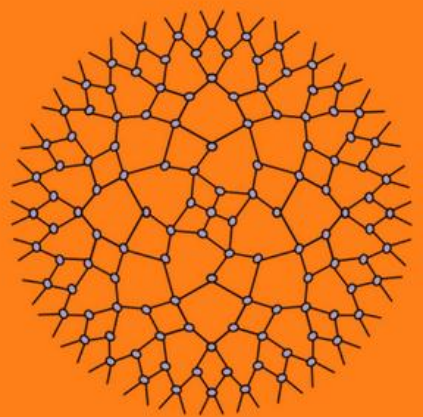
ML Algorithms

NEURAL NETWORKS



Class

A Detailed Look At Neural Networks

Topic

Multiple Neurons
&
Neural Network Architecture

Decision Making With Multiple Neurons

The average human brain has 100 billion neurons

- Interconnections between neurons are extremely complicated
- Complicated network within the neurons helps brain learn and process information effectively

Decision Making With Multiple Neurons

The average human brain has 100 billion neurons

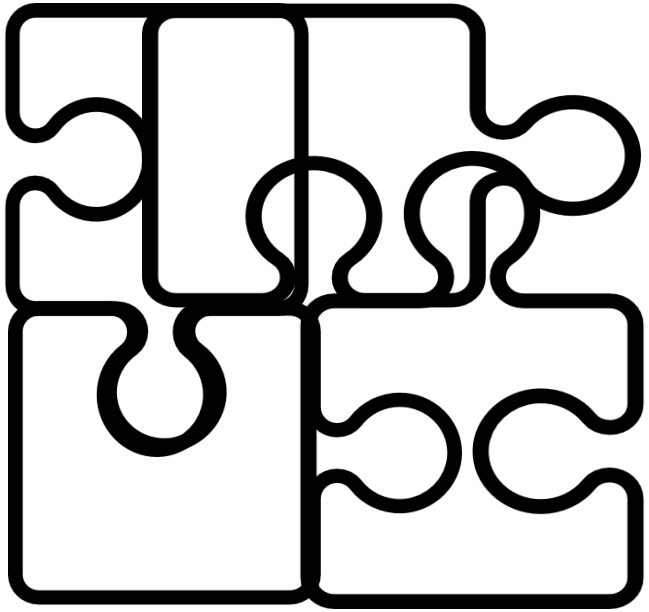
Allowing the brain to make extremely complicated decisions

Each neuron is connected to 10,000 neurons

Which together create a complicated network of about 1000 trillion connections

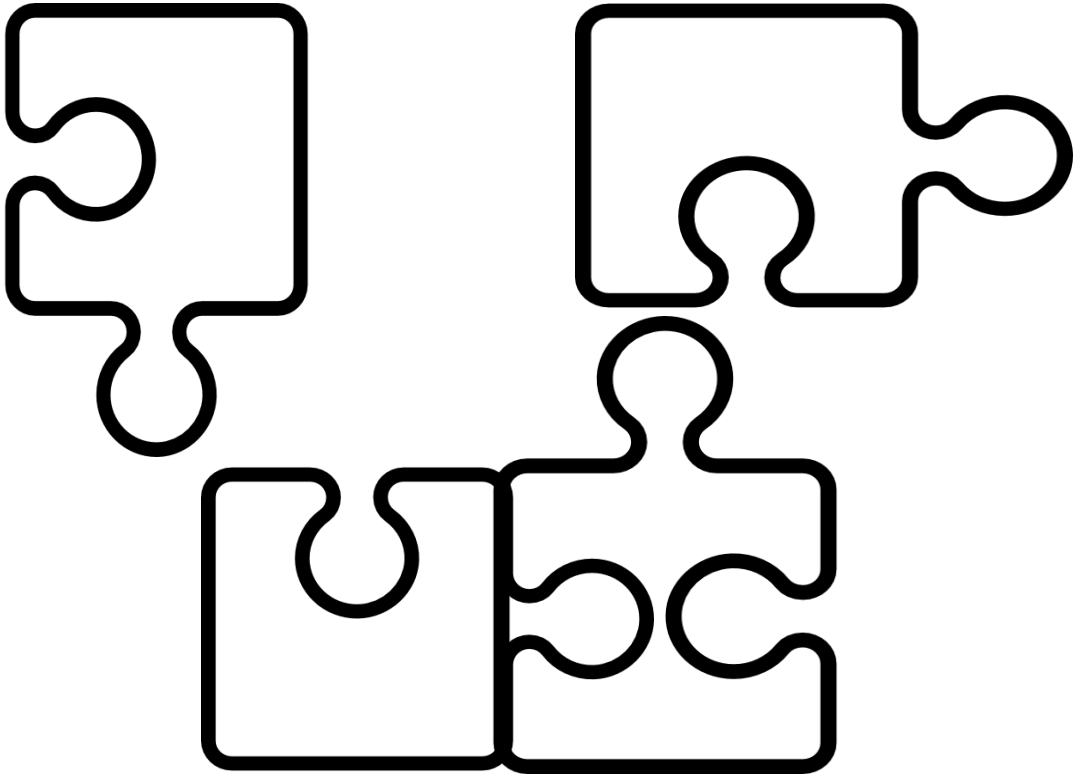
Decision Making With Multiple Neurons

One of the ways we solve complicated problems…



Decision Making With Multiple Neurons

...is by breaking them down into simpler manageable pieces



Decision Making With Multiple Neurons

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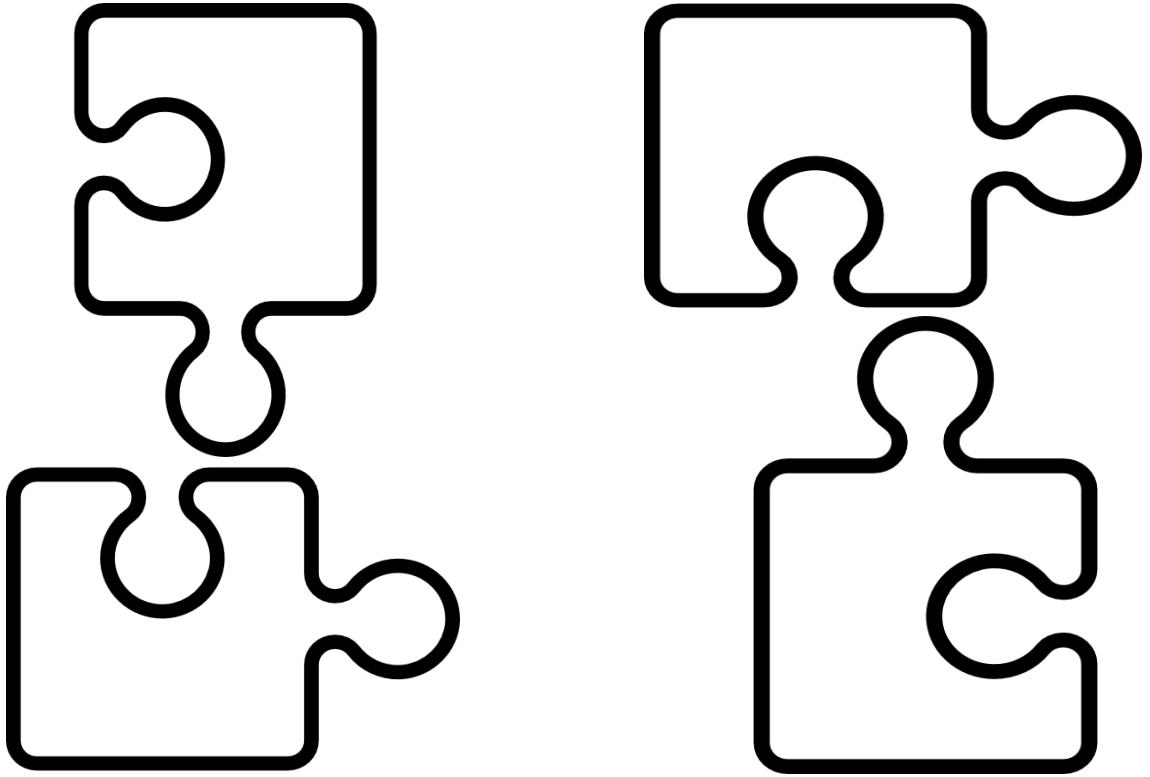
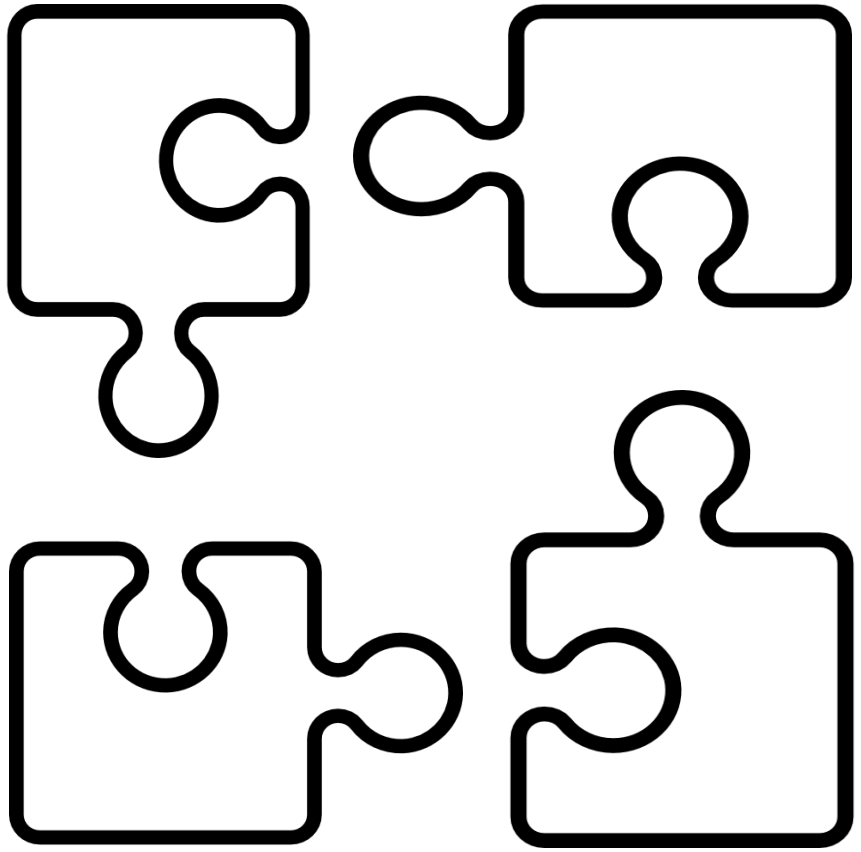


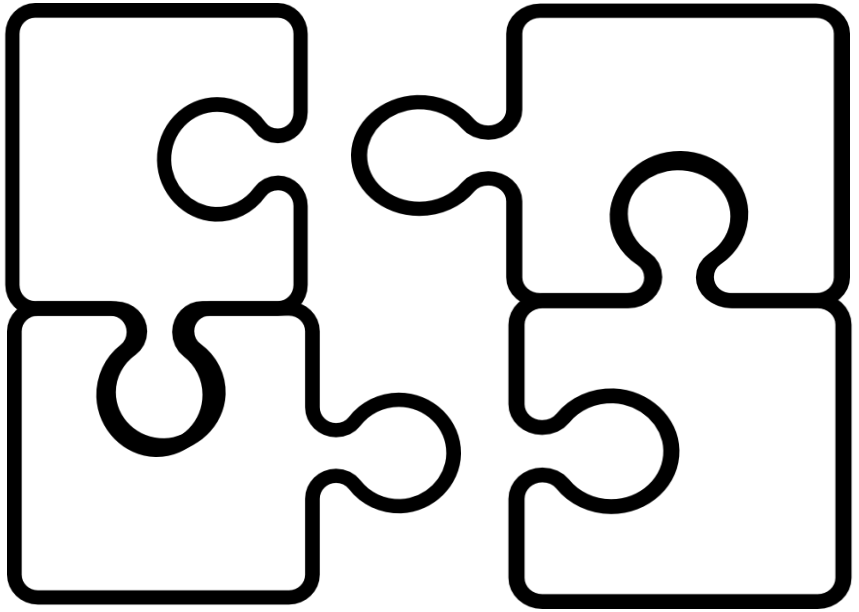
Decision Making With Multiple Neurons

We solve each simple piece...



Decision Making With Multiple Neurons

...then somehow bring these solutions together



Decision Making With Multiple Neurons

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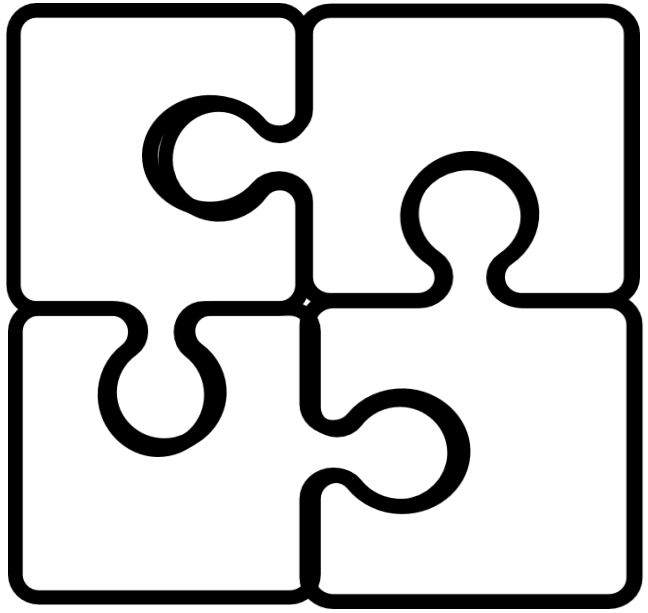
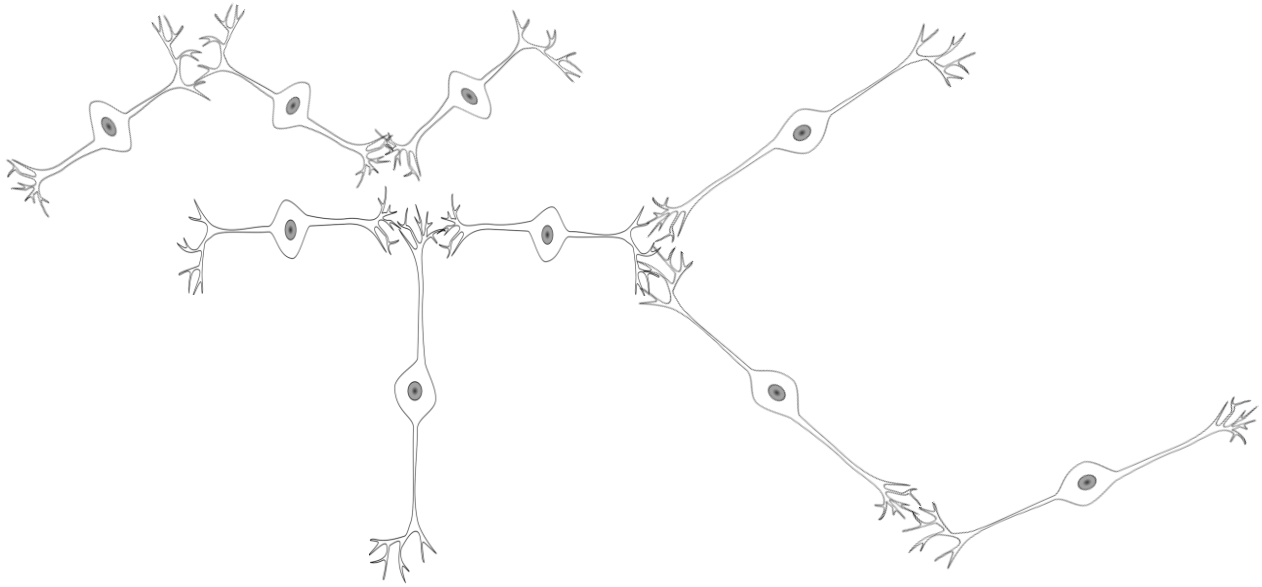


Decision Making With Multiple Neurons

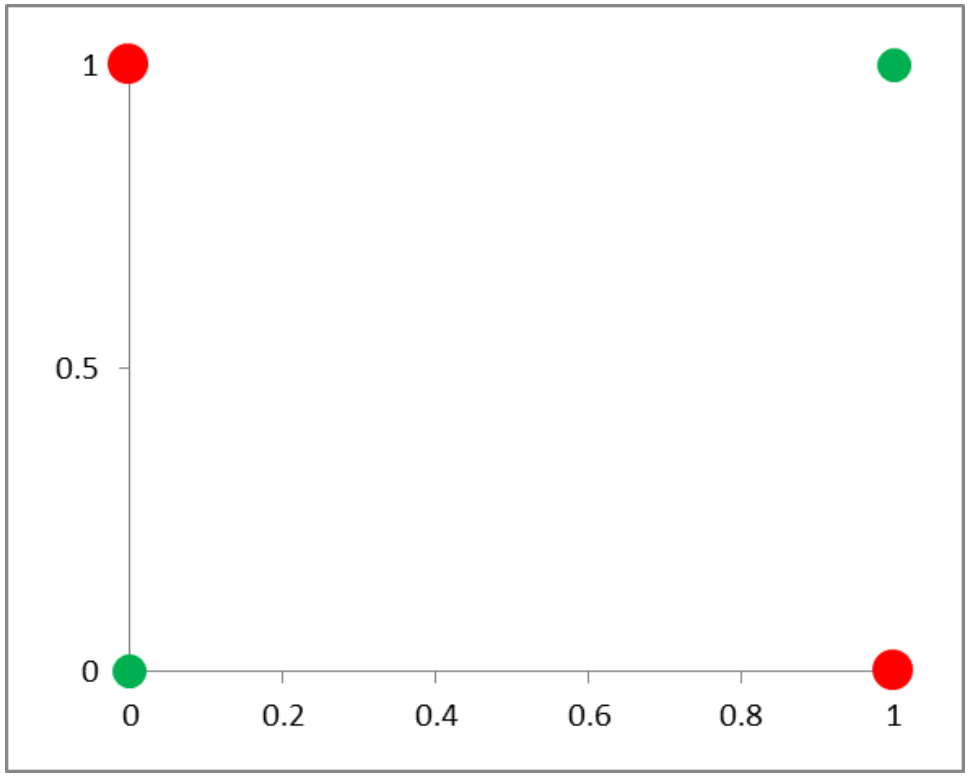
- Artificial neural networks connect individual decision making neurons by arranging them in a connected network
- A single neuron is essentially a linear classifier
- In a binary classification problem all it does is finds the line that separates the 2 classes



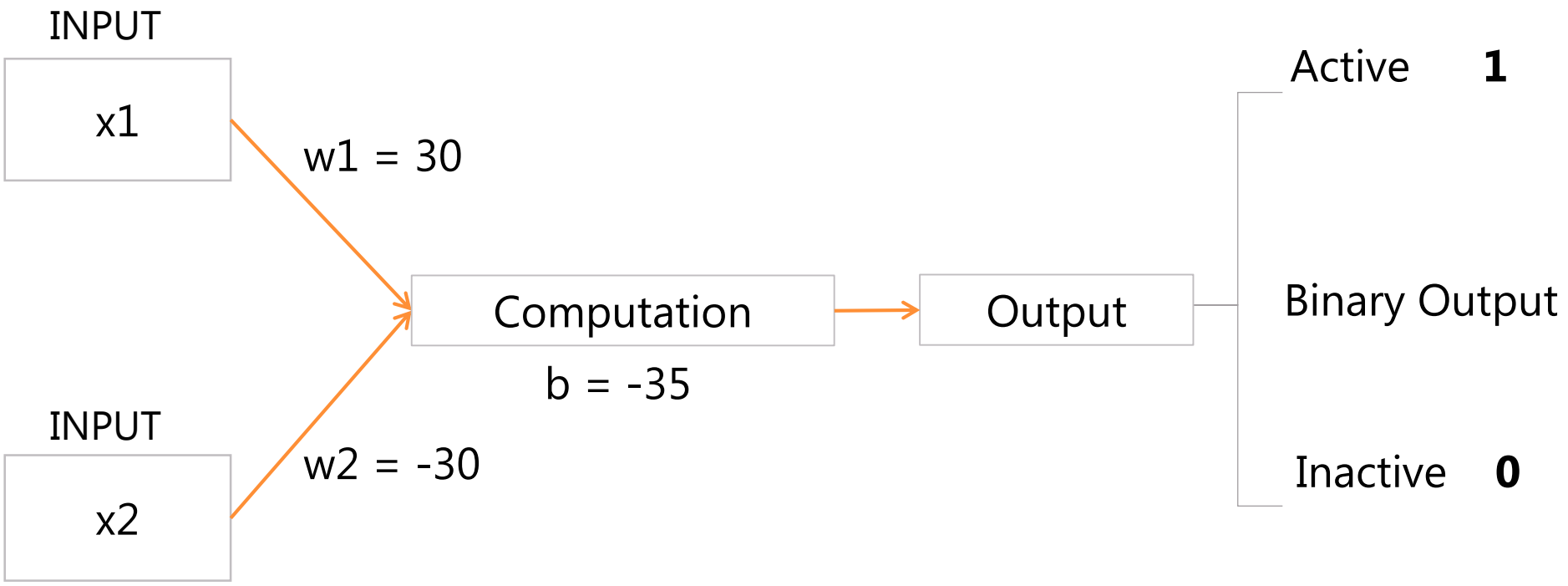
Neural Network

Decision Making With Multiple Neurons

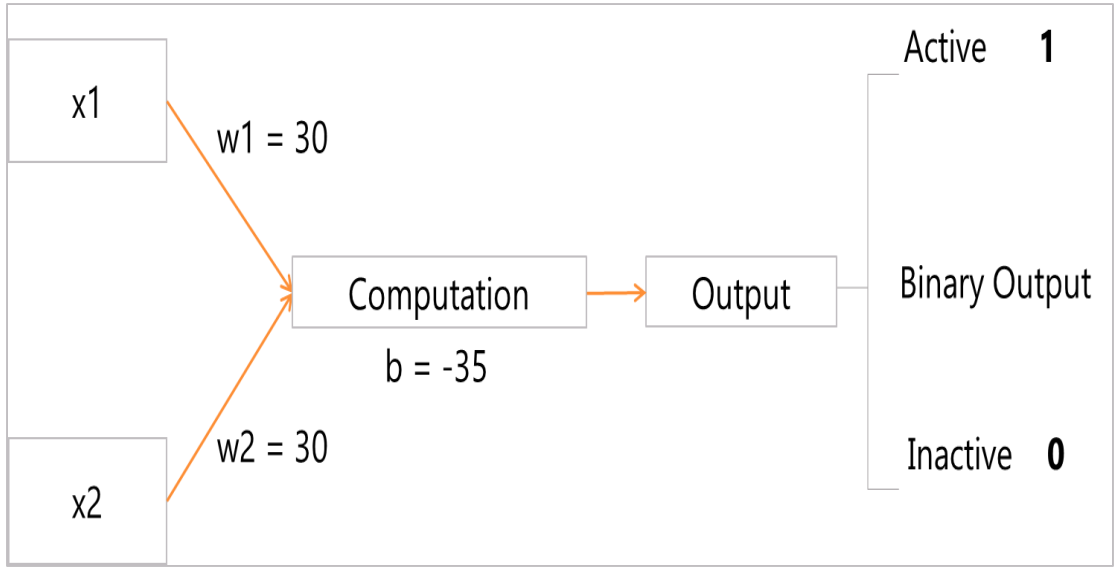
- Task: separate red dots from green
- Single neuron cannot solve this classification problem

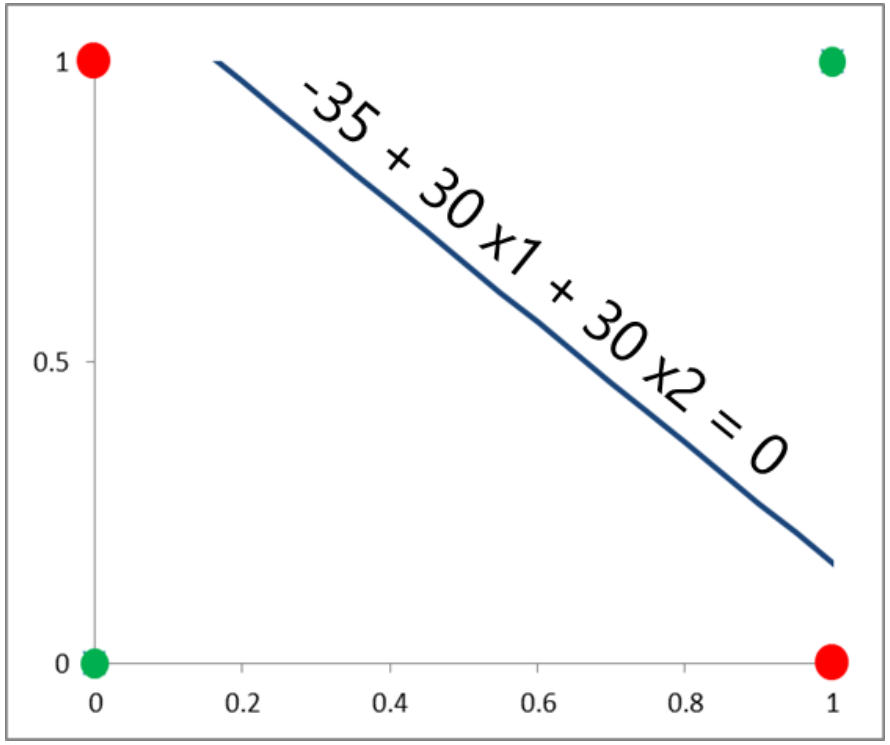


Neuron 1



Neuron 1

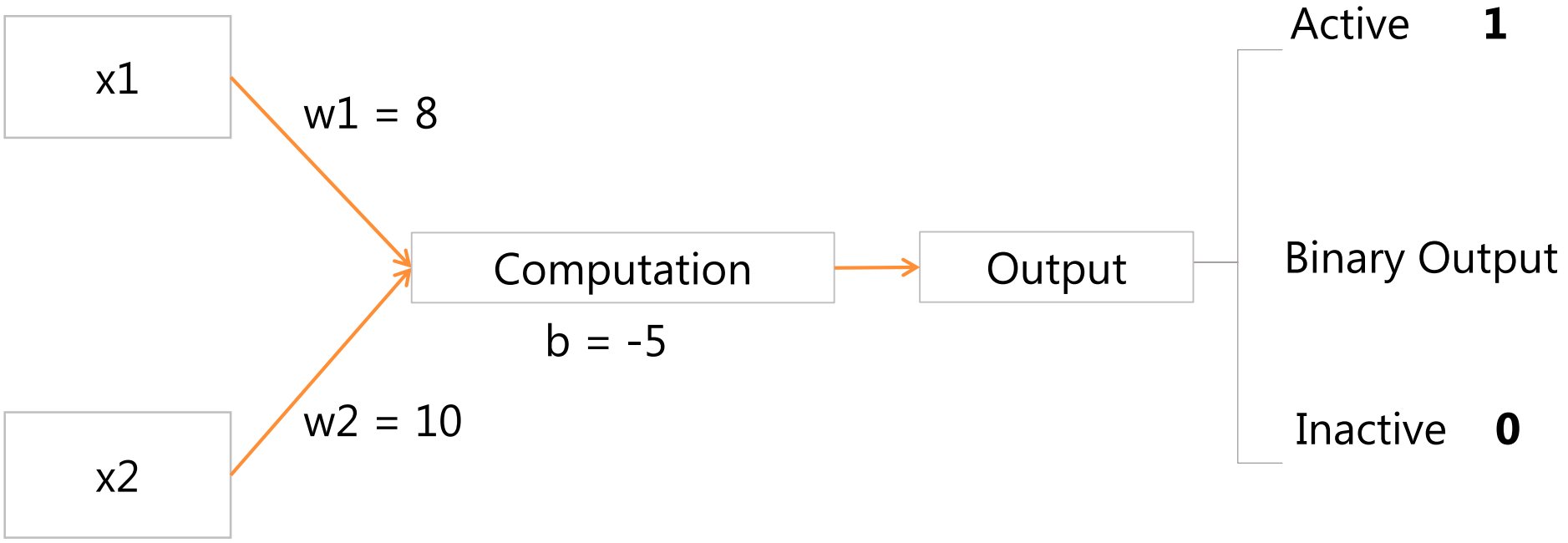




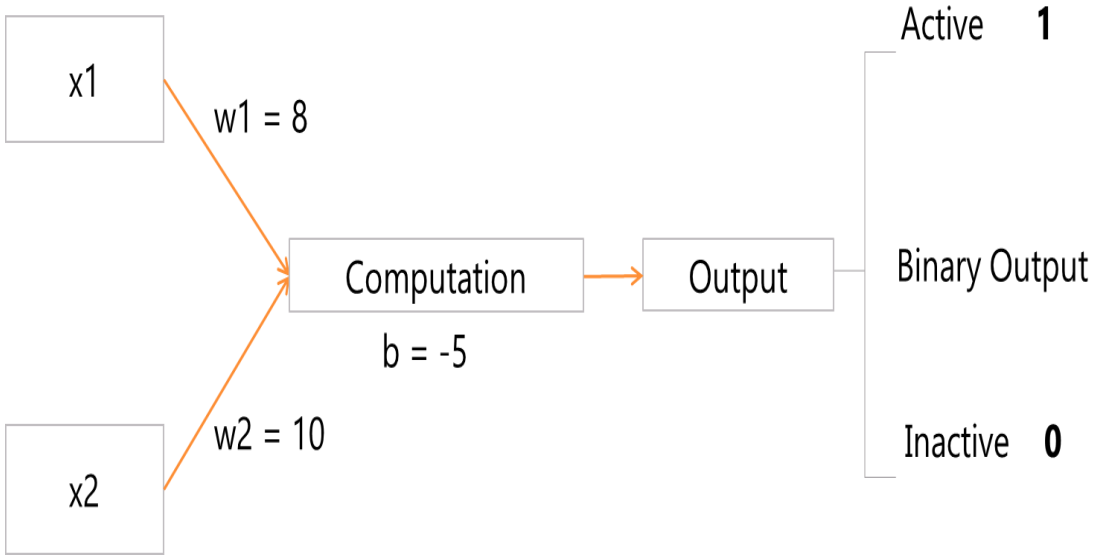
Neuron 1

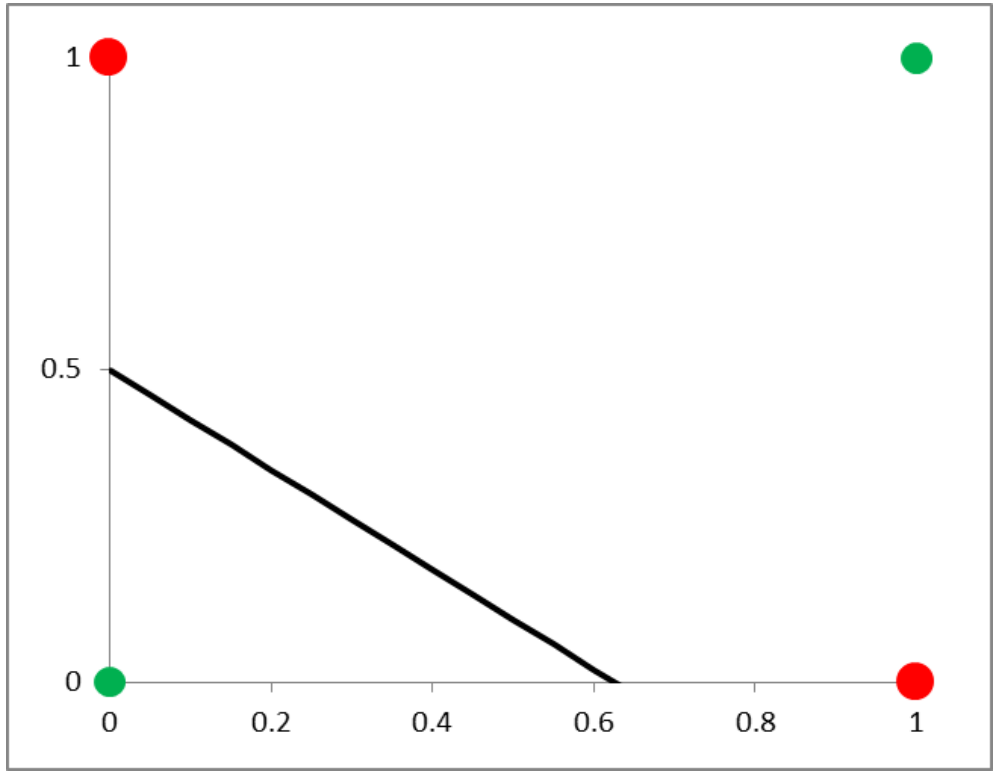
Separates the top right green dot from rest of the 3 points

Neuron 2



Neuron 2

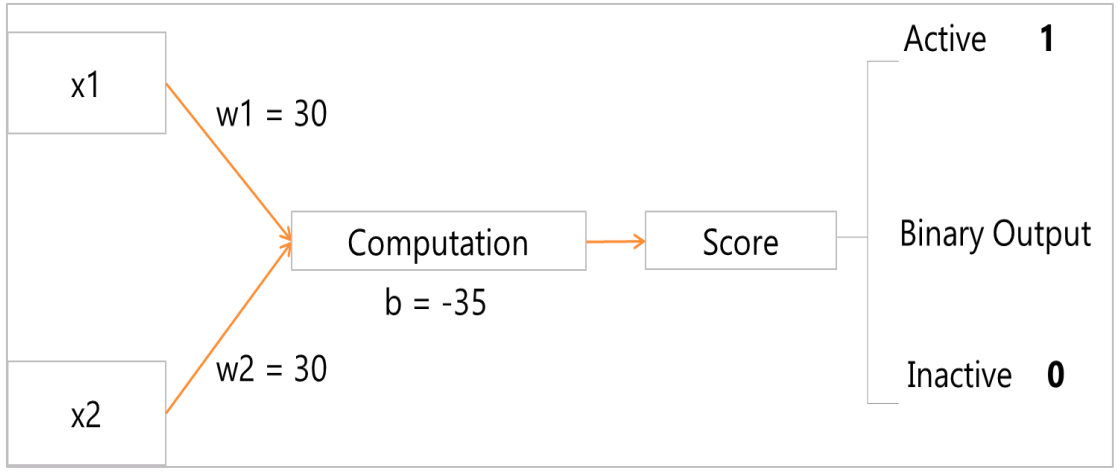


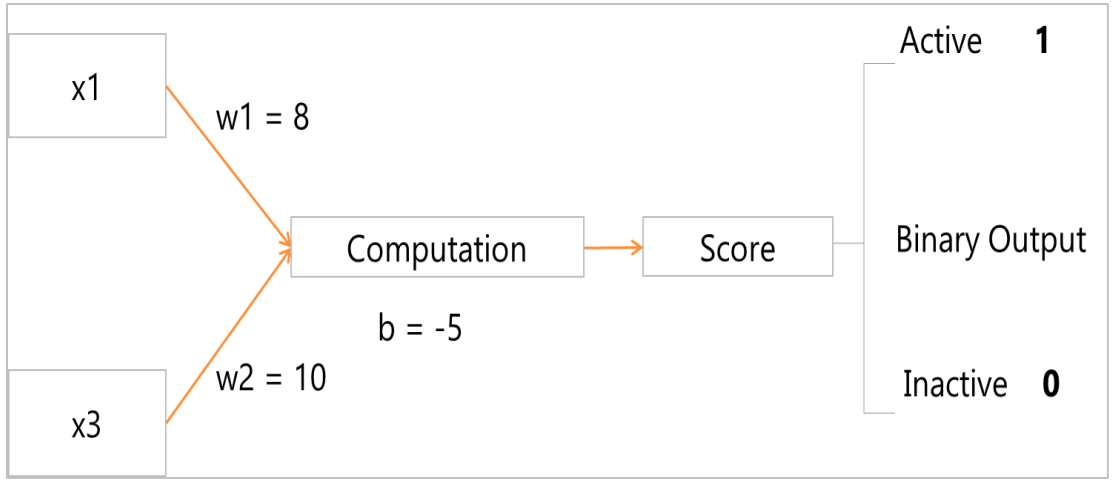


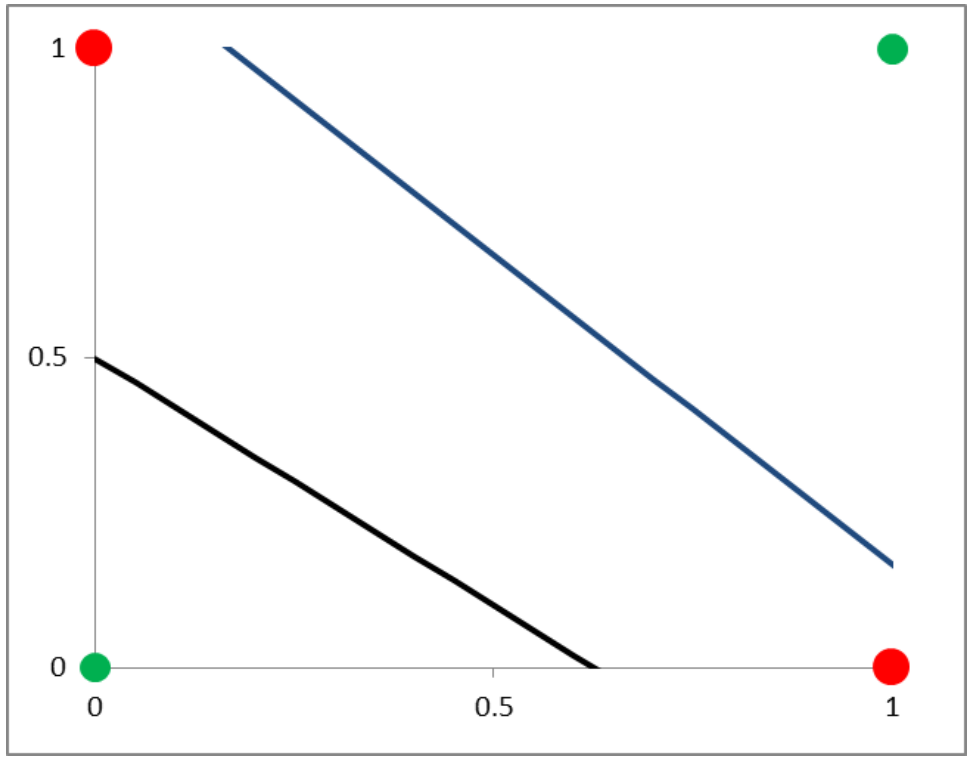
Neuron 2

Separates the bottom left green dot from rest of the 3 points

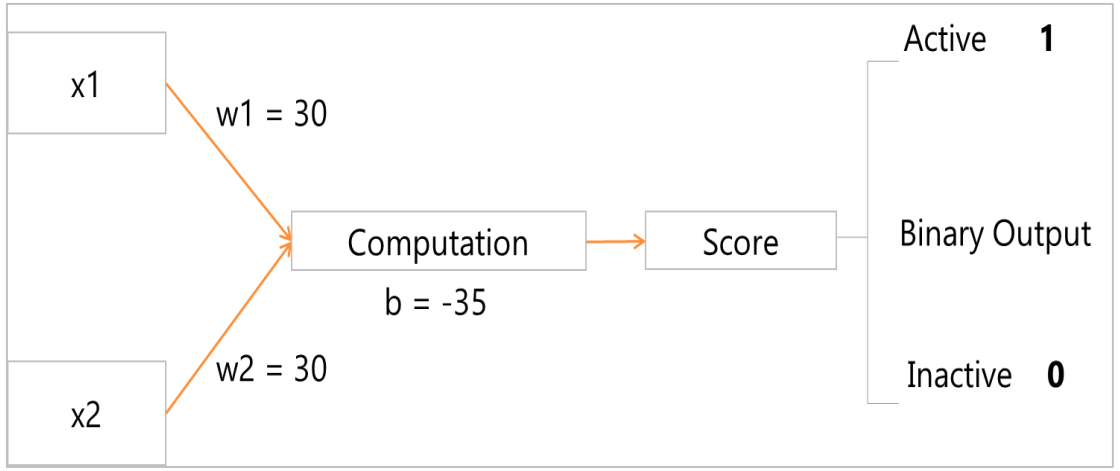
Connecting 2 Neural Networks

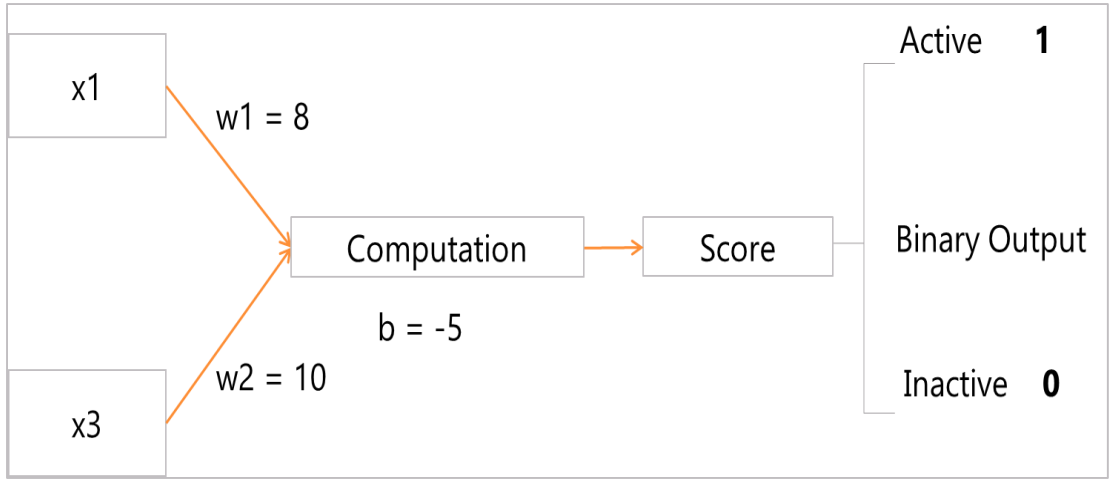


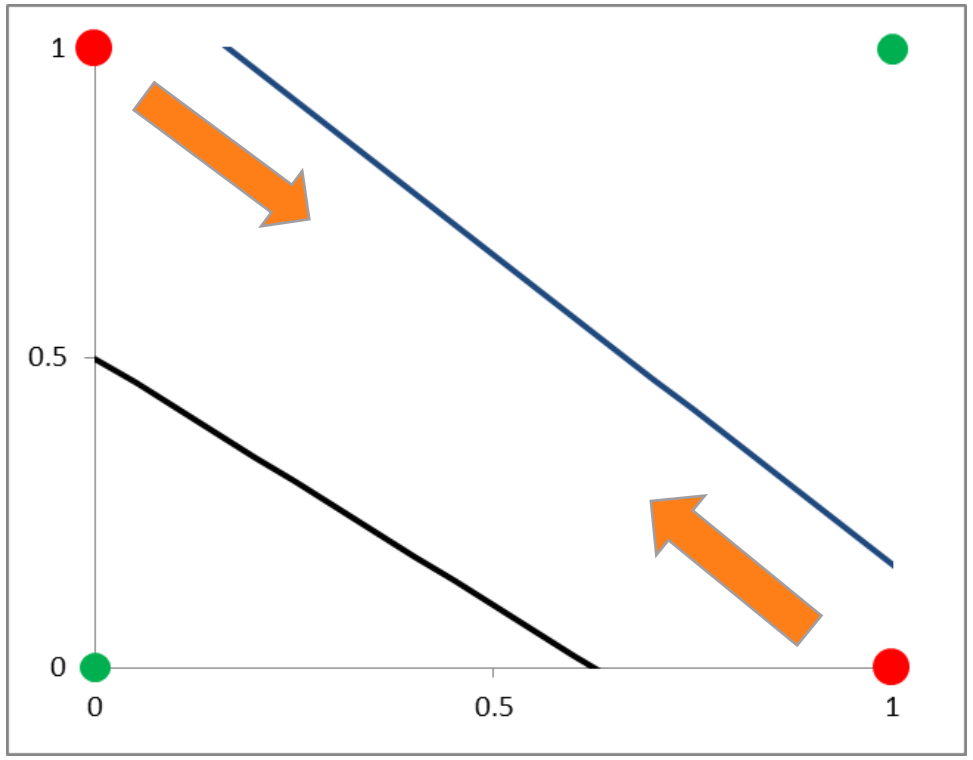




Connecting 2 Neural Networks







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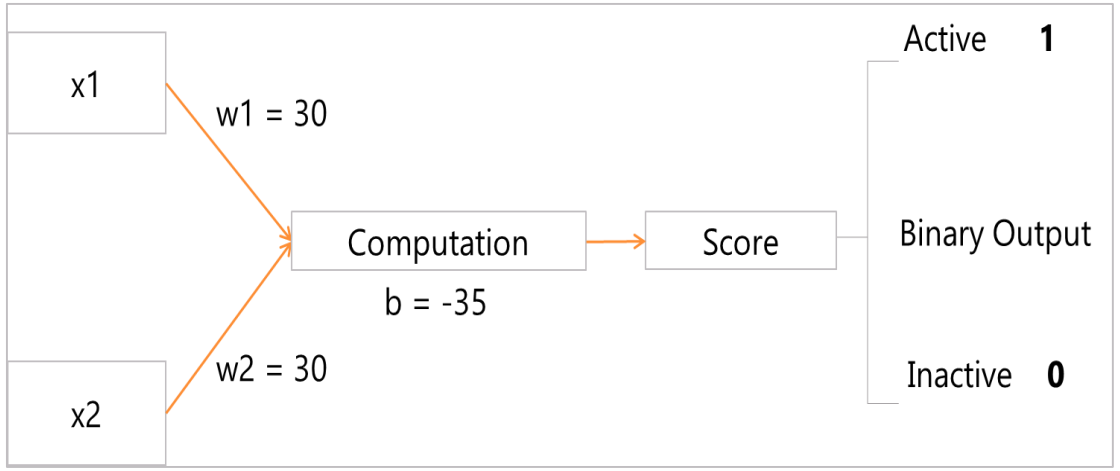
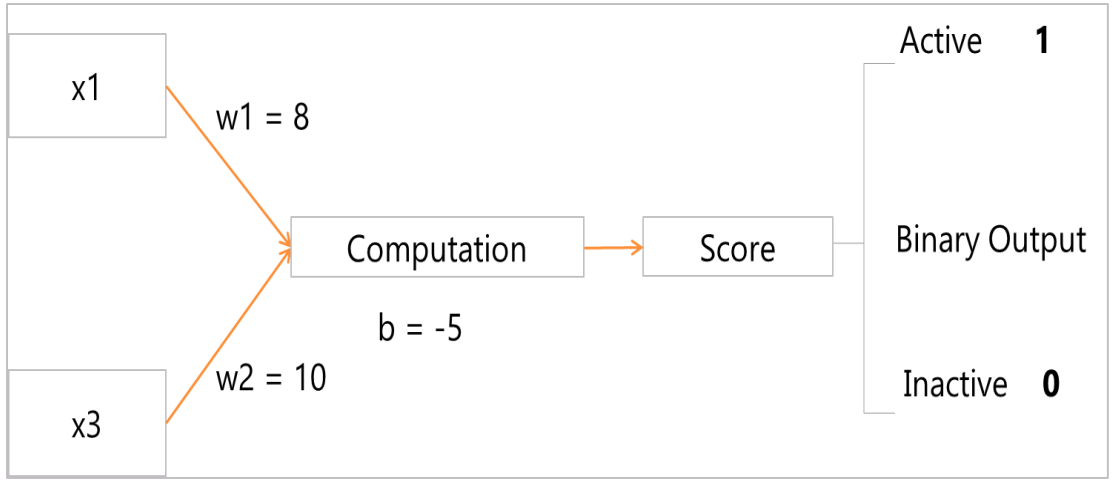
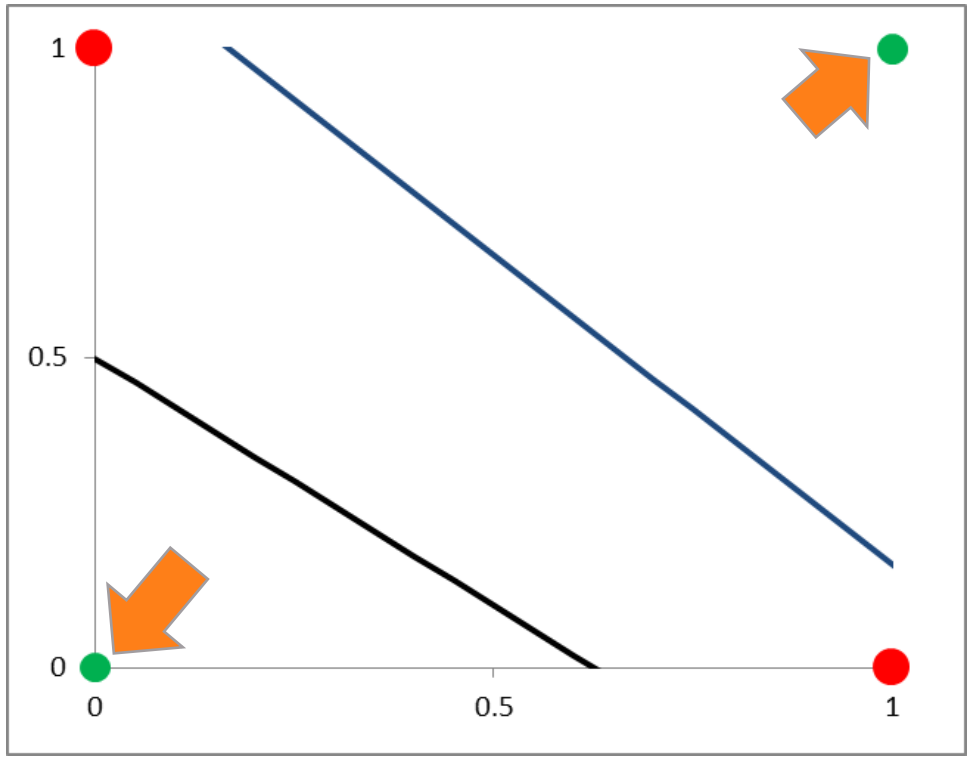
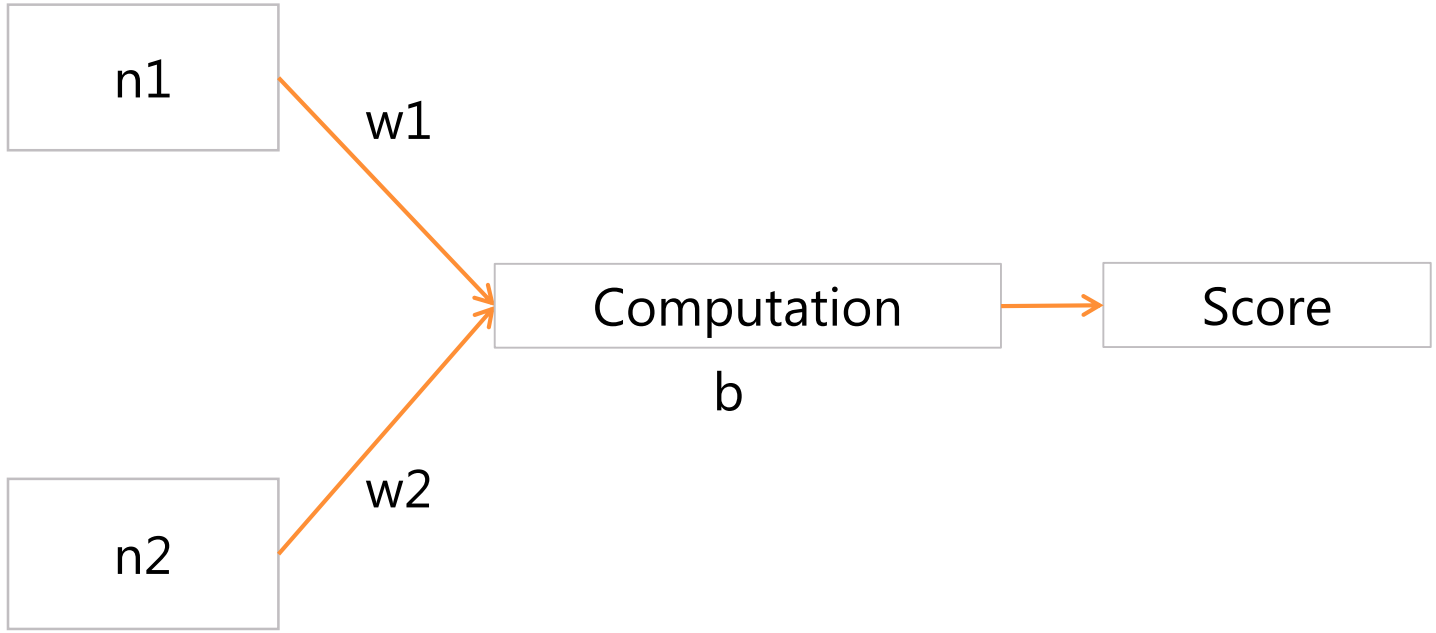


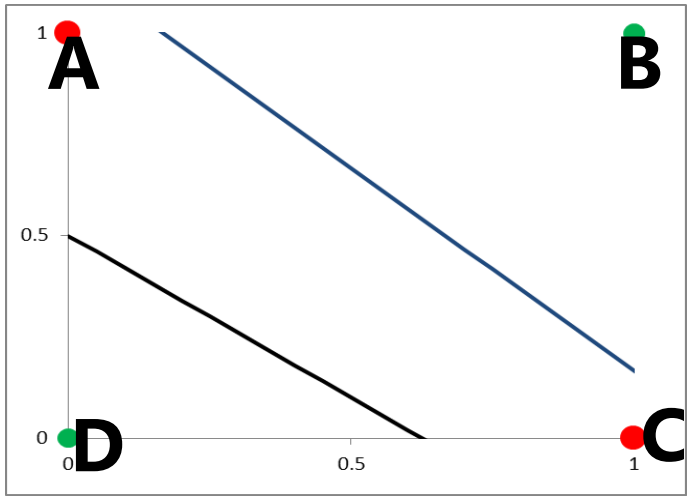


Decisions from 2 simple neurons can be combined to construct a complicated decision boundary



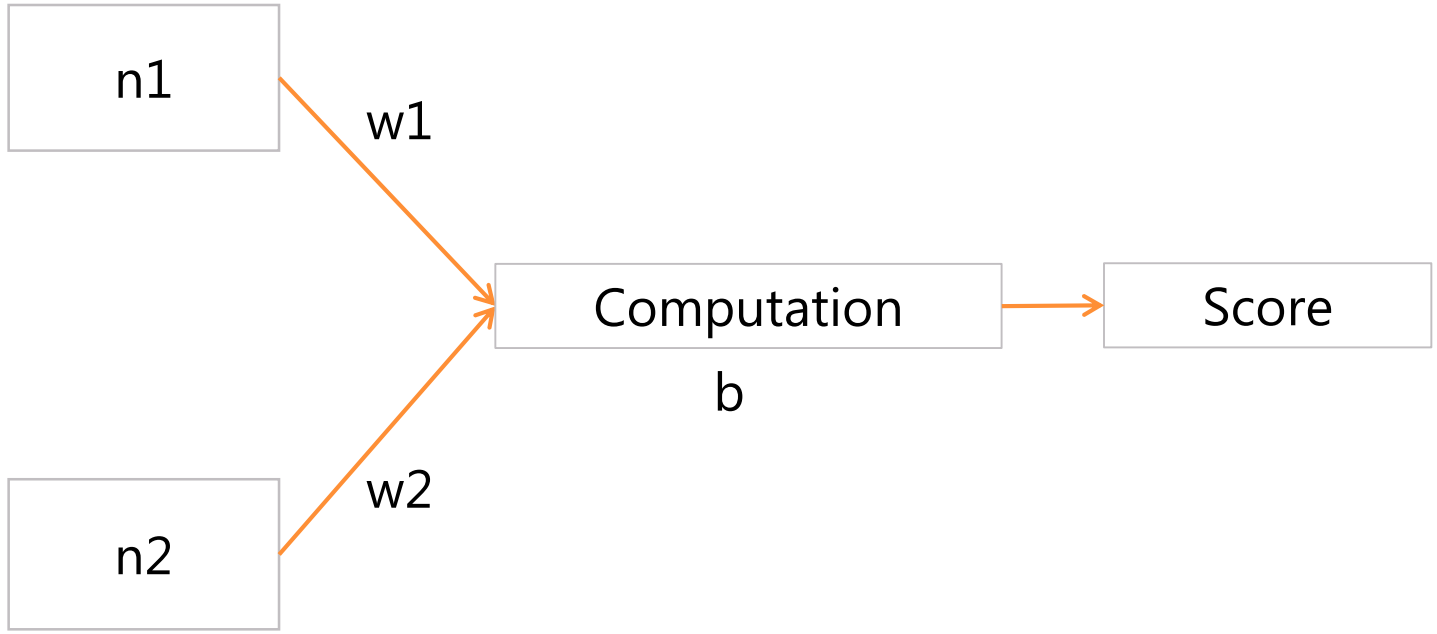
Combining Outputs From Multiple Neurons





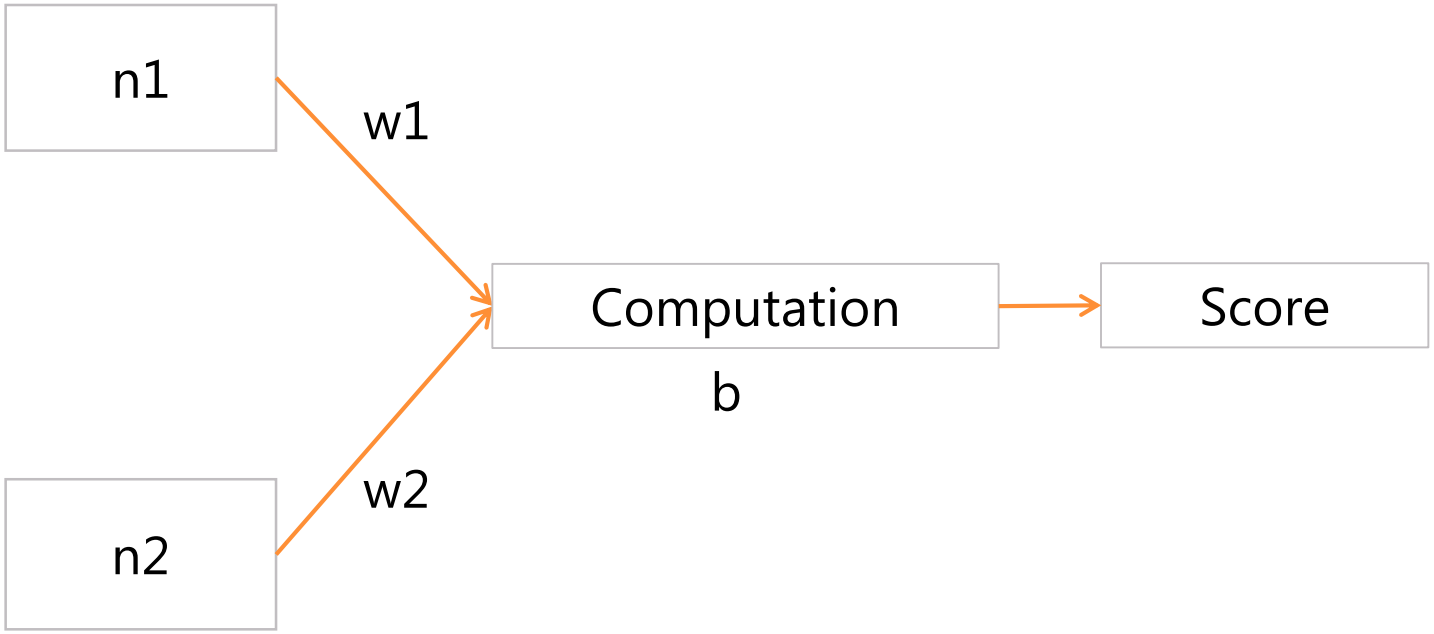
	Output from Neuron 1	Output from Neuron 2	Response
A	0	1	Red
B	1	1	Green
C	0	1	Red
D	0	0	Green

Combining Outputs From Multiple Neurons



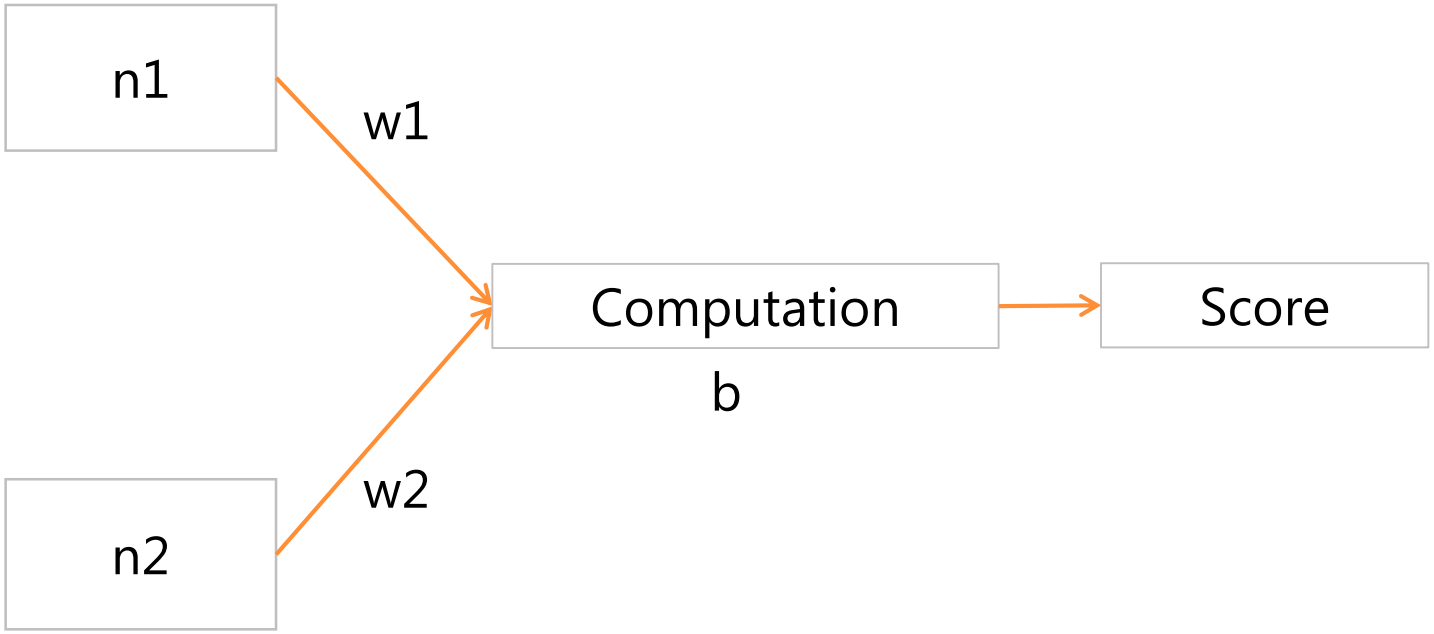
- These 2 neurons have created another set of features from the data
- This feature transformation property, which uses multiple neurons, is fairly complex

Combining Outputs From Multiple Neurons



This allows the machine learning algorithm to look at different complicated transformations on the data, without introducing mathematical complexity

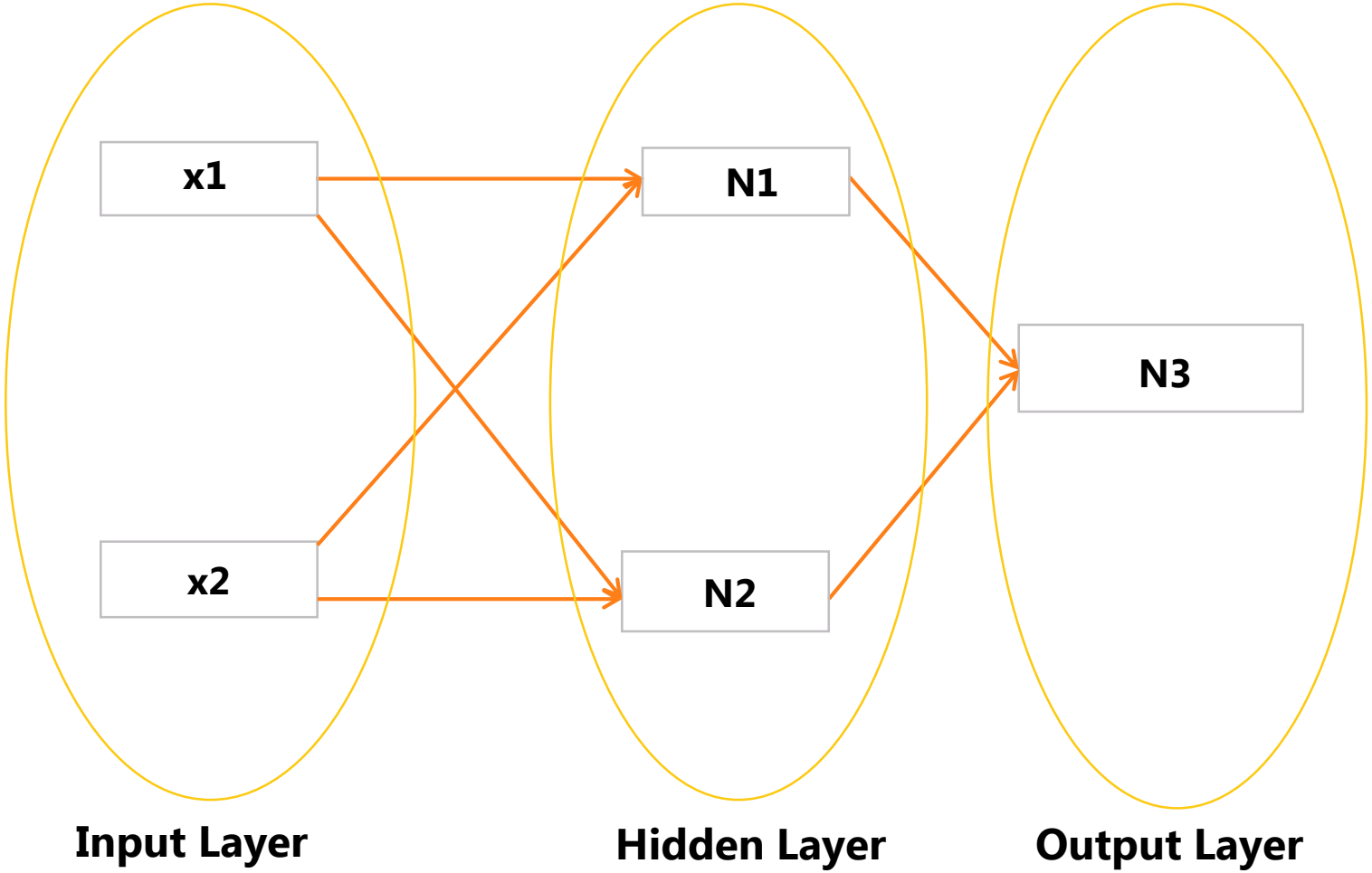
Combining Outputs From Multiple Neurons



- Try plotting the data using this transformed set of features from the 2 neurons
- You should be able to solve this classification problem using a single neuron

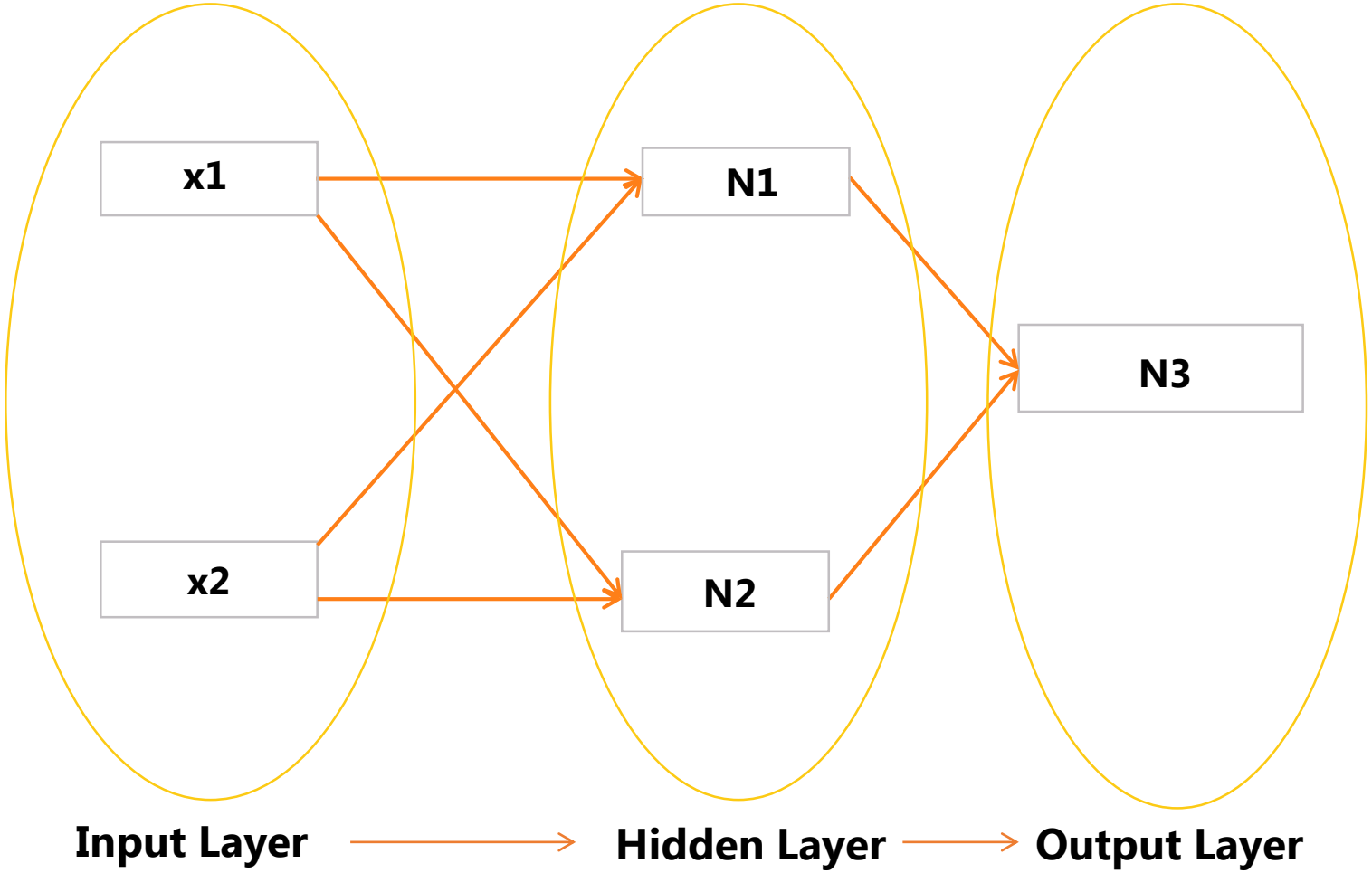
The Architecture of a Neural Network

Multi-layered perceptron model



The Architecture of a Neural Network

Multi-layered perceptron model



- Forward direction
- Feed-forward

Recap

- Decision Making With Multiple Neurons
- Neuron 1
- Neuron 2
- Connecting 2 neural networks
- Combining Outputs From Multiple Neurons
- Combining Outputs From Multiple Neurons: Neuron 1
- Combining Outputs From Multiple Neurons: Neuron 2
- The Architecture of a Neural Network

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