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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

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



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

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

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

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

←
←

General Principle

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

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

Matlab/Octave: bsxfun