1 Setting up problems

1.1 Write linear regression with matrices

Write down this system of linear equations using matrix-vector multiplication. *Hint: Remember what size matrices are allowed to be left-or-right multiplied with each other*

$$\begin{aligned} y_1 &= \alpha_0 + \alpha_1 x_1 + \alpha_2 x_2 + \alpha_3 x_3 \\ y_2 &= \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \end{aligned} \tag{1}$$

$$\begin{bmatrix} y_1 & y_2 \end{bmatrix} = \begin{bmatrix} 1 & x_1 & x_2 & x_3 \end{bmatrix} \begin{bmatrix} \\ \quad\quad ? \quad\quad \\ \\ \end{bmatrix} \tag{2}$$

1.2 Rewrite the same linear system

Rewrite your answer above so that y is a column vector.

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} \\ \quad ? \quad \\ \\ \end{bmatrix} \begin{bmatrix} \\ \quad ? \quad \\ \\ \end{bmatrix} \tag{3}$$

2 Derivatives

2.1 Sum of squared differences

Remember that the x_i and y_i are constant, and we're allowed to change the parameters a and b. If our cost function C is the SSD, then:

$$C(a, b) = \sum_i (y_i - (ax_i + b))^2. \tag{4}$$

Compute the derivatives of SSD with respect to a and b. *Hint: remember the chain rule if you don't want to multiply out the square.*

$$\frac{dC}{da} = \tag{5}$$

$$\frac{dC}{db} = \tag{6}$$