

TASK 1 LOGISTIC REGRESSION

$$C^n(w) = -(y^n \ln(\hat{y}) + (1 - y^n) \ln(1 - \hat{y}))$$

$$\hat{y} = f(x) = \frac{1}{1 + e^{-w^T x}}$$

$$\frac{\partial f}{\partial w} = x_i^n f(x^n) (1 - f(x^n))$$

$$C^n(w) = -(y \ln(f(x)) + (1 - y) \ln(1 - f(x))) \quad \left| \begin{array}{l} \text{Replace} \\ \hat{y} \text{ with } f \end{array} \right.$$

$$\frac{\partial C^n}{\partial w} = - \left[\frac{y \frac{\partial f}{\partial w}}{f(x)} + \frac{(1 - y) \left(-\frac{\partial f}{\partial w} \right)}{1 - f(x)} \right] \quad \left| \begin{array}{l} \text{Replace} \\ \frac{\partial f}{\partial w} \text{ with } x_i^n f(x^n) (1 - f(x^n)) \end{array} \right.$$

$$= - \left[\frac{y \cdot x_i^n \cancel{f(x^n)} (1 - f(x^n))}{f(x^n)} + \frac{(1 - y) x_i^n \cancel{f(x^n)} (1 - f(x^n))}{1 - f(x^n)} \right] \quad \left| \begin{array}{l} \text{"Multiply out"} \\ \text{HeHe :)} \end{array} \right.$$

$$= - \left[y^n x_i^n - \cancel{f(x^n)} y^n x_i^n - x_i^n \cancel{f(x^n)} + \cancel{f(x^n)} y^n x_i^n \right] \quad \left| \begin{array}{l} \text{Simplify by} \\ \text{and} \\ f(x^n) = \hat{y}^n \end{array} \right.$$

$$= - (y^n - \hat{y}^n) x_i^n$$