

What is vectorization?

Tuesday, August 22, 2017 2:49 PM

$$z = w^T x + b$$

$$W = \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w \end{bmatrix}$$

$$X = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x \end{bmatrix}$$

$$w \in \mathbb{R}^{1 \times n}$$
$$x \in \mathbb{R}^{n \times 1}$$

Non-vectorized

$z = 0$
for i in range(n_x):
 $z \pm w[i] * x[i]$
 $z \pm b$

Vectorized:

$$z = \underbrace{\text{np.dot}(w, x)}_{w^T x} + b$$

Whenever possible, avoid explicit for-loops

Tuesday, August 22, 2017

9:19 PM

$$u = Av$$

$$u_i = \sum_j A_{ij} v_j$$

$$u = \text{np.zeros}(n, 0)$$

for i ... ←

for j ←

$$u[i] += A[i][j] * v[j]$$

$$u = \text{np.dot}(A, v)$$

Vector and Matrix Values Functions

Tuesday, August 22, 2017 9:26 PM

$$V = \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_n \end{bmatrix} \quad u = \begin{bmatrix} e^{v_1} \\ e^{v_2} \\ \vdots \\ e^{v_n} \end{bmatrix}$$

$u = \text{np.zeros}(n, 1)$
for i in $\text{range}(n)$:
 $u[i] = \text{math.exp}(v[i])$

Numpy

$u = \text{np.exp}(v)$

NO EXPLICIT
LOOP

Other np
element wise
functions
np.log
np.abs
etc.

Vectorizing Logistic Regression

Tuesday, August 22, 2017

9:40 PM

$$X = \begin{bmatrix} | & | & | & | \\ x_1 & x_2 & x_3 & x_m \\ | & | & | & | \end{bmatrix} (n \times m) \quad \mathbb{R}^{n \times m}$$

$$z = \begin{bmatrix} z^{(1)} & z^{(2)} & z^{(3)} & \dots & z^{(m)} \end{bmatrix} = \underbrace{w^T X}_{[b, b, b, \dots, b]_{1 \times m}} + \underbrace{b}_{[b, b, b, \dots, b]_{1 \times m}}$$

PYTHON:

$$z = \text{np.dot}(w.T, X) + b$$

$$= w^T \begin{bmatrix} | & | & \dots & | \\ x_1 & x_2 & \dots & x_m \\ | & | & \dots & | \end{bmatrix} + b$$
$$= \begin{bmatrix} w^T x_1 + b & w^T x_2 + b & \dots & w^T x_m + b \end{bmatrix}$$