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Basics of Neural Network Programming

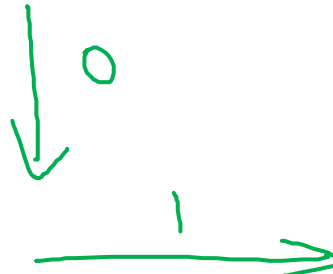
Broadcasting in Python

Broadcasting example

Calories from Carbs, Proteins, Fats in 100g of different foods:

	↓ Apples	↓ Beef	↓ Eggs	↓ Potatoes	
Carb	56.0	0.0	4.4	68.0	= A (3,4)
Protein	1.2	104.0	52.0	8.0	
Fat	1.8	135.0	99.0	0.9	

59 cal $\frac{56}{59} \approx 94.9\%$



Calculate % of calories from Carb, Protein, Fat. Can you do this without explicit for-loop?

```
cal = A.sum(axis = 0)  
percentage = 100 * A / (cal.reshape(1,4))
```

↑(3,4) / (1,4)

Broadcasting example

$$\begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

+

$$\begin{bmatrix} 100 \\ 100 \\ 100 \\ 100 \end{bmatrix} \quad \text{100}$$

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

(m,n) $(2,3)$

+

$$\begin{bmatrix} 100 & 200 & 300 \\ 100 & 200 & 300 \end{bmatrix}$$

$(1,n) \rightsquigarrow (m,n)$ $(2,3)$

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

(m,n)

+

$$\begin{bmatrix} 100 & 100 & 100 \\ 200 & 200 & 200 \end{bmatrix}$$

$(m,1)$

\rightsquigarrow
 (m,n)

=



General Principle

(m, n)	$+$	$(1, n)$	\rightsquigarrow	(m, n)
<u>matrix</u>	\times	$(m, 1)$	\rightsquigarrow	(m, n)
	$/$			

$$\begin{array}{rclcl} (m, 1) & + & \mathbb{R} & & \\ \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} & + & 100 & = & \begin{bmatrix} 101 \\ 102 \\ 103 \end{bmatrix} \\ [1 \ 2 \ 3] & + & 100 & = & [101 \quad 102 \quad 103] \end{array}$$

Matlab/Octave: bsxfun