



deeplearning.ai

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
Protein	1.2	104.0	52.0	8.0
Fat	1.8	135.0	99.0	0.9

= A
(3,4)



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

$$\begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix} + \begin{bmatrix} 100 \\ 100 \\ 100 \\ 100 \end{bmatrix} \quad \text{100}$$

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} + \begin{bmatrix} 100 & 200 & 300 \\ 100 & 200 & 300 \end{bmatrix}$$

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

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} + \begin{bmatrix} 100 & 100 & 100 \\ 200 & 200 & 200 \end{bmatrix} =$$

$(m,n) \quad (m,1) \rightsquigarrow (m,n)$



General Principle

$$\begin{array}{ccc} (m, n) & + & (1, n) \\ \text{matrix} & \times & \rightsquigarrow (m, n) \\ \hline & / & \end{array}$$

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

$$(m, 1)$$

+

$$\mathbb{R}$$

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

+

$$100$$

$$= \begin{bmatrix} 101 \\ 102 \\ 103 \end{bmatrix}$$

$$[1 \ 2 \ 3]$$

+

$$100$$

$$= [101 \quad 102 \quad 103]$$

Matlab/Octave: bsxfun