

$$\nabla E = \frac{dE}{dw} = \frac{dE}{dw_1, w_2, w_3} = \begin{bmatrix} \frac{\partial E}{\partial w_1} & \frac{\partial E}{\partial w_2} & \frac{\partial E}{\partial w_3} \end{bmatrix}$$

$$= \begin{bmatrix} -\sum_{i=1}^m (y_i - \hat{y}_i) & -\sum_{i=1}^m (y_i - \hat{y}_i) x_{i1} & -\sum_{i=1}^m (y_i - \hat{y}_i) x_{i2} \end{bmatrix}$$

For a single training example, i.e., when $m=1$, the above becomes,

$$\nabla E = \begin{bmatrix} (y - \hat{y}) & -(y - \hat{y}) x_1 & -(y - \hat{y}) x_2 \end{bmatrix}$$

PROBLEM 3: Example

Let f be a function of two variables x_1, x_2 defined as,

$$f(x_1, x_2) = x_1^2 + 2 \sin x_2$$

then

$$\nabla f = \frac{df(x_1, x_2)}{dx_1, dx_2} = \begin{bmatrix} \frac{\partial}{\partial x_1} [x_1^2 + 2 \sin x_2] & \frac{\partial}{\partial x_2} [x_1^2 + 2 \sin x_2] \end{bmatrix}$$

$$= \begin{bmatrix} 2x_1 + 0 & 0 + 2 \cos x_2 \end{bmatrix}^T$$

$$= \begin{bmatrix} 2x_1 & 2 \cos x_2 \end{bmatrix}^T$$

To evaluate ∇f at $(x_1, x_2) = (5, 2.5)$, we simply put values in the above expression.

$$\nabla f = \begin{bmatrix} 2 \times 5 & 2 \cos 2.5 \end{bmatrix}^T$$