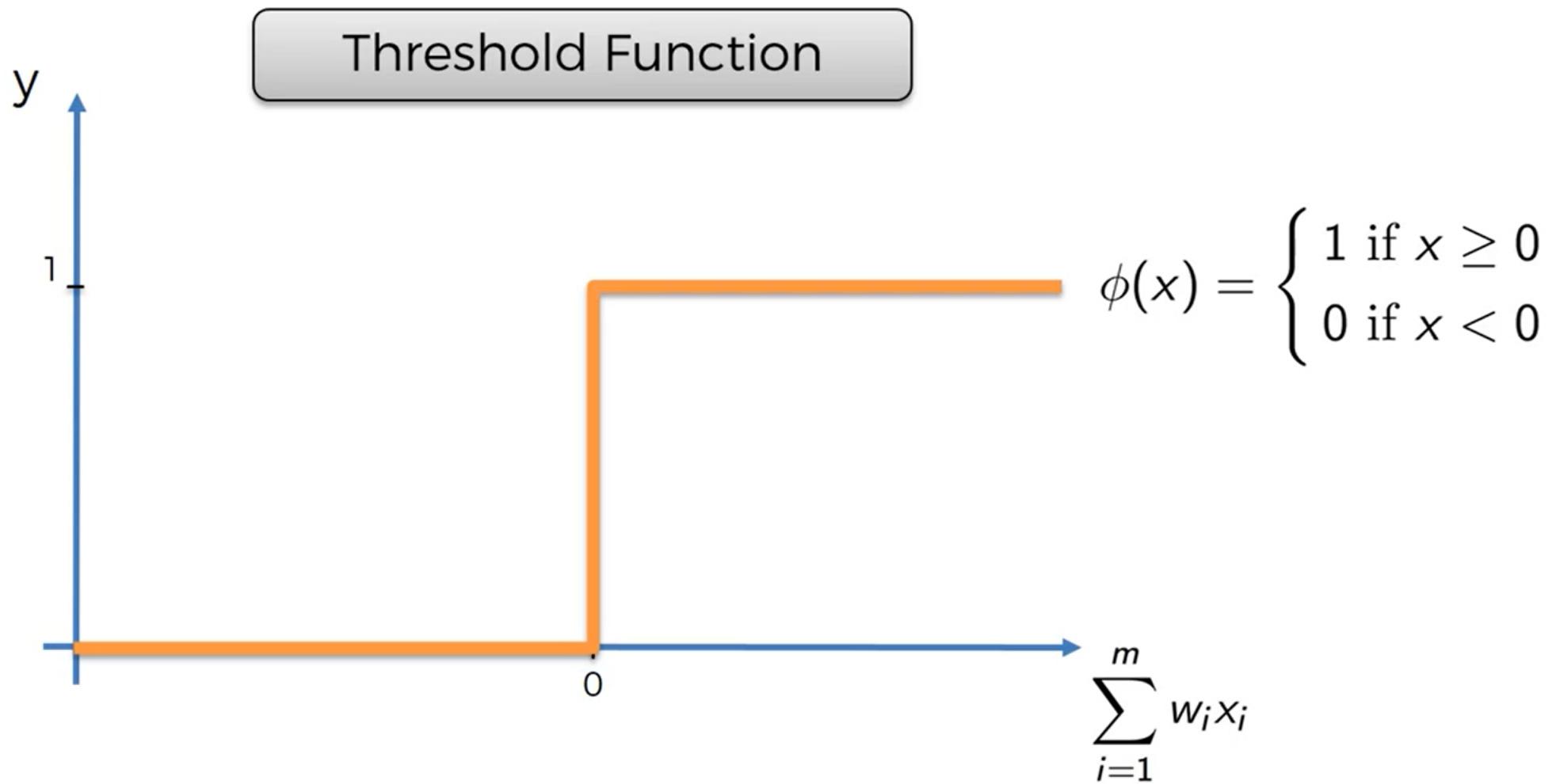
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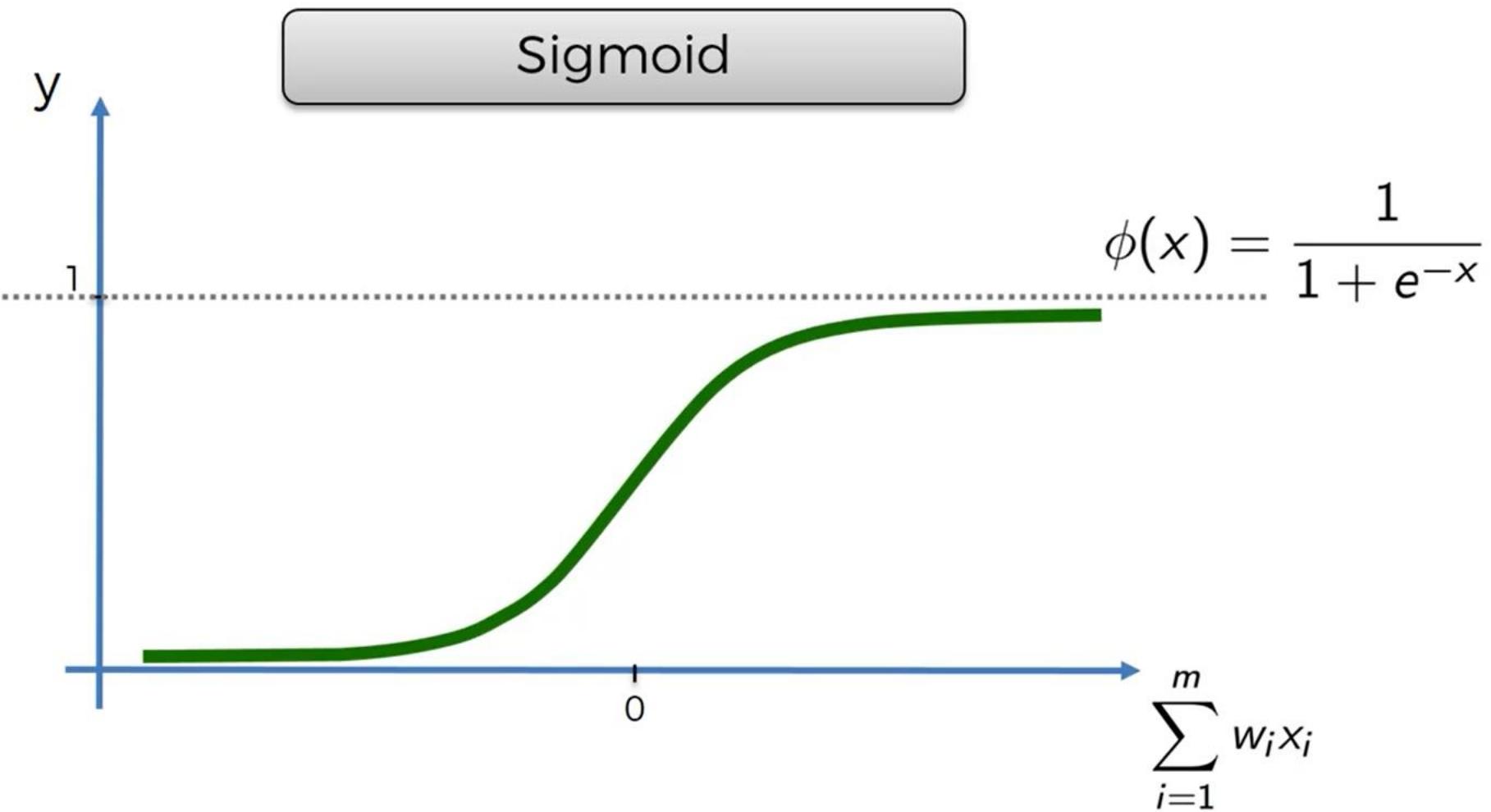
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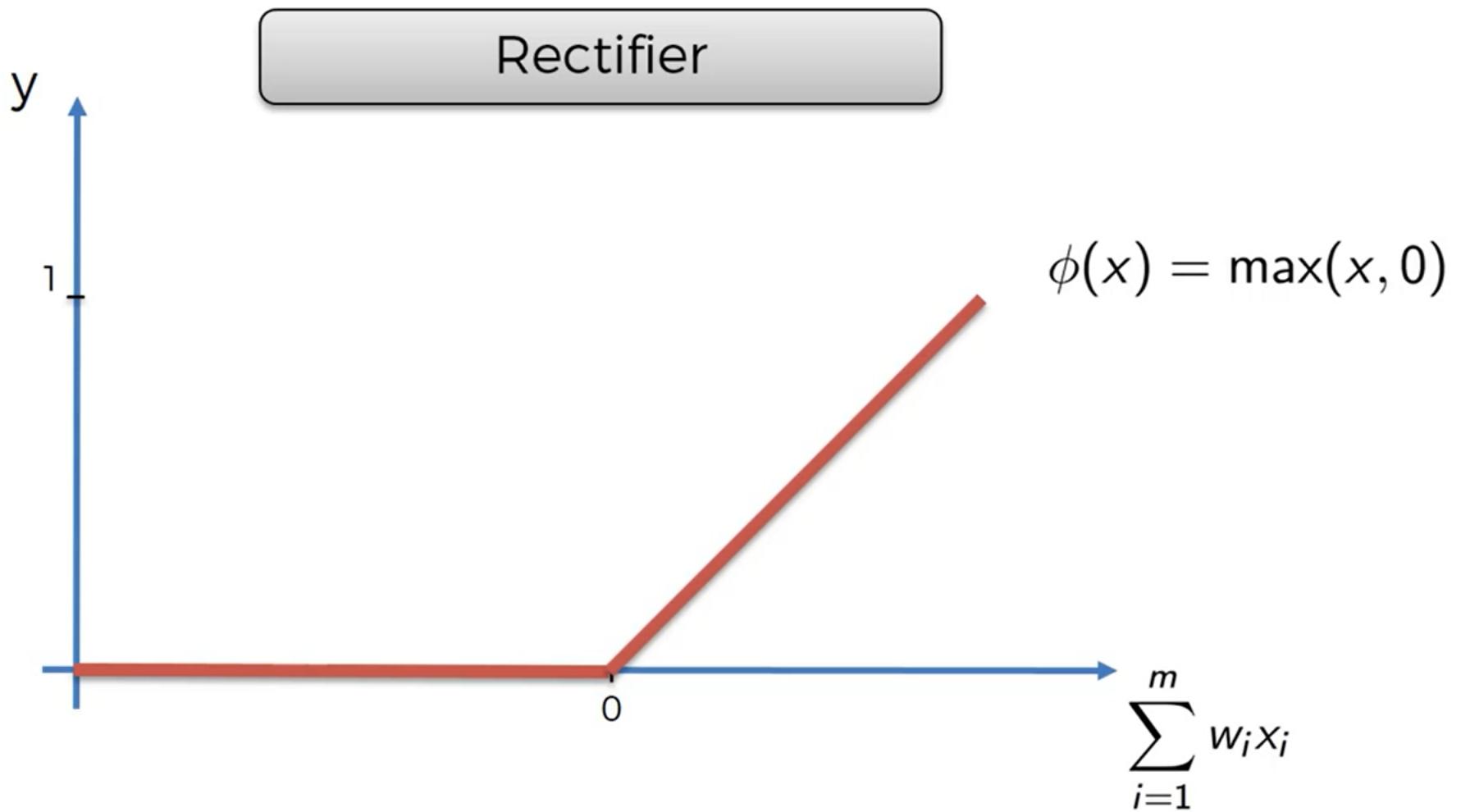
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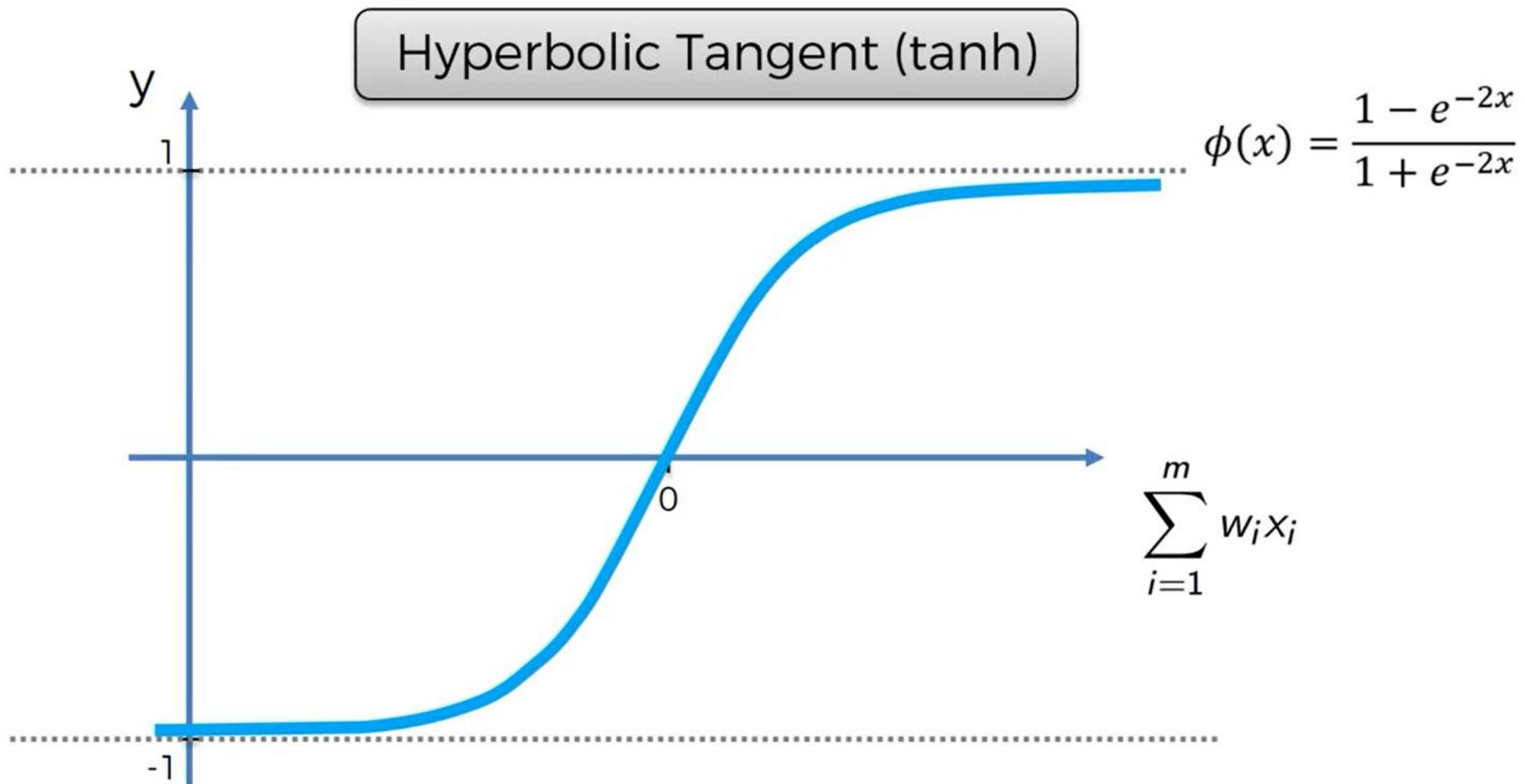
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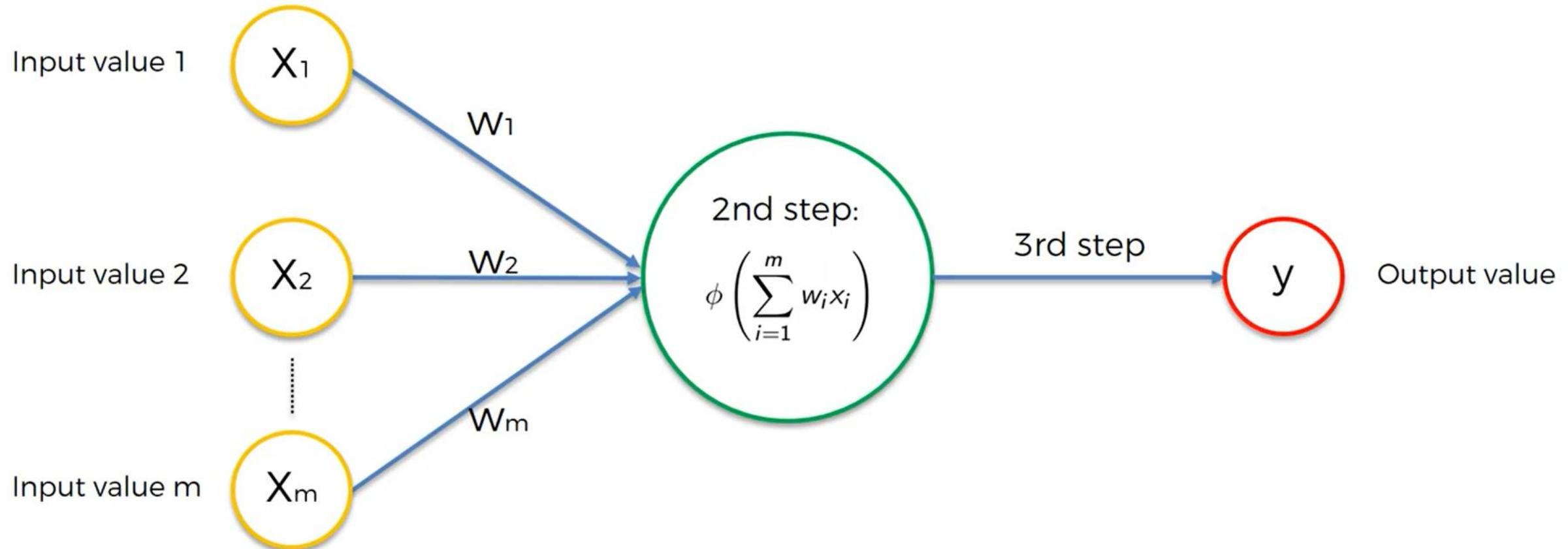
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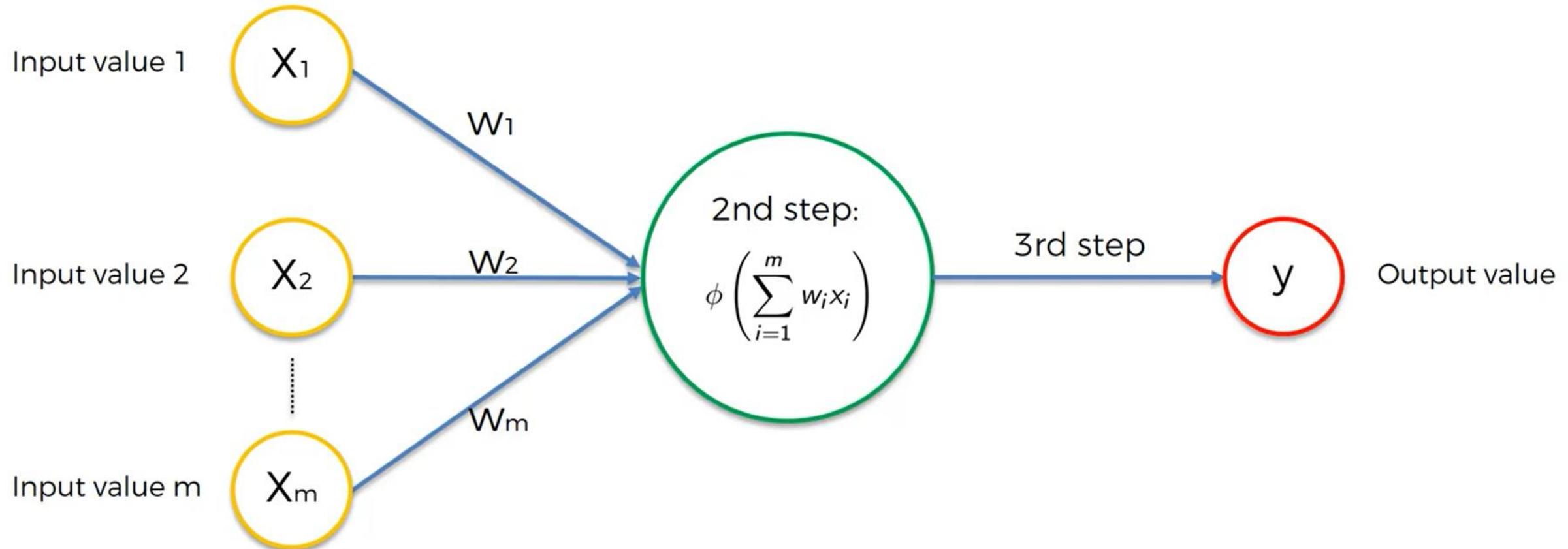
The Activation Function



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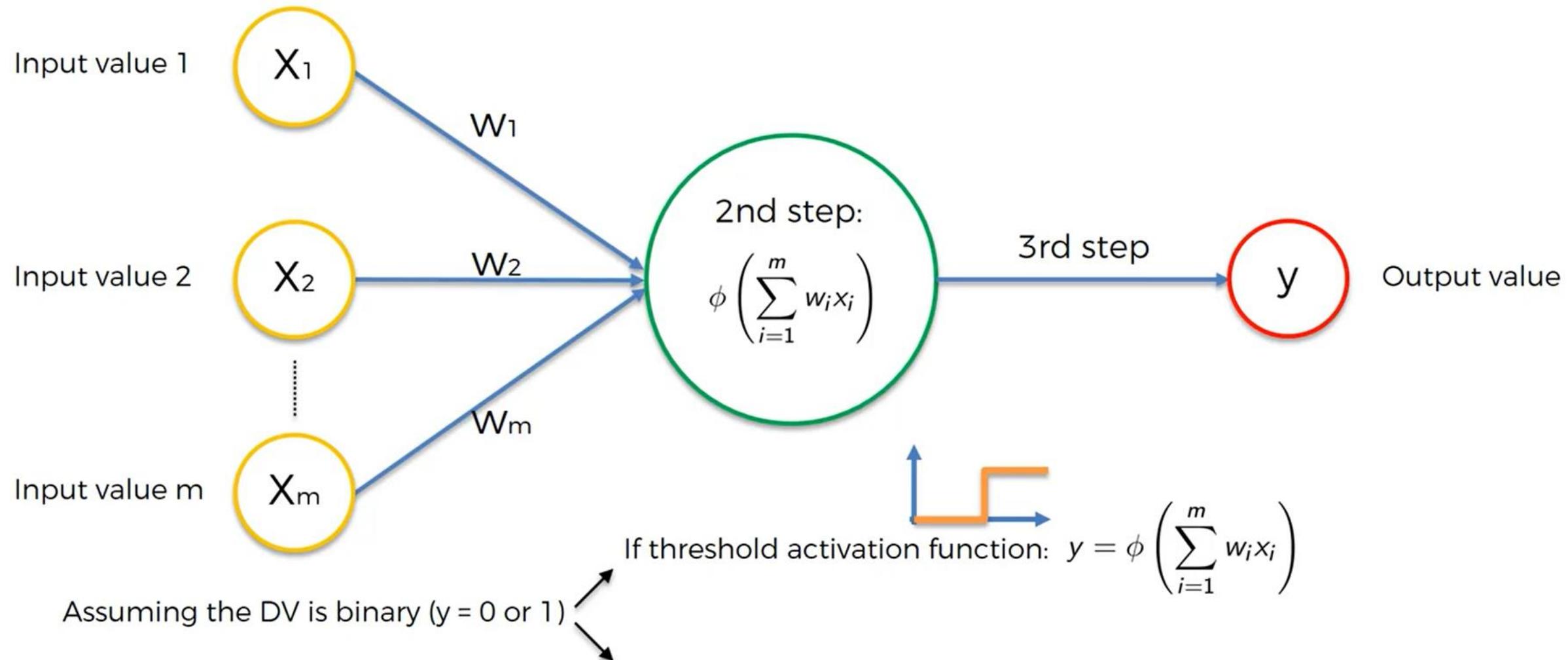


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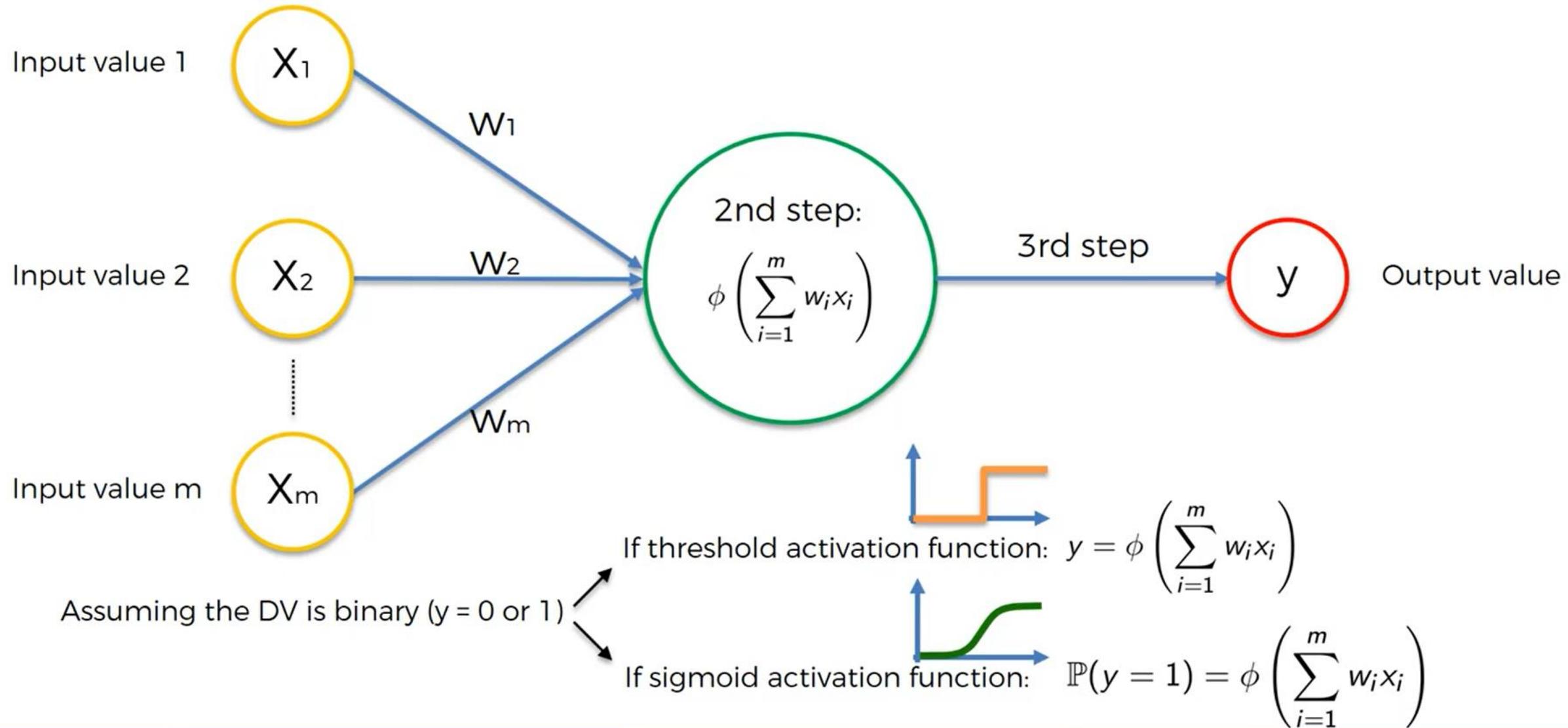


Assuming the DV is binary ($y = 0$ or 1)

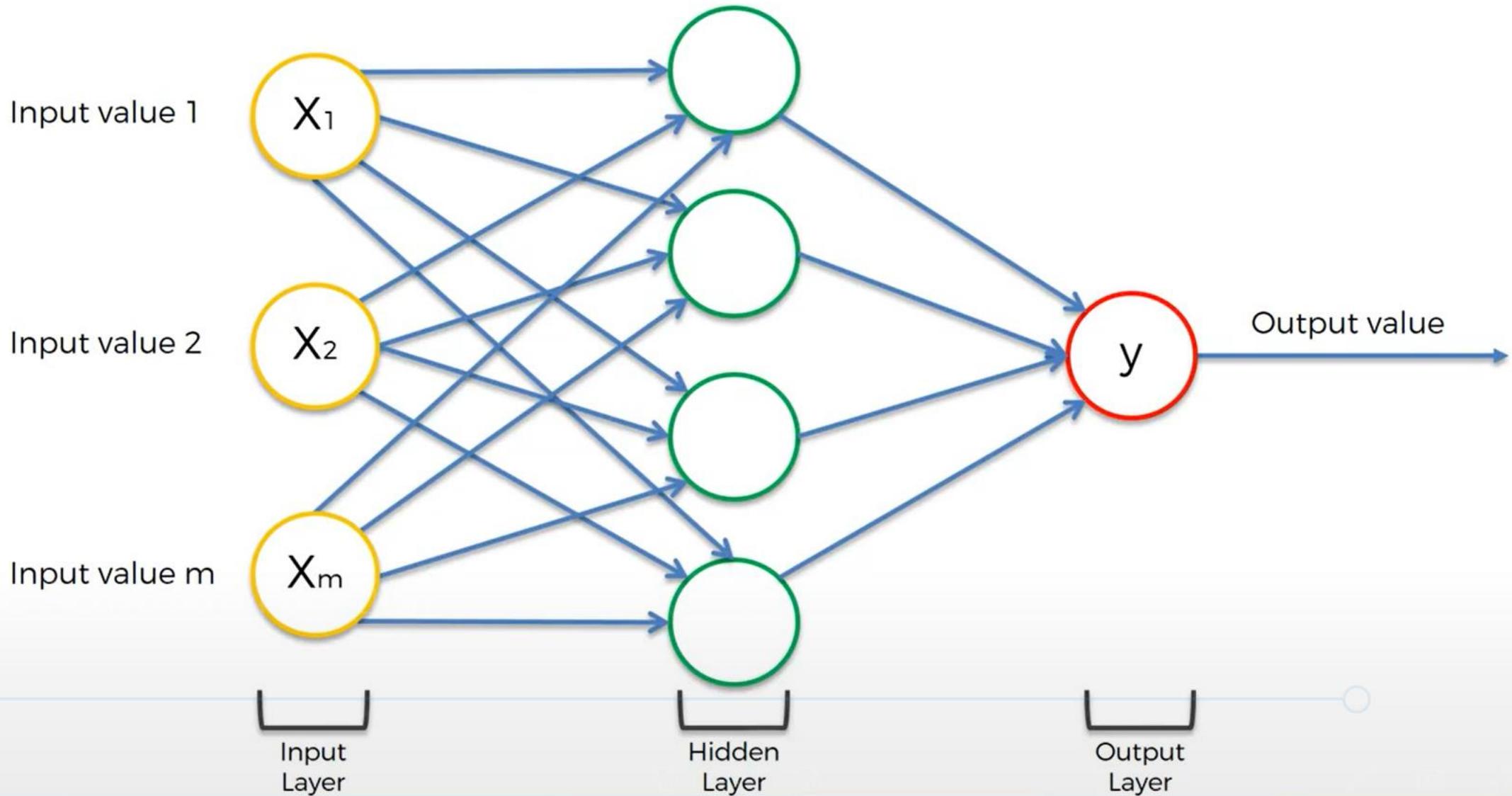
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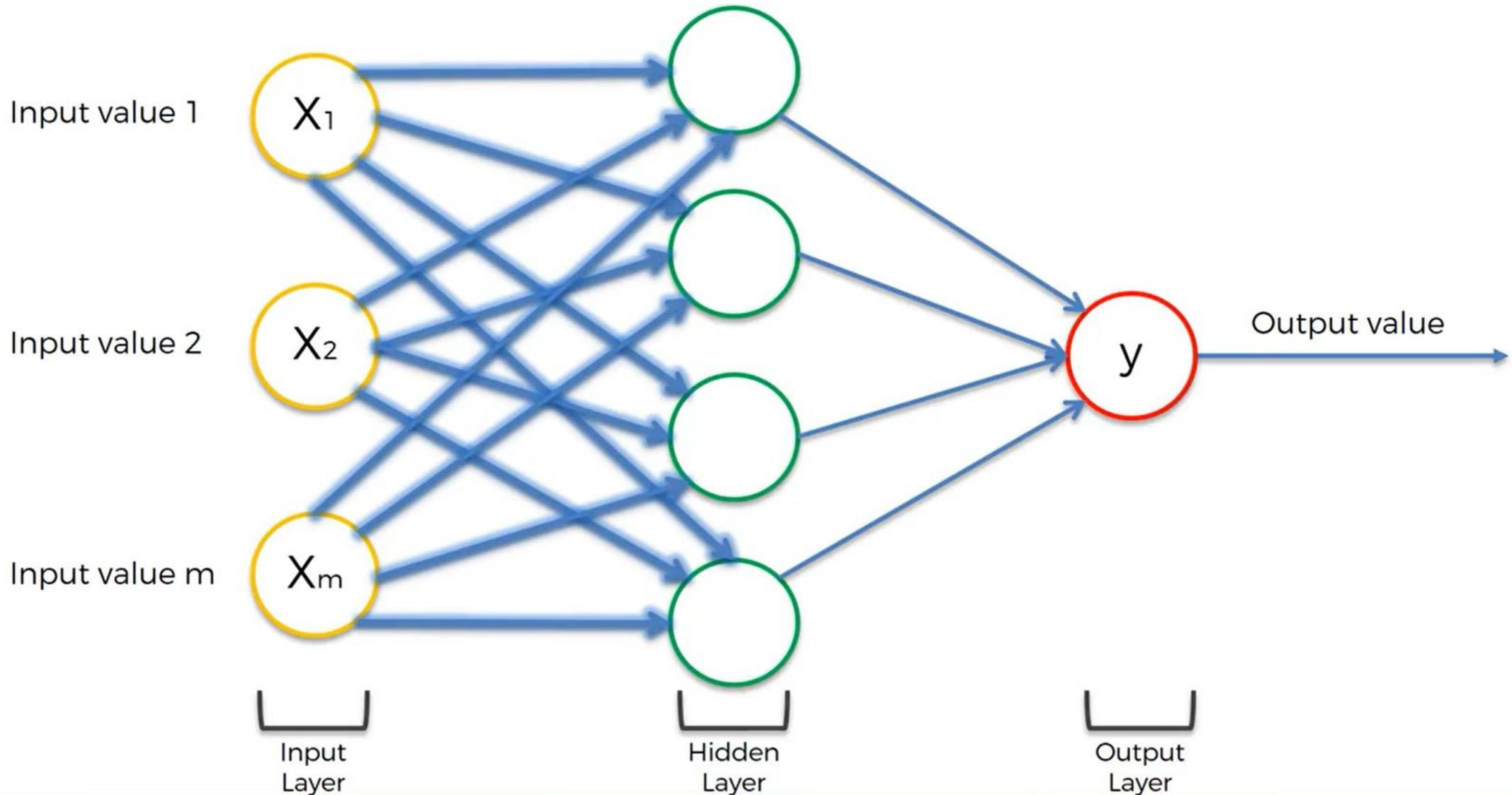
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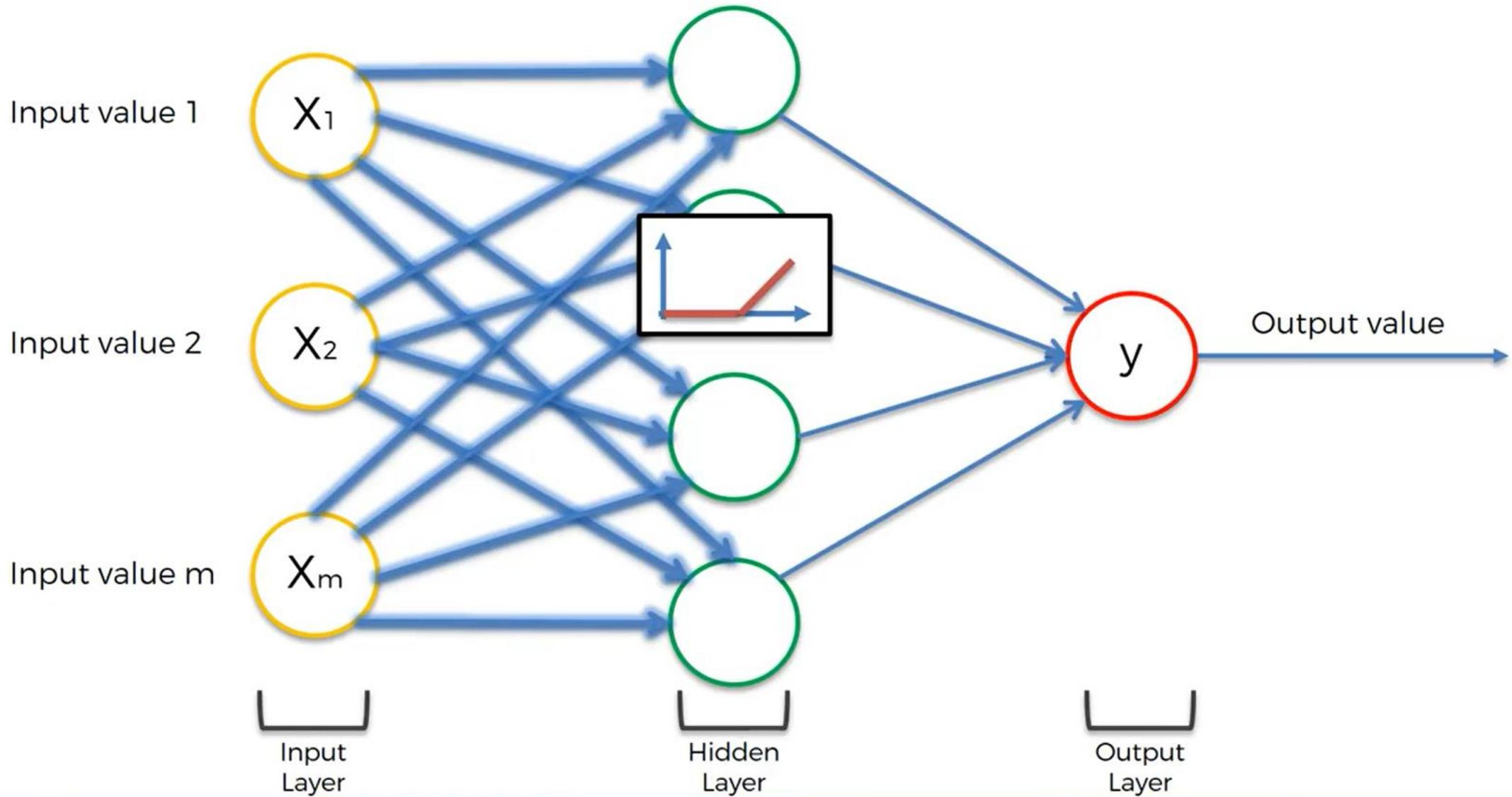
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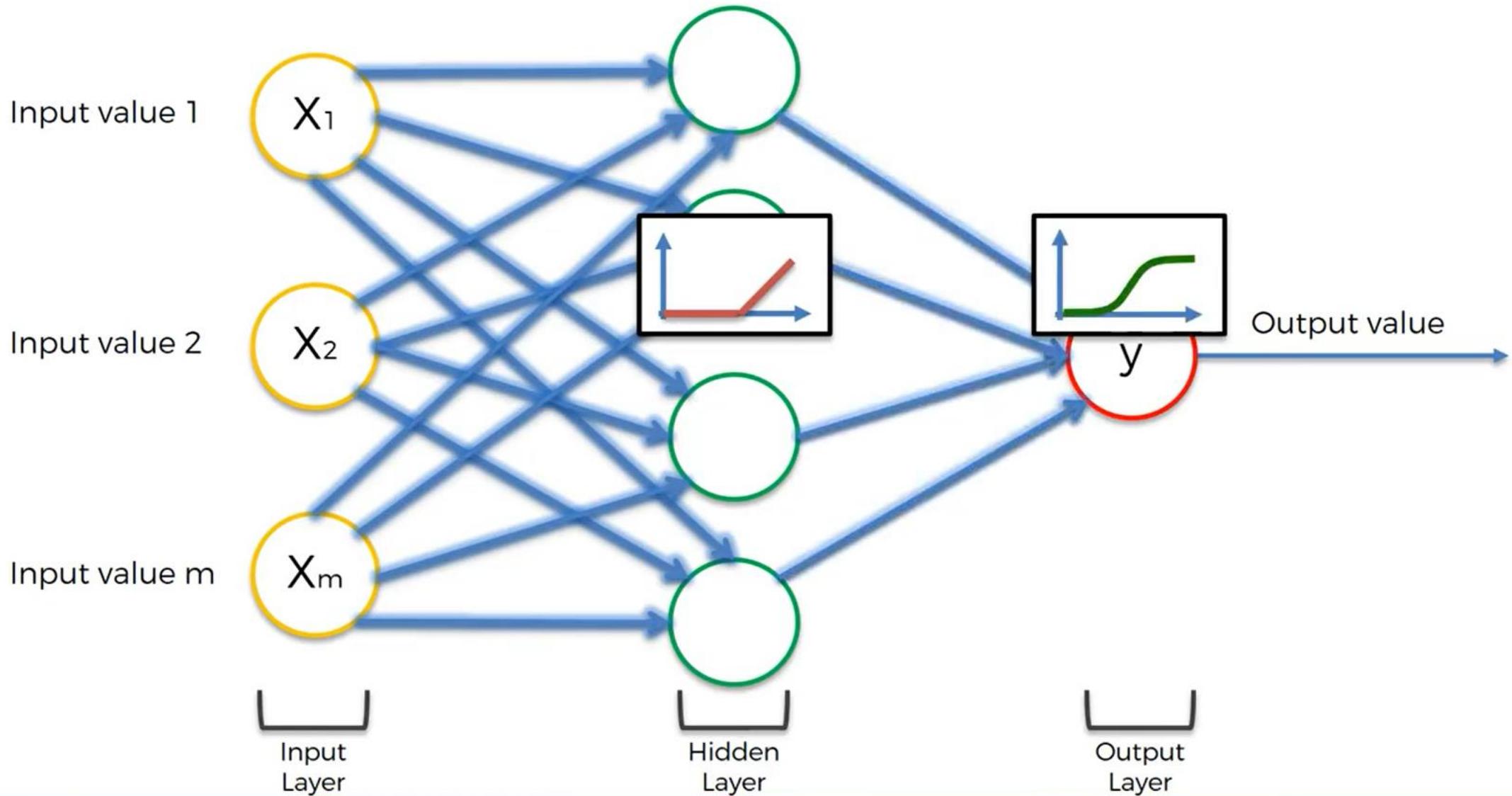
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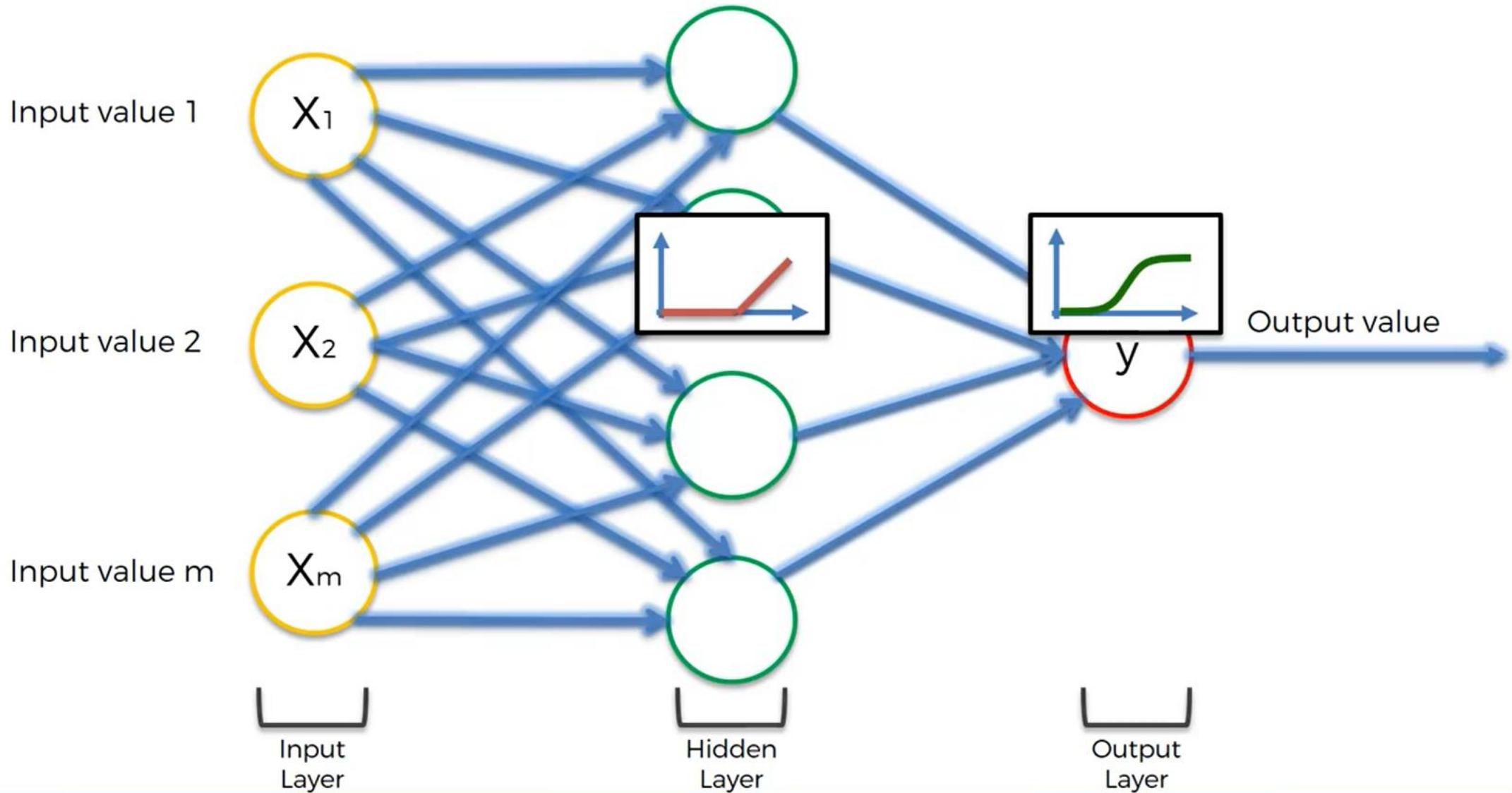
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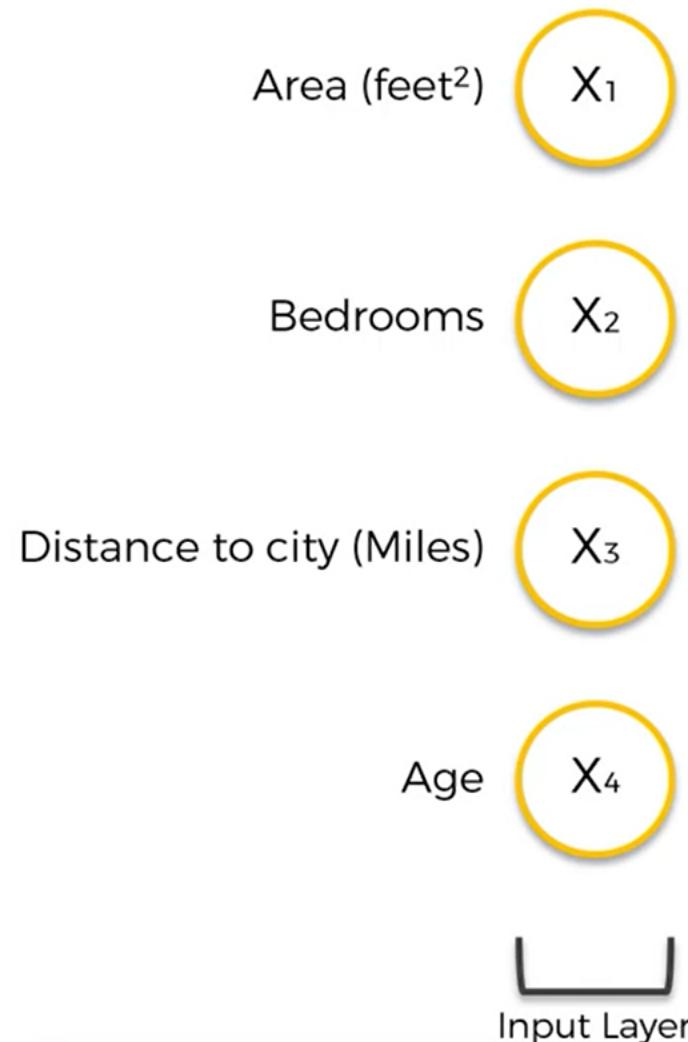
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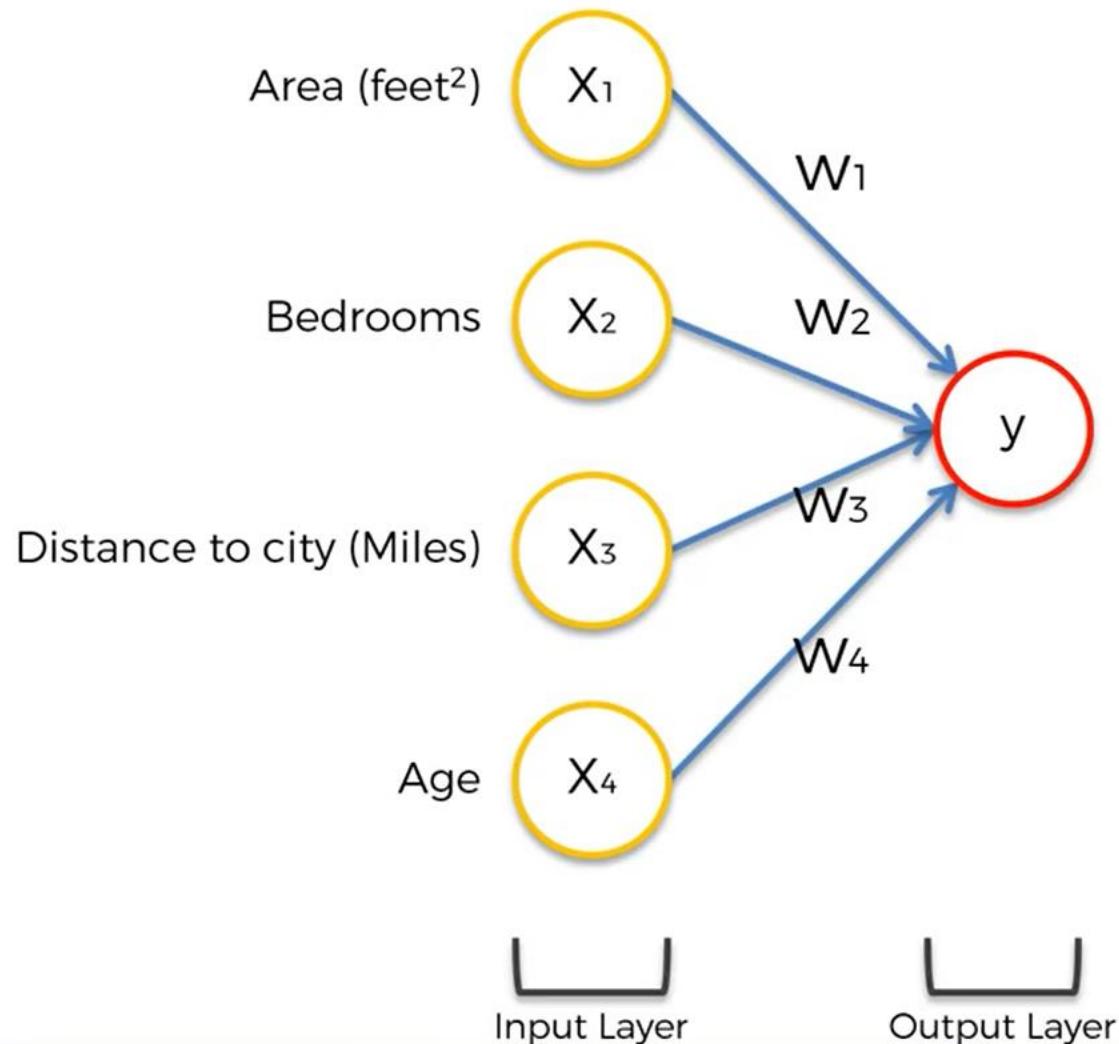
How do NNs Work?



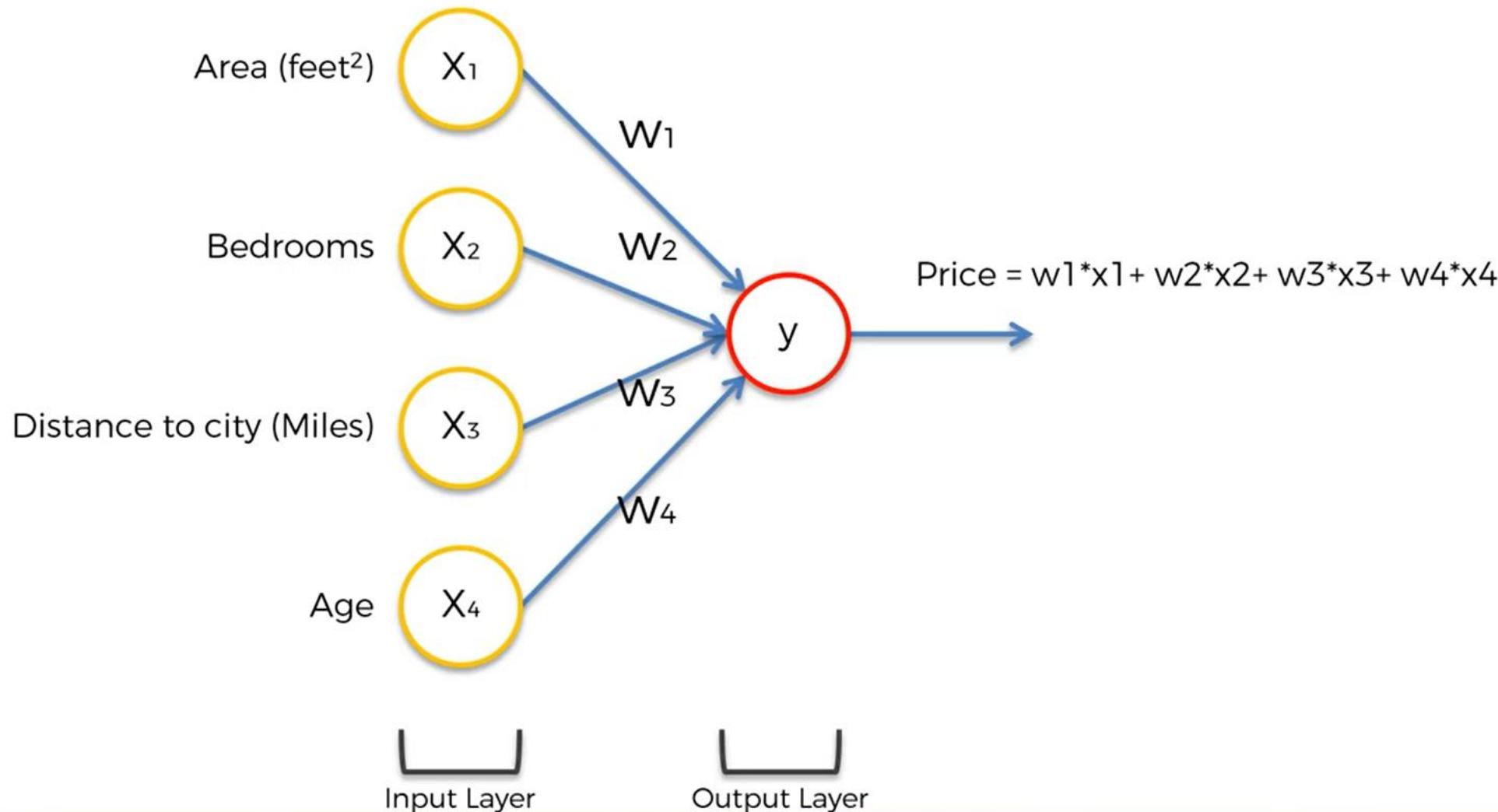
How Do Neural Networks Work?



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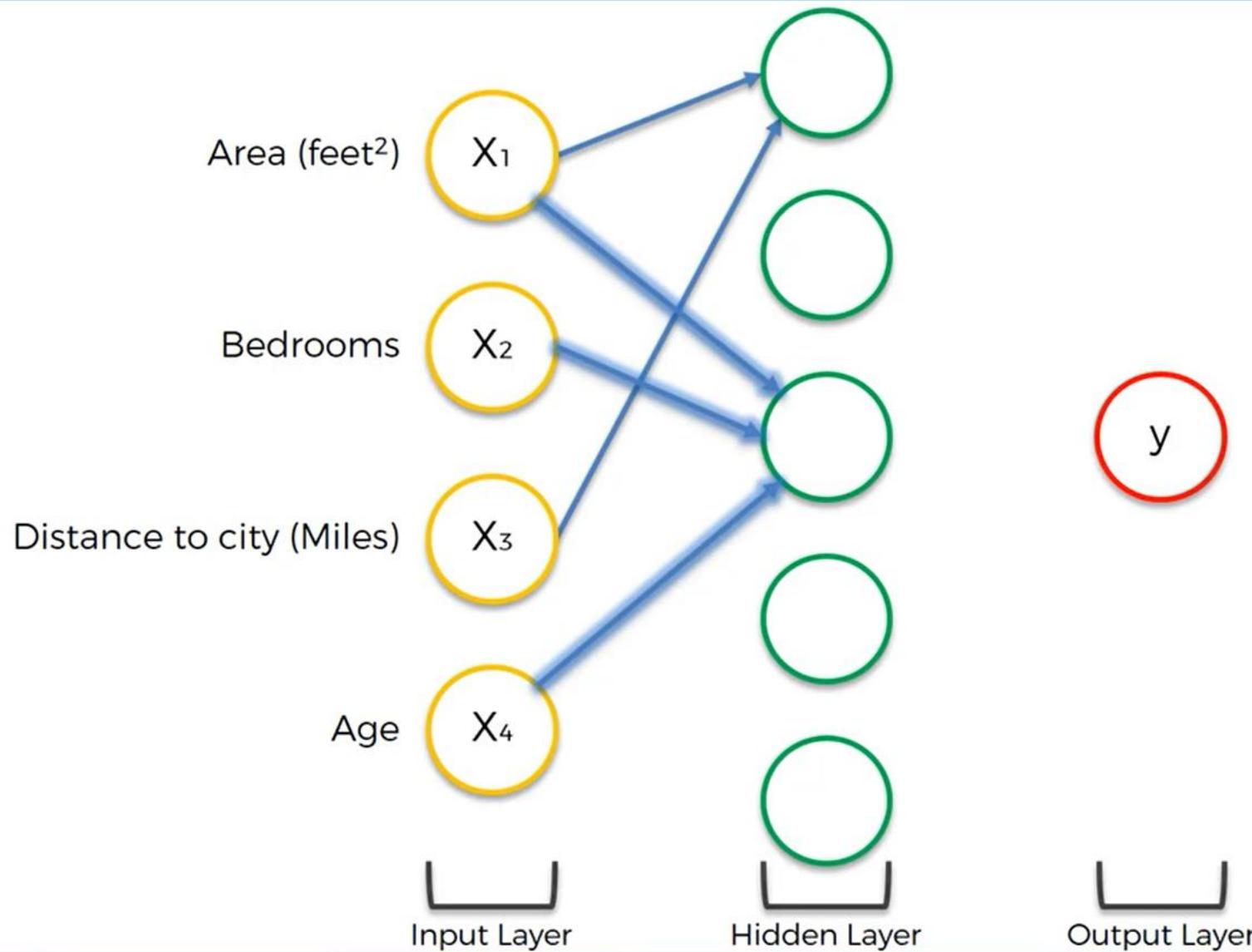
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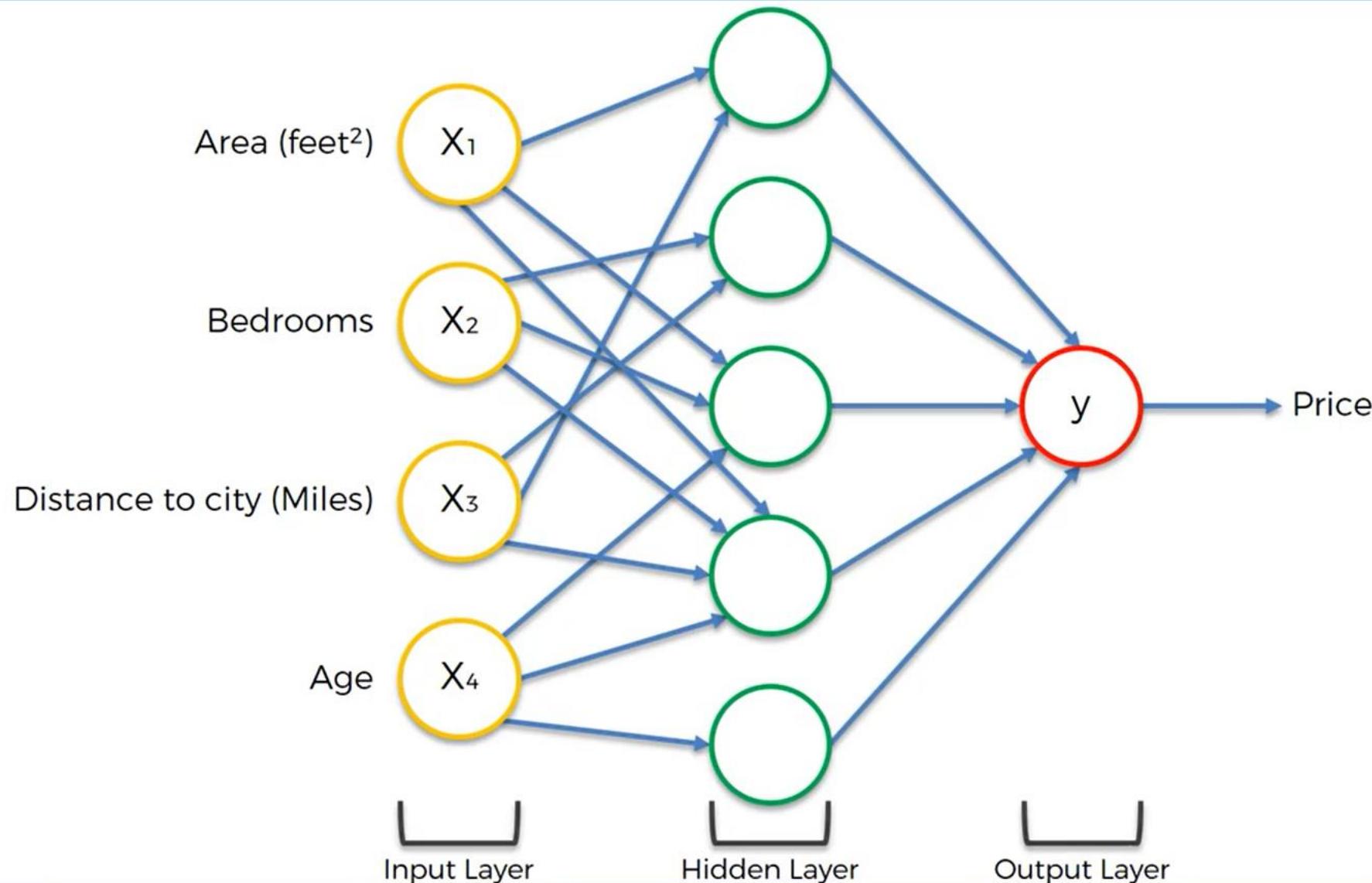
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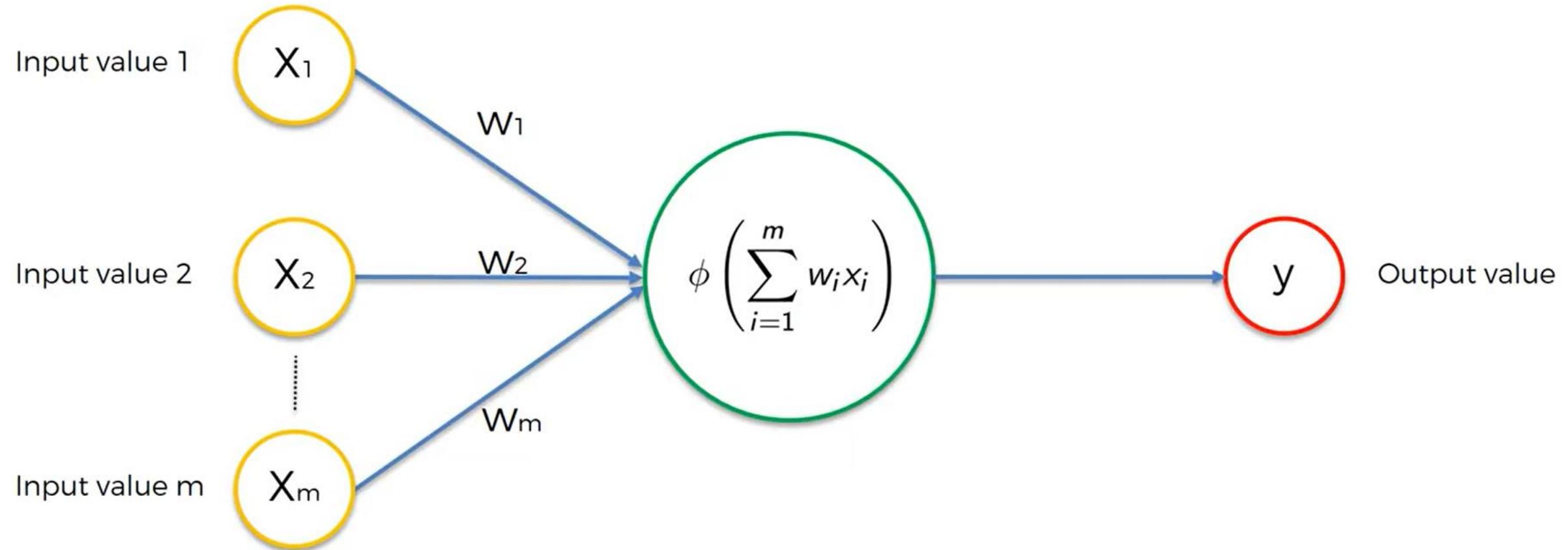
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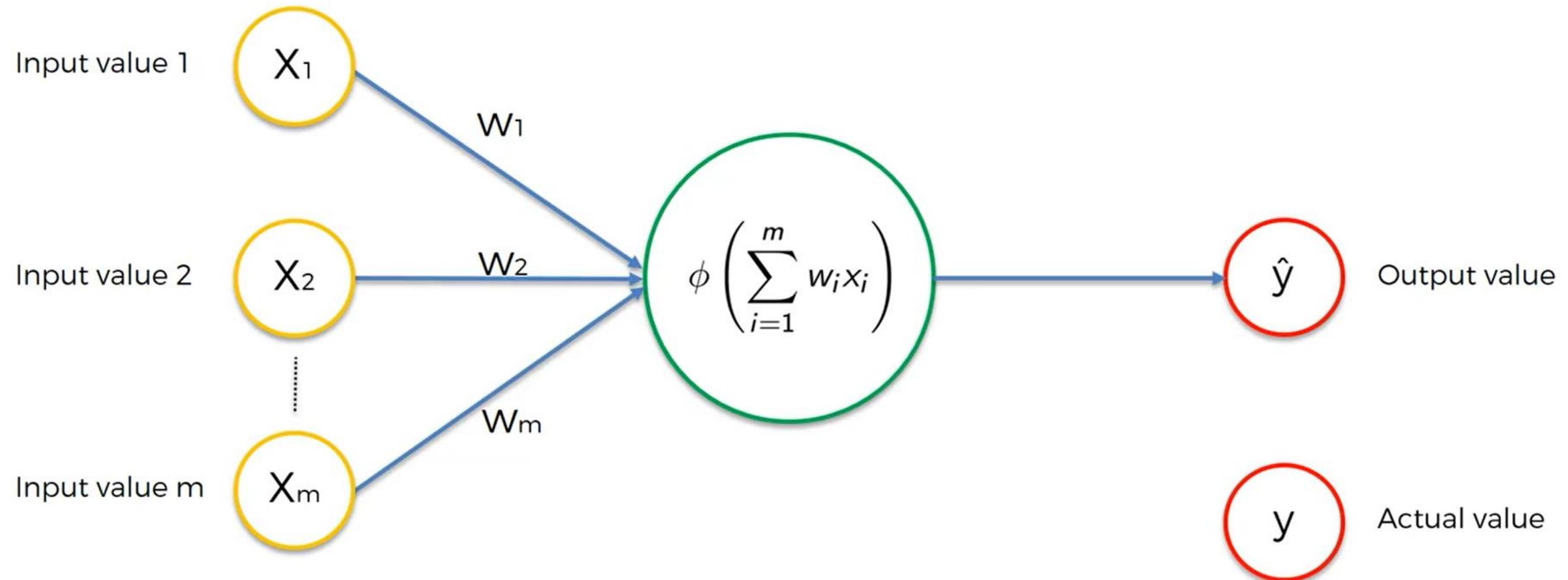
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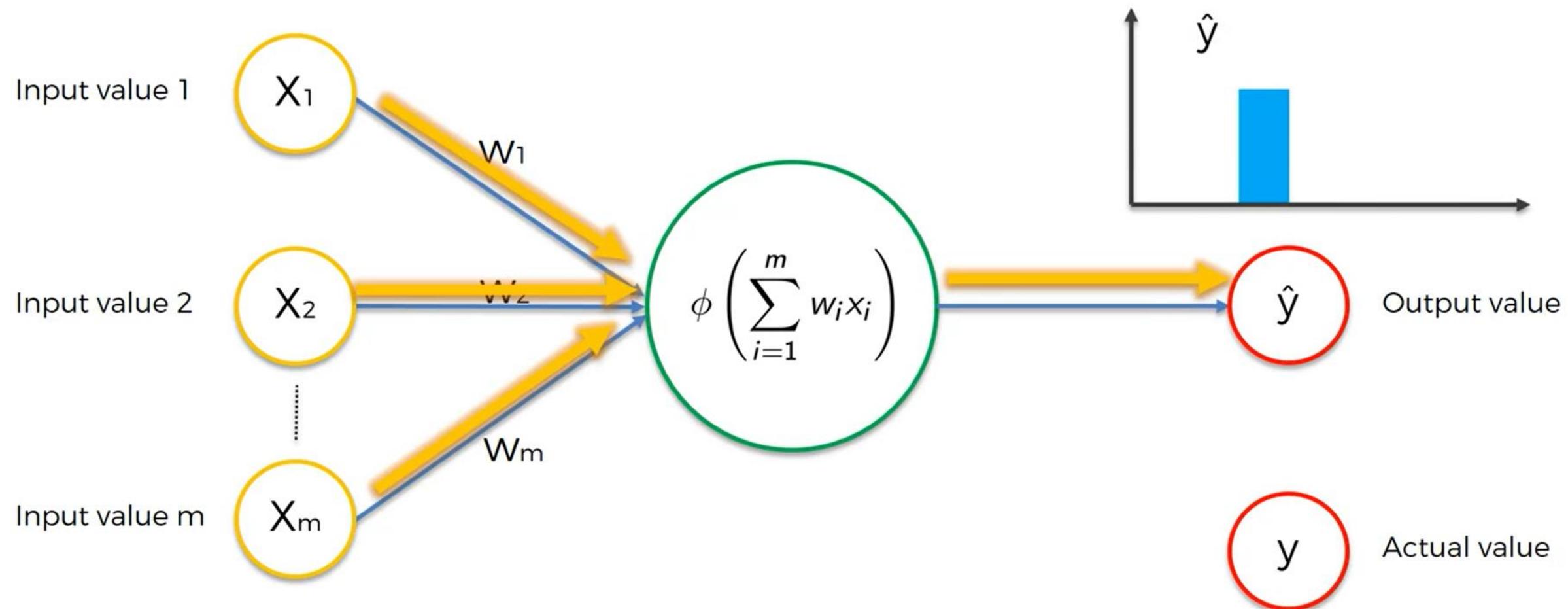
How do Neural Networks learn?



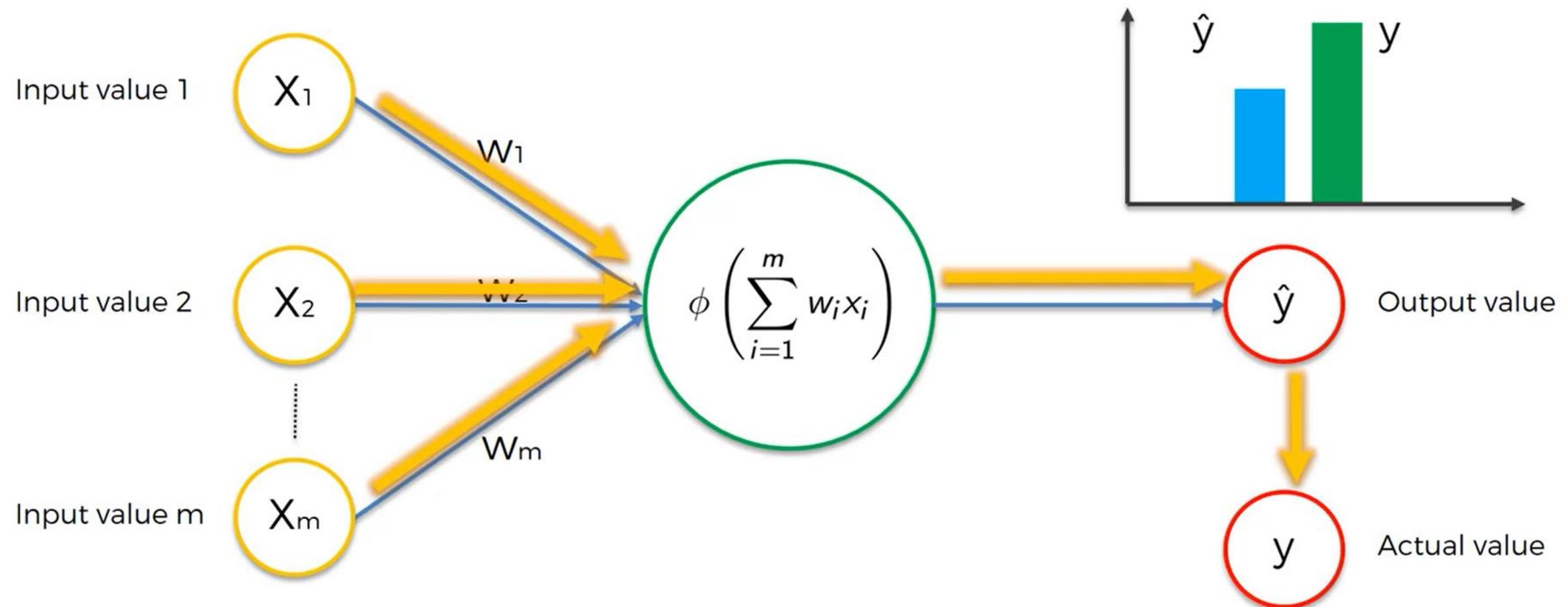
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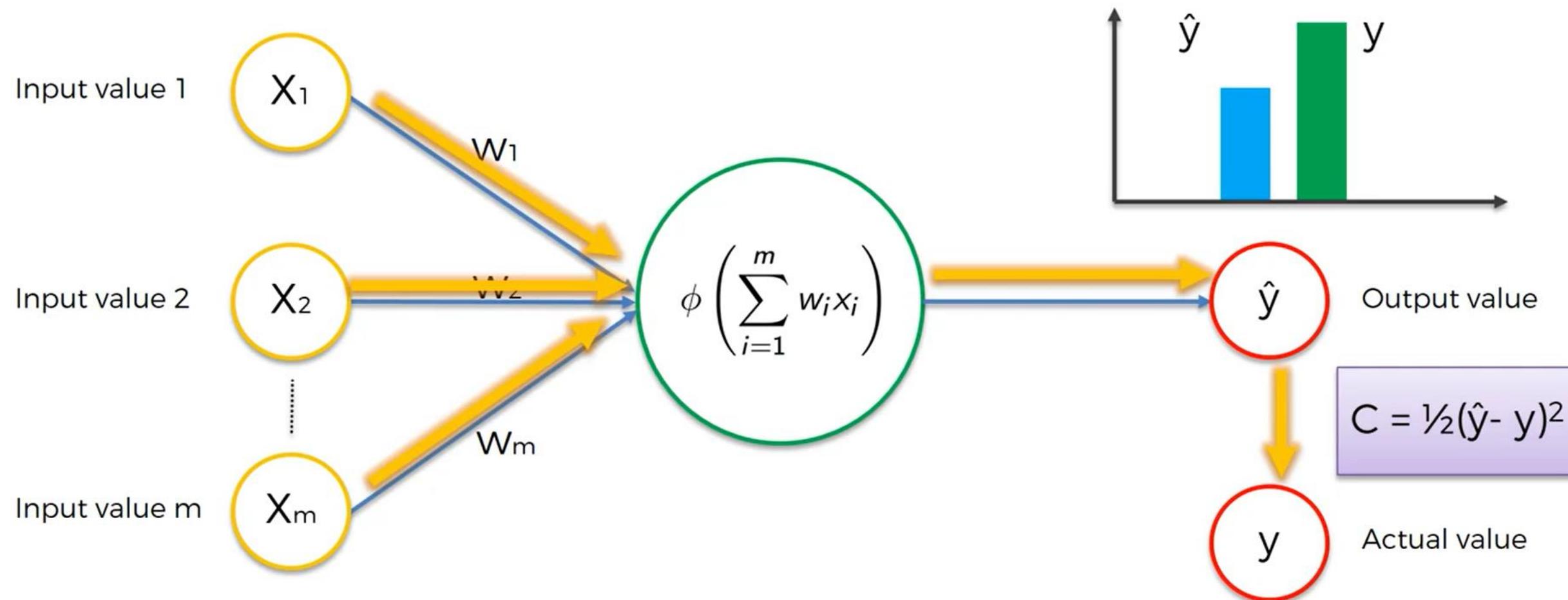
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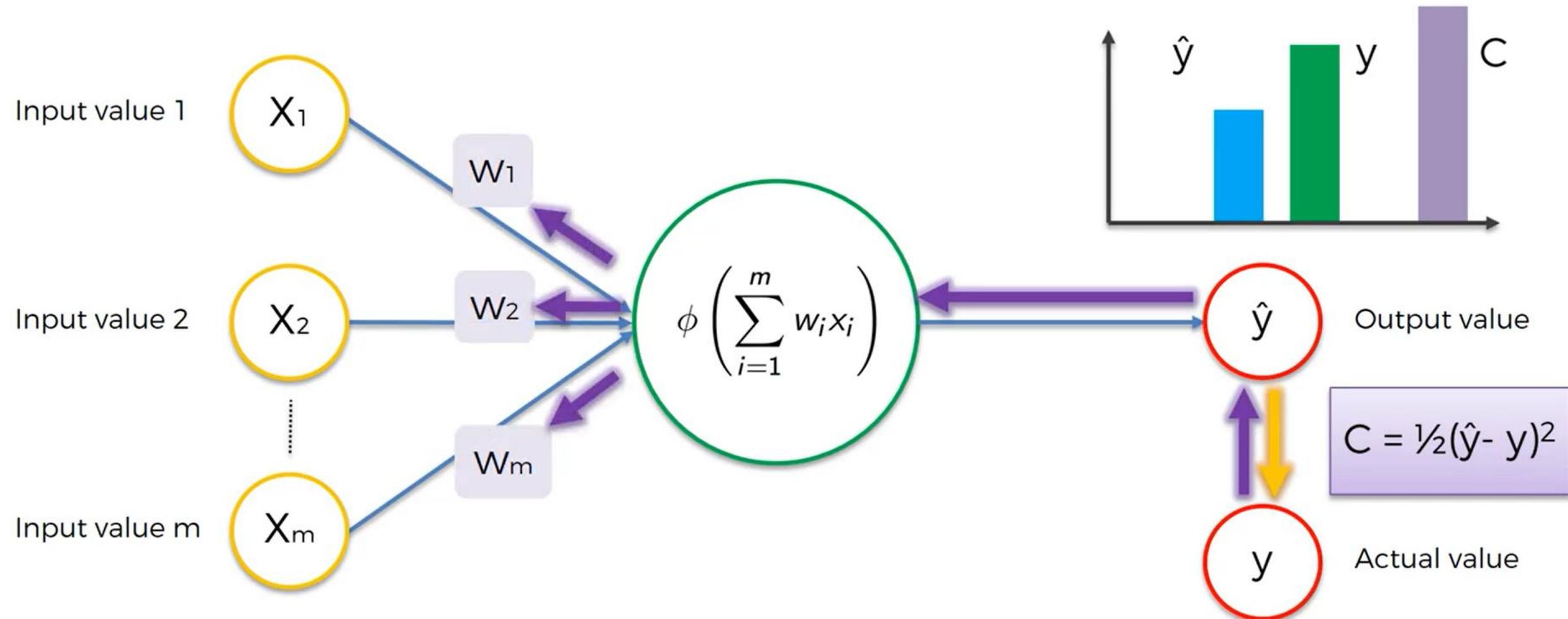
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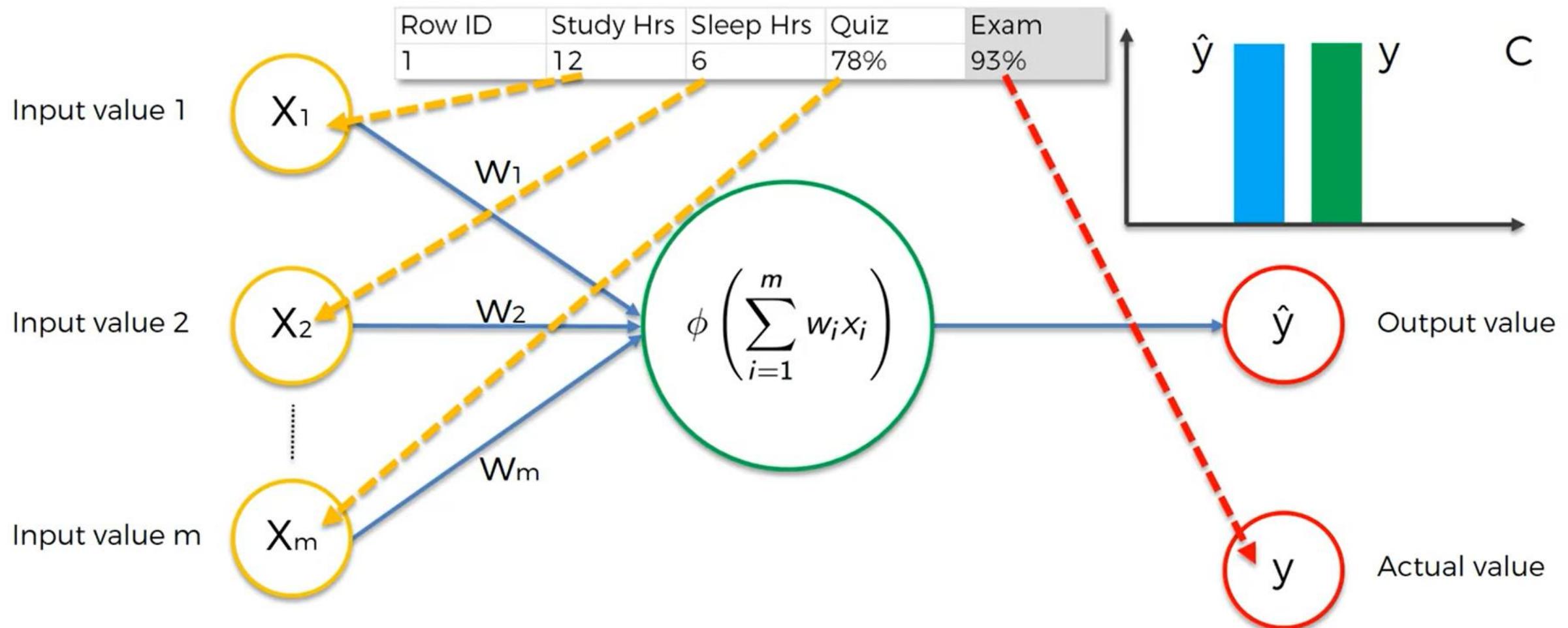
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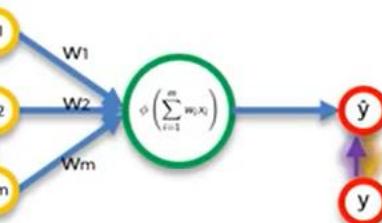
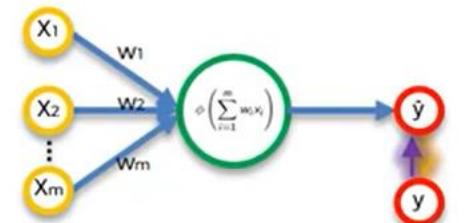
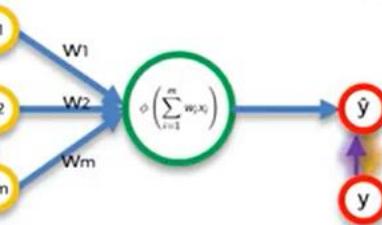
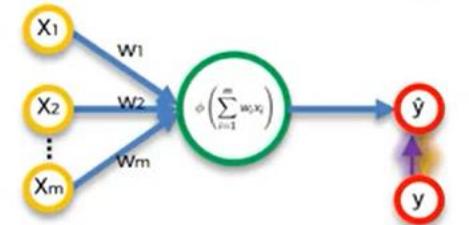
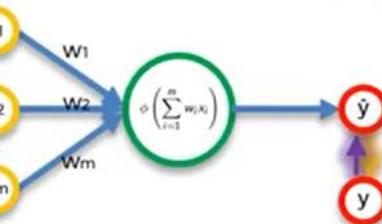
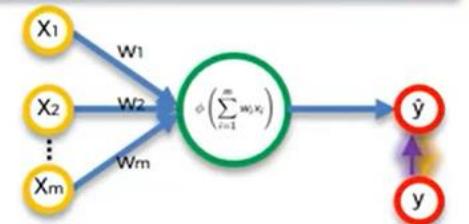
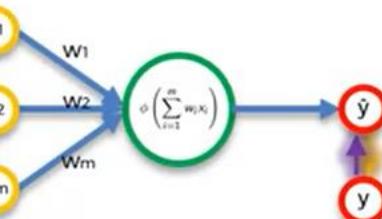
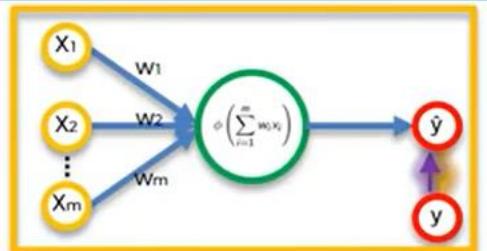
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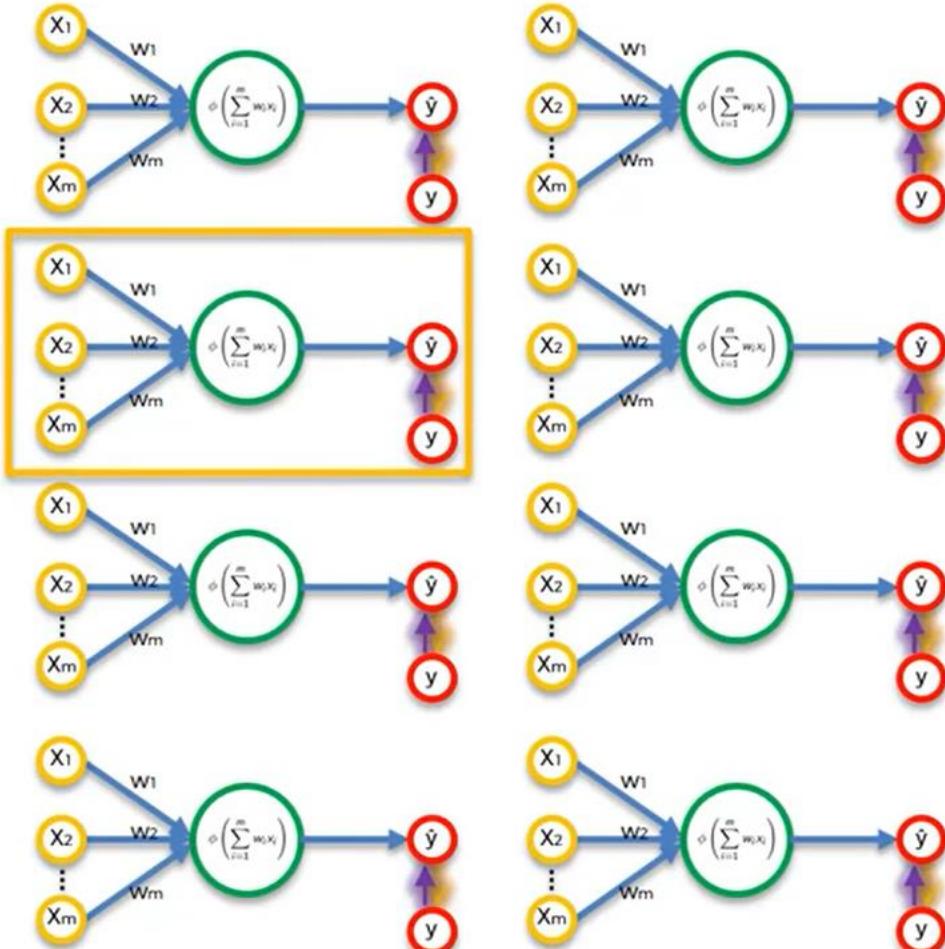
How do Neural Networks learn?



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1	12	6	78%	93%
2	22	6.5	24%	68%
3	115	4	100%	95%
4	31	9	67%	75%
5	0	10	58%	51%
6	5	8	78%	60%
7	92	6	82%	89%
8	57	8	91%	97%



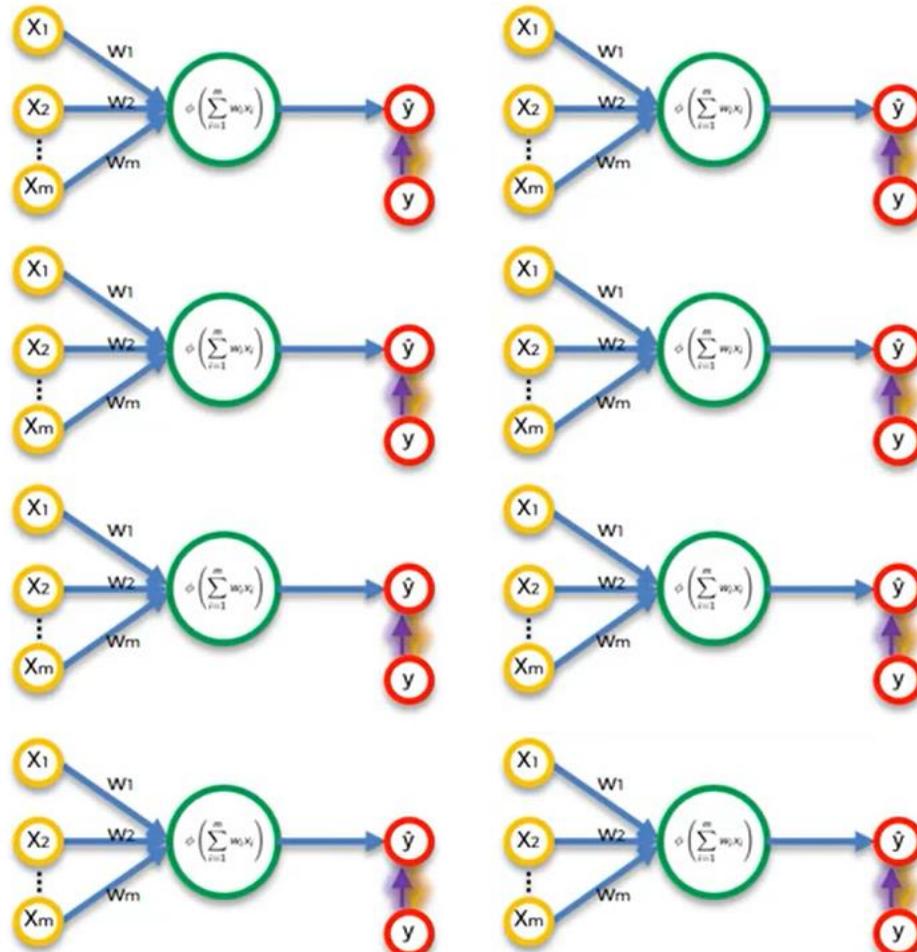
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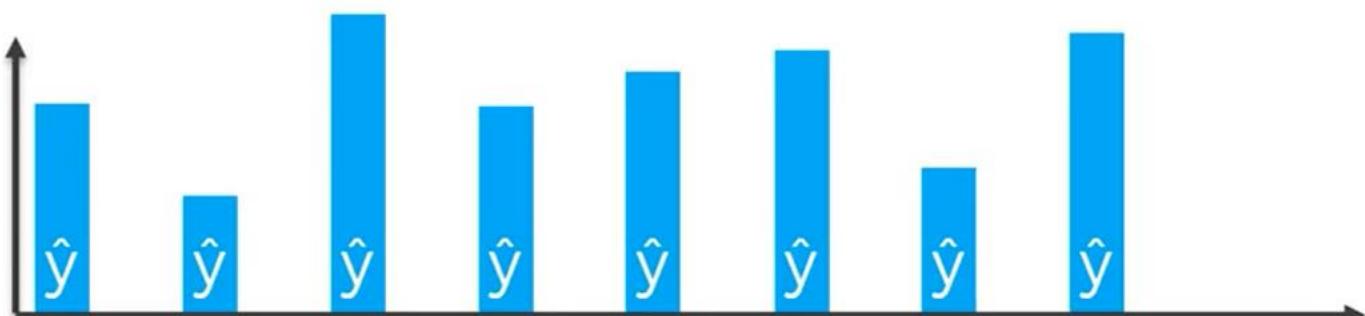
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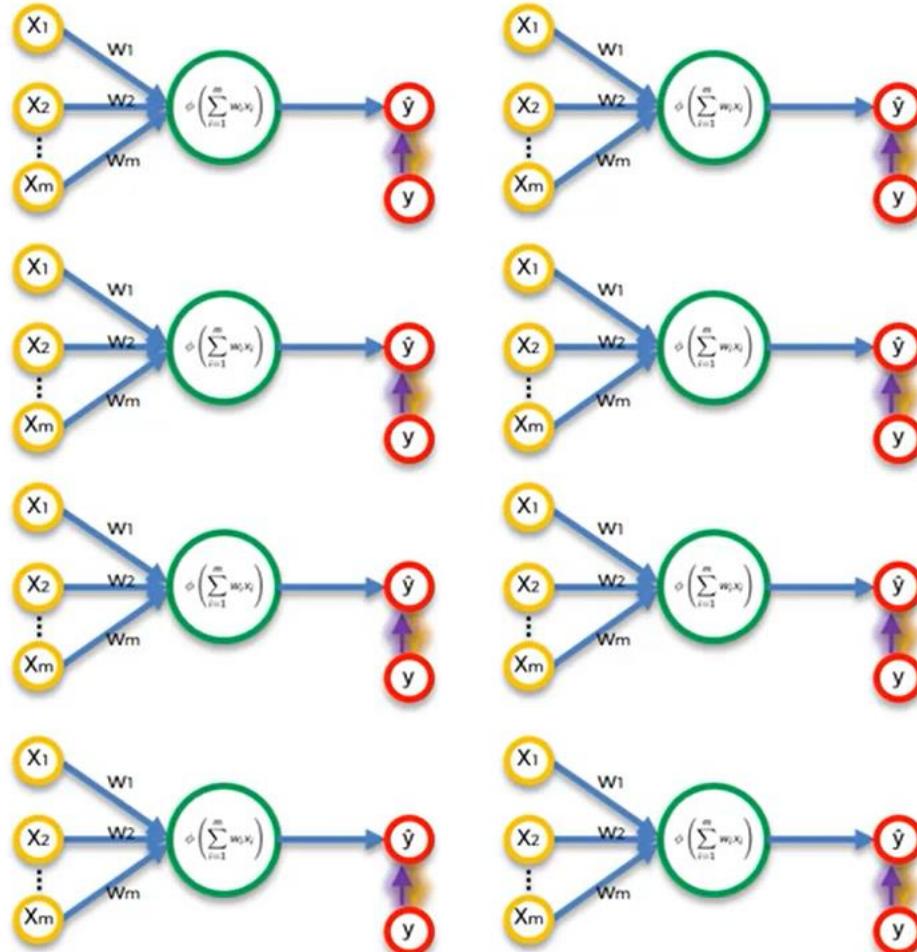
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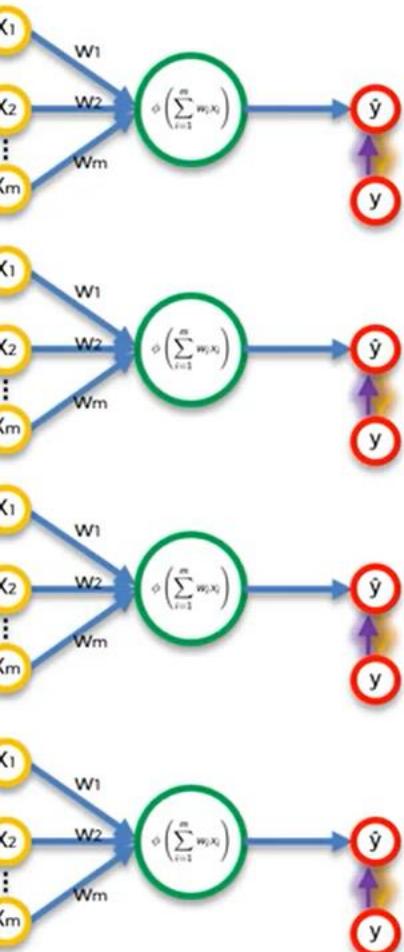
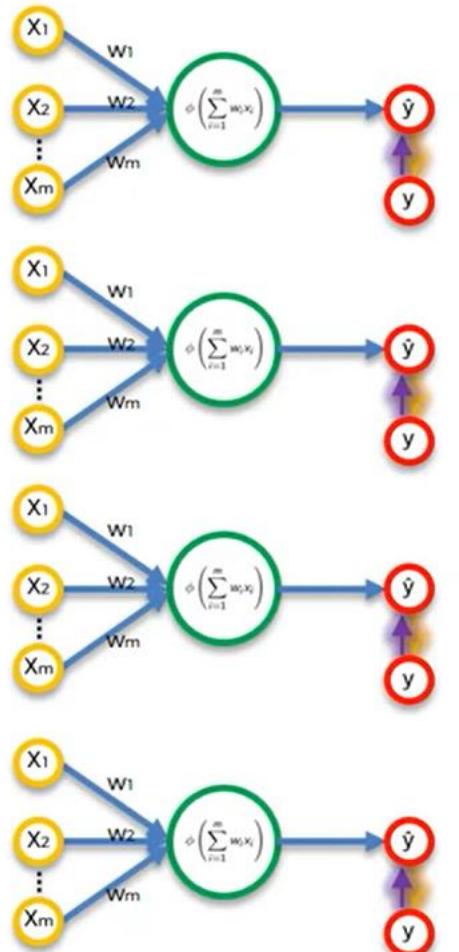
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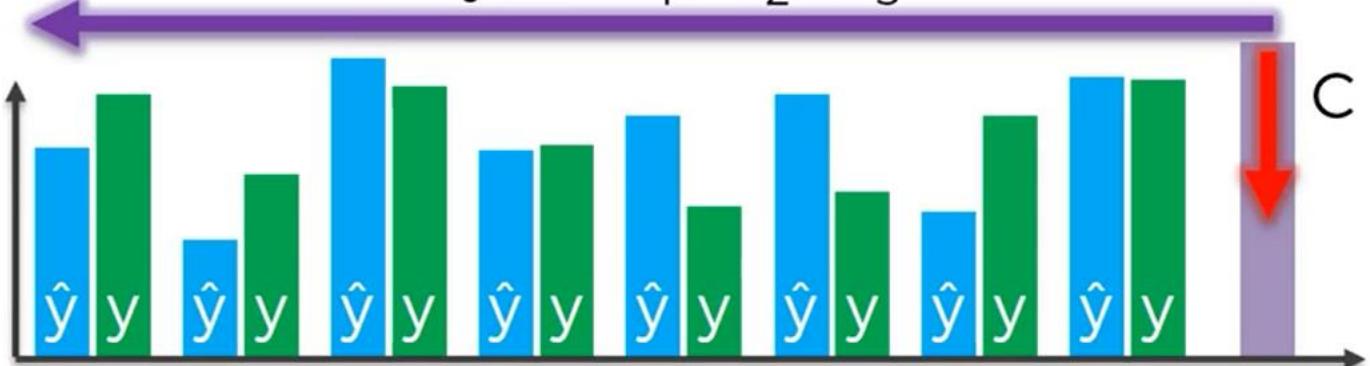
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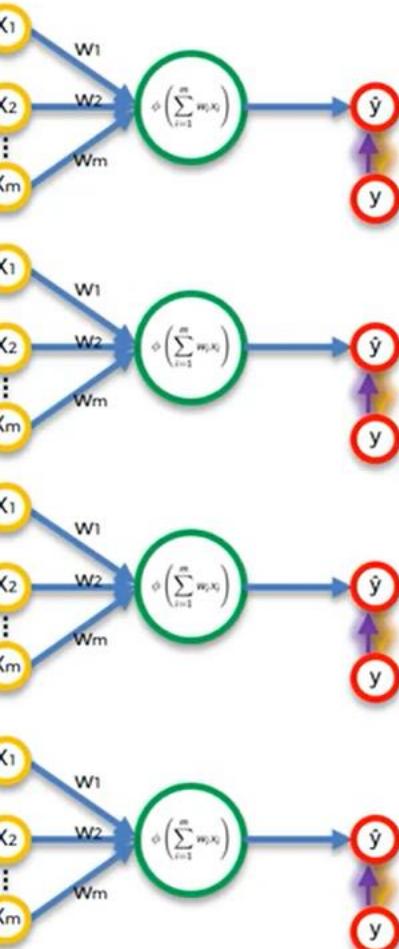
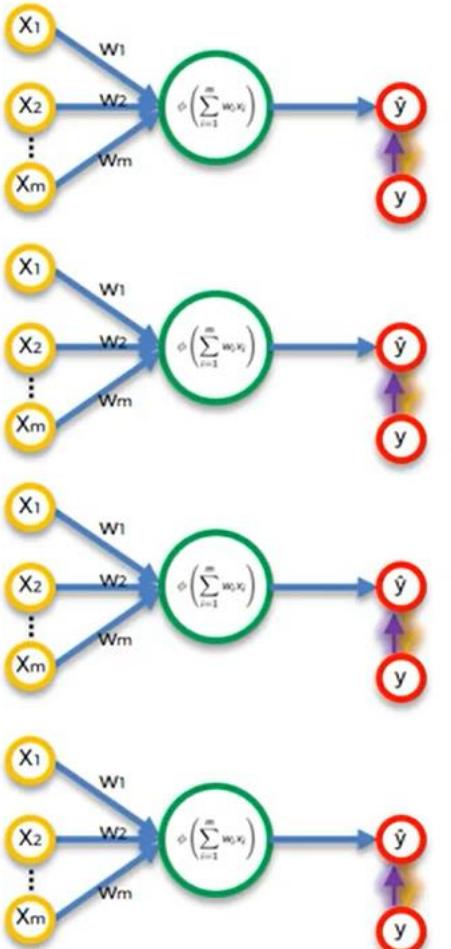
$$C = \sum \frac{1}{2}(\hat{y} - y)^2$$

Adjust w_1, w_2, w_3



Gradient Descent

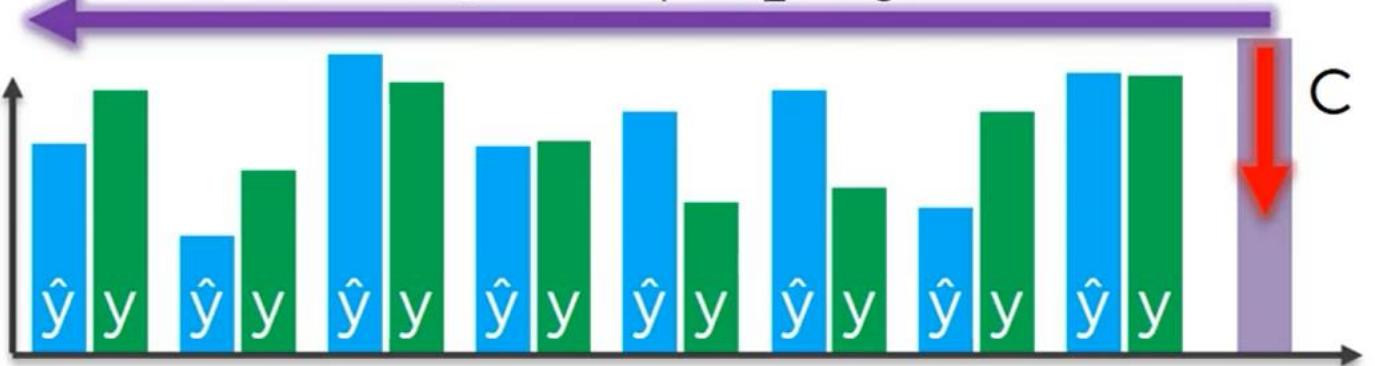
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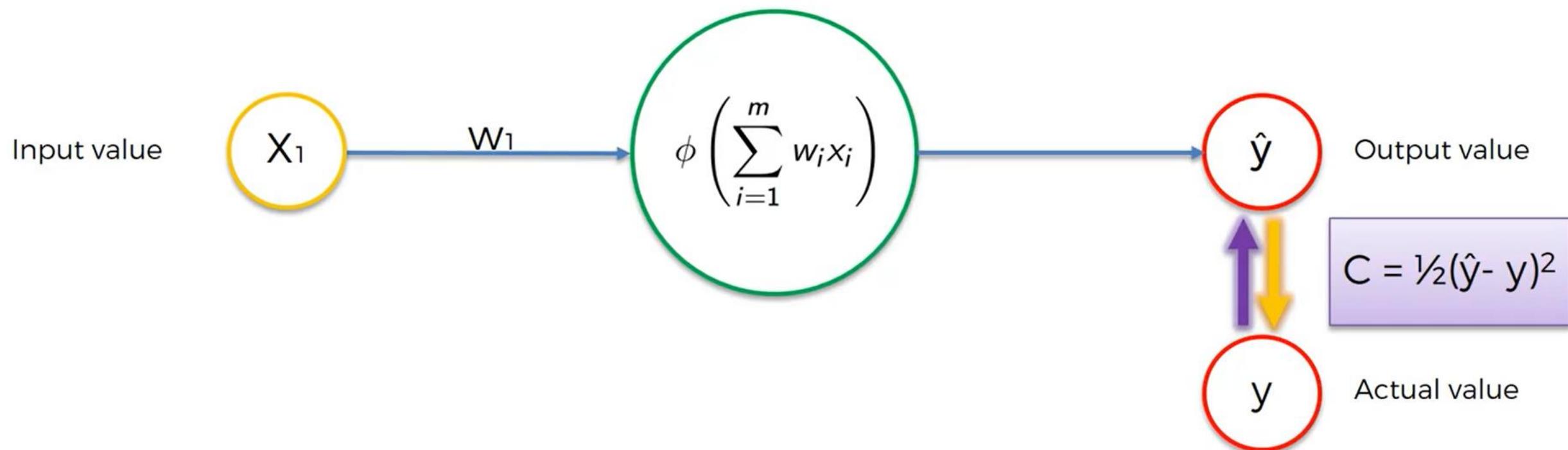
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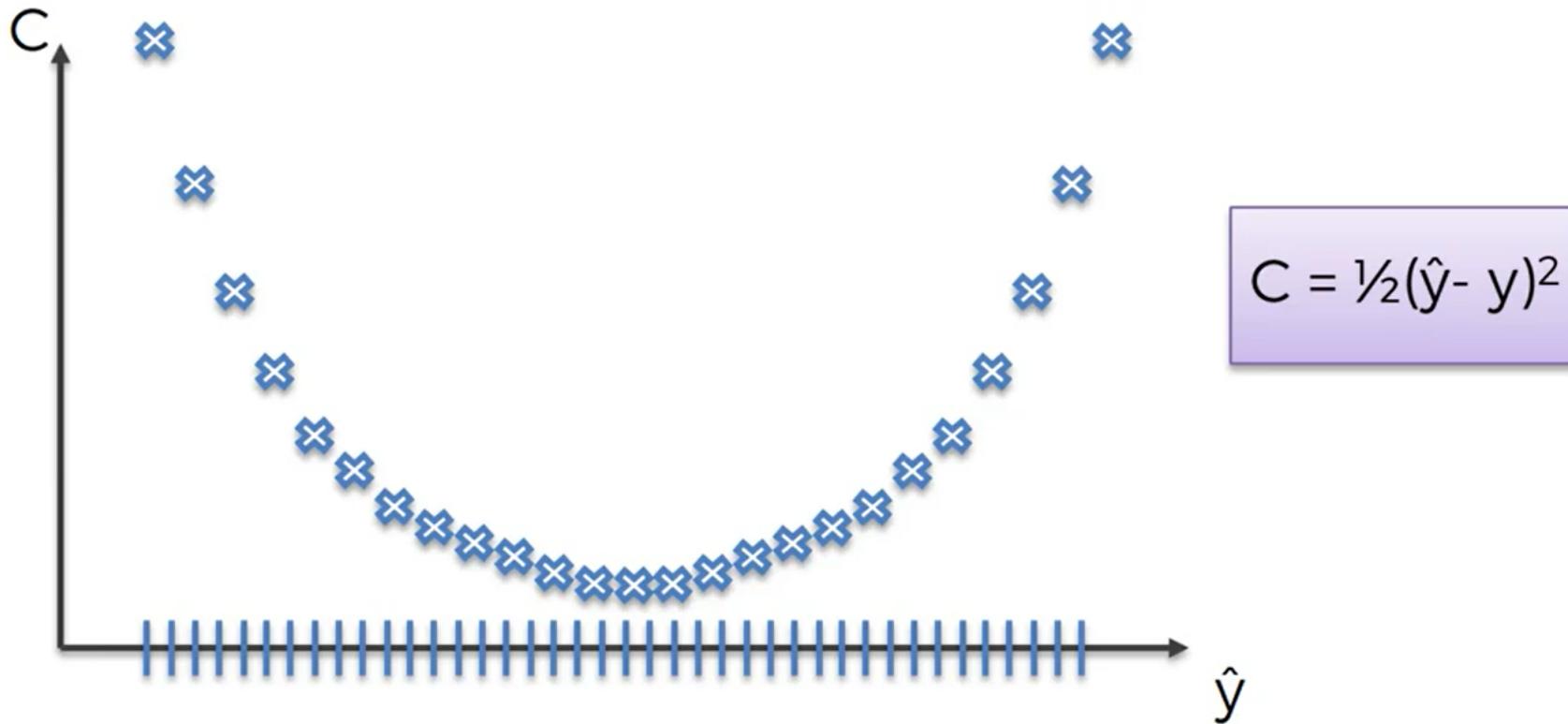
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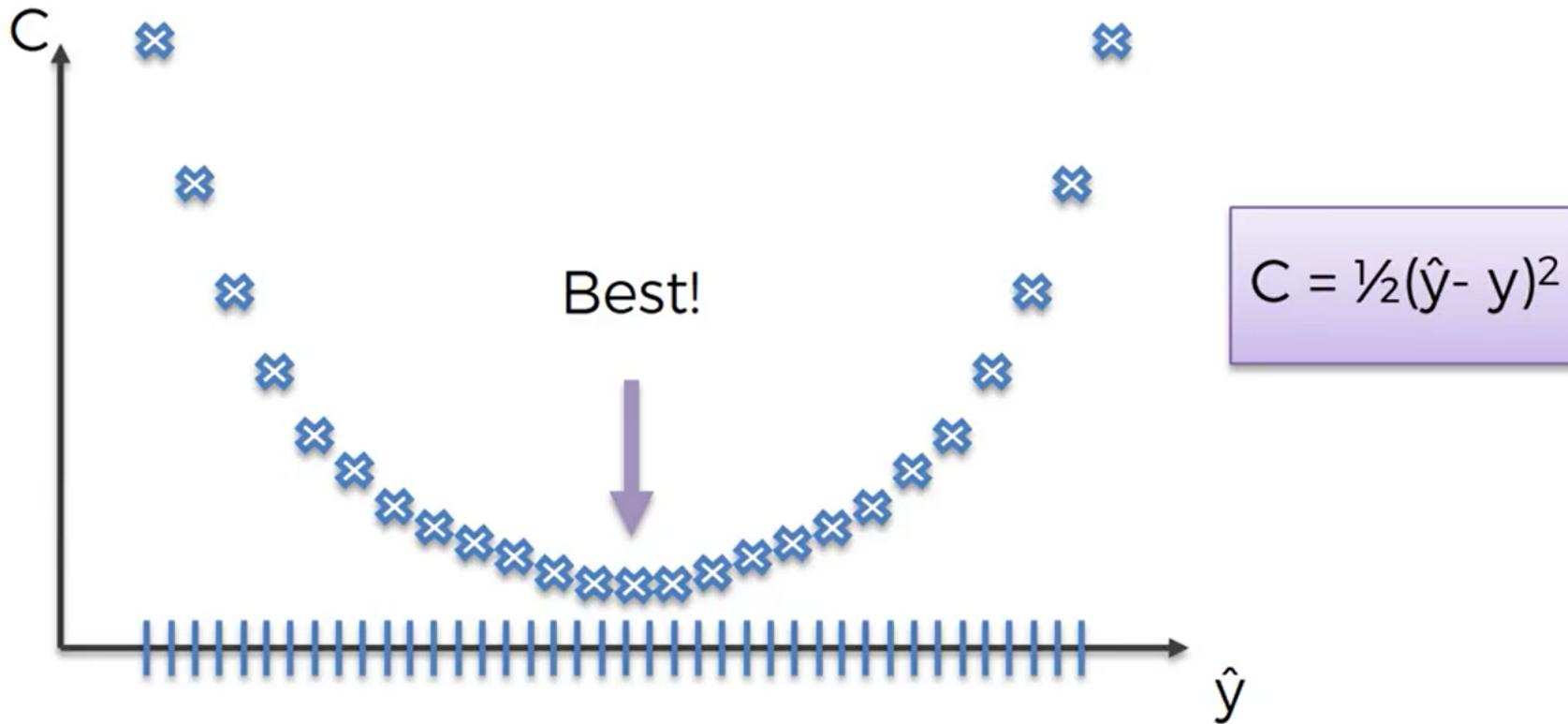
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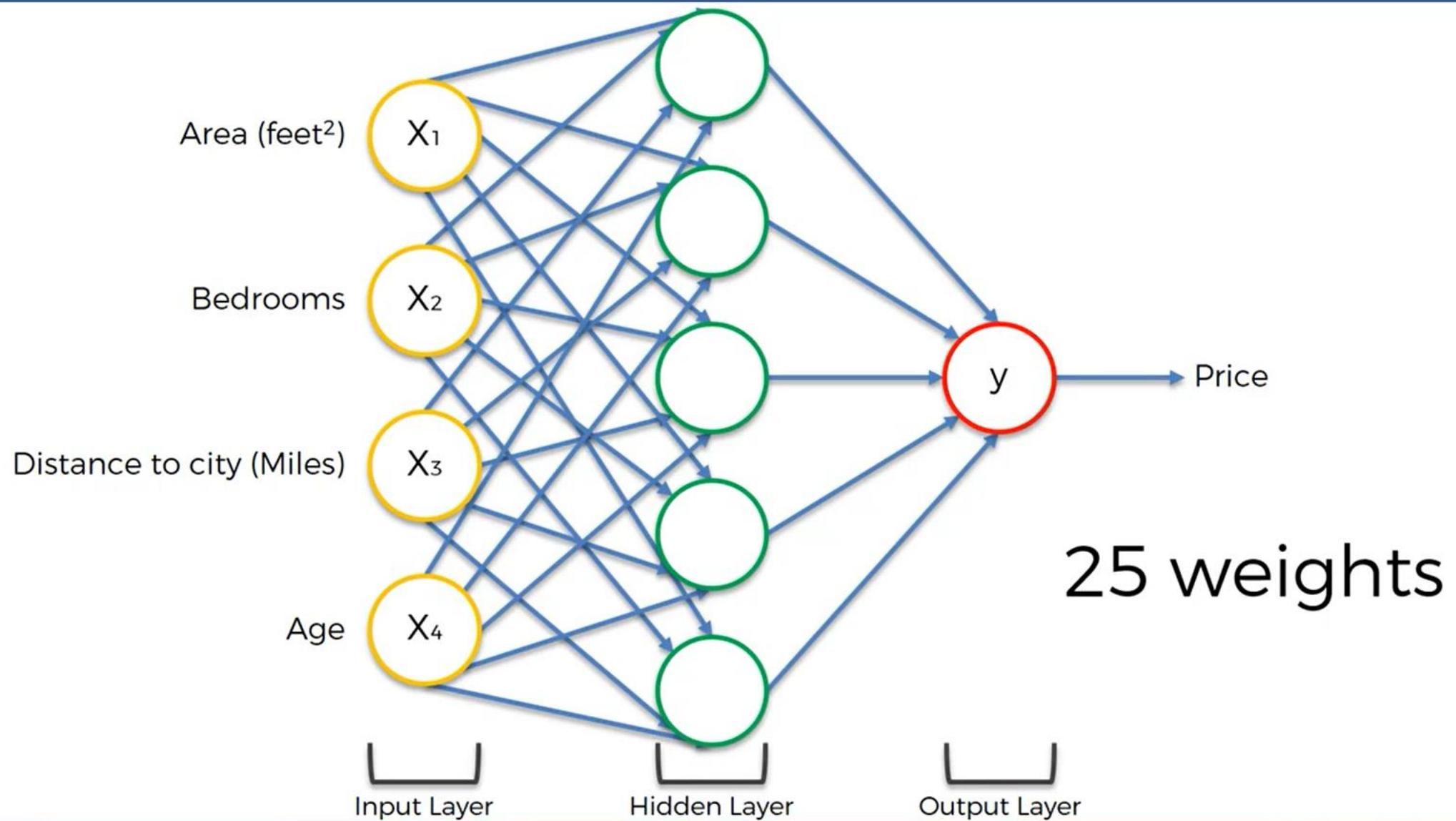
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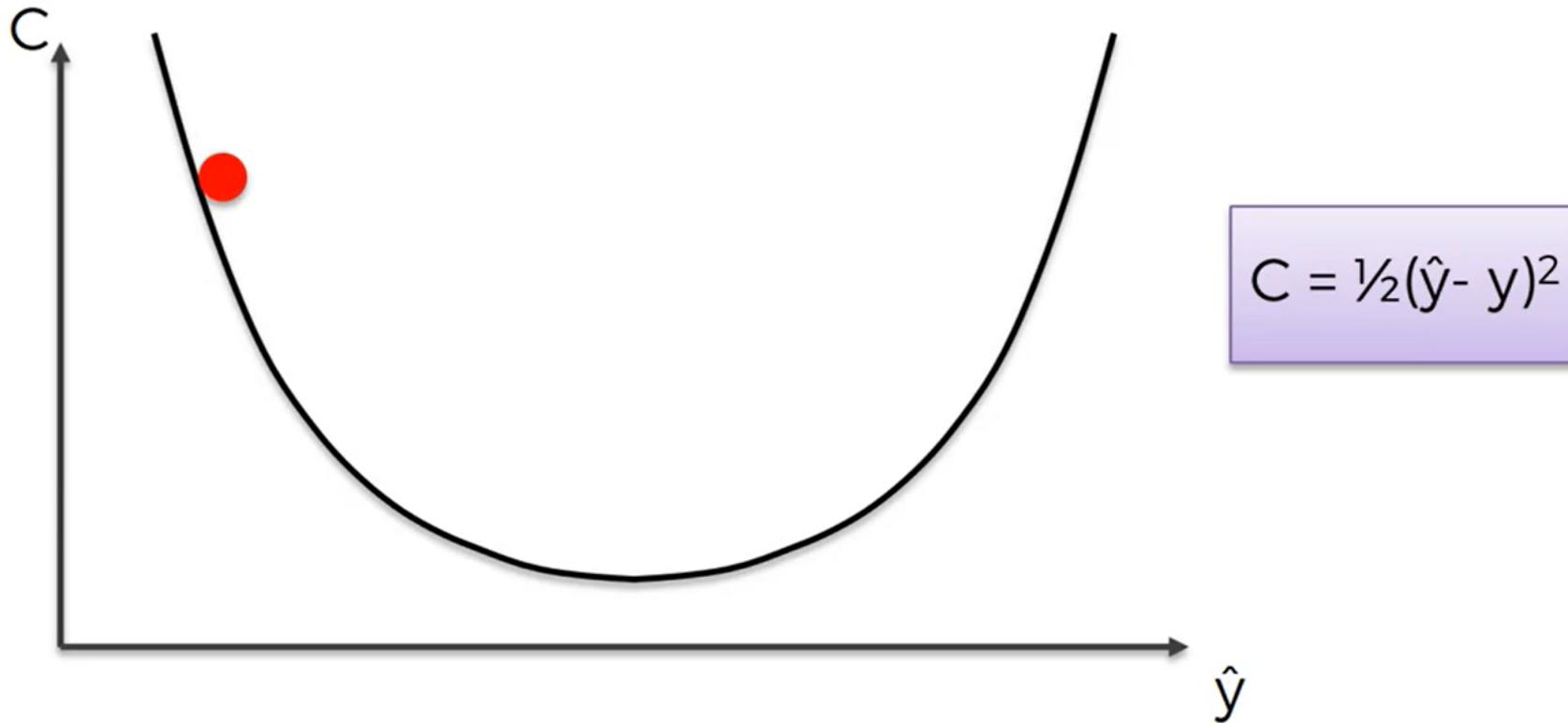
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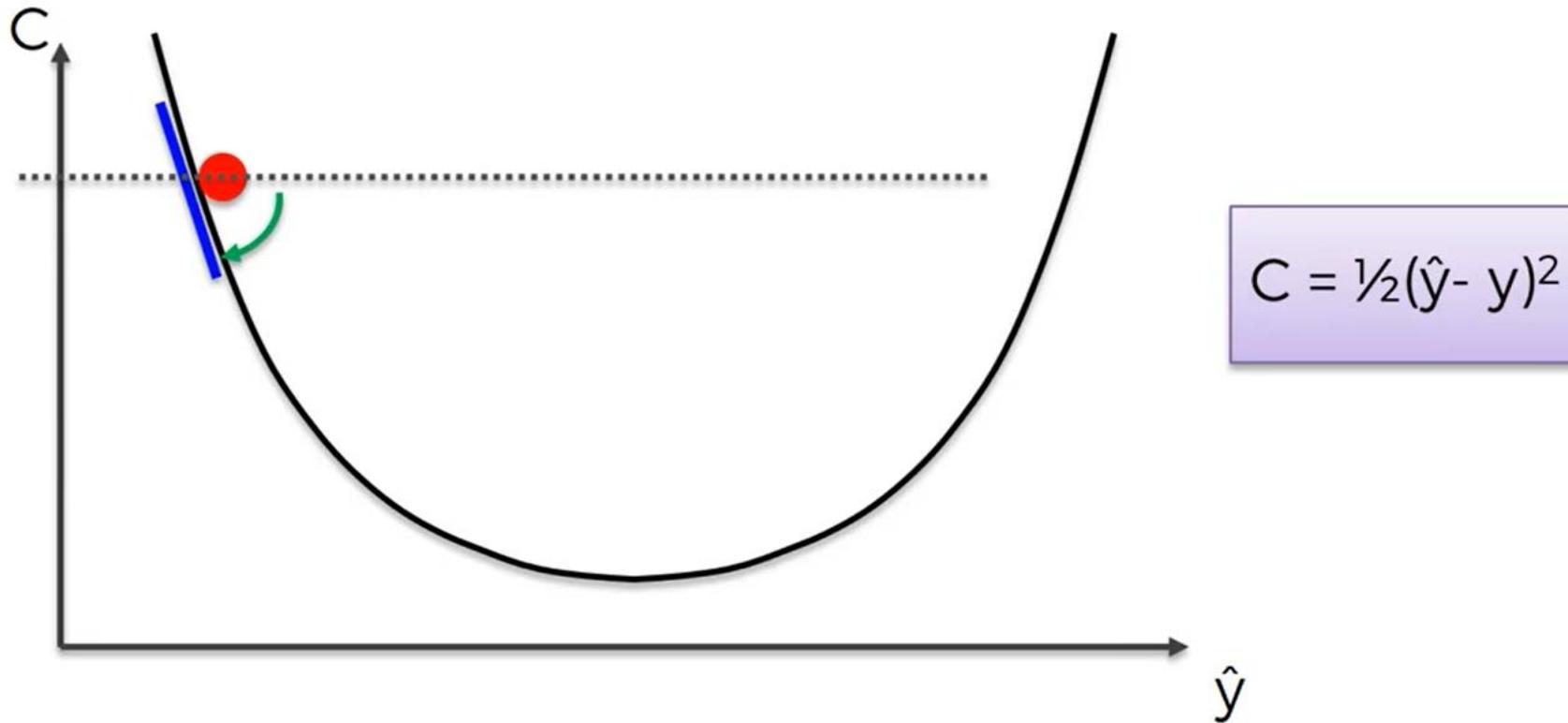
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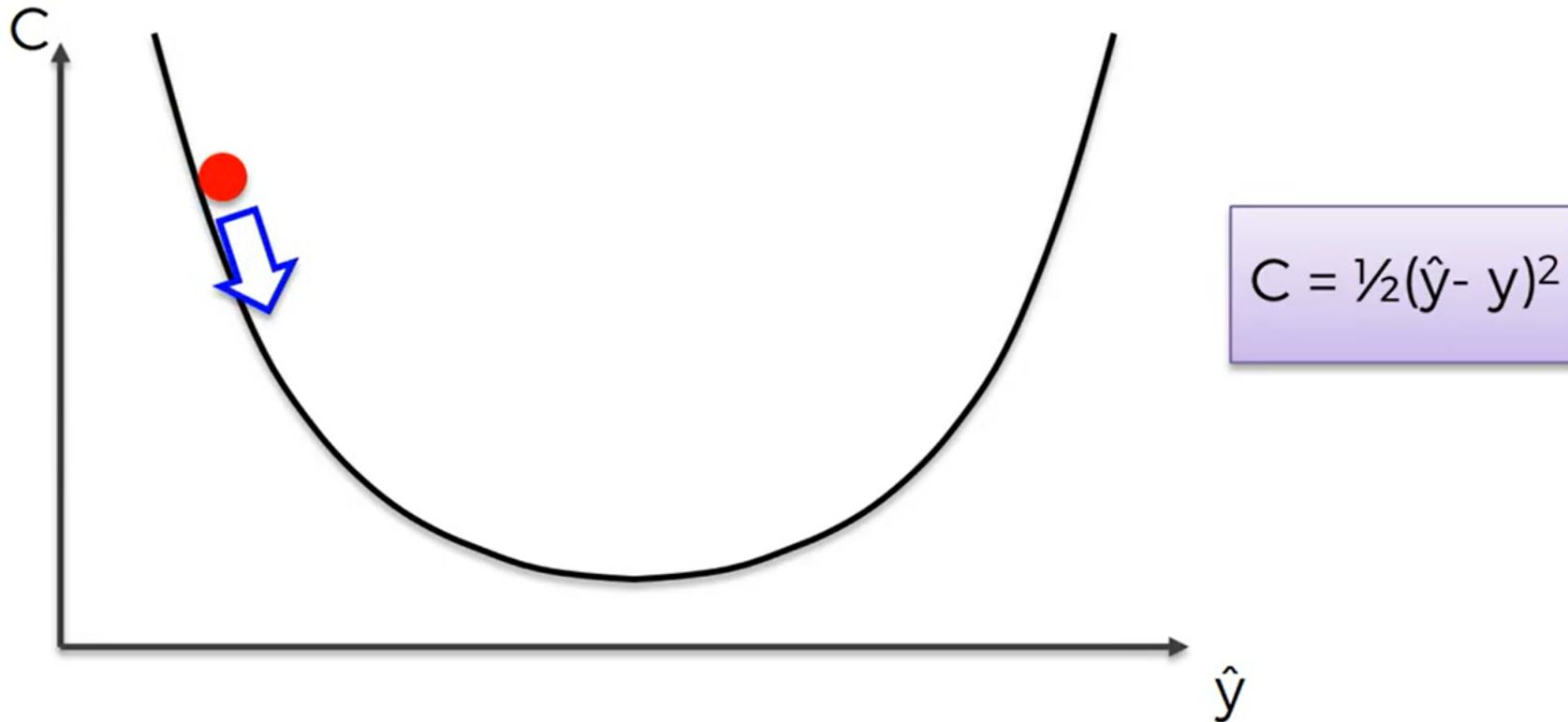
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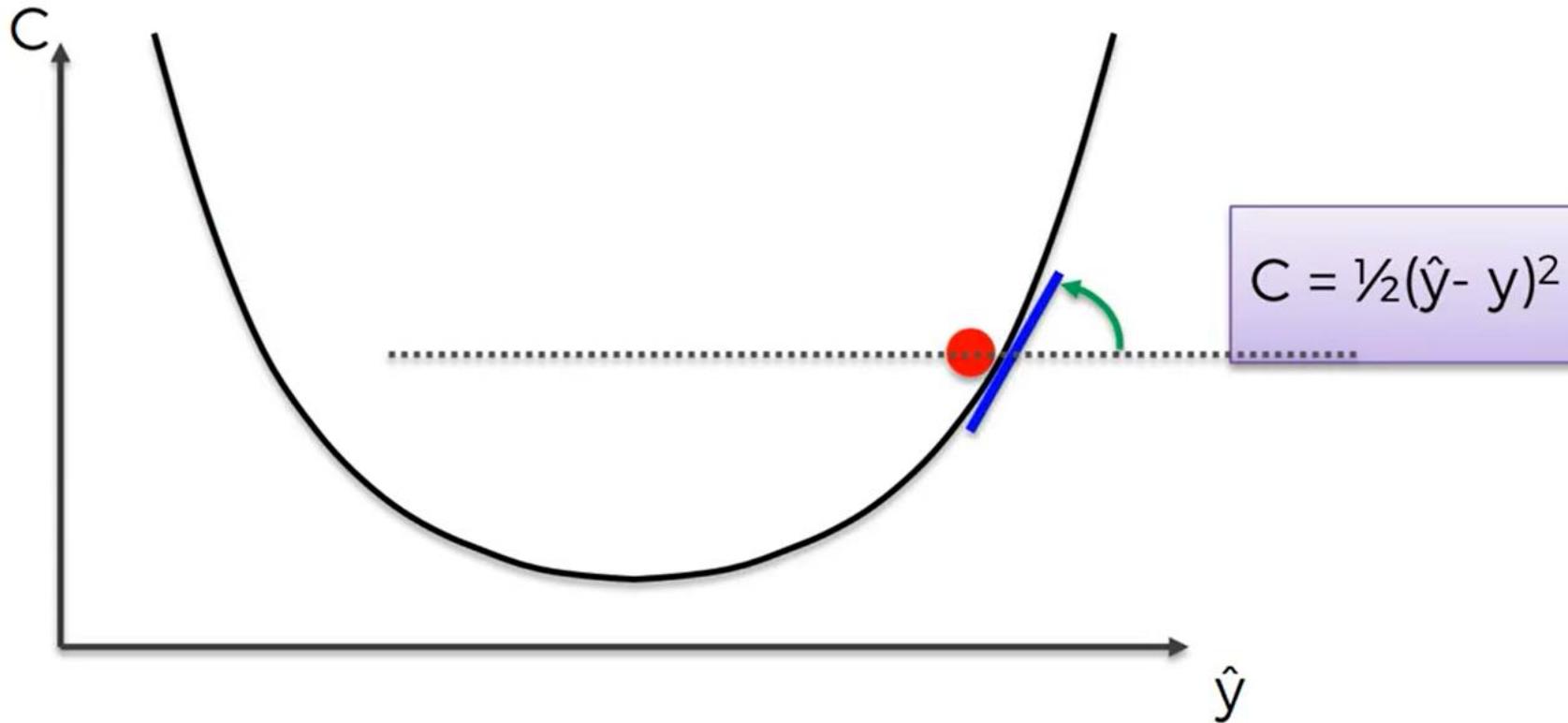
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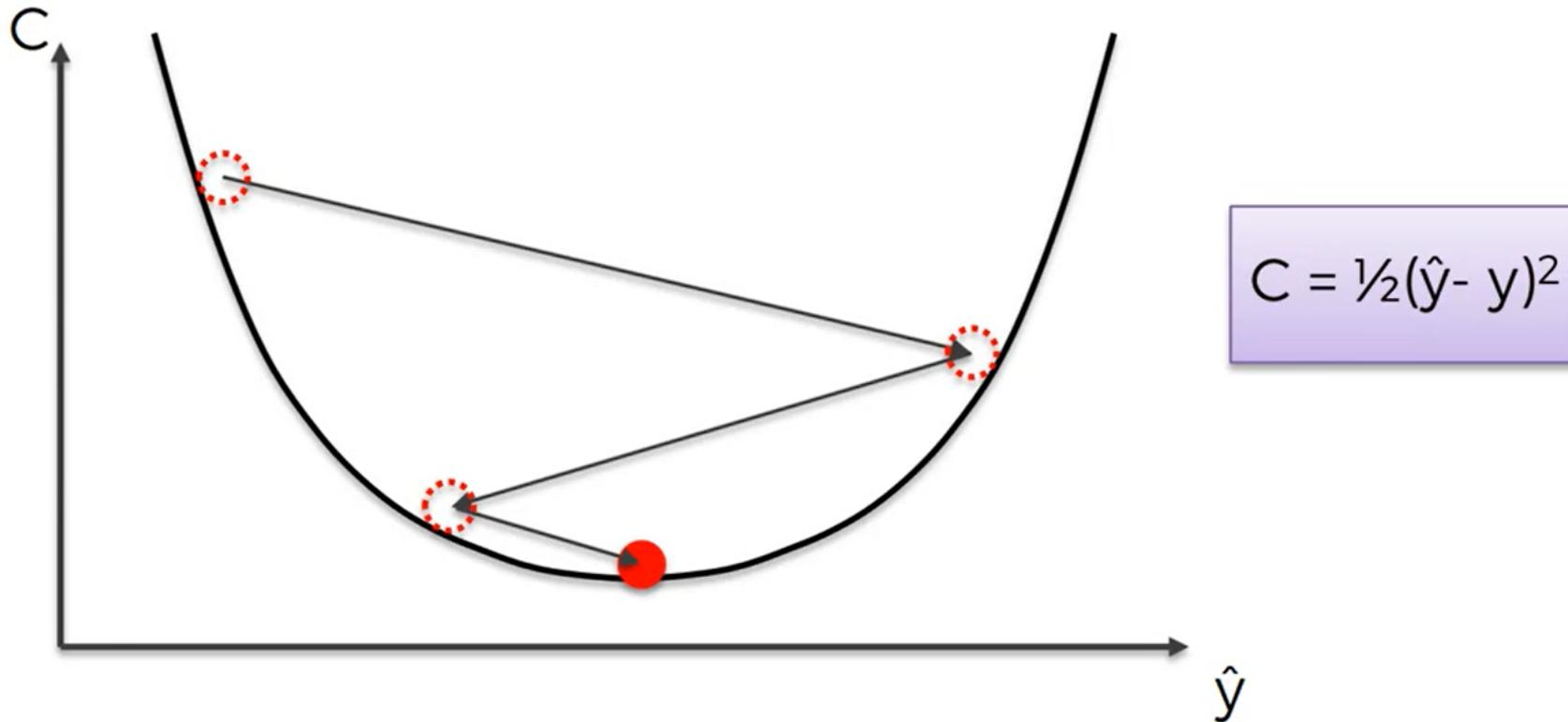
Gradient Descent



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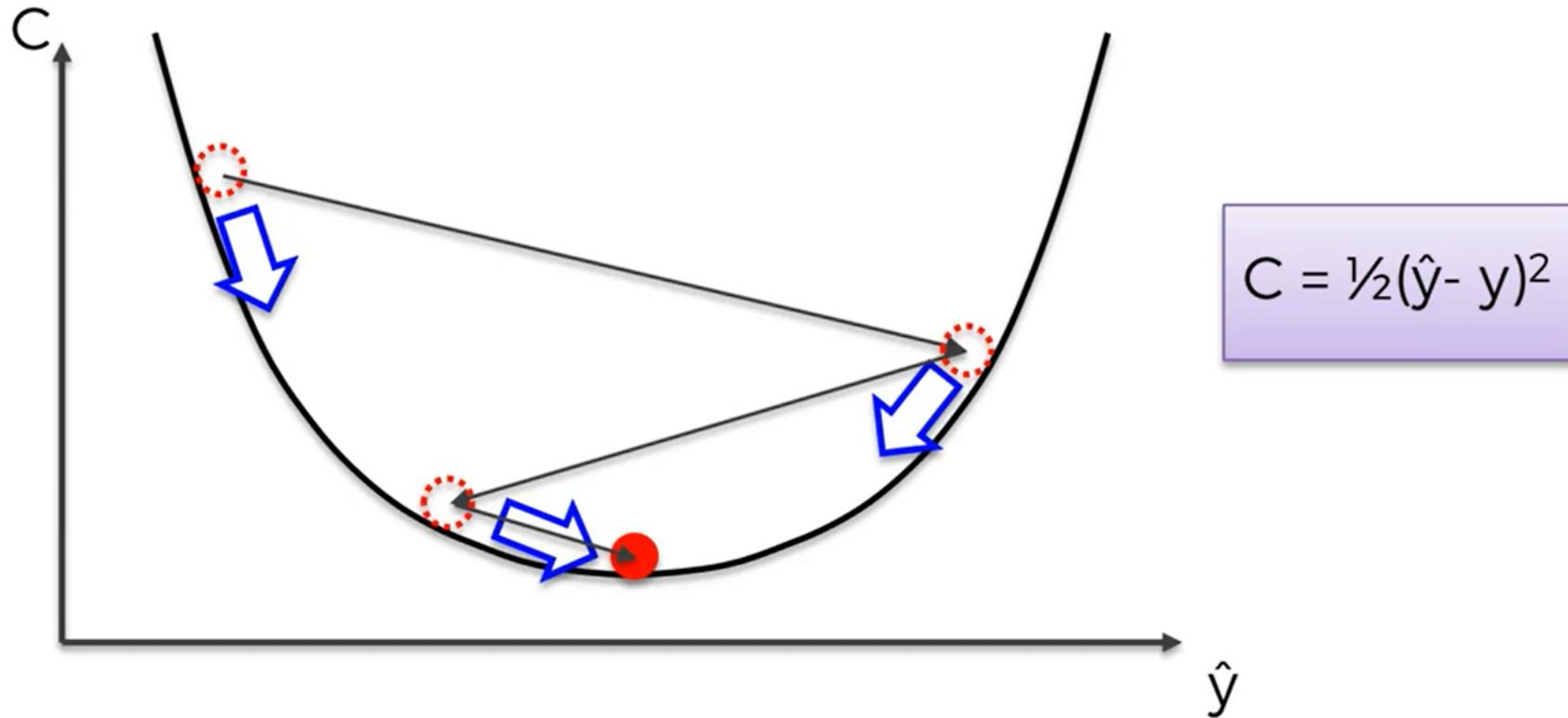


Gradient Descent

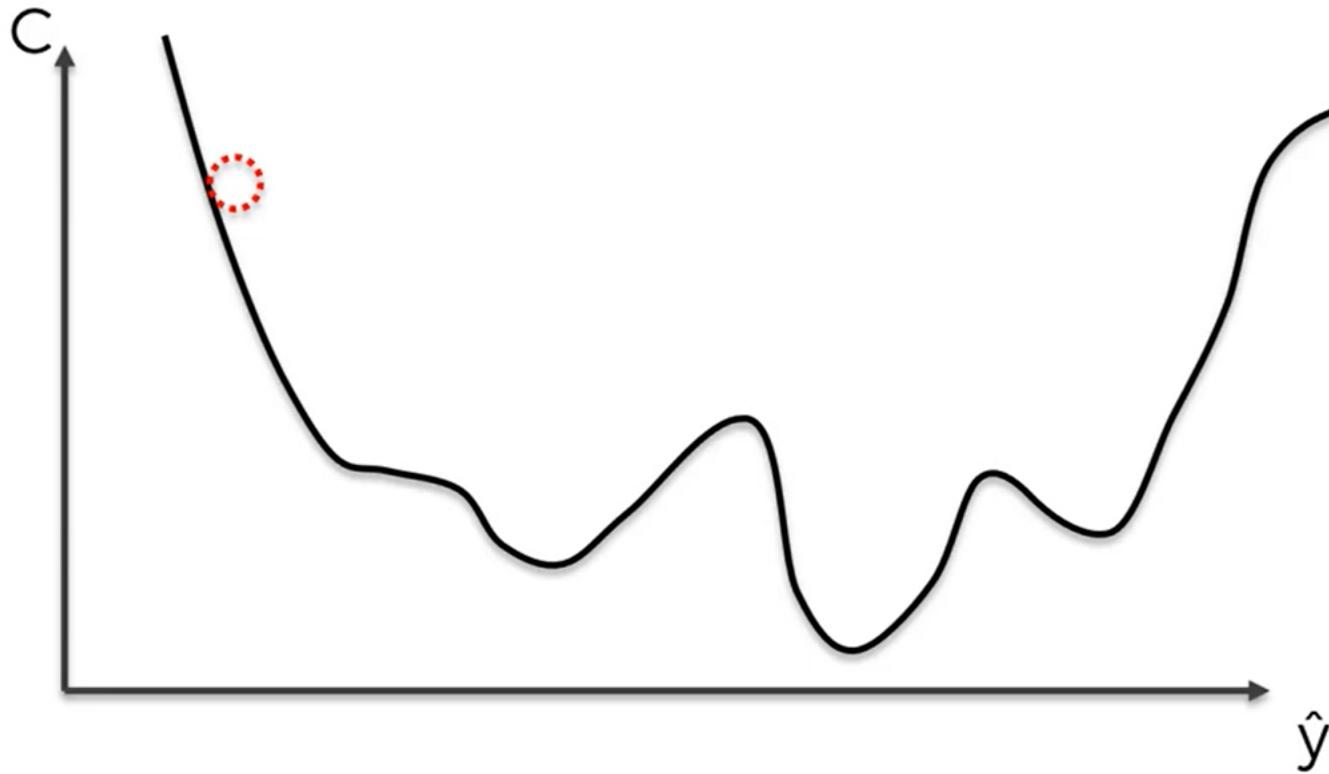


Stochastic Gradient Descent

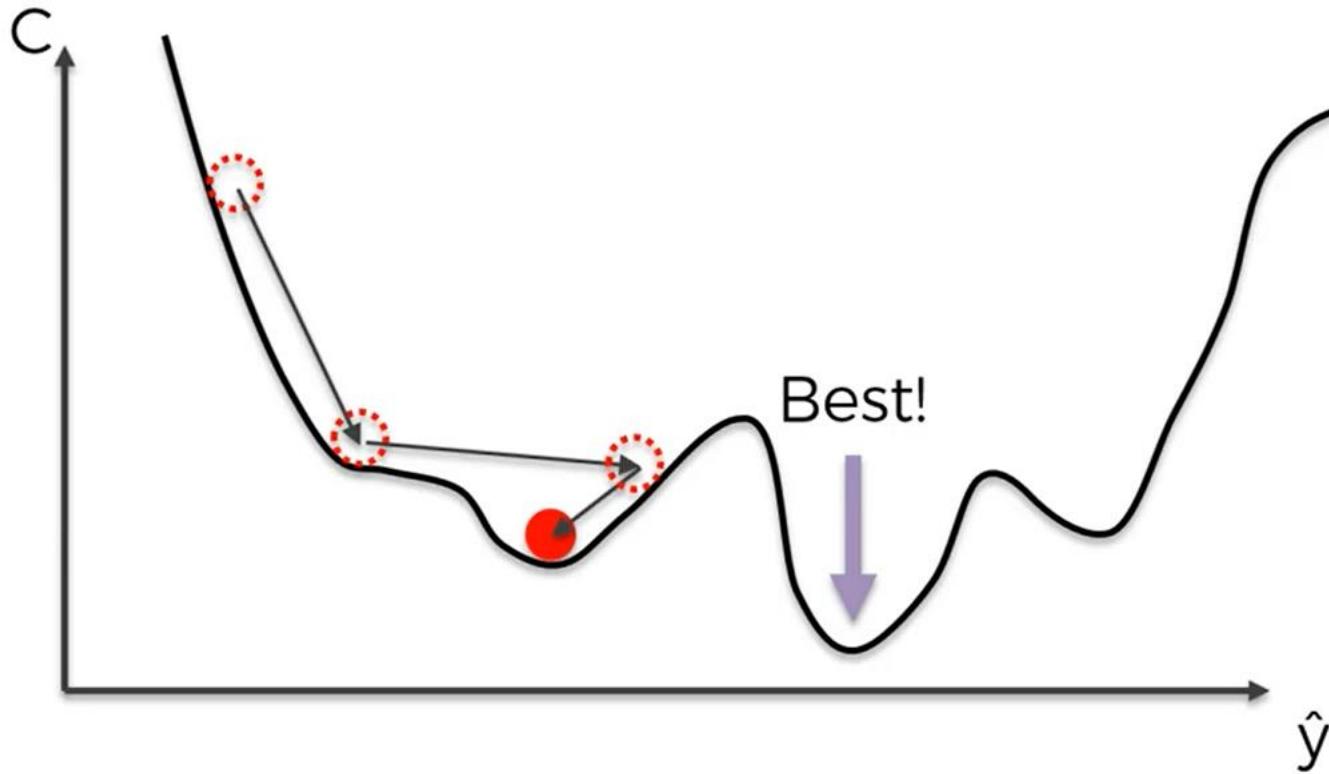
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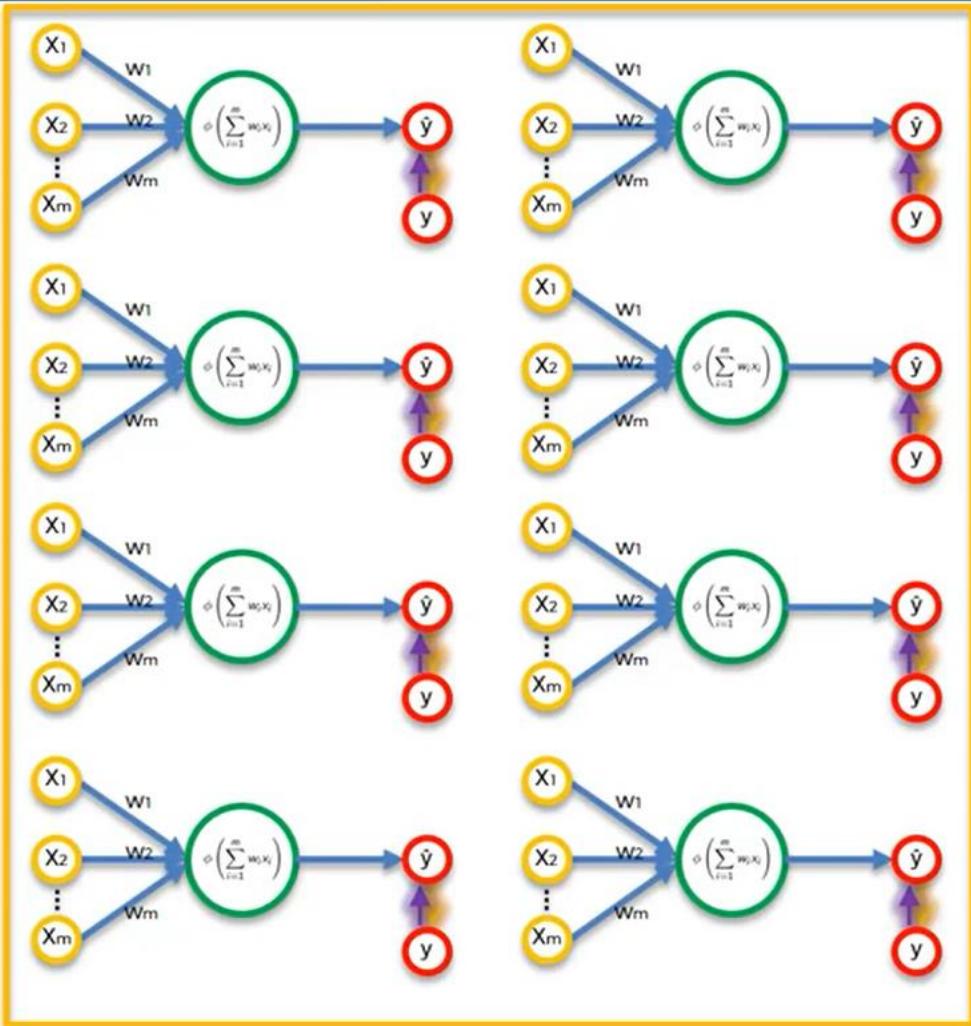
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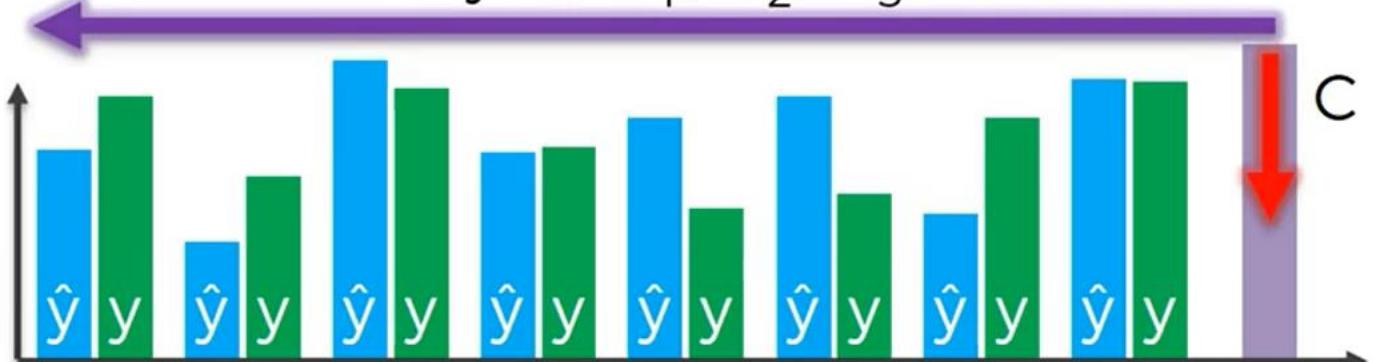
Stochastic Gradient Descent



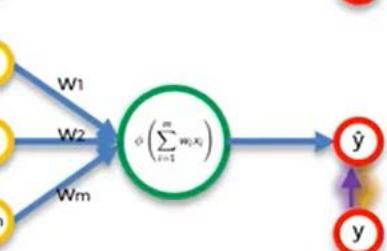
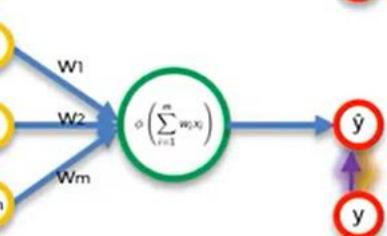
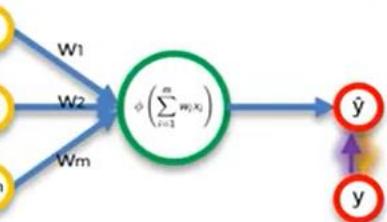
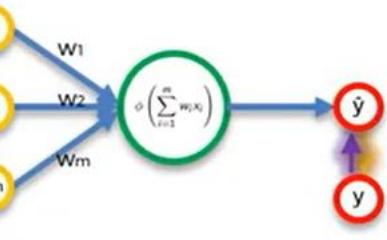
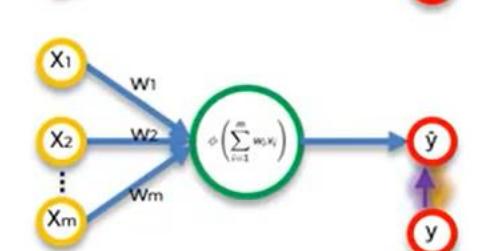
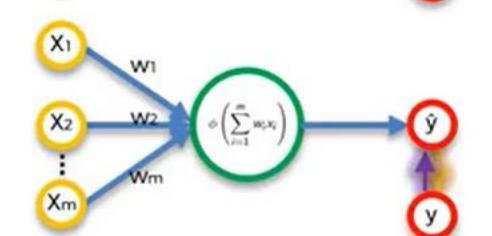
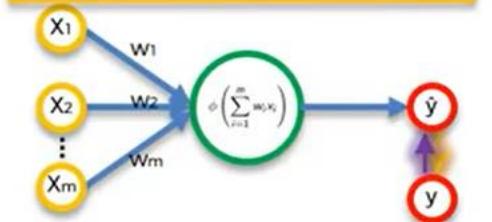
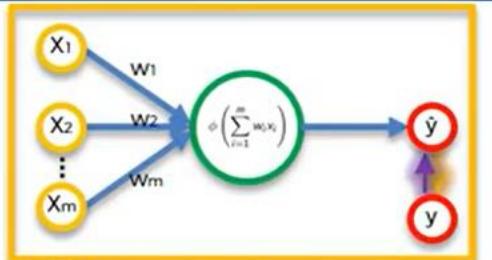
Row ID	Study Hrs	Sleep Hrs	Quiz	Exam
1	12	6	78%	93%
2	22	6.5	24%	68%
3	115	4	100%	95%
4	31	9	67%	75%
5	0	10	58%	51%
6	5	8	78%	60%
7	92	6	82%	89%
8	57	8	91%	97%

$$C = \sum \frac{1}{2}(\hat{y} - y)^2$$

Adjust w_1, w_2, w_3



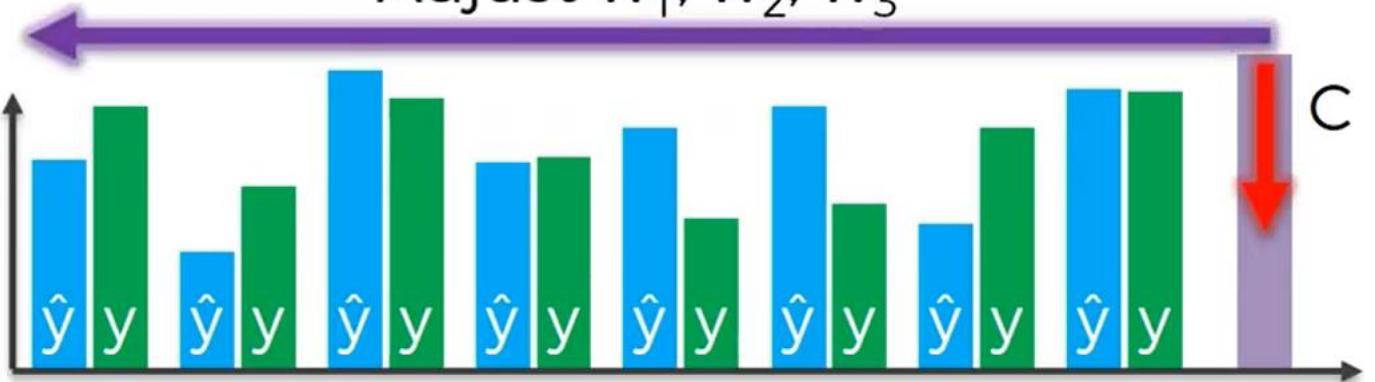
Stochastic Gradient Descent



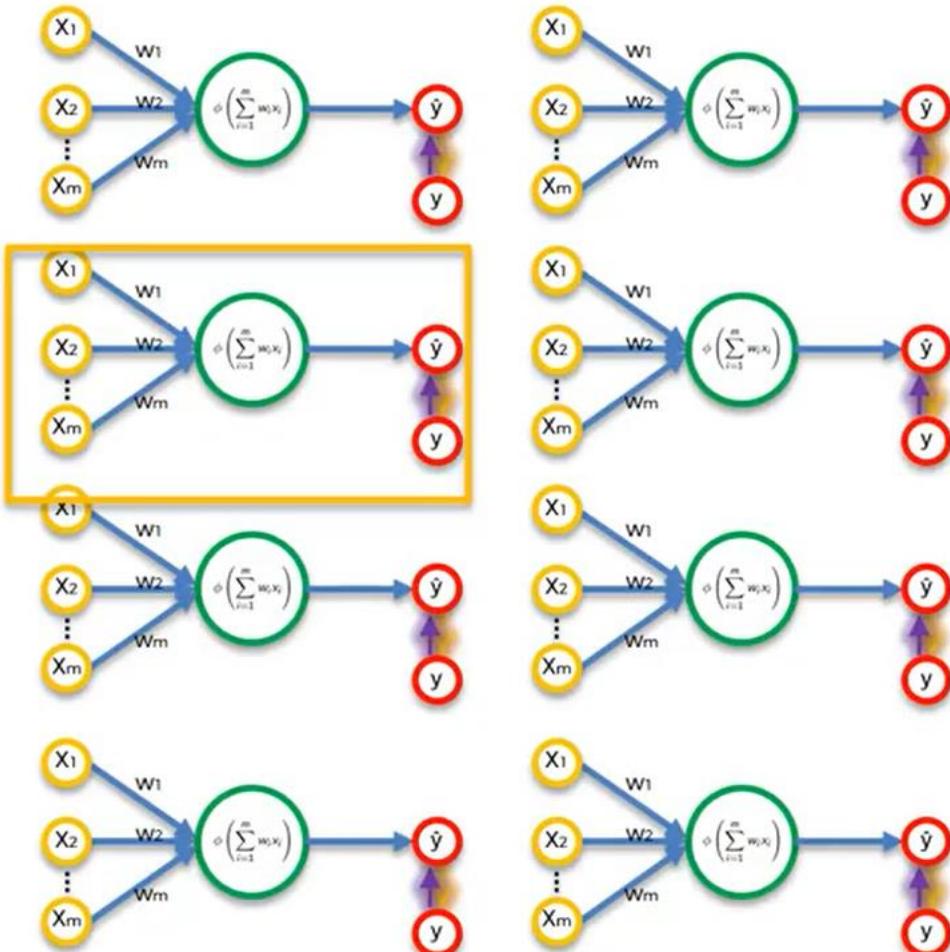
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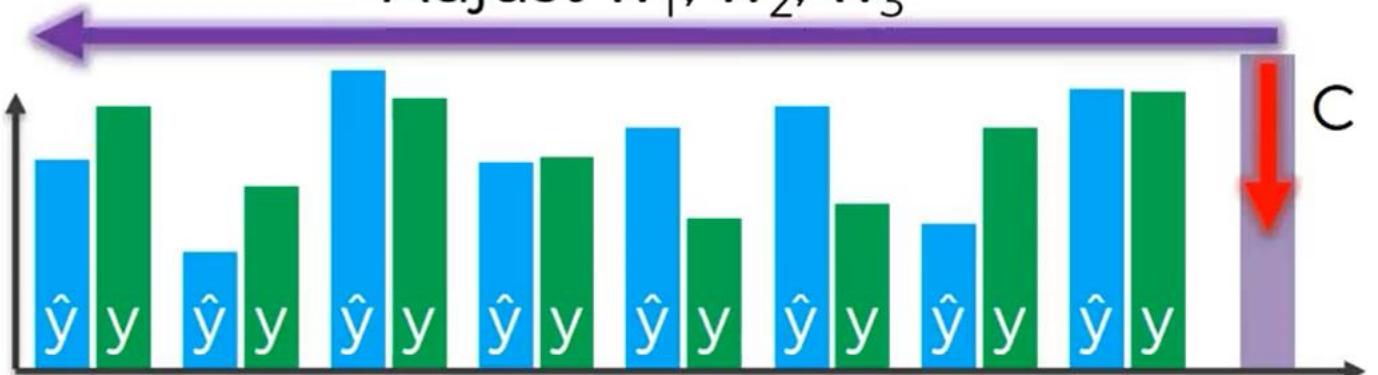
Stochastic Gradient Descent



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Upd w's ←

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Batch
Gradient
Descent

Stochastic
Gradient
Descent

Backpropagation

Gradient Descent

Forward Propagation

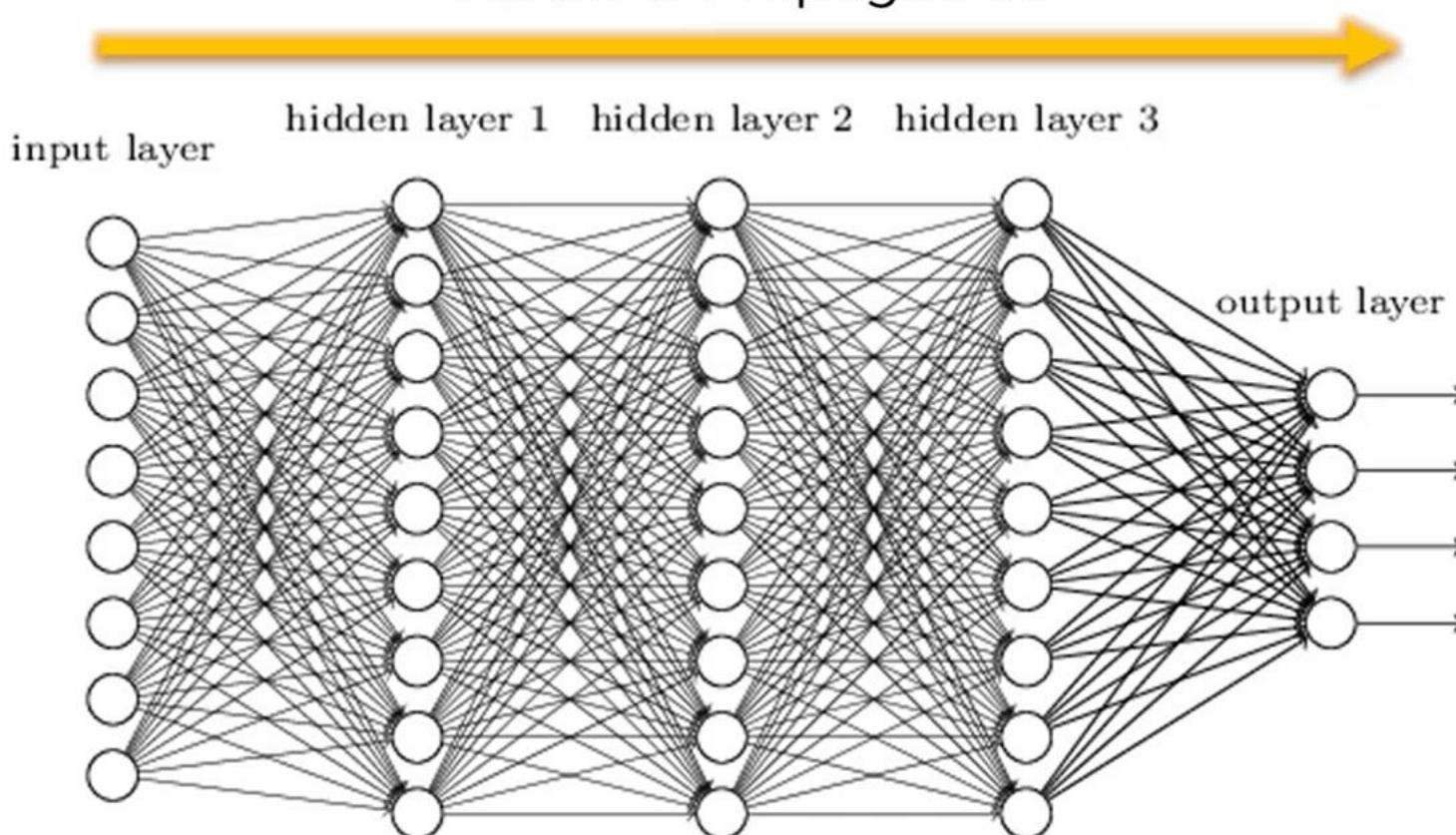


Image Source: neuralnetworksanddeeplearning.com

Gradient Descent

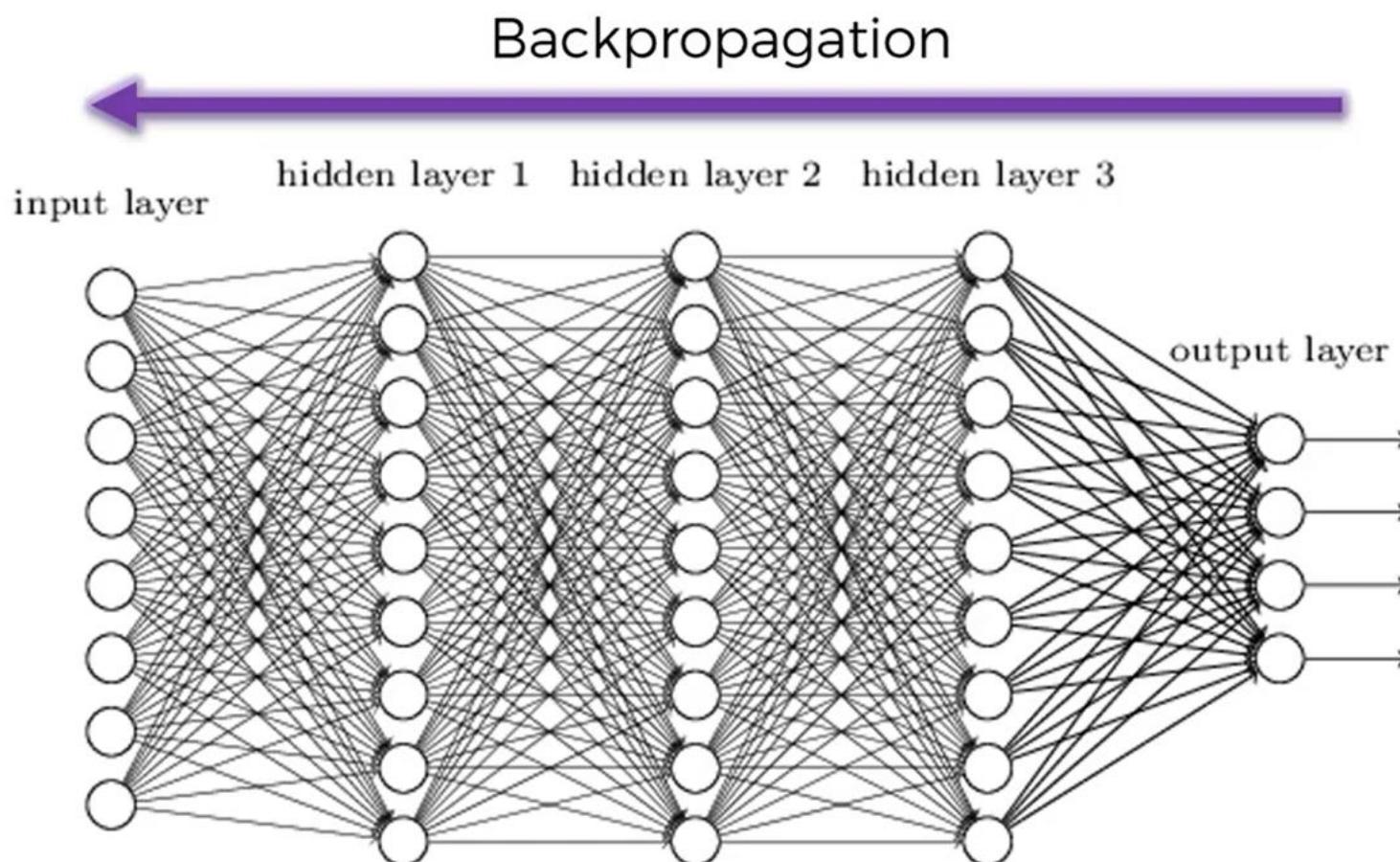


Image Source: neuralnetworksanddeeplearning.com

Training the ANN with Stochastic Gradient Descent

STEP 1: Randomly initialise the weights to small numbers close to 0 (but not 0).



STEP 2: Input the first observation of your dataset in the input layer, each feature in one input node.



STEP 3: Forward-Propagation: from left to right, the neurons are activated in a way that the impact of each neuron's activation is limited by the weights. Propagate the activations until getting the predicted result y .



STEP 4: Compare the predicted result to the actual result. Measure the generated error.



STEP 5: Back-Propagation: from right to left, the error is back-propagated. Update the weights according to how much they are responsible for the error. The learning rate decides by how much we update the weights.



STEP 6: Repeat Steps 1 to 5 and update the weights after each observation (Reinforcement Learning). Or:



Repeat Steps 1 to 5 but update the weights only after a batch of observations (Batch Learning).

STEP 7: When the whole training set passed through the ANN, that makes an epoch. Redo more epochs.