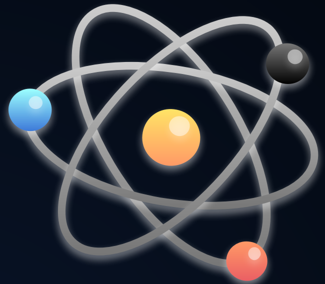
AI CLUB



Google Classroom: vlafrzz
Remind: @aiclub2023
Instagram: @ayala_aiclub

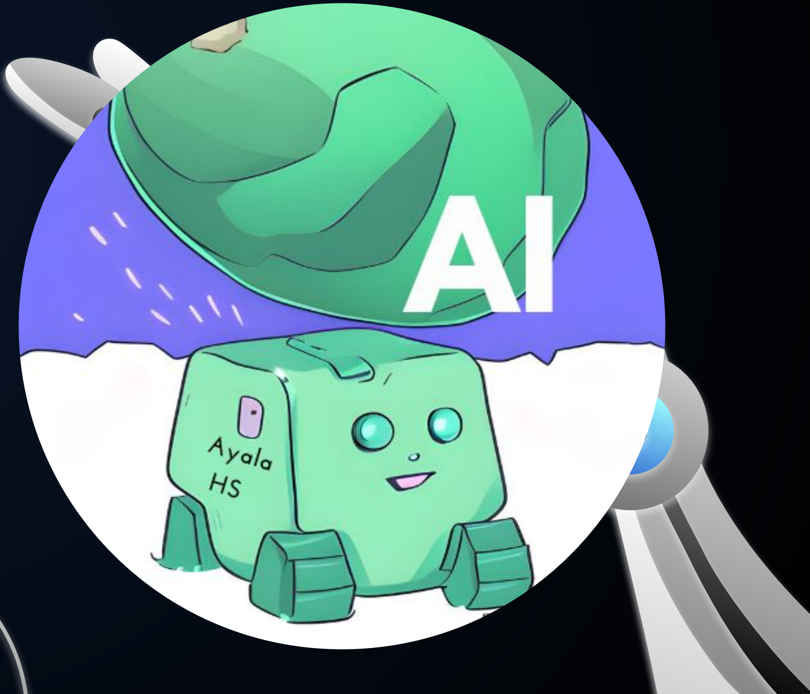
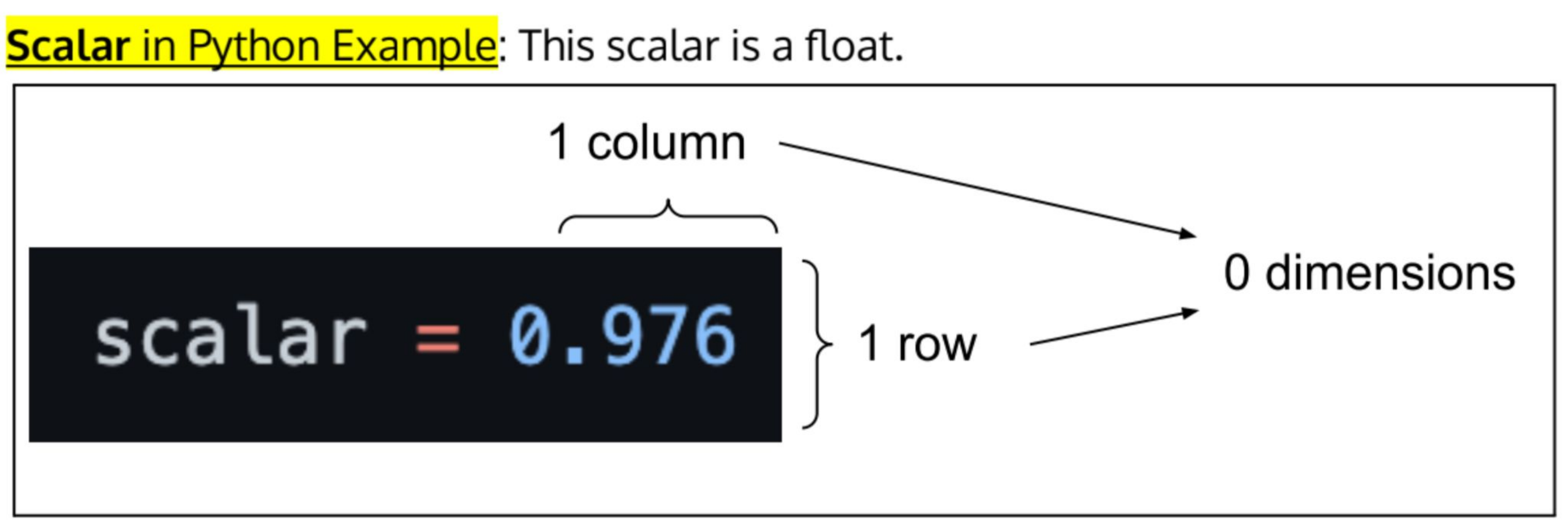


TABLE OF CONTENTS

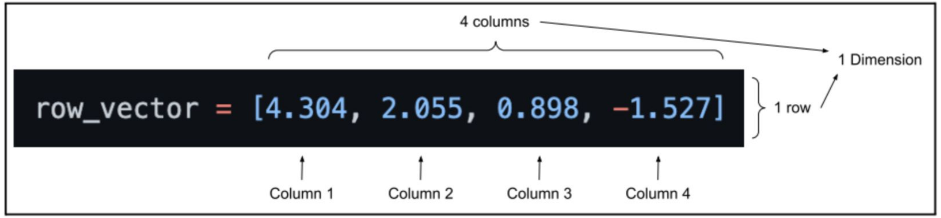
Scalar/Scalars

The Python name for scalar includes int, Float (decimal), or just any other type to STORE 1 VALUE.



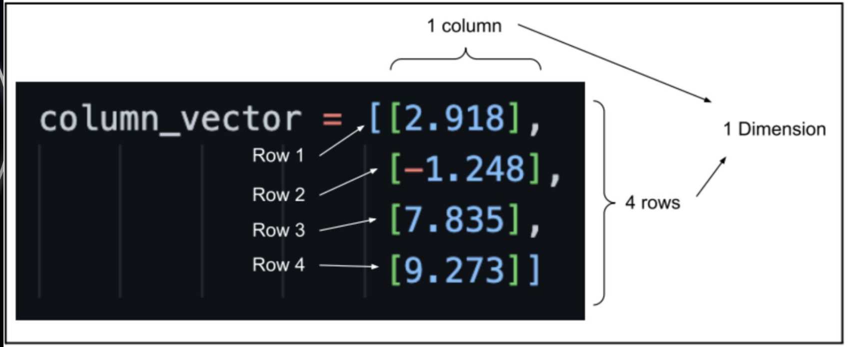
Vector/Vectors

Row Vector in Python Example: This is a 4-element vector (list containing 4 element



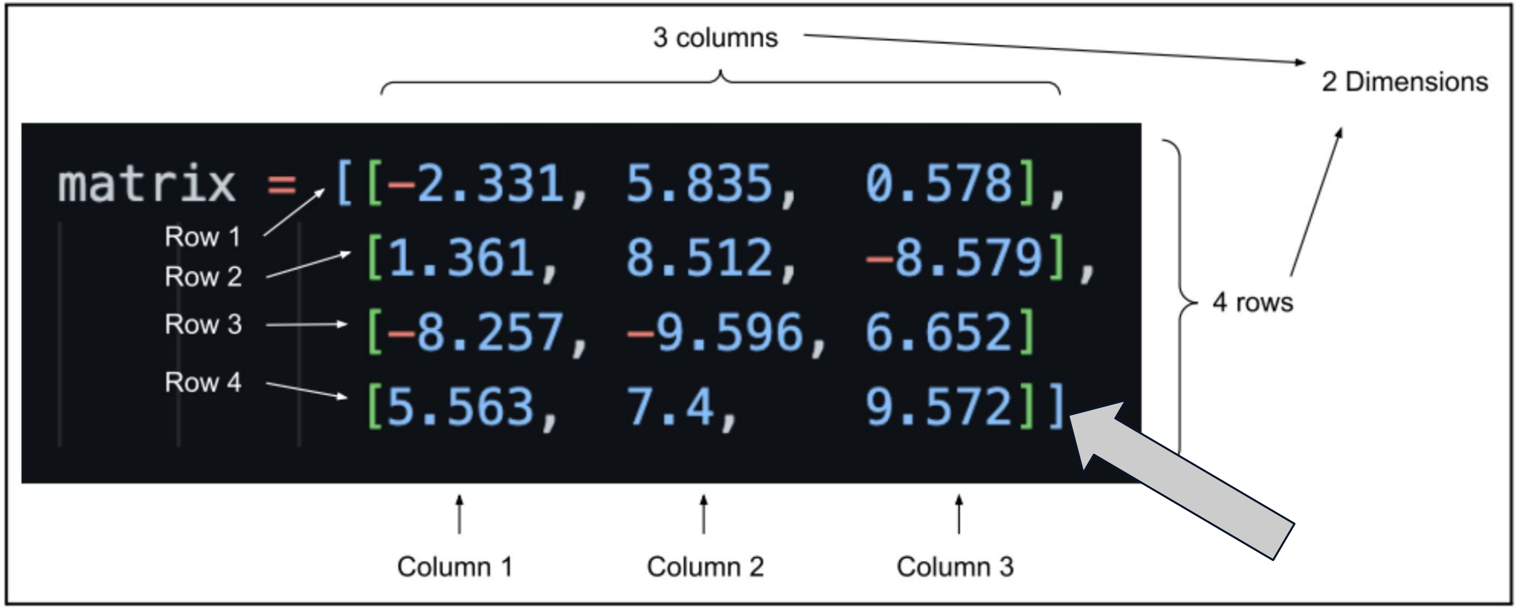
This vector has **one dimension** since there is only 1 row, which makes the row dimension insignificant. Because it has **1 row**, we call this a **4-element row vector**.

Column Vector in Python Example: This is another 4-element vector.



Matrix/Matrices

Matrix in Python Example: This is a (4, 3) or 4 by 3 matrix.



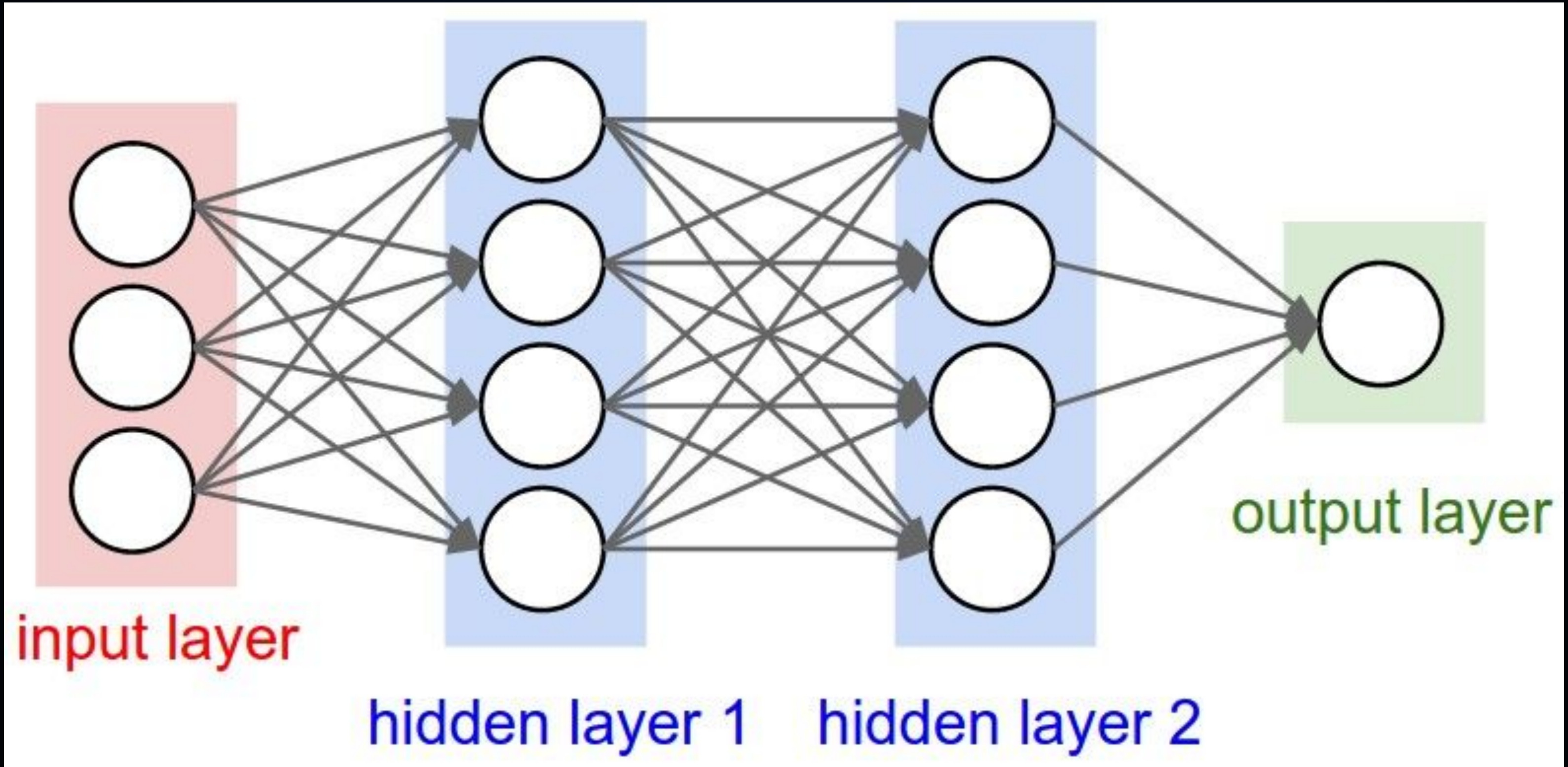
Steps for Artificial Neural Network

Step 1:

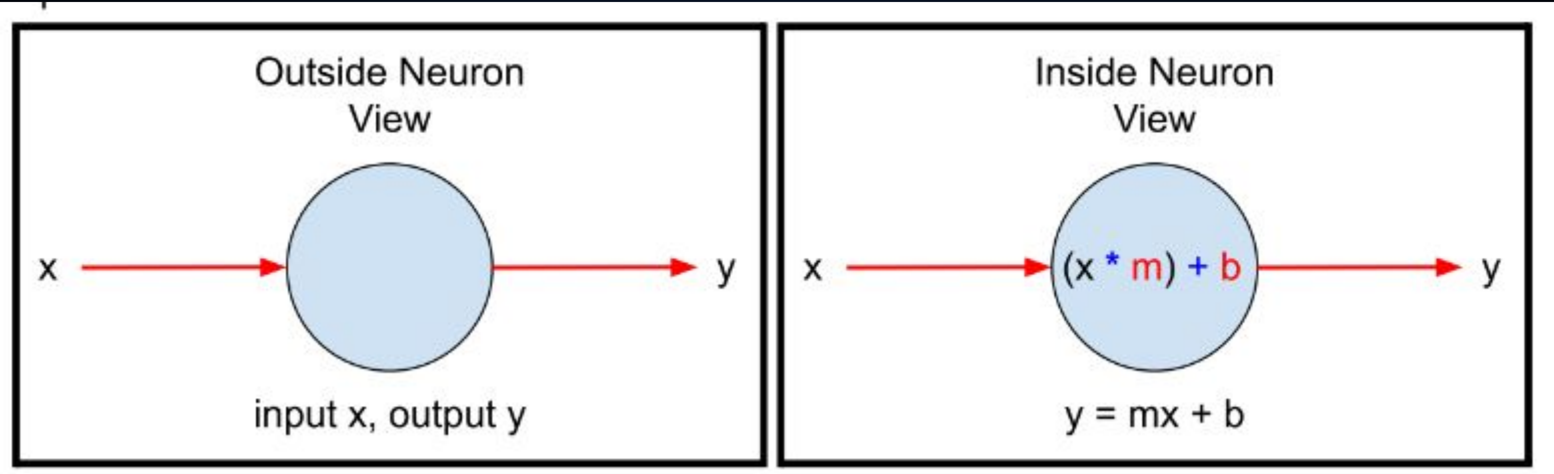
Step 2:

Step 3:

Artificial Neural Networks



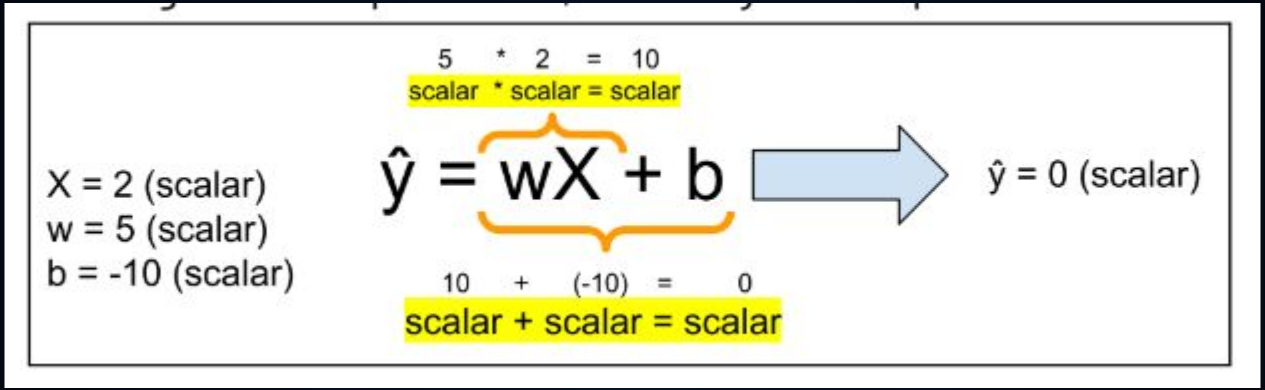
Artificial Neuron (1 Input Feature)



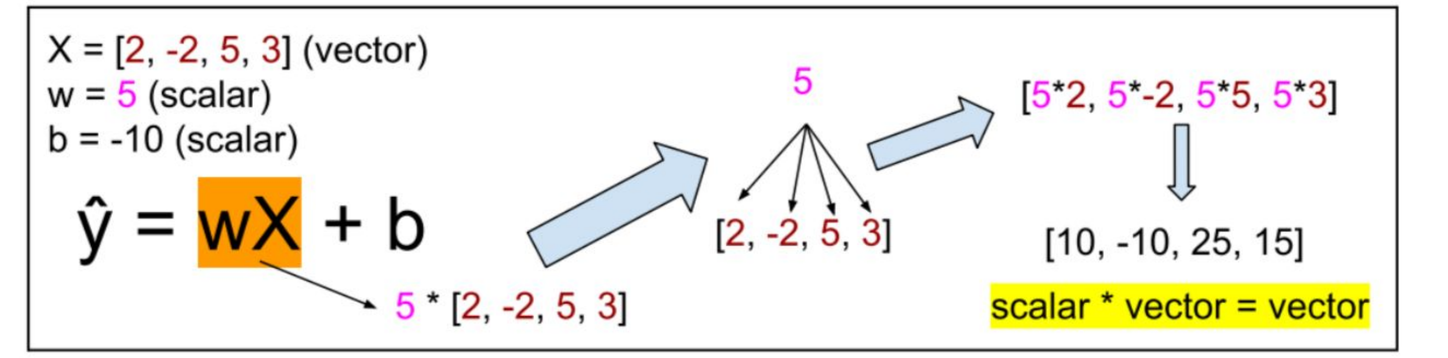
Variables in AI

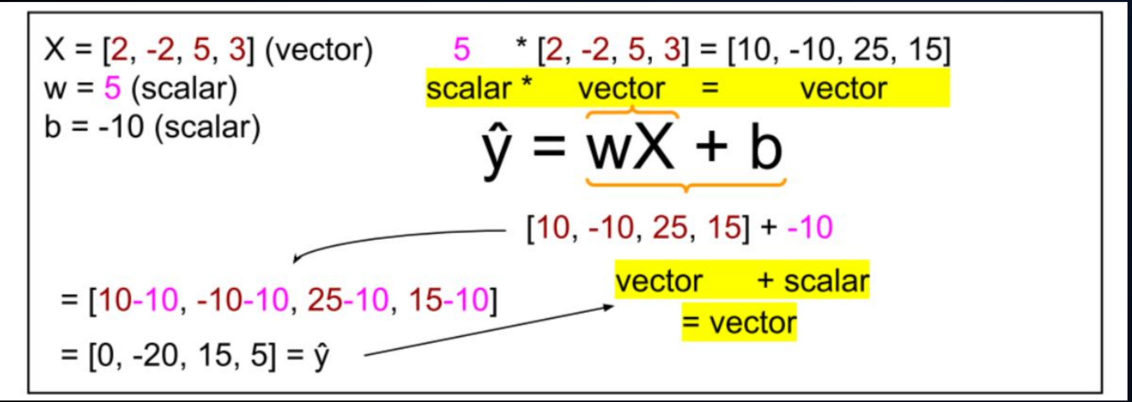
Variable	Math Meaning	AI Conversion
x	input	Denoted with letter **X**, meaning **input to the neuron**
m	slope	Denoted with letter **w**, which is the **weight** variable
b	y-intercept	Denoted with letter **b**, which is the **bias** variable
y	output	Denoted with **ŷ (y_hat)**, meaning the **neuron's prediction**

Working with Scalars

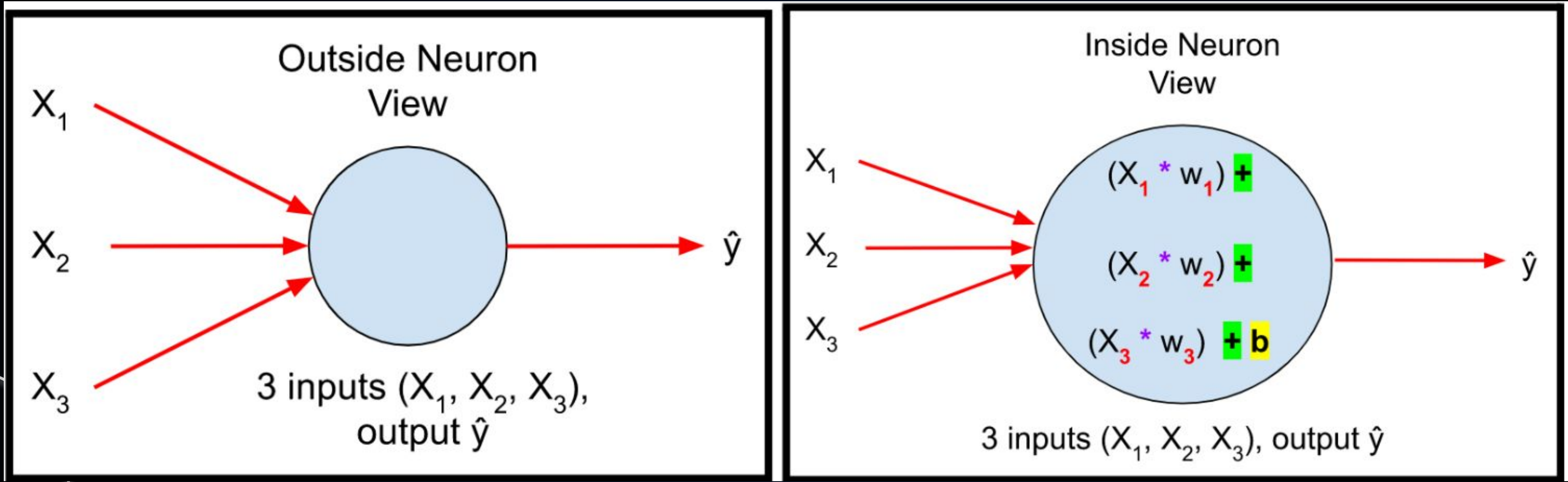


Multiple Examples





Artificial Neuron (Multiple Inputs)



$X = [X_1, X_2, X_3]$ (vector)
$w = [w_1, w_2, w_3]$ (vector)

$$[w_1, w_2, w_3] * [X_1, X_2, X_3] = [w_1 * X_1, w_2 * X_2, w_3 * X_3]$$

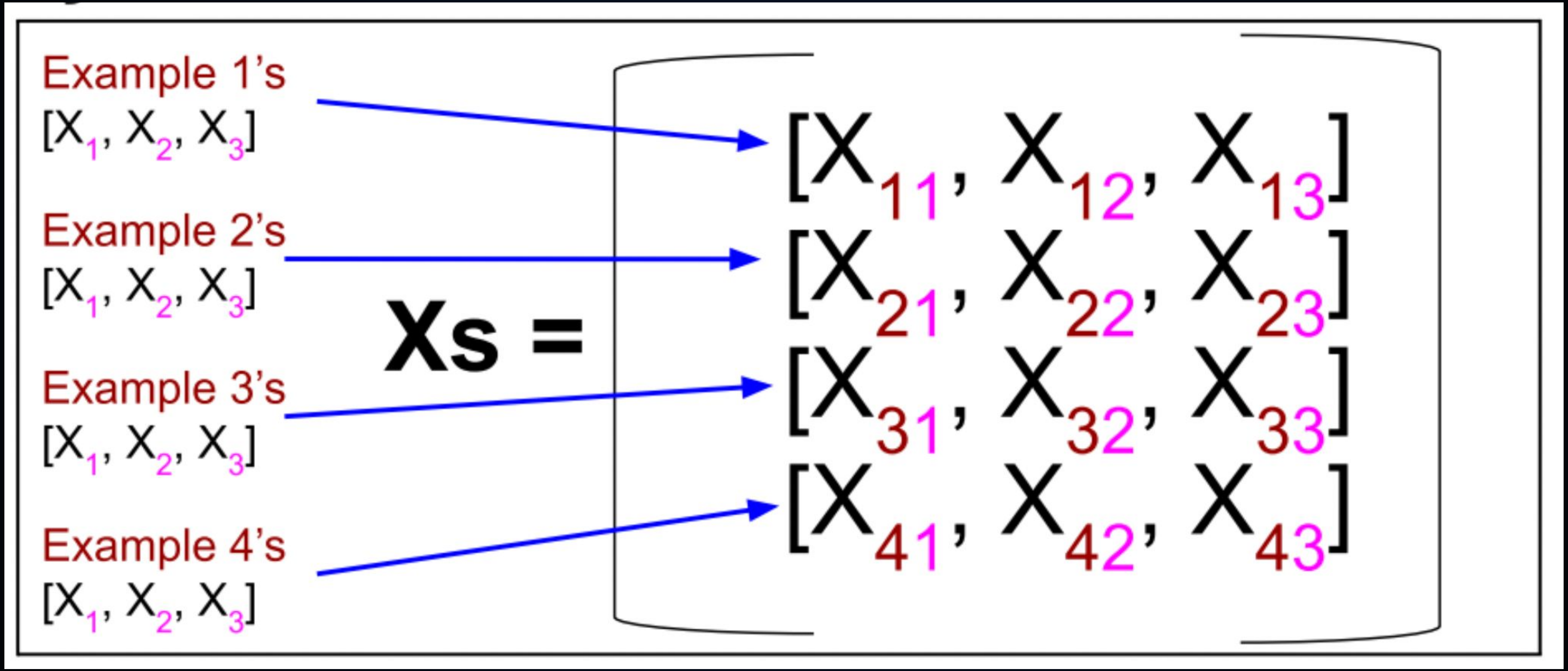
vector * vector = vector

$$\hat{y} = wX + b$$

$$\hat{y} = w_1X_1 + w_2X_2 + w_3X_3 + b$$

$$\hat{y} = \text{sum}(wX) + b.$$

Multiple Examples



Multiple Examples (Multiplication)

$$\hat{y} = \text{sum}(\boxed{wX}) + b$$

$$[w_1, w_2, w_3] \times \begin{array}{cl} \begin{bmatrix} [X_{11}, X_{12}, X_{13}] \\ [X_{21}, X_{22}, X_{23}] \\ [X_{31}, X_{32}, X_{33}] \\ [X_{41}, X_{42}, X_{43}] \end{bmatrix} & \begin{array}{l} \text{Example 1} \\ \text{Example 2} \\ \text{Example 3} \\ \text{Example 4} \end{array} \end{array}$$

$$= \begin{array}{cl} \begin{bmatrix} [w_1{*}X_{11}, w_2{*}X_{12}, w_3{*}X_{13}] \\ [w_1{*}X_{21}, w_2{*}X_{22}, w_3{*}X_{23}] \\ [w_1{*}X_{31}, w_2{*}X_{32}, w_3{*}X_{33}] \\ [w_1{*}X_{41}, w_2{*}X_{42}, w_3{*}X_{43}] \end{bmatrix} & \begin{array}{l} \text{Example 1} \\ \text{Example 2} \\ \text{Example 3} \\ \text{Example 4} \end{array} \end{array}$$

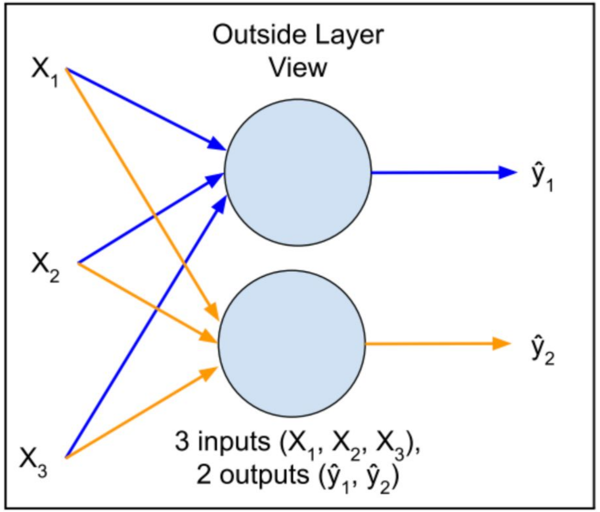
Multiple Examples (Addition)

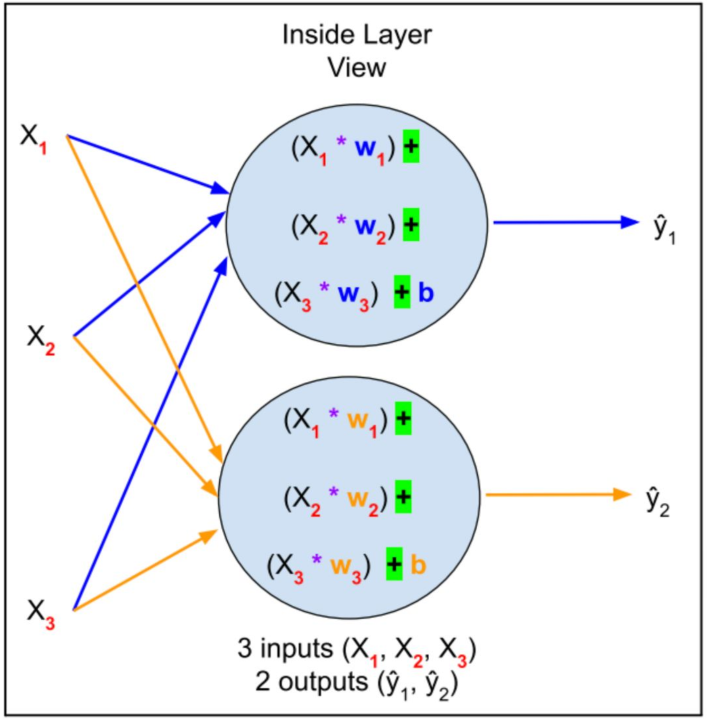
$$\text{sum}\left(\begin{bmatrix} [w_1{}^*X_{11},\ w_2{}^*X_{12},\ w_3{}^*X_{13}] \\ [w_1{}^*X_{21},\ w_2{}^*X_{22},\ w_3{}^*X_{23}] \\ [w_1{}^*X_{31},\ w_2{}^*X_{32},\ w_3{}^*X_{33}] \\ [w_1{}^*X_{41},\ w_2{}^*X_{42},\ w_3{}^*X_{43}] \end{bmatrix}\right) + b = \begin{bmatrix} [w_1{}^*X_{11} + w_2{}^*X_{12} + w_3{}^*X_{13}] \\ [w_1{}^*X_{21} + w_2{}^*X_{22} + w_3{}^*X_{23}] \\ [w_1{}^*X_{31} + w_2{}^*X_{32} + w_3{}^*X_{33}] \\ [w_1{}^*X_{41} + w_2{}^*X_{42} + w_3{}^*X_{43}] \end{bmatrix} + b$$

$$= \begin{array}{cl} \begin{bmatrix} [w_1{}^*X_{11} + w_2{}^*X_{12} + w_3{}^*X_{13} + b] \\ [w_1{}^*X_{21} + w_2{}^*X_{22} + w_3{}^*X_{23} + b] \\ [w_1{}^*X_{31} + w_2{}^*X_{32} + w_3{}^*X_{33} + b] \\ [w_1{}^*X_{41} + w_2{}^*X_{42} + w_3{}^*X_{43} + b] \end{bmatrix} & \begin{array}{l} \text{Example 1} \\ \text{Example 2} \\ \text{Example 3} \\ \text{Example 4} \end{array} \end{array}$$

Layer of Neurons:

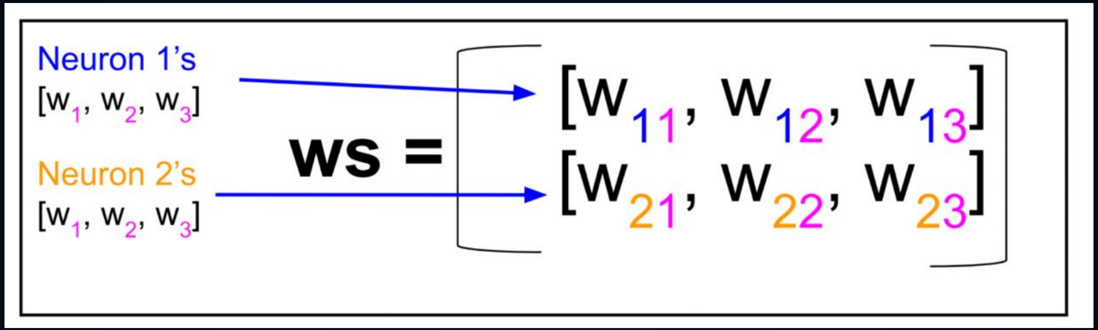
Let’s take a look at the outside and inside view of a layer of artificial neurons:

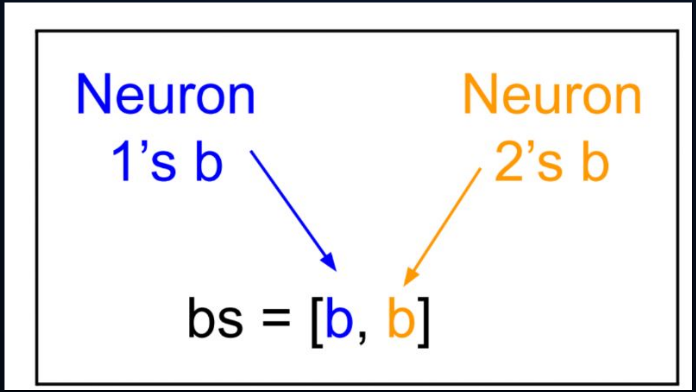




Each neuron in a layer receives all input features. They receive the same 3 input features and output one value for each example.

Vectorization





Equation Vectorization

$$\hat{y} = \boxed{\text{sum}(wX)} + b$$

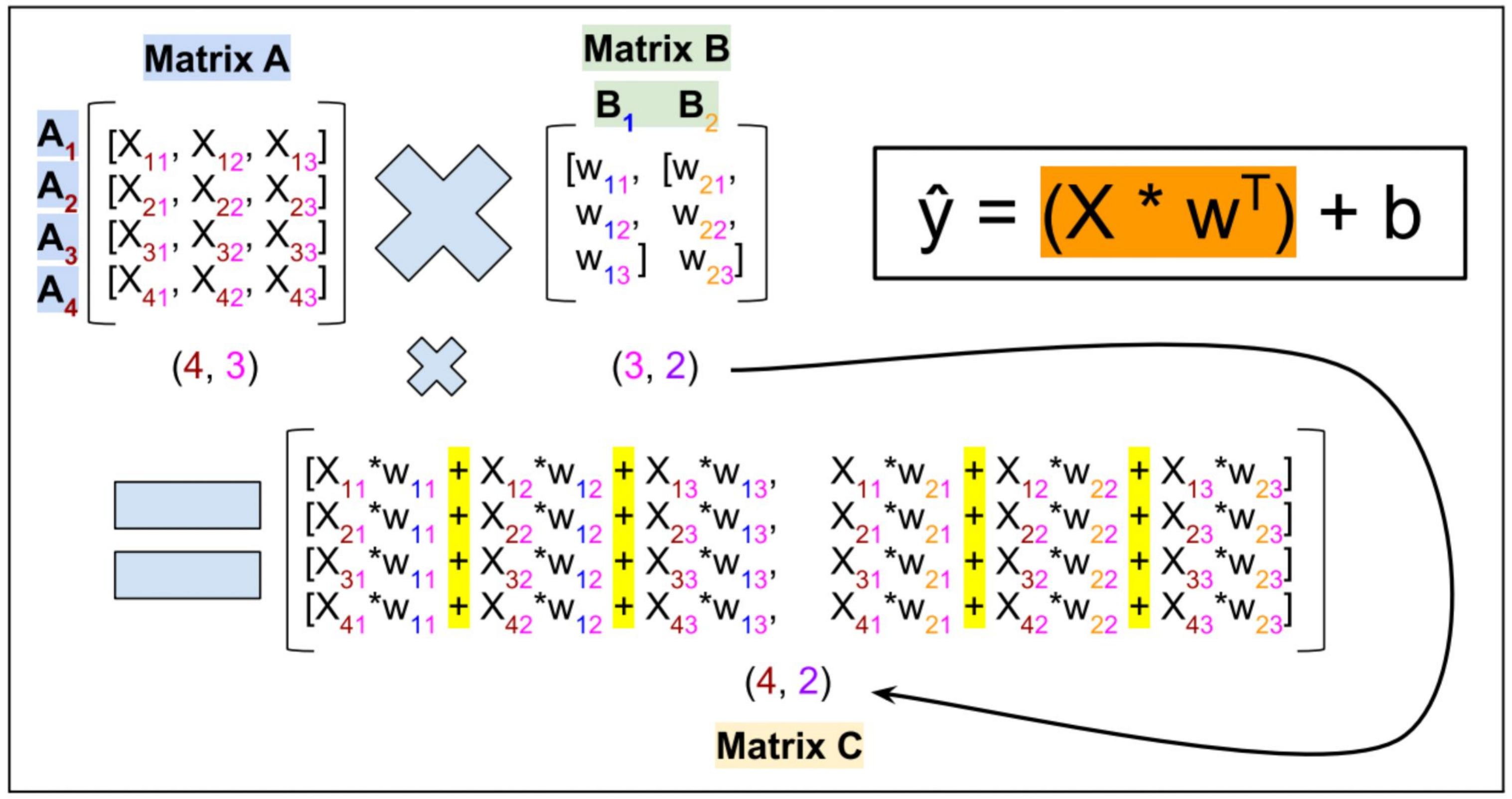
$$\begin{bmatrix} [w_{11}, w_{12}, w_{13}] \\ [w_{21}, w_{22}, w_{23}] \end{bmatrix} \times \underset{X^T}{\begin{matrix} [X_1, \\ X_2, \\ X_3\ ] \end{matrix}} = \textbf{sum}\left(\begin{bmatrix} [w_{11} {}^*X_1, w_{12} {}^*X_2, w_{13} {}^*X_3] \\ [w_{21} {}^*X_1, w_{22} {}^*X_2, w_{23} {}^*X_3] \end{bmatrix} \right) = \begin{bmatrix} [w_{11} {}^*X_1 + w_{12} {}^*X_2 + w_{13} {}^*X_3] \\ [w_{21} {}^*X_1 + w_{22} {}^*X_2 + w_{23} {}^*X_3] \end{bmatrix}$$

$$(2, 3) \times (3, 1) \longrightarrow (2, 1)$$

Equation Vectorization (cont.)

$$\begin{bmatrix} [w_{11}{*}X_1 + w_{12}{*}X_2 + w_{13}{*}X_3] \\ [w_{21}{*}X_1 + w_{22}{*}X_2 + w_{23}{*}X_3] \end{bmatrix} + \begin{matrix} [b, \\ b] \end{matrix} = \begin{bmatrix} [w_{11}{*}X_1 + w_{12}{*}X_2 + w_{13}{*}X_3 + b] \\ [w_{21}{*}X_1 + w_{22}{*}X_2 + w_{23}{*}X_3 + b] \end{bmatrix} \begin{matrix} \text{Neuron 1's Prediction} \\ \text{Neuron 2's Prediction} \end{matrix}$$

Matrix Multiplication (Dot Product)



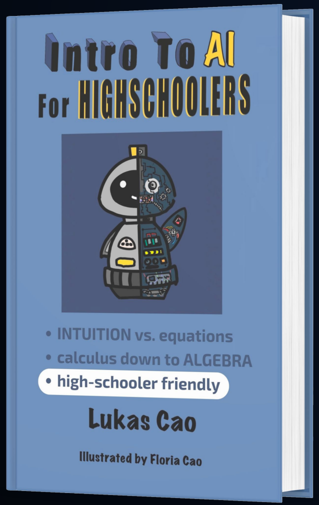
Equation Vectorization

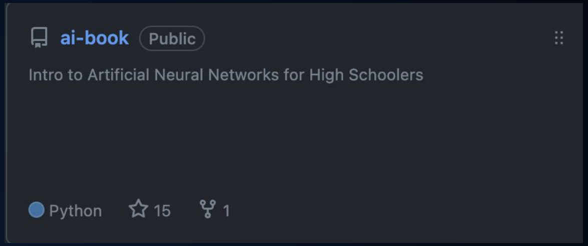
$$
\begin{bmatrix}
[X_{11}{*}w_{11} + X_{12}{*}w_{12} + X_{13}{*}w_{13}, & X_{11}{*}w_{21} + X_{12}{*}w_{22} + X_{13}{*}w_{23}] \\
[X_{21}{*}w_{11} + X_{22}{*}w_{12} + X_{23}{*}w_{13}, & X_{21}{*}w_{21} + X_{22}{*}w_{22} + X_{23}{*}w_{23}] \\
[X_{31}{*}w_{11} + X_{32}{*}w_{12} + X_{33}{*}w_{13}, & X_{31}{*}w_{21} + X_{32}{*}w_{22} + X_{33}{*}w_{23}] \\
[X_{41}{*}w_{11} + X_{42}{*}w_{12} + X_{43}{*}w_{13}, & X_{41}{*}w_{21} + X_{42}{*}w_{22} + X_{43}{*}w_{23}]
\end{bmatrix}
+ [b, b]
$$

$$
= \begin{bmatrix}
[X_{11}{*}w_{11} + X_{12}{*}w_{12} + X_{13}{*}w_{13} + b, & X_{11}{*}w_{21} + X_{12}{*}w_{22} + X_{13}{*}w_{23} + b] \\
[X_{21}{*}w_{11} + X_{22}{*}w_{12} + X_{23}{*}w_{13} + b, & X_{21}{*}w_{21} + X_{22}{*}w_{22} + X_{23}{*}w_{23} + b] \\
[X_{31}{*}w_{11} + X_{32}{*}w_{12} + X_{33}{*}w_{13} + b, & X_{31}{*}w_{21} + X_{32}{*}w_{22} + X_{33}{*}w_{23} + b] \\
[X_{41}{*}w_{11} + X_{42}{*}w_{12} + X_{43}{*}w_{13} + b, & X_{41}{*}w_{21} + X_{42}{*}w_{22} + X_{43}{*}w_{23} + b]
\end{bmatrix}
$$

Homework

Chapter 01





https://github.com/ohhh25/ai-book/blob/main/Chapter%2001/Chapter%2001.pdf