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))
```

reshape() cost O(1)

(3,4) / (1,4)

# Broadcasting example

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

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

(m, n) (2,3) (1, n) ⇝ (m, n) (2,3)

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

(m, n) (m, 1) (m, n)

# General Principle

$(m,n)$ matrix $\quad +, -, *, / \quad (1,n) \rightsquigarrow (m,n)$ apply element wisely

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

$(m,1) \quad + \quad \mathbb{R}$

$\begin{bmatrix}1\\2\\3\end{bmatrix} + 100 = \begin{bmatrix}101\\102\\103\end{bmatrix}$

$[1\ 2\ 3] + 100 = [101\ \ 102\ \ 103]$

Matlab/Octave: bsxfun