



Deep Learning, Opening the Machine





## 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.

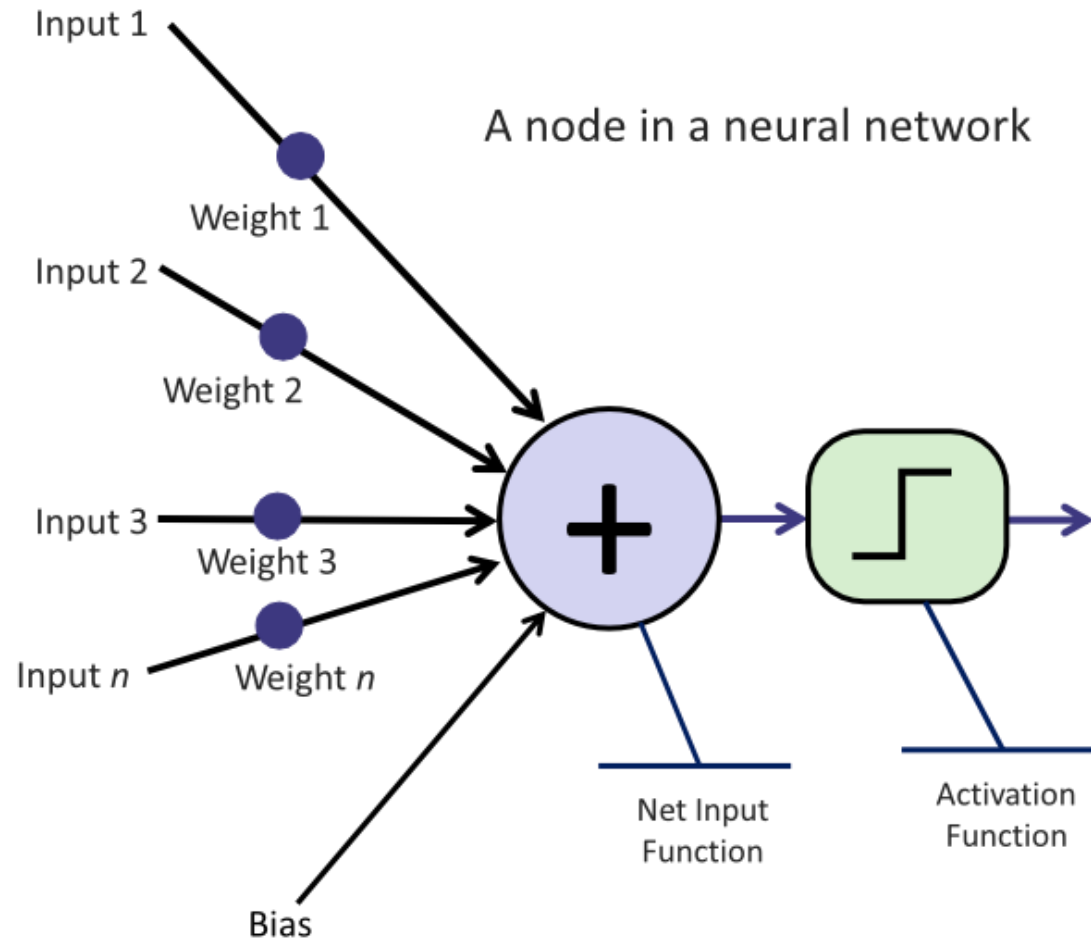


# Neural Network Neurons





# Remember The Node?

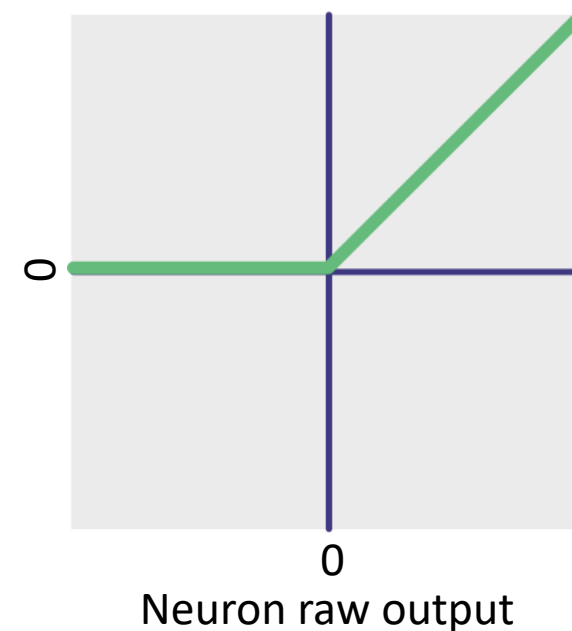


## 1. Linear Transformation

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

## 2. Activation Function

Neuron output after  
applying activation function

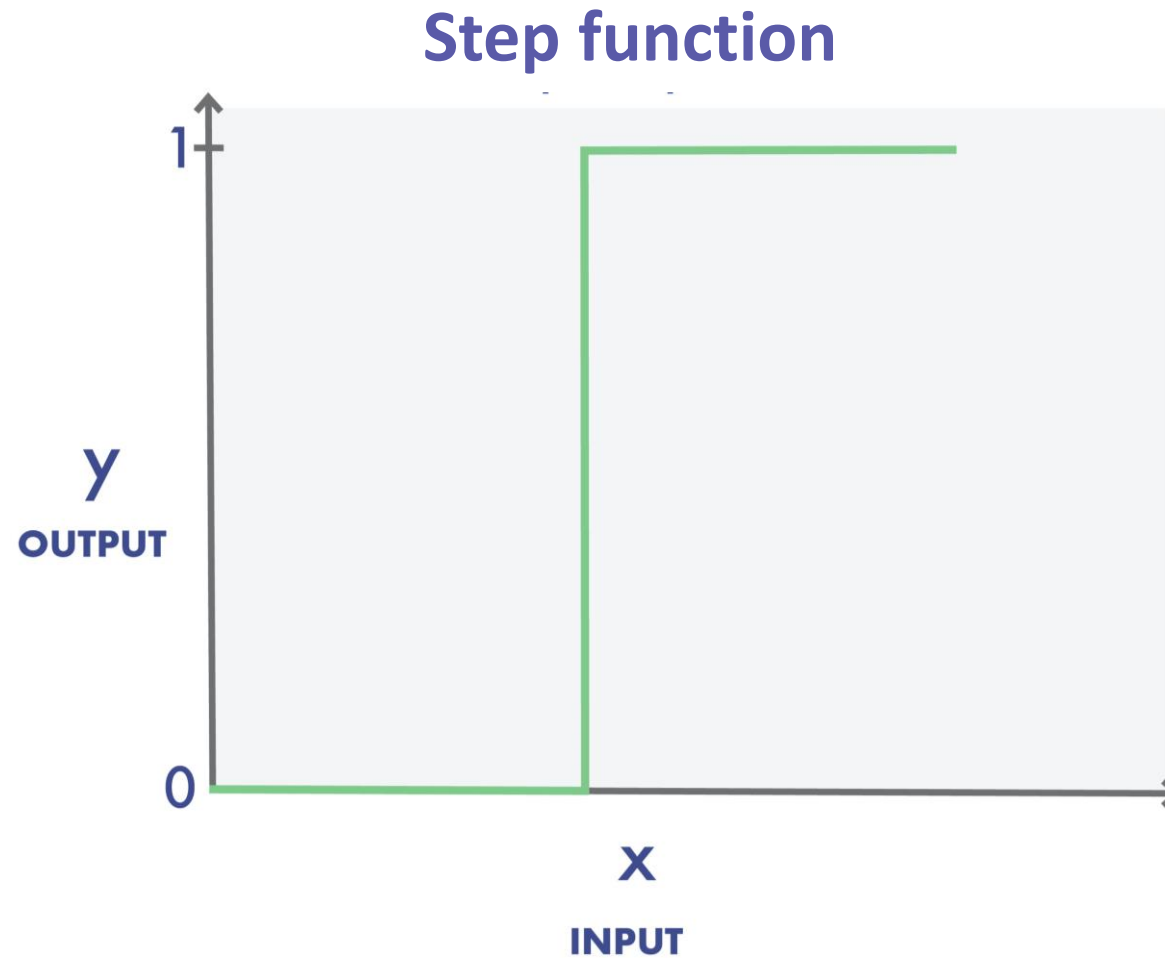




**Functions, ACTIVATE!**

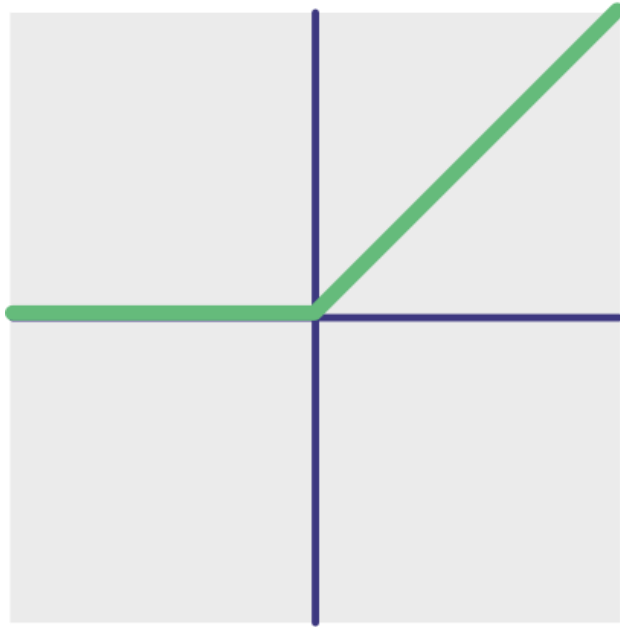


# What do Activation Functions do?

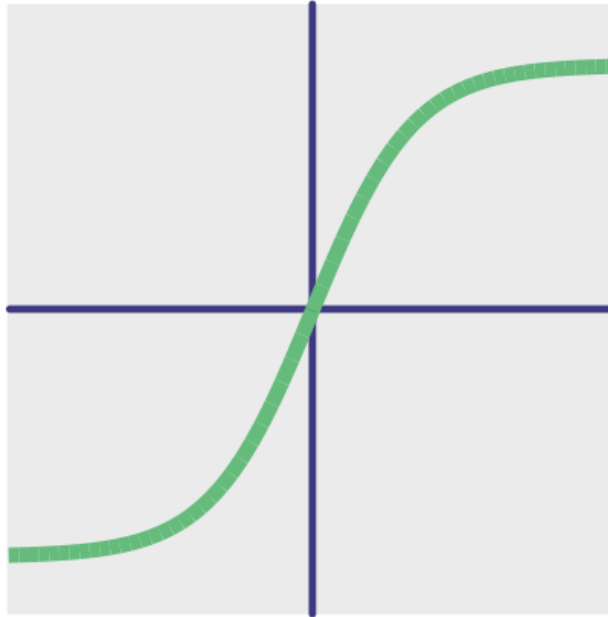




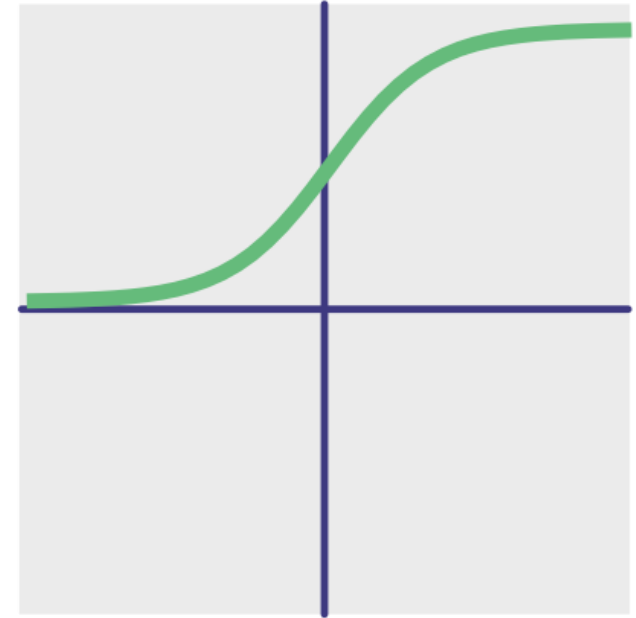
# Common Activation Functions



ReLU  
(Rectified Linear Unit)



tanh  
(Hyperbolic tangent)



Sigmoid





# Where Do Initial Weights and Biases Come From?





# They're Random (Usually...)

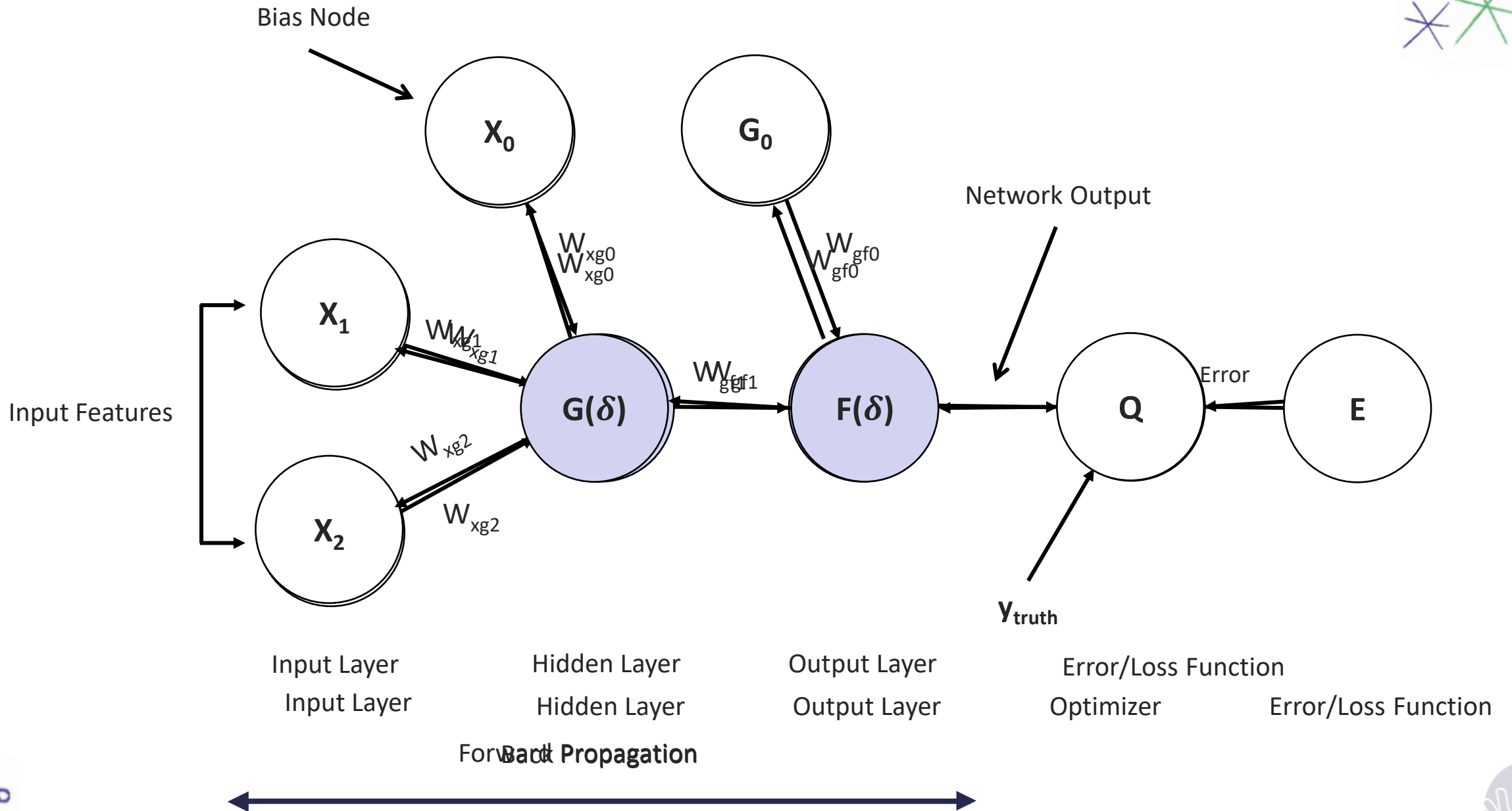


This image was generated using AI tools

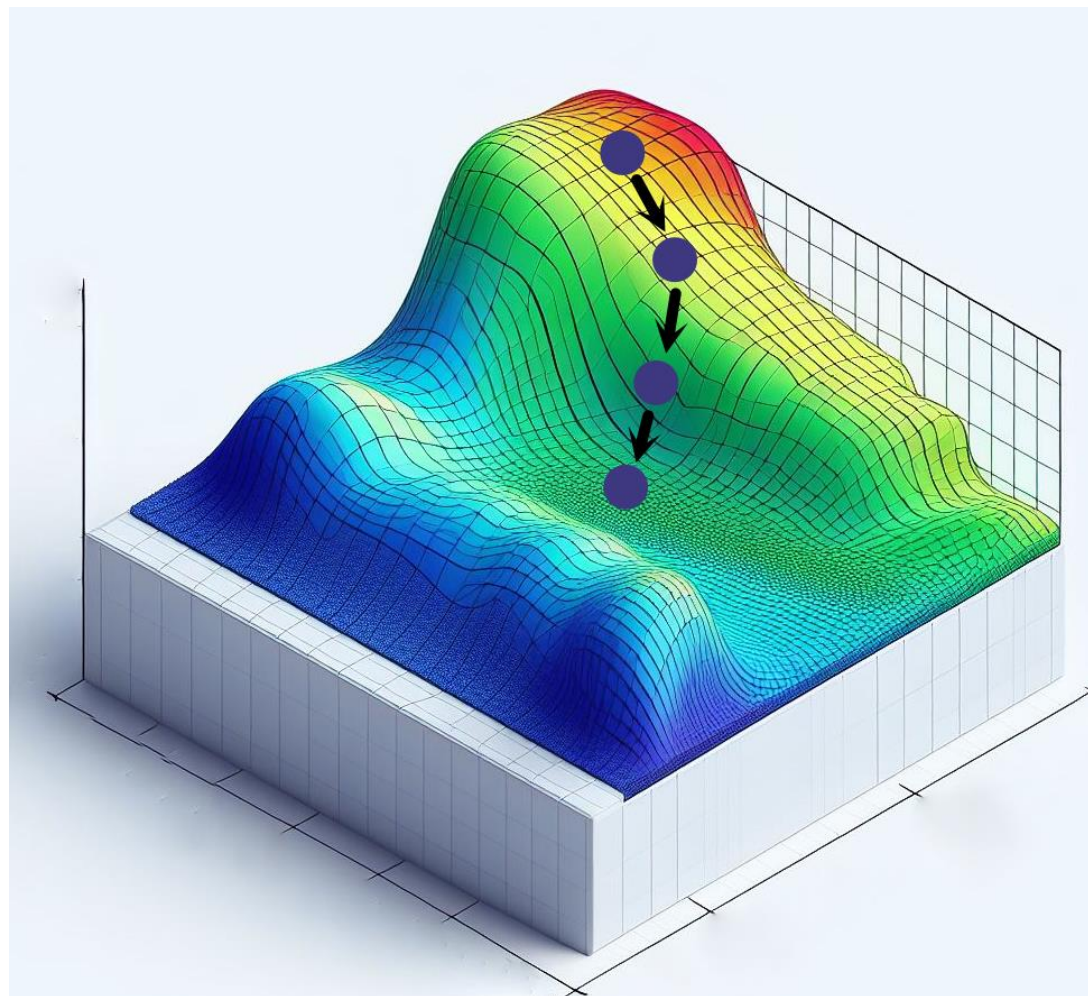




# **A Closer Look at The Training Process**



# The Low Down



This image was generated using AI tools

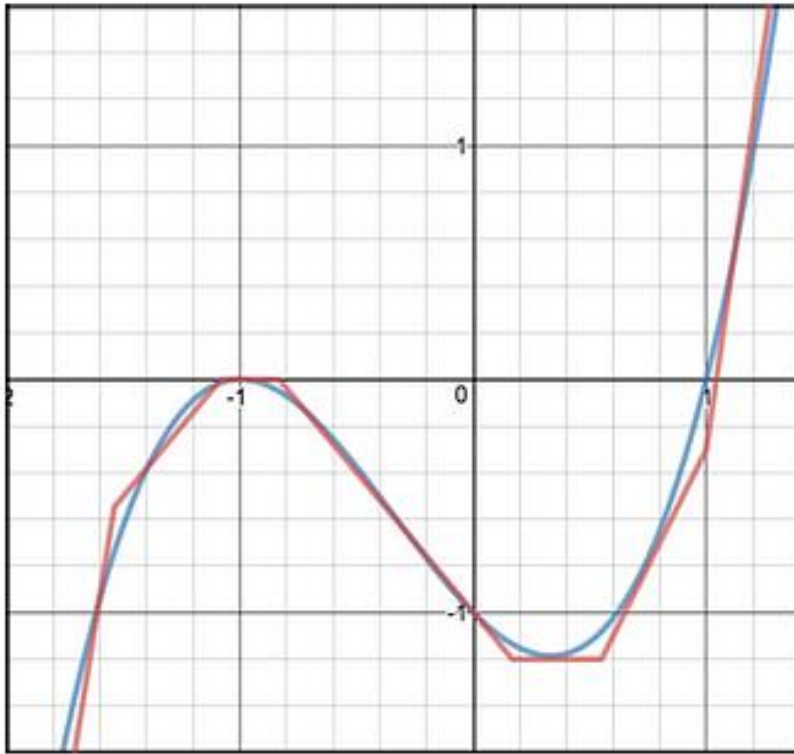




**WHY do we use Neural Networks?**



# Universal Approximation!



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

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

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







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

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

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

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

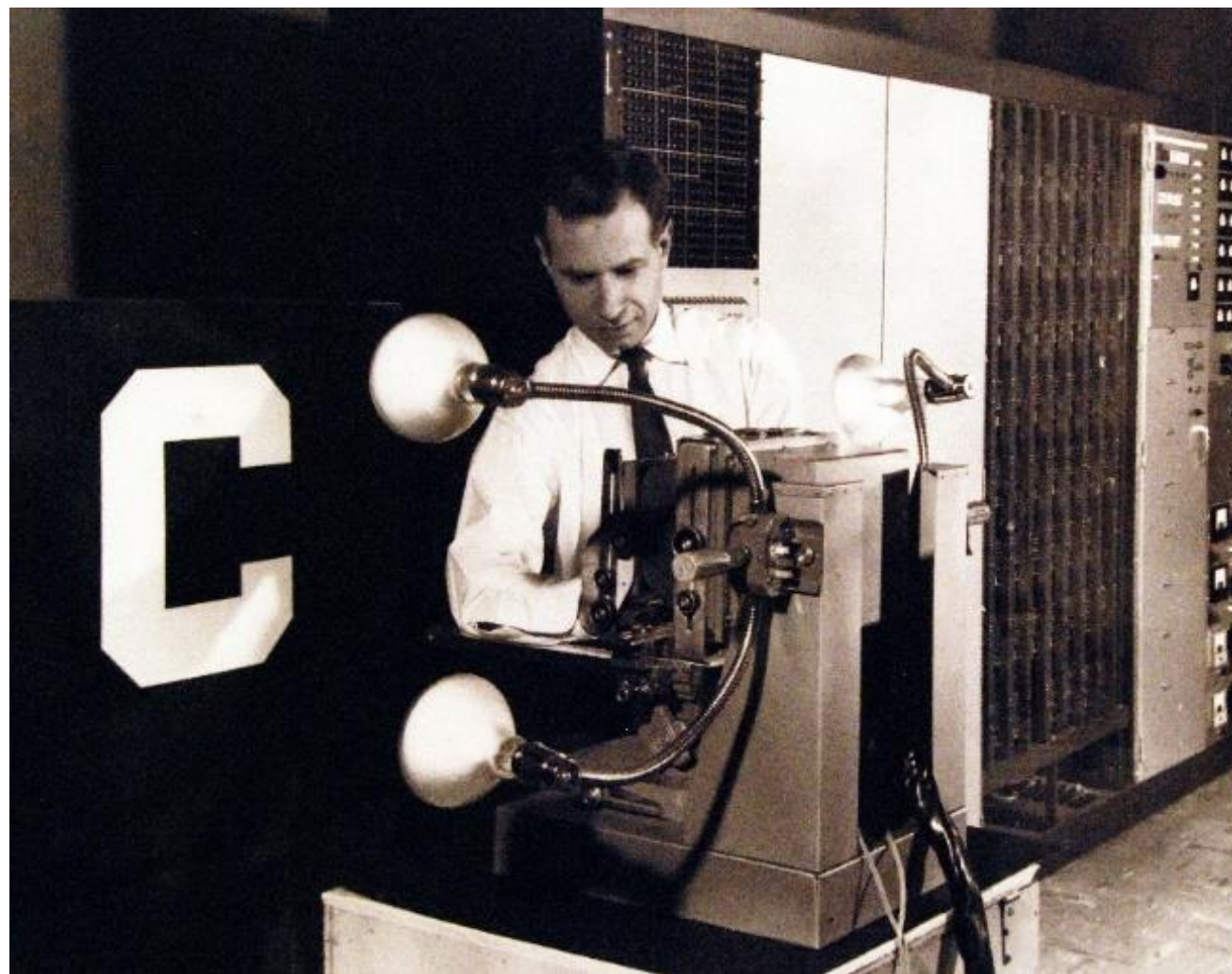




# **The Perceptron or AI's Humble Beginnings**



# The Lonely Node







## The Perceptron

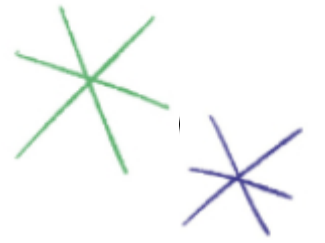
02\_code\_a\_perceptron.ipynb

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!)

