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Logistic Regression

5 questions

1.

Suppose that you have trained a logistic regression classifier, and it outputs on a new example x a prediction $h_{\theta}(x) = 0.7$. This means (check all that apply):

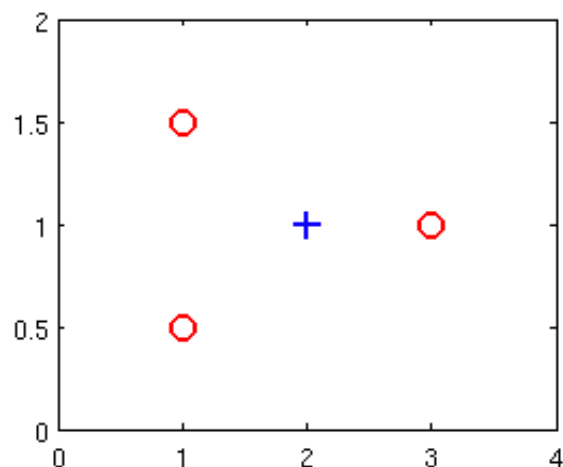
- ☐ Our estimate for $P(y = 0|x; \theta)$ is 0.7.
- ☐ Our estimate for $P(y = 1|x; \theta)$ is 0.7.
- ☐ Our estimate for $P(y = 0|x; \theta)$ is 0.3.
- ☐ Our estimate for $P(y = 1|x; \theta)$ is 0.3.

2.

Suppose you have the following training set, and fit a logistic regression classifier

$$h_{\theta}(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2).$$

x_1	x_2	y
1	0.5	0
1	1.5	0
2	1	1
3	1	0



Which of the following are true? Check all that apply.

- ☒ $J(\theta)$ will be a convex function, so gradient descent should converge to the global minimum.
- ☐ Adding polynomial features (e.g., instead using $h_{\theta}(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_1^2 + \theta_4 x_1 x_2 + \theta_5 x_2^2)$) could increase how well we can fit the training data.
- ☐ The positive and negative examples cannot be separated using a straight line. So, gradient descent will fail to converge.

- ☐ Because the positive and negative examples cannot be separated using a straight line, linear regression will perform as well as logistic regression on this data.
-

3.

For logistic regression, the gradient is given by $\frac{\partial}{\partial \theta_j} J(\theta) = \sum_{i=1}^m (h_{\theta}(x^{(i)}) - y^{(i)})x_j^{(i)}$. Which of these is a correct gradient descent update for logistic regression with a learning rate of α ? Check all that apply.

- ☐ $\theta := \theta - \alpha \frac{1}{m} \sum_{i=1}^m (\theta^T x - y^{(i)}) x^{(i)}.$
- ☐ $\theta := \theta - \alpha \frac{1}{m} \sum_{i=1}^m \left(\frac{1}{1+e^{-\theta^T x^{(i)}}} - y^{(i)} \right) x^{(i)}.$
- ☒ $\theta_j := \theta_j - \alpha \frac{1}{m} \sum_{i=1}^m (\theta^T x - y^{(i)}) x_j^{(i)}$ (simultaneously update for all j).
- ☐ $\theta := \theta - \alpha \frac{1}{m} \sum_{i=1}^m (h_{\theta}(x^{(i)}) - y^{(i)}) x^{(i)}.$
-

4.

Which of the following statements are true? Check all that apply.

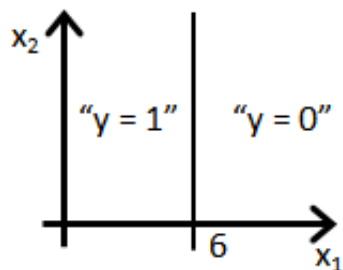
- ☐ For logistic regression, sometimes gradient descent will converge to a local minimum (and fail to find the global minimum). This is the reason we prefer more advanced optimization algorithms such as fminunc (conjugate gradient/BFGS/L-BFGS/etc).
- ☒ The cost function $J(\theta)$ for logistic regression trained with $m \geq 1$ examples is always greater than or equal to zero.

- ☒ The one-vs-all technique allows you to use logistic regression for problems in which each $y^{(i)}$ comes from a fixed, discrete set of values.
 - ☐ Since we train one classifier when there are two classes, we train two classifiers when there are three classes (and we do one-vs-all classification).
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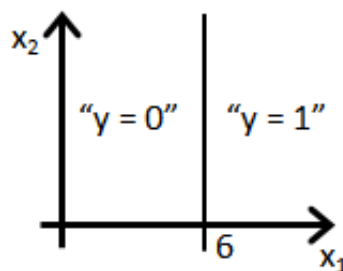
5.

Suppose you train a logistic classifier $h_{\theta}(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2)$. Suppose $\theta_0 = 6, \theta_1 = -1, \theta_2 = 0$. Which of the following figures represents the decision boundary found by your classifier?

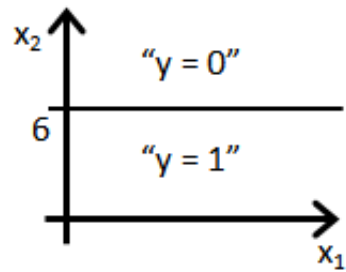
☐ Figure:



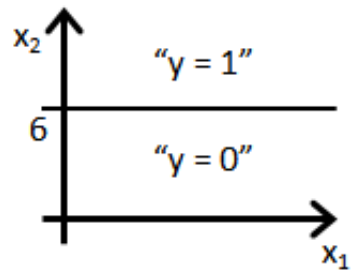
☐ Figure:



☐ Figure:



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