

## Ex 1 (4 pts). Logistic Regression

$$k=2 ; w = \begin{bmatrix} 0 & 0 \end{bmatrix} ; b = 0$$

$$\frac{y_i \text{ GPA}_i}{1 + e^{y_i w x_i}} : \text{ for } x = \begin{bmatrix} 1 & 1 \end{bmatrix}, \frac{(1)(1)}{1 + e^0} = 0.5$$

$$\text{for } x = \begin{bmatrix} 0.9 & 1 \end{bmatrix}, \frac{(1)(0.9)}{1 + e^0} = 0.45$$

$$\text{for } x = \begin{bmatrix} 0.9 & 0.875 \end{bmatrix}, \frac{(1)(0.9)}{1 + e^0} = 0.45$$

$$\text{for } x = \begin{bmatrix} 0.7 & 0.75 \end{bmatrix}, \frac{(-1)(0.7)}{1 + e^0} = -0.35$$

$$\text{for } x = \begin{bmatrix} 0.6 & 0.875 \end{bmatrix}, \frac{(-1)(0.6)}{1 + e^0} = -0.3$$

$$\frac{y_i \text{ GRE}_i}{1 + e^{y_i w x_i}} : \text{ for } x = \begin{bmatrix} 1 & 1 \end{bmatrix}, \frac{(1)(1)}{1 + e^0} = 0.5$$

$$\text{for } x = \begin{bmatrix} 0.9 & 1 \end{bmatrix}, \frac{(1)(1)}{1 + e^0} = 0.5$$

$$\text{for } x = \begin{bmatrix} 0.9 & 0.875 \end{bmatrix}, \frac{(1)(0.875)}{1 + e^0} = 0.4375$$

$$\text{for } x = \begin{bmatrix} 0.7 & 0.75 \end{bmatrix}, \frac{(-1)(0.75)}{1 + e^0} = -0.375$$

$$\text{for } x = \begin{bmatrix} 0.6 & 0.875 \end{bmatrix}, \frac{(-1)(0.875)}{1 + e^0} = -0.4375$$

$$E_i = \ln(1 + e^{-y_i w x_i}) :$$

$$\text{for } x = [1 \ 1], \quad E = \ln(1 + e^{(-1)(0)}) = 0.693$$

$$x = [0.9 \ 1], \quad E = 0.693$$

$$x = [0.9 \ 0.875], \quad E = 0.693$$

$$x = [0.7 \ 0.75], \quad E = 0.693$$

$$x = [0.6 \ 0.875], \quad E = 0.693$$

$$\frac{y_i \text{ Dummy } y_i}{1 + e^{-y_i w x_i}} : \text{ for } y_i; x = [1 \ 1], \quad \frac{(1)(1)}{1+1} = 0.5$$

$$y = 1; x [0.9 \ 1], \quad = 0.5$$

$$y = 1; x [0.9 \ 0.875], \quad = 0.5$$

$$y = -1; x = [0.7 \ 0.75], \quad = -0.5$$

$$y = -1; x = [0.6 \ 0.875], \quad = -0.5$$

$$w_1 = \text{mean} \left( \frac{y \text{ GPA}}{1 + e^{y w x}} \right) = \frac{0.5 + 0.45 + 0.45 - 0.35 - 0.3}{5} = 0.15$$

$$w_2 = \text{mean} \left( \frac{y \text{ GRE}}{1 + e^{y w x}} \right) = \frac{0.5 + 0.5 + 0.4375 - 0.375 - 0.4375}{5} = 0.125$$

$$b = \text{mean} \left( \frac{y \text{ Dummy } y}{1 + e^{y w x}} \right) = \frac{0.5 + 0.5 + 0.5 - 0.5 - 0.5}{5} = 0.1$$

	$\frac{y_i \text{ GPA}_i}{1 + e^{y_i w x_i}}$	$\frac{y_i \text{ GRE}_i}{1 + e^{y_i w x_i}}$	$\frac{y_i \text{ Dummy}_i}{1 + e^{y_i w x_i}}$	$E = \ln(1 + e^{-y_i w x_i})$
$x_i = [1 \quad 1]$	0.5	0.5	0.5	0.693
$x_i = [0.9 \quad 1]$	0.45	0.5	0.5	0.693
$x_i = [0.9 \quad 0.875]$	0.45	0.4375	0.5	0.693
$x_i = [0.7 \quad 0.75]$	- 0.375	- 0.375	- 0.5	0.693
$x_i = [0.6 \quad 0.875]$	- 0.3	- 0.4375	- 0.5	0.693

after 1<sup>st</sup> iteration:

$$w_1 = [0.15 \quad 0.125]$$

$$b = 0.1$$