

Vectorized formulas for linear regression calculations

- The prediction function for each example is :

$$f_b(x^{(i)}) = \mathbf{b}^T \mathbf{x}^{(i)} = [b_0 \quad b_1 \quad \dots \quad b_n] \begin{bmatrix} x_0^{(i)} \\ x_1^{(i)} \\ \vdots \\ x_n^{(i)} \end{bmatrix}$$

- The prediction function for all examples is :

$$f_b(\mathbf{x}) = \mathbf{X}\mathbf{b} = \begin{bmatrix} x_0^{(1)} & \dots & x_n^{(1)} \\ \vdots & \ddots & \vdots \\ x_0^{(m)} & \dots & x_n^{(m)} \end{bmatrix} \begin{bmatrix} b_0 \\ \vdots \\ b_n \end{bmatrix}$$

- The cost function (MSE) is :

$$J(\mathbf{b}) = \frac{1}{2m} (\mathbf{X}\mathbf{b} - \mathbf{y})^T (\mathbf{X}\mathbf{b} - \mathbf{y})$$

- The derivative of the cost function is :

$$\frac{\partial J(\mathbf{b})}{\partial \mathbf{b}} = \frac{1}{m} \mathbf{X}^T (\mathbf{X}\mathbf{b} - \mathbf{y})$$