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$$C = \frac{-1}{m} \sum_i \left(y_i \log(y_p) + (1-y_i) \log(1-y_p) \right)$$

$$\frac{\partial C}{\partial B_i} = \frac{-1}{m} \left(\frac{y_i}{y_p} - \frac{(1-y_i)}{(1-y_p)} \right) \frac{\partial y_p}{\partial B} \qquad y_p = y_{predicted}$$

$$y_p = \sigma(B \cdot x)$$

$$\frac{\partial y_p}{\partial B} = \frac{\partial \sigma}{\partial (B \cdot x)} \frac{\partial B \cdot x}{\partial B} \qquad \sigma = \text{sigmoid function}$$

$$= \sigma(1-\sigma) \cdot x$$

$$= y_p (1-y_p)\, x.$$

$$\frac{\partial C}{\partial B_i} = \frac{-1}{m} \left(\frac{y_i (1-y_p) - y_p (1-y_i)}{y_p (1-y_p)} \right) \cdot y_p (1-y_p) \cdot x$$

$$= \frac{1}{m} (y_p - y_i)\, x$$