

## < Vectorization >

$$f_{w,b}(x) = w_1 x_1 + w_2 x_2 + \dots + w_n x_n + b$$

$$\begin{array}{l} \vec{w} = [w_1, w_2, \dots, w_n] \\ b = \text{number} \end{array} \Rightarrow \text{parameters of the model}$$
  
$$\vec{x} = [x_1, x_2, \dots, x_n] \Rightarrow \text{feature of the model}$$

$$f_{\vec{w},b}(\vec{x}) = \vec{w} \cdot \vec{x} + b = w_1 x_1 + w_2 x_2 + \dots + b$$

↳ "dot product"

## < Vectorization with code > - Model

\* Parameters and features

$$\begin{array}{l} \vec{w} = [w_1, w_2, w_3] \\ b = \text{number} \\ \vec{x} = [x_1, x_2, x_3] \end{array} \rightarrow n=3$$

① Without vectorization

$$f_{\vec{w},b}(\vec{x}) = w_1 x_1 + w_2 x_2 + w_3 x_3 + b \Rightarrow$$

code:

$$f = w[0] * x[0] + w[1] * x[1] + w[2] * x[2] + b$$

~~code:~~

② Without vectorization with for loop

$$f_{\vec{w},b}(\vec{x}) = \left( \sum_{j=1}^n w_j \cdot x_j \right) + b$$

summation

code:

$$f = 0$$

for  $j$  in range(0, n):

$$f = f + w[j] * x[j]$$

$$f = f + b$$

③ Vectorization

$$f_{\vec{w},b}(\vec{x}) = \vec{w} \cdot \vec{x} + b$$

code:

$$\Rightarrow f = \text{np.dot}(w, x) + b$$

Using vectorization

① makes code shorter

② makes calculation much faster