



ML Monday

Week 3



Presented by Kyle Dampier



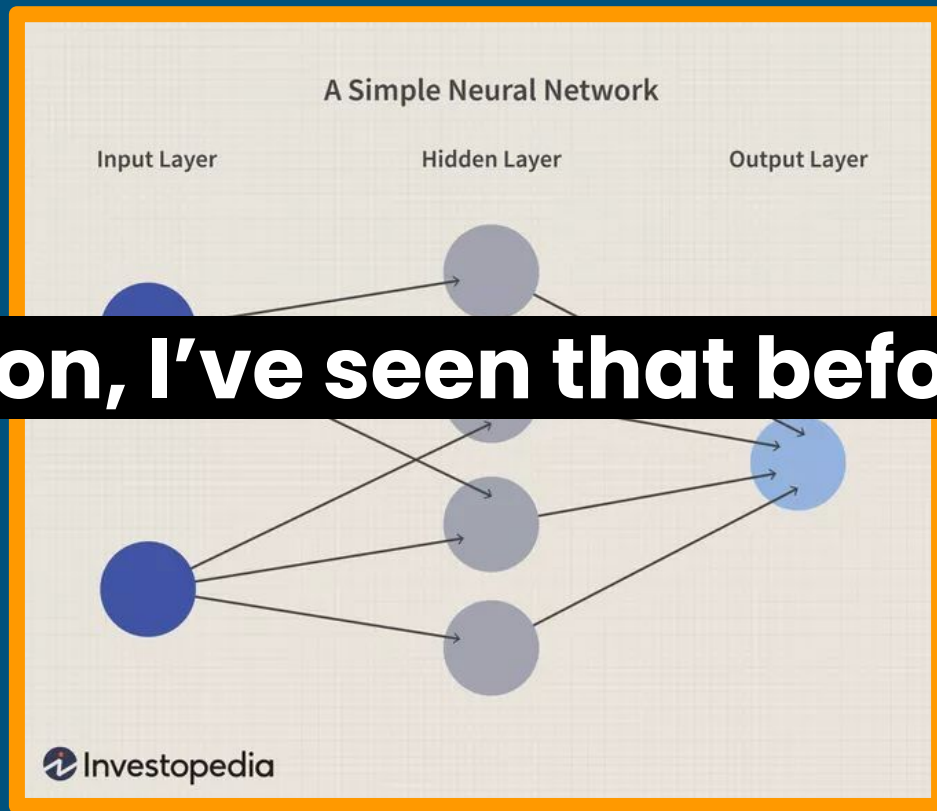
Agenda

- What are Neural Networks?
 - What are Convolutions?
 - Find and Collect Images
 - Import Image Data
 - *Constructing our first Neural Network (if time)*
-

Agenda

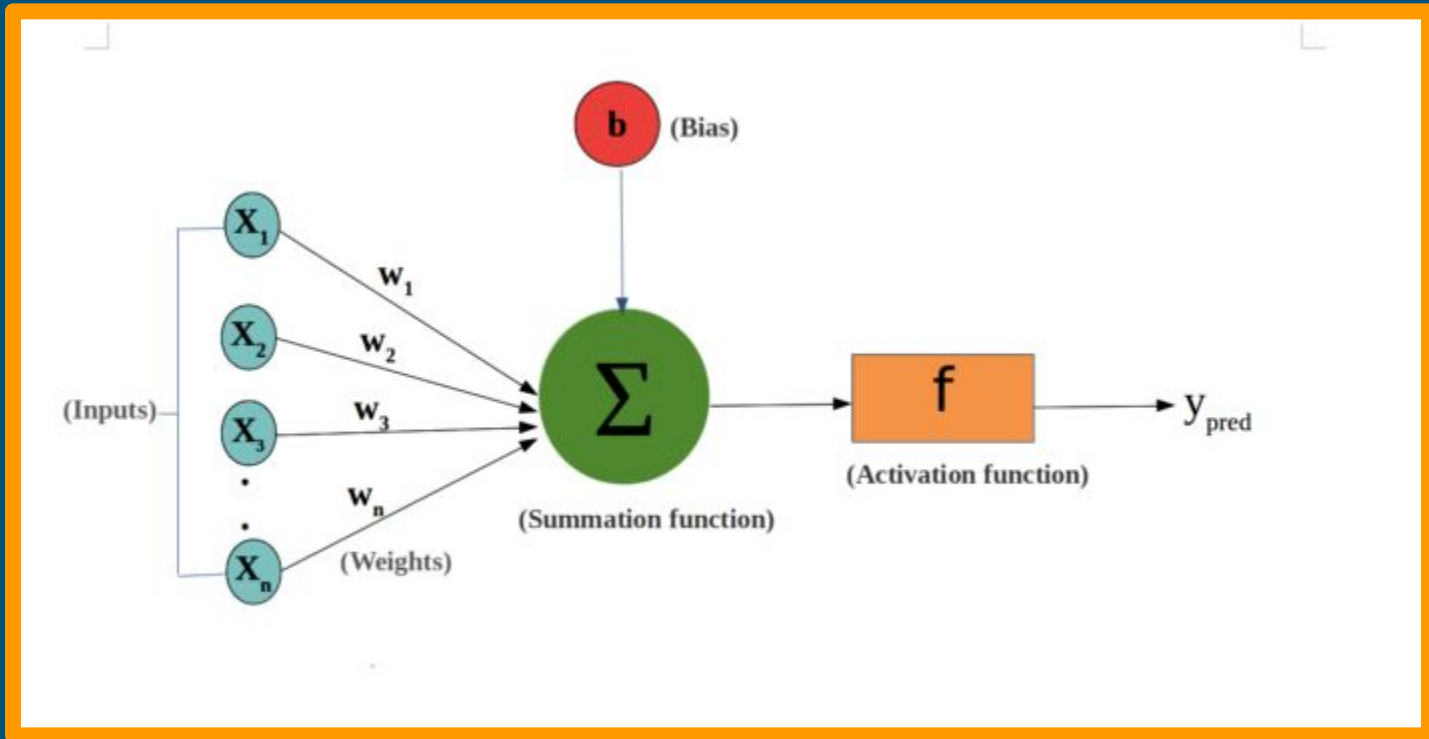
- **What are Neural Networks?**
 - What are Convolutions?
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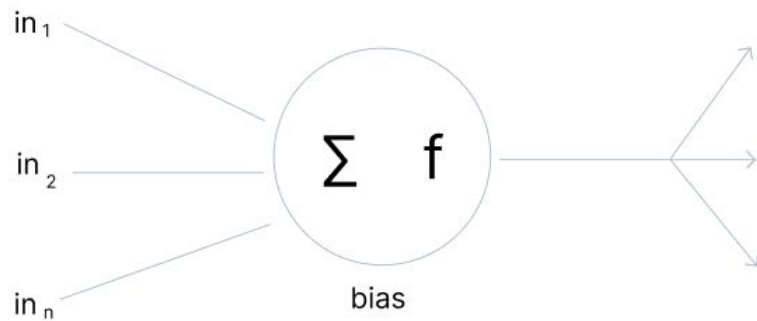
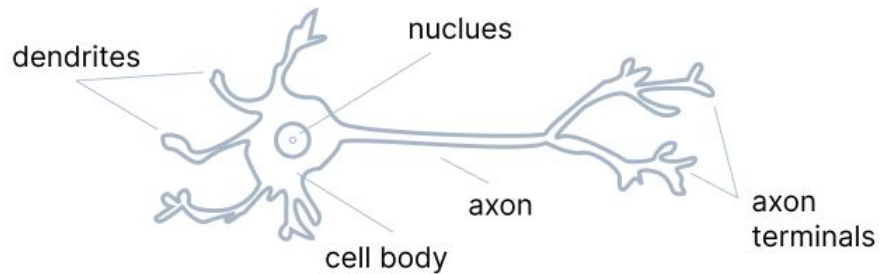
Basic Neural Network



Cmon, I've seen that before...

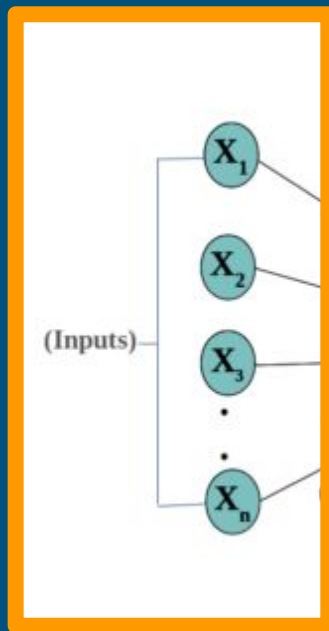
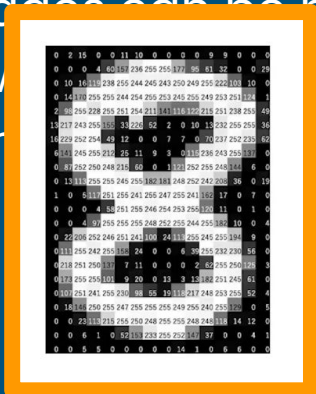
How about this?





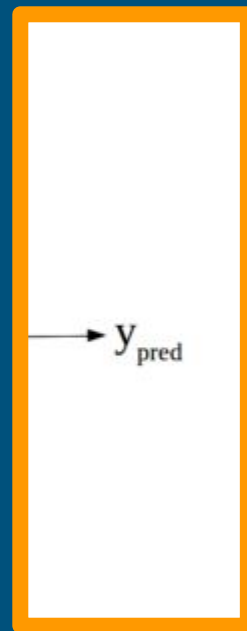
Inputs & Outputs

- List of numbers
 - Most of the time
- $F(\mathbf{x}) = y$
- $F(\text{inputs}) = \text{output}$
- Images can be broken down into numbers



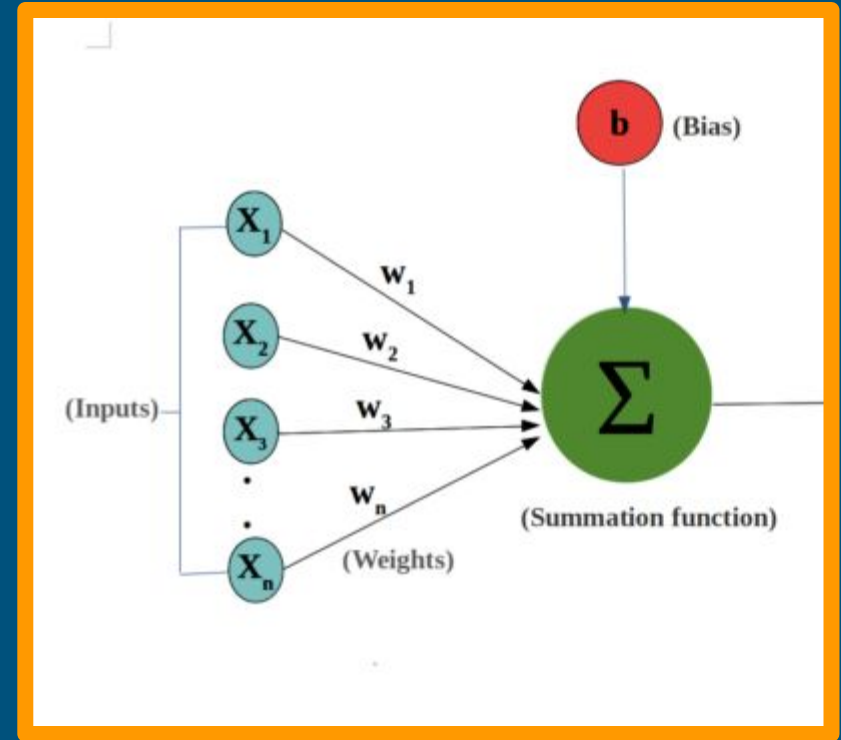
Neural Network

Some Function F



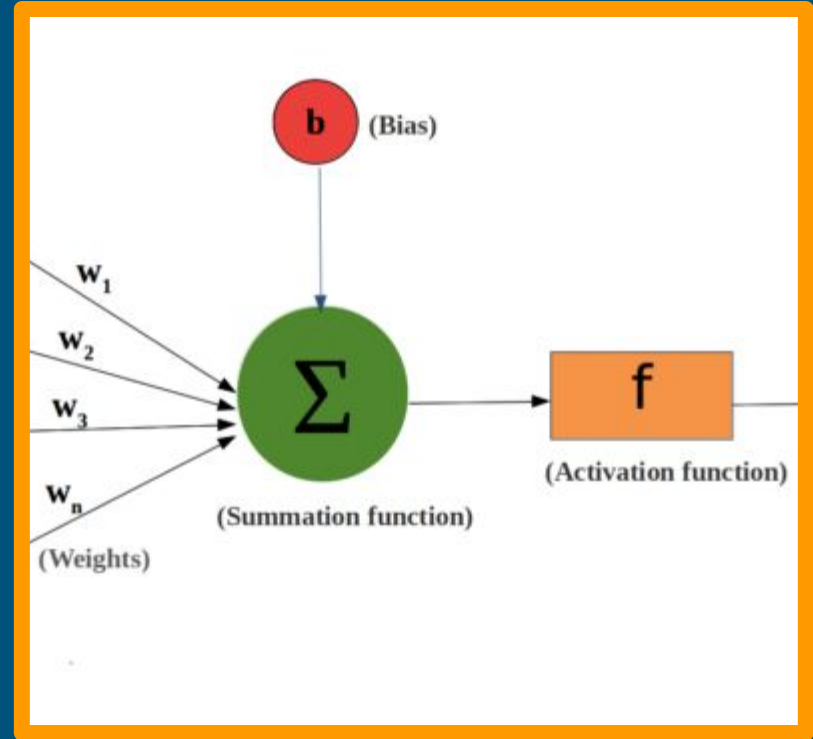
Weights & Biases

- Lines = Weights
 - Scales function
 - $F(x * \mathbf{w}) = y$
- Circles = Biases
 - Shifts function
 - $F(x * \mathbf{w} + x * \mathbf{b}) = y$



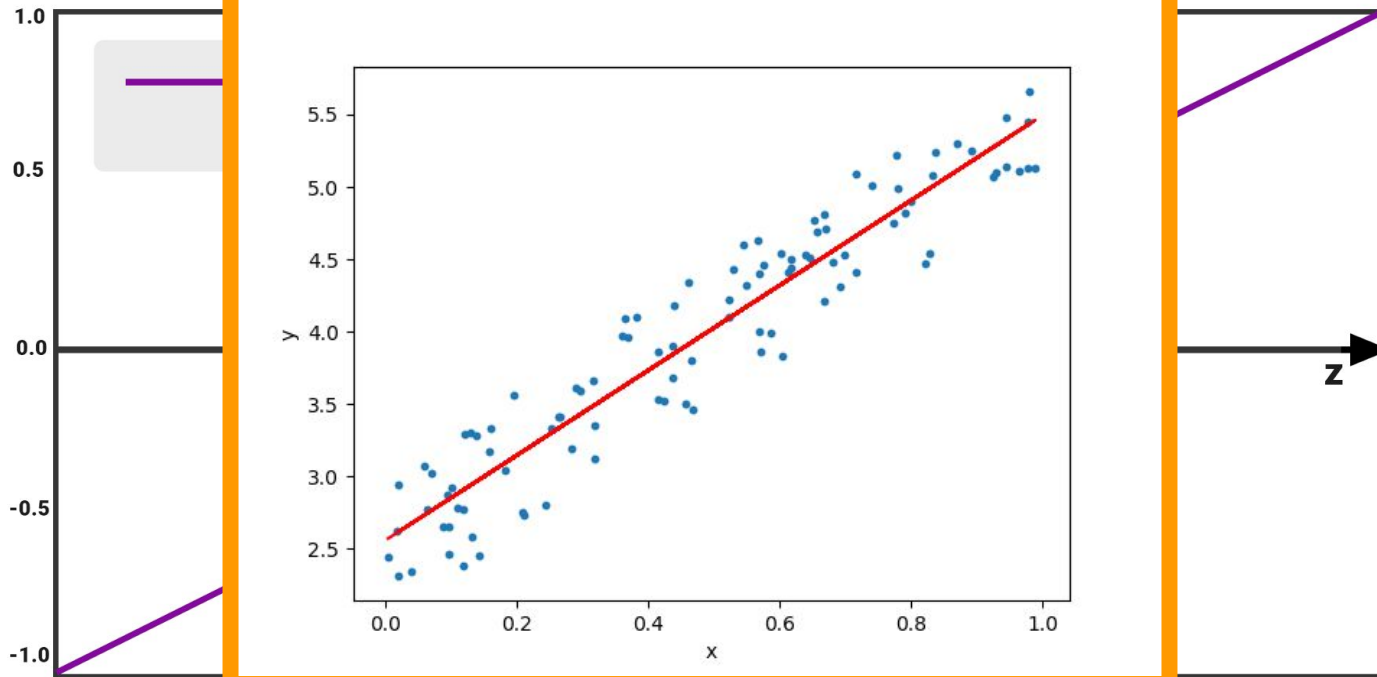
Activation Function

- Tries to **fit** inputs and outputs based on activation function.
- **F**(x) = y
- Different types of activation functions?



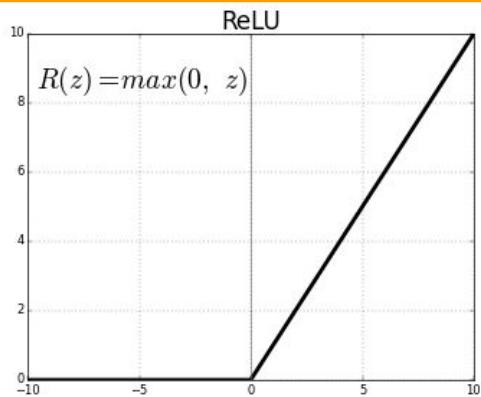
Regression

Linear Activation Function



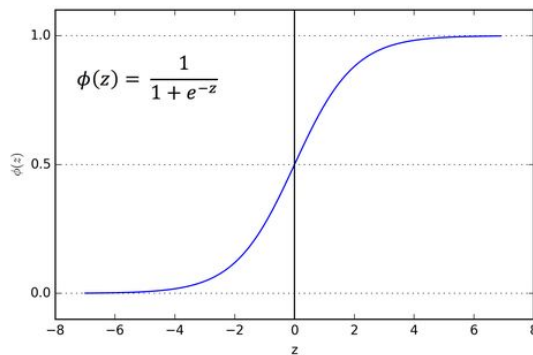
ReLU

Rectified Linear Unit



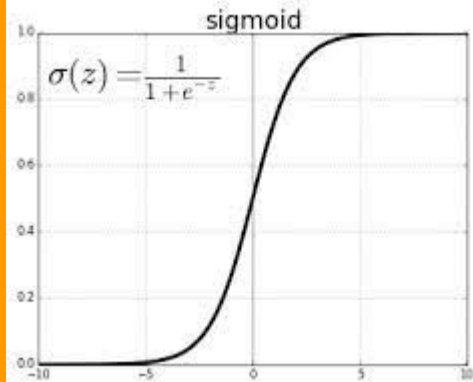
tanh

inverse tangent

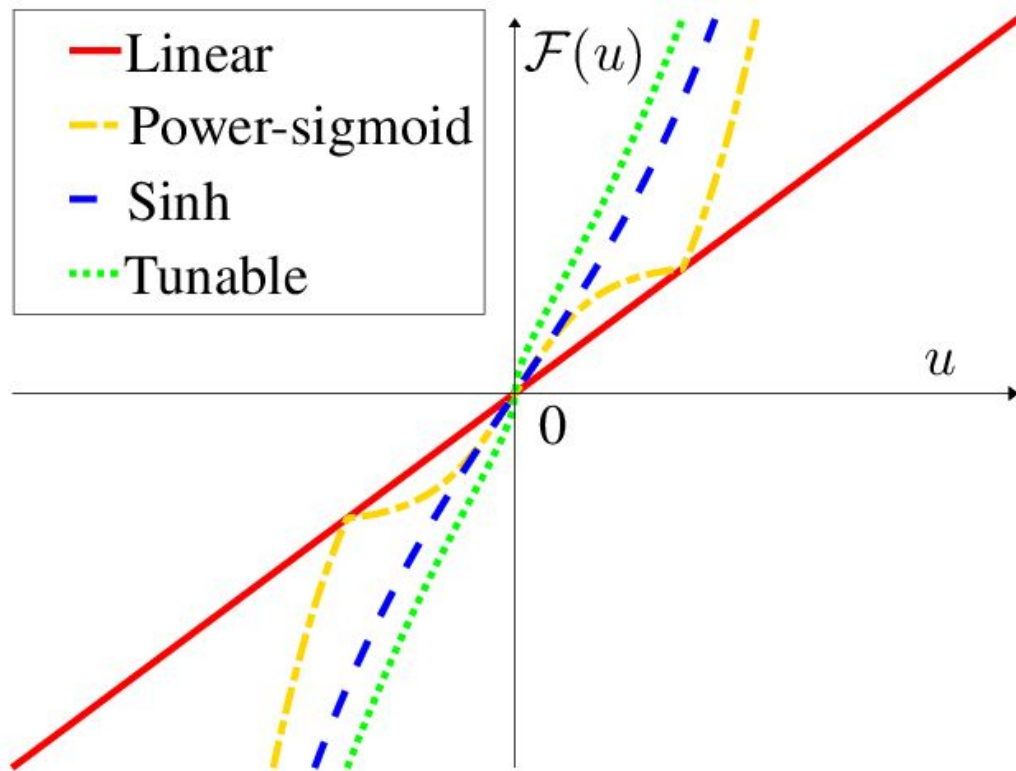


Sigmoid

aka Logistic

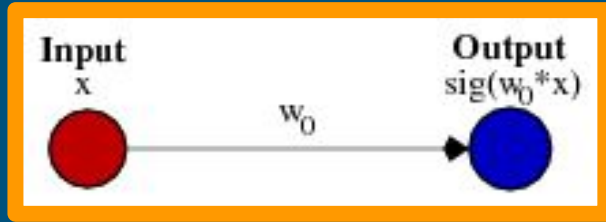


And Many More...



I thought this was cool

Changing Weights

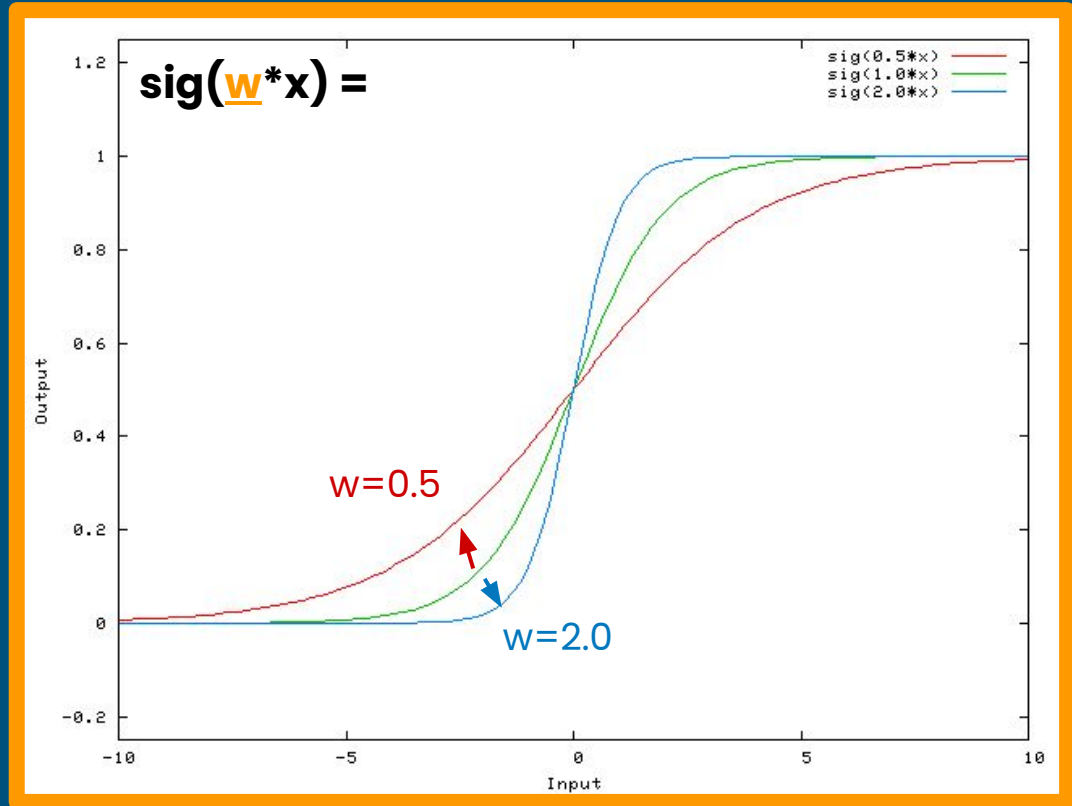


Activation Function: **Sigmoid**

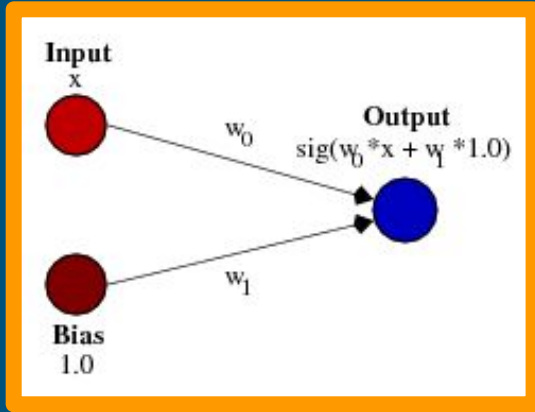
$$\text{sig}(x) = y$$

Weight = w

Input = x



Changing Biases



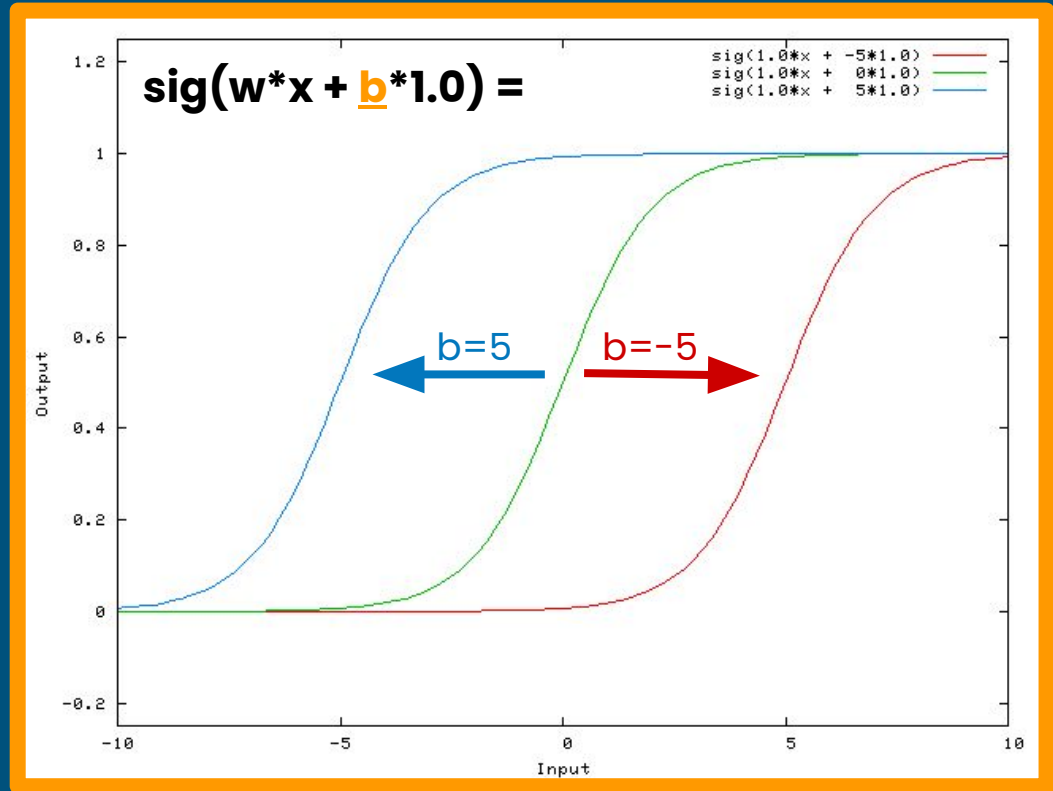
Activation Function: **Sigmoid**

$$\text{sig}(x) = y$$

Weight = **w**

Input = **x**

Bias = **b**



The Whole Picture...

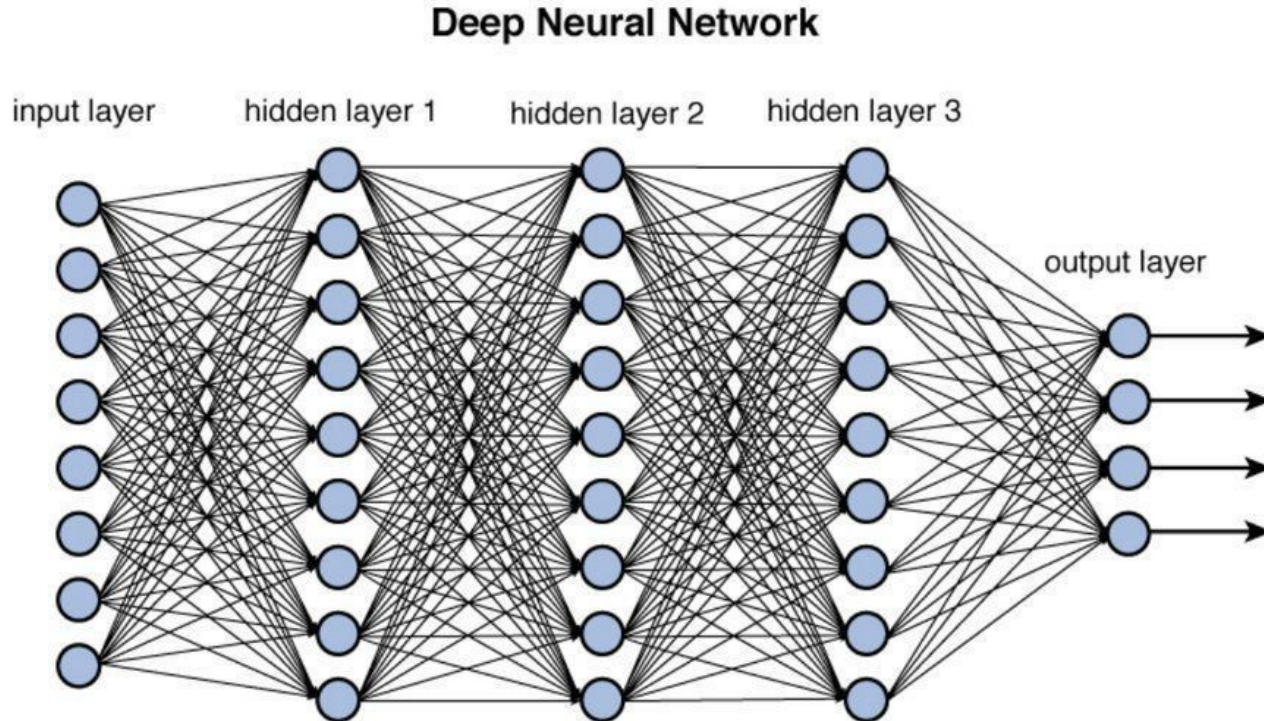


Figure 12.2 Deep network architecture with multiple layers.

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How is Image Data Stored?

```
0 2 15 0 0 11 10 0 0 0 9 9 0 0 0
0 0 0 4 60 157 236 255 255 177 95 61 32 0 0 29
0 10 16 119 238 255 244 245 243 250 249 255 222 103 10 0
0 14 170 255 255 244 254 255 253 245 255 249 253 251 124 1
2 98 255 228 255 251 254 211 141 116 122 215 251 238 255 49
13 217 243 255 155 33 226 52 2 0 10 13 232 255 255 36
16 229 252 254 49 12 0 0 7 7 0 70 237 252 235 62
6 141 245 255 212 25 11 9 3 0 115 236 243 255 137 0
0 87 252 250 248 215 60 0 1 121 252 255 248 144 6 0
0 13 115 255 255 245 255 182 181 248 252 242 208 36 0 19
1 0 5 117 251 255 241 255 247 255 241 162 17 0 7 0
0 0 0 4 58 251 255 246 254 253 255 120 11 0 1 0
0 0 4 97 255 255 255 248 252 255 244 255 182 10 0 4
0 22 206 252 246 251 241 100 24 113 255 245 255 194 9 0
0 111 255 242 255 158 24 0 0 6 39 255 232 230 56 0
0 218 251 250 137 7 11 0 0 0 2 62 255 250 123 3
0 173 255 255 101 9 20 0 13 3 13 182 251 245 61 0
0 107 251 241 255 230 98 55 19 115 217 248 253 255 52 4
0 16 148 250 255 247 255 255 255 249 255 240 255 129 0 5
0 0 23 113 215 255 250 248 255 255 248 248 118 14 12 0
0 0 6 1 0 52 153 233 255 252 147 37 0 0 4 1
0 0 5 5 0 0 0 0 0 14 1 0 5 6 0 0
```



How is Image Data Stored?



Colour Image

=



+



+



Blue

141	142	143	144	145
151	152	153	154	155
161	162	163	164	165
171	172	173	174	175
181	182	183	184	185
191	192	193	194	195

R

					141	142	143	144	145
					151	152	153	154	155
					161	162	163	164	165
35	36	37	38	39	173	174	175		
45	46	47	48	49	183	184	185		
55	56	57	58	59	193	194	195		
65	66	67	68	69					
75	76	77	78	79					
85	86	87	88	89					

R

G

How is Image Data Stored?

[illegible]

11



Finally... Convolutions



3	1	1	2	8	4
1	0	7	3	2	6
2	3	5	1	1	3
1	4	1	2	6	5
3	2	1	3	7	2
9	2	6	2	5	1

Original image 6x6

"Convolution"

\otimes

1	0	-1
1	0	-1
1	0	-1

Filter 3x3

=

-7	...		
...	...		

Output 4x4

Sound familiar?



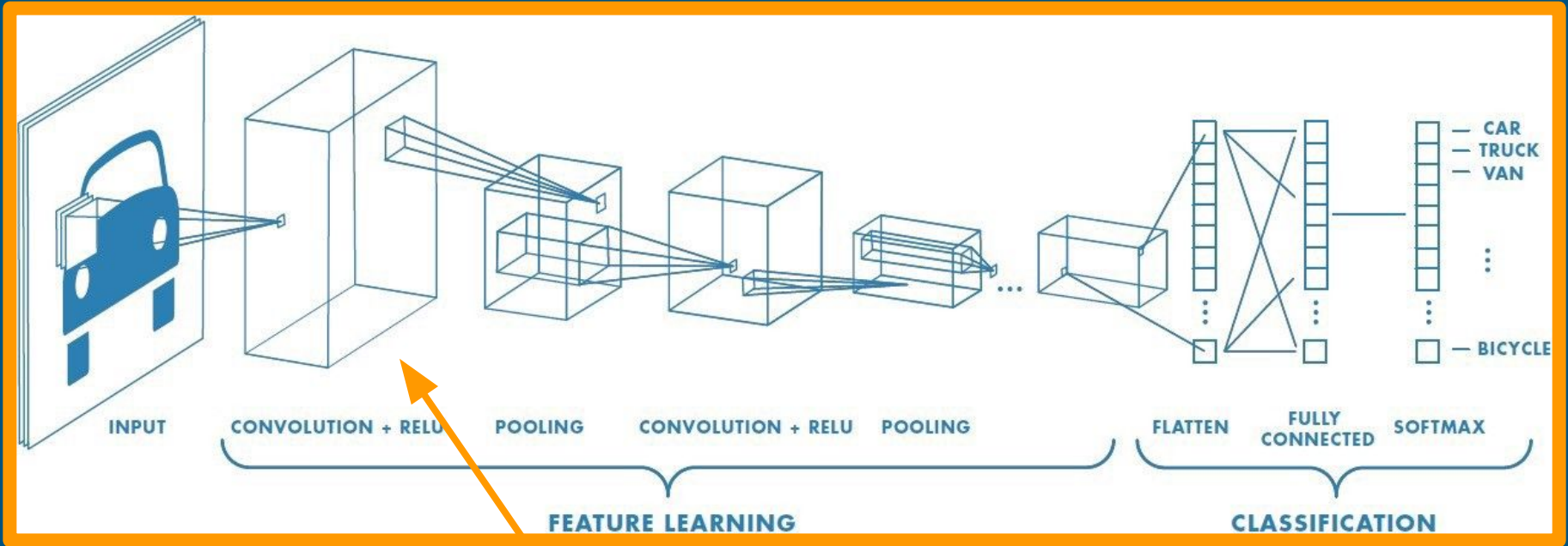
Result of the element-wise
product and sum of the
filter matrix and the original
image

Extracts Features



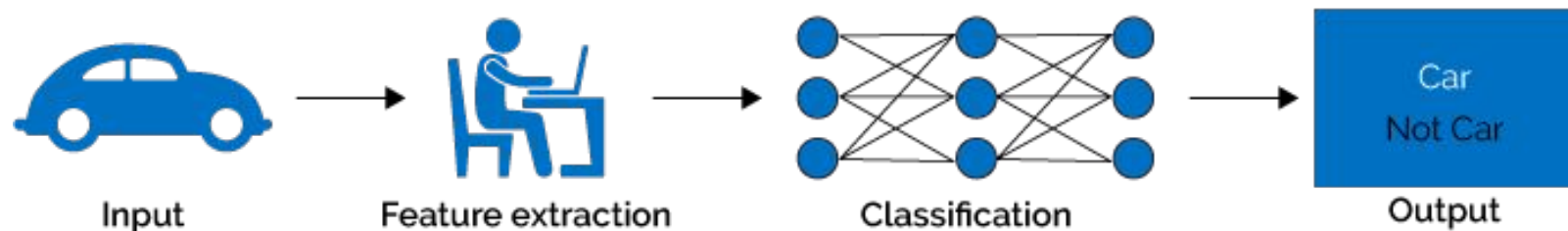
Easier for computer to understand

Feature Learning

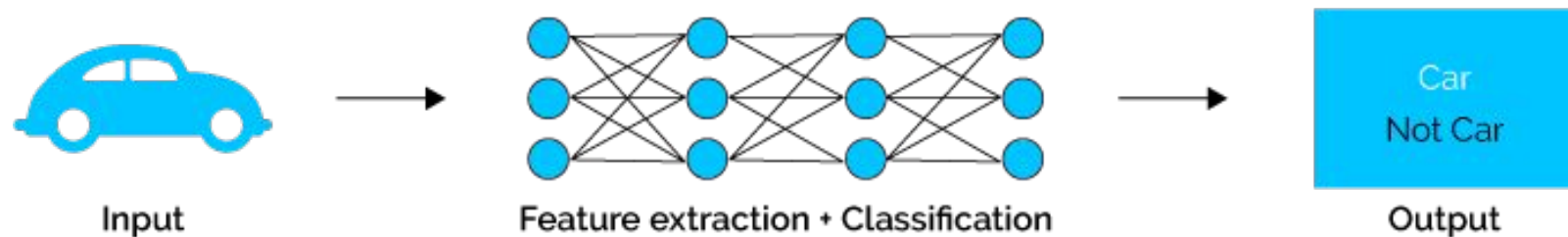


What does this do?

Machine Learning



Deep Learning



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Finding Image Data

Kaggle

Limited to available datasets



Search Engines

Use Google to find images



Downloading Images

Image Downloader

Google Chrome Plugin



Selenium

Python Library



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Lets Code...