

What is vectorization?

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

$$\left\{ \begin{array}{l} W = \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w \end{bmatrix} \quad X = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x \end{bmatrix} \quad \begin{array}{l} w \in \mathbb{R}^{1 \times} \\ x \in \mathbb{R}^{1 \times} \end{array} \end{array} \right.$$

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

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$$u = Av$$

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

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

for i ... ←

for j ←

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

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

Vector and Matrix Values Functions

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

$u = \text{np.zeros}(n, 1)$
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.