



Neural Network: Advanced





Module 2 Objectives

1. Describe the basis of a neural network (neuron).
2. Identify and describe an artificial neuron (perceptron).
3. Discuss bias and weights.
4. Describe and identify activation functions.
5. Describe and simulate image processing in a small neural network.
6. Implement and train a perceptron using TensorFlow.

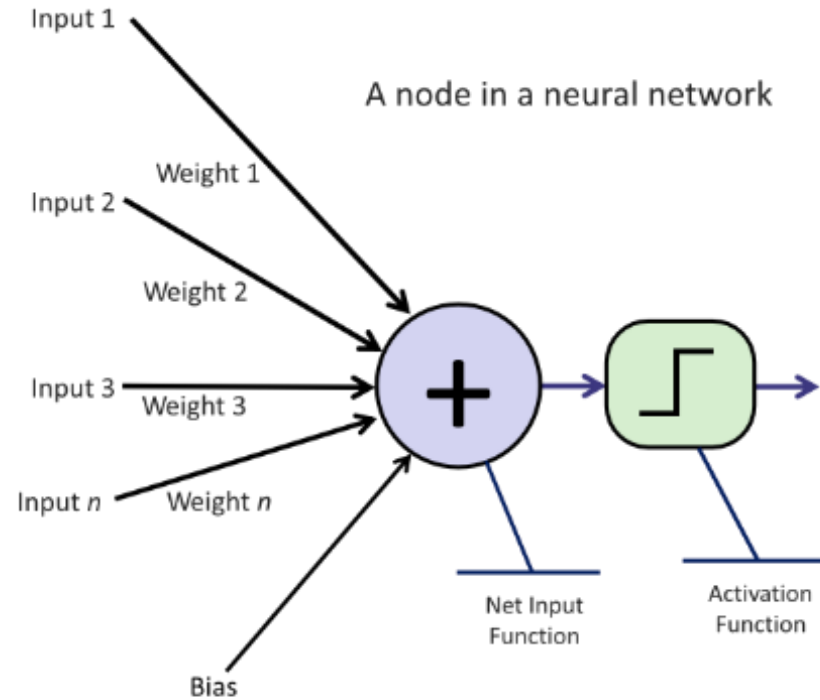


Neural Network Neurons





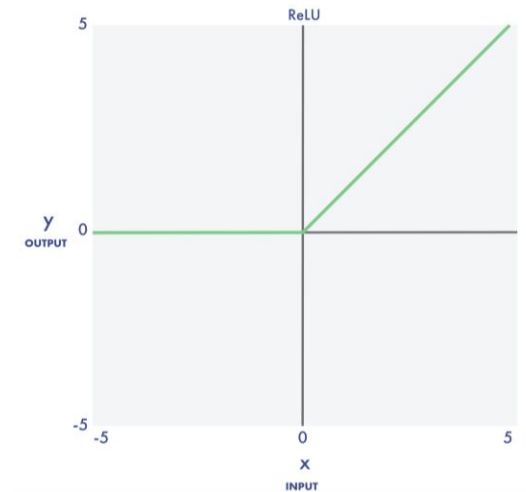
Remember The Node?



1. Linear Transformation

$$Sum = w_1 \times x_1 + w_2 \times x_2 + \dots + w_n \times x_n + bias$$

2. Activation Function



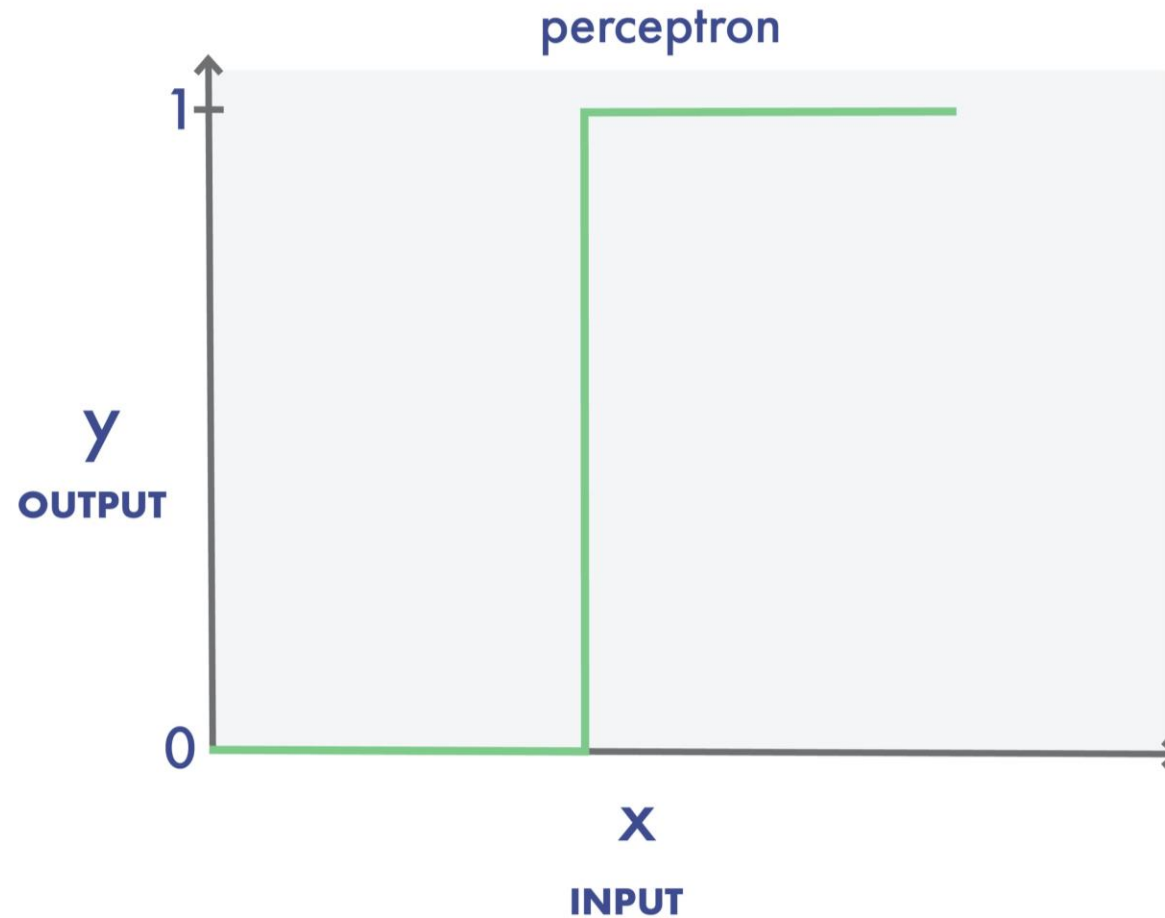


Functions, ACTIVATE!



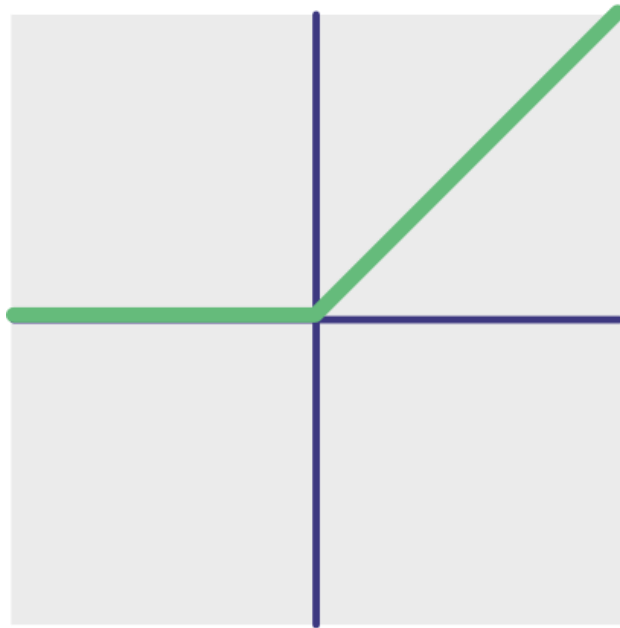


What do Activation Functions do?

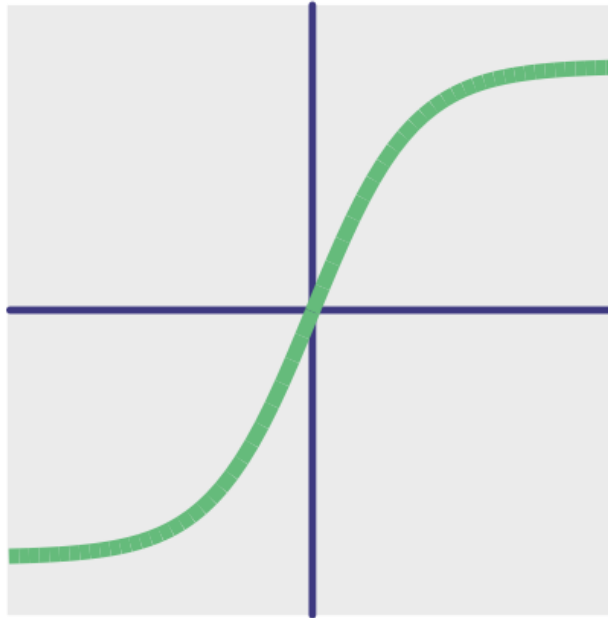




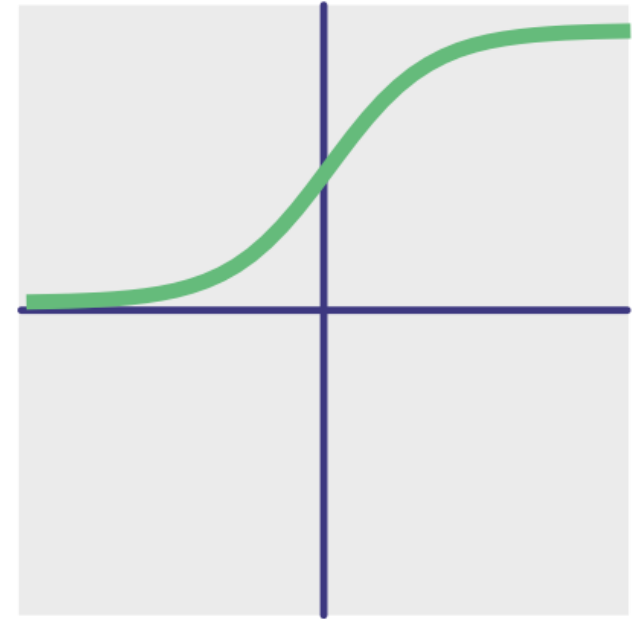
Common Activation Functions



ReLU
(Rectified Linear Unit)



tanh
(Hyperbolic tangent)



Sigmoid





Where Do Initial Weights and Biases Come From?

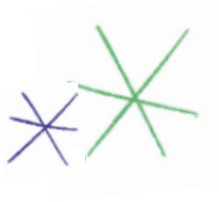


They're Random (Usually...)

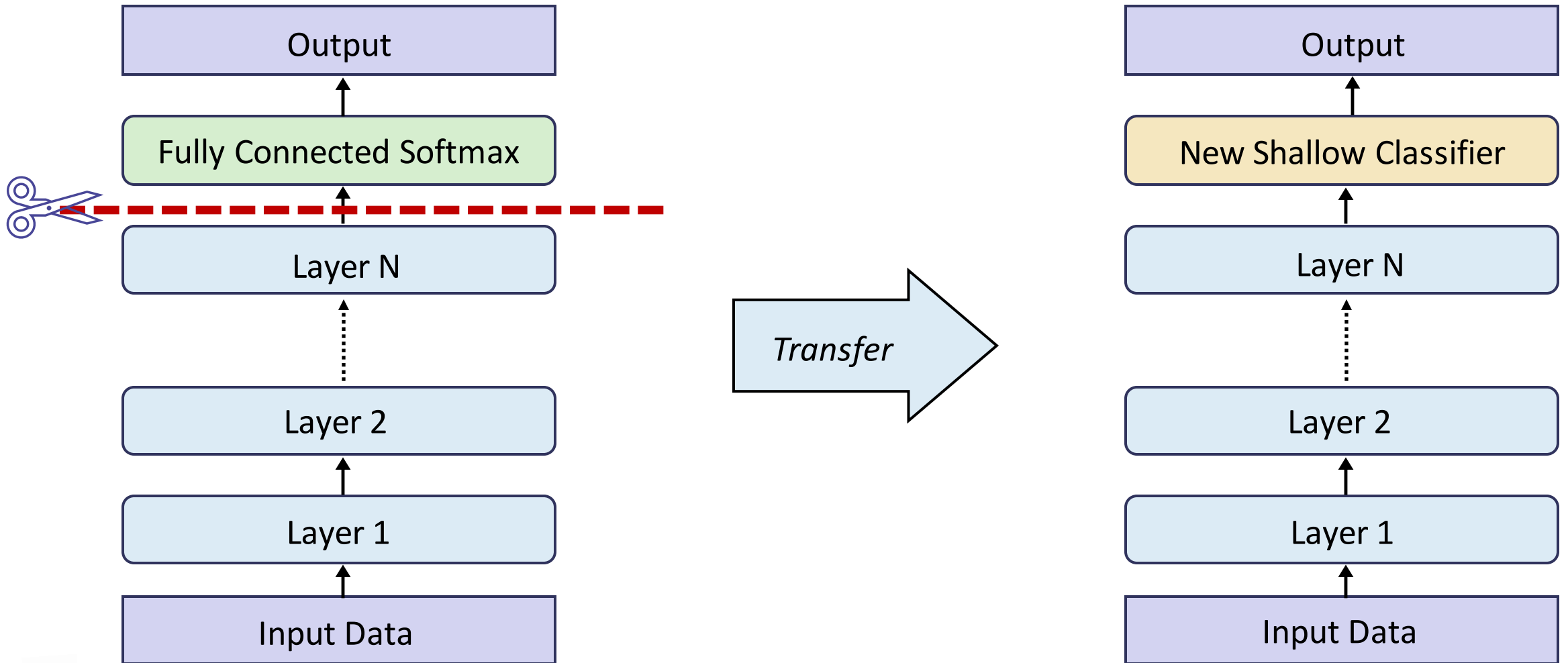


This image was generated using AI tools



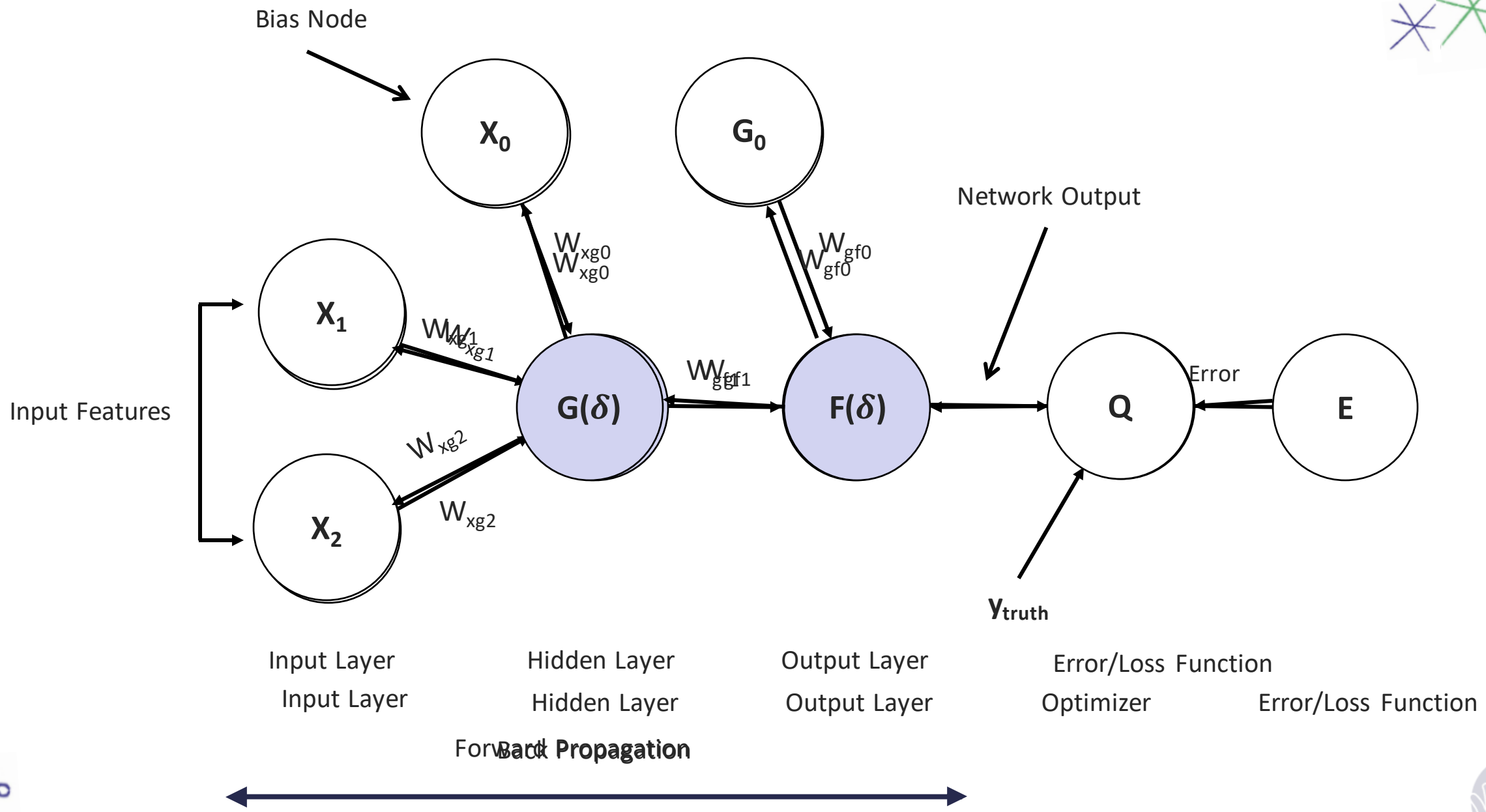
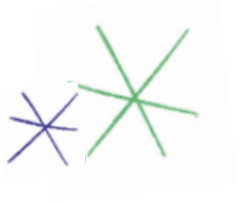


We Can Also Use What We've "Learned"

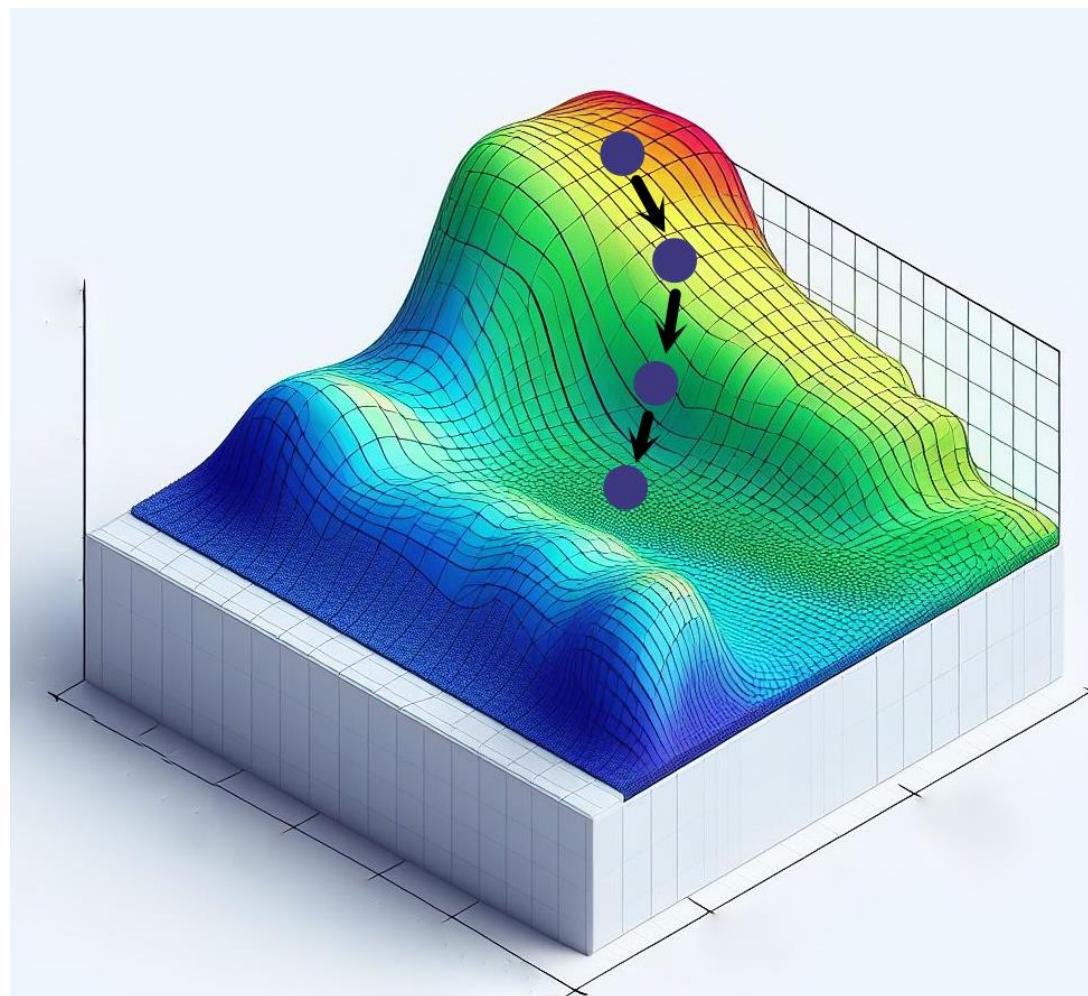




A Closer Look at The Training Process



The Low Down



This image was generated using AI tools

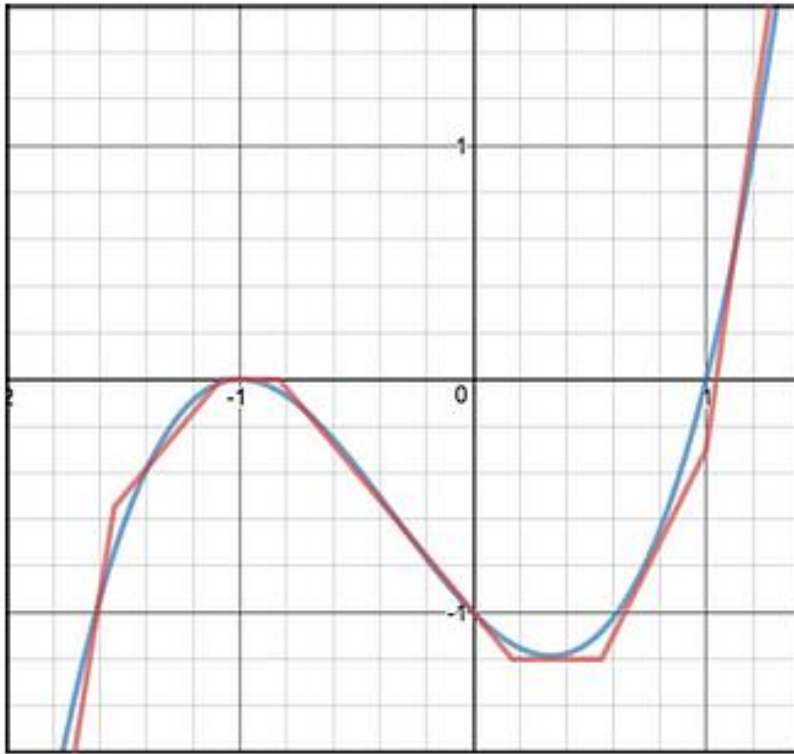




WHY do we use Neural Networks?



Universal Approximation!



$$n_1(x) = \text{Relu}(-5x - 7.7)$$

$$n_2(x) = \text{Relu}(-1.2x - 1.3)$$

$$n_3(x) = \text{Relu}(1.2x + 1)$$




$$n_4(x) = \text{Relu}(1.2x - .2)$$

$$n_5(x) = \text{Relu}(2x - 1.1)$$

$$n_6(x) = \text{Relu}(5x - 5)$$

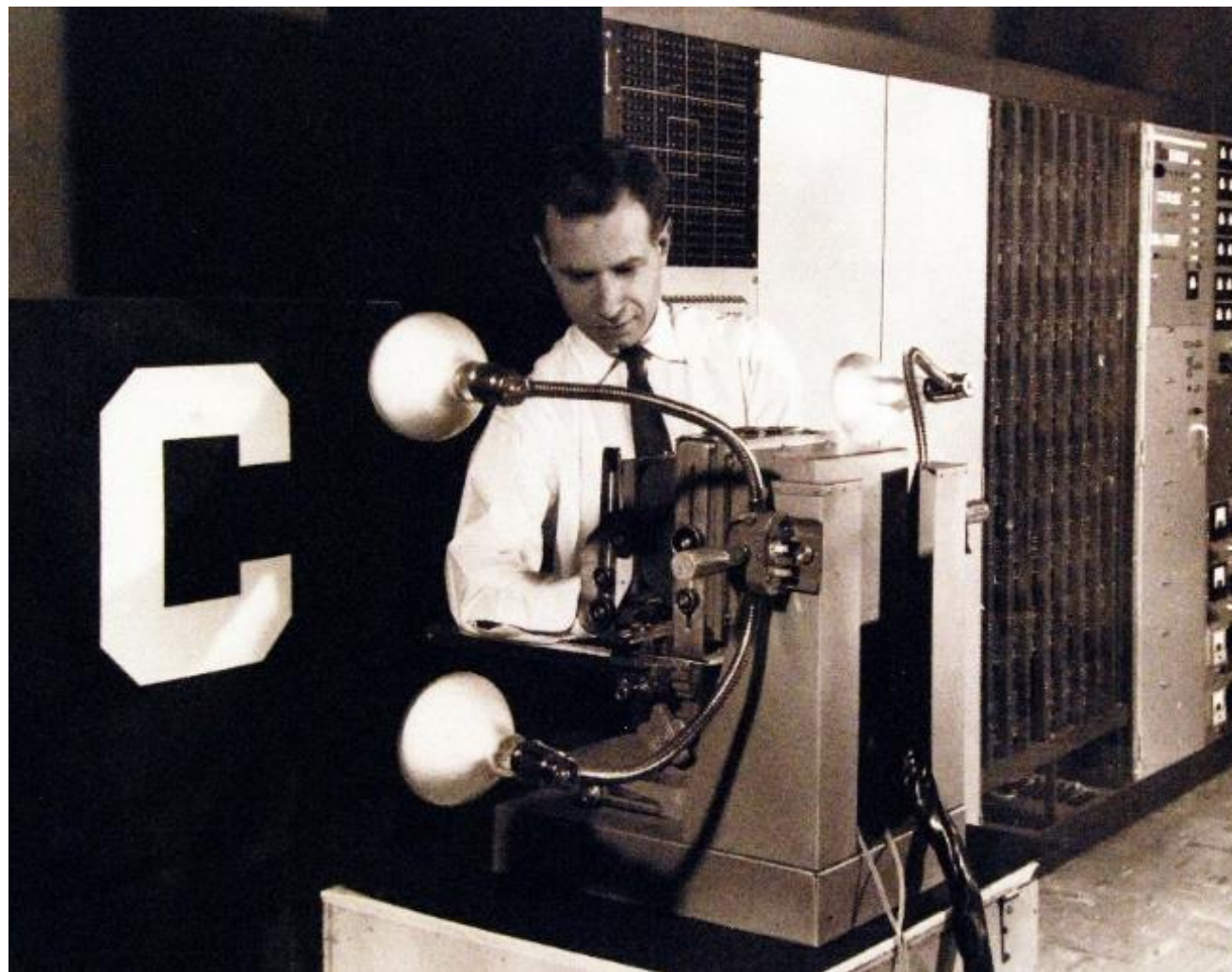
$$Z(x) = -n_1(x) - n_2(x) - n_3(x) \\ + n_4(x) + n_5(x) + n_6(x)$$

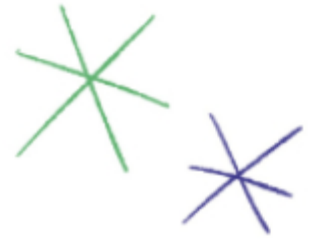




The Perceptron or AI's Humble Beginnings

The Lonely Node





The Perceptron

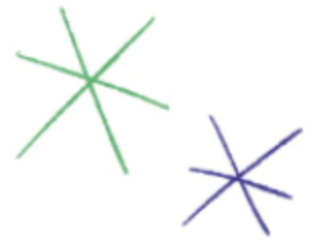
02_code_a_perceptron.ipynb

This notebook will walk you through building and training your own binary classification model, then using it to make predictions!

Network Capacity



Exercise



Look at This

03_mnist_classifier.ipynb

This notebook will walk you through training an image classification model using a full neural network.

Questions?

(QR CODE FOR SURVEY!)

