# Logistic Regression

$$p(y|x) = \sigma(x) = \frac{1}{1+e^{-x}}$$

$$-\log(\sigma(x)) = \log(1+e^{-x}) = p$$

$$\log(1+e^{-x}) \qquad \log(e^{-z}(e^{z}+1))$$

$$\frac{\partial}{\partial w}\Big(\underbrace{-z}_{-w^T f(x)} + \log(e^{z}+1)\Big]$$

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

$$f(x)\left[\frac{e^{w^T f(x)}}{1+e^{w^T f(x)}} - 1\right]$$

$$- f(x)\left[1 - \frac{e^{w^T f(x)}}{1+e^{w^T f(x)}}\right] = \frac{\partial}{\partial w} \cancel{z} \Rightarrow + w$$

$$1-\sigma(z)$$

$$\frac{1+e^{-z}-1}{\phantom{x}} \qquad \frac{e^{-z}}{1+e^{-z}} = p(y=0|x)$$

$$-\log\left(\frac{e^{-z}}{1+e^{-z}}\right) \rightarrow \log(1+e^{-z}) - \log(e^{-z})$$

$$+ z$$

$$\frac{\partial}{\partial w}\left(z + \log(1+e^{-z}\right)$$

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

$$f(x)\left[-\frac{e^{-w^T f(x)}}{1+e^{-v}} + 1\right]$$

$$f(x)\left[p(y)\right] = \frac{\partial}{\partial w}$$