1 Introduction

One college:

Proof

$$\ell(f_i(x),1)+\lambda\, c(x_z,x) \quad \text{Recourse function} \tag{1}$$

$$\ell(f_i(x),1)=(1-f_i(x))^2 \quad \text{Def. of binary cross-entropy} \tag{2}$$

$$(1-f_i(x))^2+\lambda\, c(x_z,x)$$

$$f_i(x)=\frac{1}{1+e^{-w^Tx}} \quad \text{Logistic function} \tag{3}$$

$$(1-\frac{1}{1+e^{-w^Tx}})^2+\lambda\, c(x_z,x)$$

$$c(x_z,x)=\|x_z-x\|^2 \quad \text{L1 Norm} \tag{4}$$

$$(1-\frac{1}{1+e^{-w^Tx}})^2+\lambda\|x_z-x\|^2$$

$$-\frac{2w^T\mathrm{e}^{-w^Tx}\left(1-\frac{1}{\mathrm{e}^{-w^Tx}+1}\right)}{\left(\mathrm{e}^{-w^Tx}+1\right)^2}-2\lambda\left(x_z-x\right) \quad \text{1st derivative} \tag{5}$$

$$\tag{6}$$

$$f'(x)=2\cdot\frac{-we^{w^Tx}}{(1+e^{w^Tx})^2}\cdot(1-\frac{1}{1+e^{w^Tx}})^2+-2\lambda(x_z-x) \tag{7}$$

$$f''(x)=\frac{2\left(\lambda\mathrm{e}^{4w^Tx}+\left(4\lambda-w^{2T}\right)\mathrm{e}^{3w^Tx}+\left(6\lambda+2w^{2T}\right)\mathrm{e}^{2w^Tx}+4\lambda\mathrm{e}^{w^Tx}+\lambda\right)}{\left(\mathrm{e}^{w^Tx}+1\right)^4} \tag{8}$$

Two colleges:

$$\ell(f_i(x),1)+\lambda\, c(x_z,x) \tag{9}$$

$$f(x)=1-\Pi_{i=1}^{n}(1-f_i(x)) \tag{10}$$

$$f_1(x)=(1-\frac{1}{1+e^{w^Tx}})^2 \tag{11}$$

$$f_2(x) = (1 - \frac{1}{1+e^{w^T x}})^2 \tag{12}$$

$$f(x) = 1 - \Pi_{i=1}^{n}(1 - f_i(x)) \tag{13}$$

$$f(x) = 1 - [(1-(1-\frac{1}{1+e^{w^T x}}))^2 \cdot (1-(1-\frac{1}{1+e^{w^T x}}))^2] \tag{14}$$

2 Using `flalign`

Proof

$$\ell(f_i(x),1) + \lambda\, c(x_z, x) \qquad \text{Recourse function} \tag{15}$$

$$\ell(f_i(x),1) = (1 - f_i(x))^2 \qquad \text{Def. of binary cross-entropy} \tag{16}$$

$$(1 - f_i(x))^2 + \lambda\, c(x_z, x)$$

$$f_i(x) = \frac{1}{1+e^{-w^T x}} \qquad \text{Logistic function} \tag{17}$$

$$(1 - \frac{1}{1+e^{-w^T x}})^2 + \lambda\, c(x_z, x)$$

$$c(x_z, x) = \|x_z - x\|^2 \qquad \text{L1 Norm} \tag{18}$$

$$(1 - \frac{1}{1+e^{-w^T x}})^2 + \lambda \|x_z - x\|^2$$

$$-\frac{2w^T \mathrm{e}^{-w^T x}\left(1 - \frac{1}{\mathrm{e}^{-w^T x}+1}\right)}{\left(\mathrm{e}^{-w^T x}+1\right)^2} - 2\lambda\,(x_z - x) \qquad \text{1st derivative} \tag{19}$$

$$\tag{20}$$