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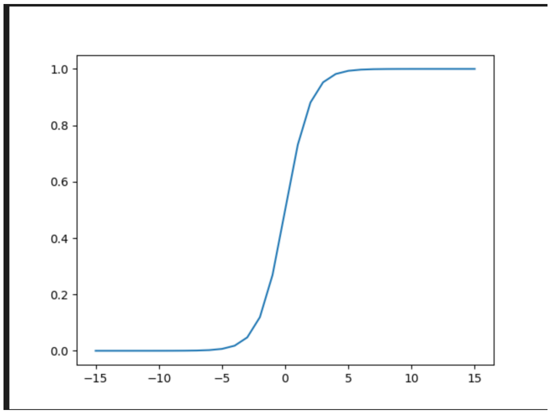
jcs188
ECE 1395

1a) X shape: (100, 3)
y shape: (100, 1)

1d)



Output reaches .9 at z=3

1e) Cost: [0.30103]

1f) theta_min: [4.51985121e-01 2.14498748e-12 3.66380577e-11]
Cost at convergence: 26.119496

1h) Accuracy: .961

1i) Admission probability: 0.622222222197
They should be admitted because the probability is greater than 50 percent.

1j)

HW3

Bonus:

$$h_\theta(x) = g(\theta^T x)$$

$$g(z) = \frac{1}{1+e^{-z}}$$

$$\frac{d(g(z))}{dz} = \frac{0(1+e^{-z}) - (1)(e^{-z}(-1))}{(1+e^{-z})^2}$$

$$\frac{d(g(z))}{dz} = \frac{e^{-z}}{(1+e^{-z})^2} = \frac{1+e^{-z}}{(1+e^{-z})^2} - \frac{1}{(1+e^{-z})^2}$$

$$\frac{d(g(z))}{dz} = \frac{1}{1+e^{-z}}\left(1 - \frac{1}{1+e^{-z}}\right) = g(z)(1-g(z))$$

$$\frac{\partial(J(\theta))}{\partial(\theta_j)} = \frac{-1}{m}\sum_{i=1}^{m}\left[y^{(i)}\frac{1}{h_\theta(x^{(i)})}\left(\frac{\partial(h_\theta(x^{(i)}))}{\partial(\theta_j)}\right)\right] + \sum_{i=1}^{m}\left[(1-y^{(i)})\frac{1}{(1-h_\theta(x^{(i)}))}\left(\frac{\partial(1-h_\theta(x^{(i)}))}{\partial(\theta_j)}\right)\right]$$

$$= \frac{-1}{m}\sum_{i=1}^{m}\left[y^{(i)}\frac{1}{h_\theta(x^{(i)})}g(z)(1-g(z))\left(\frac{\partial(\theta^T)}{\partial(\theta_j)}\right)\right] + \sum_{i=1}^{m}(1-y^{(i)})\frac{1}{(1-h_\theta(x^{(i)}))}(-g(z))(1-g(z))\left(\frac{\partial(\theta^T x)}{\partial(\theta_j)}\right)$$

$$\frac{\partial(J(\theta))}{\partial\theta_j} = \frac{-1}{m}\sum_{i=1}^{m}\left[y^{(i)}\frac{1}{h_\theta(x^{(i)})}h_\theta(x^{(i)})(1-h_\theta(x^{(i)}))x_j^{(i)}\right] + \sum_{i=1}^{m}\left[(1-y^{(i)})\frac{1}{(1-h_\theta(x^{(i)}))}(-h_\theta(x^{(i)}))(1-h_\theta(x^{(i)}))x_j^{(i)}\right]$$

$$= \frac{-1}{m}\sum_{i=1}^{m}\left[y^{(i)}(1-h_\theta(x^{(i)}))x_j^{(i)} - (1-y^{(i)})h_\theta(x^{(i)})x_j^{(i)}\right]$$

$$= \frac{-1}{m}\sum_{i=1}^{m}\left[y^{(i)} - y^{(i)}h_\theta(x^{(i)}) - h_\theta(x^{(i)}) + y^{(i)}h_\theta(x^{(i)})\right]x_j^{(i)}$$

$$\frac{\partial(J(\theta))}{\partial(\theta_j)} = \frac{-1}{m}\sum_{i=1}^{m}\left[y^{(i)} - h_\theta(x^{(i)})\right]x_j^{(i)}$$

$$\frac{\partial J(\theta)}{\partial\theta_j} = \frac{1}{m}\sum_{i=1}^{m}\left(h_\theta(x^{(i)}) - y^{(i)}\right)x_j^{(i)}$$

2a) Theta: [[6204.54488128]
 [-161.91737591]
 [10.20285895]]