Logistic Regression - Intuition

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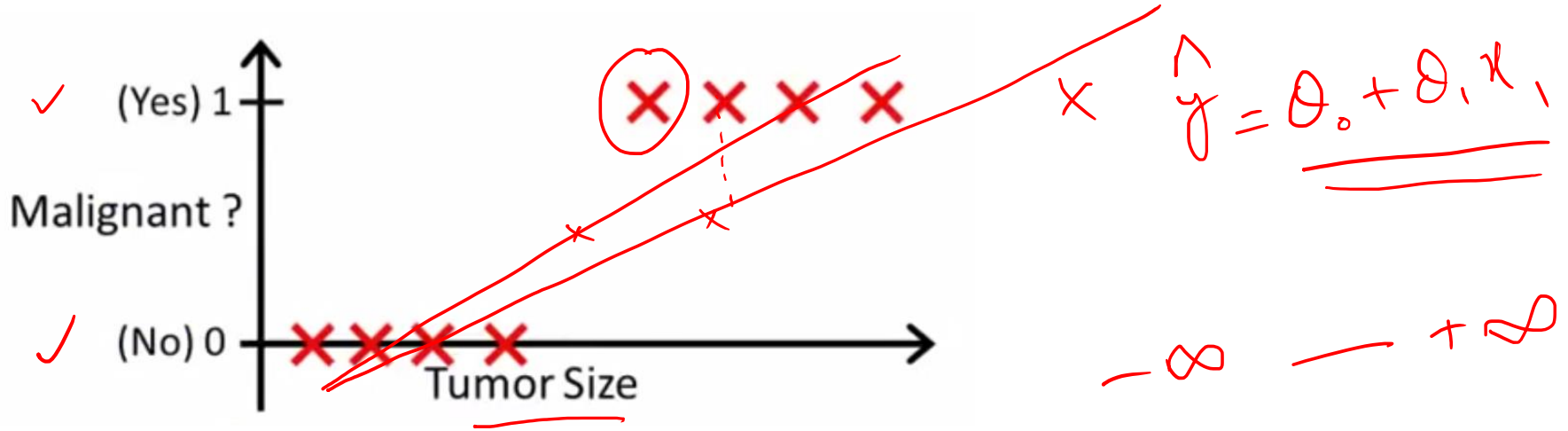
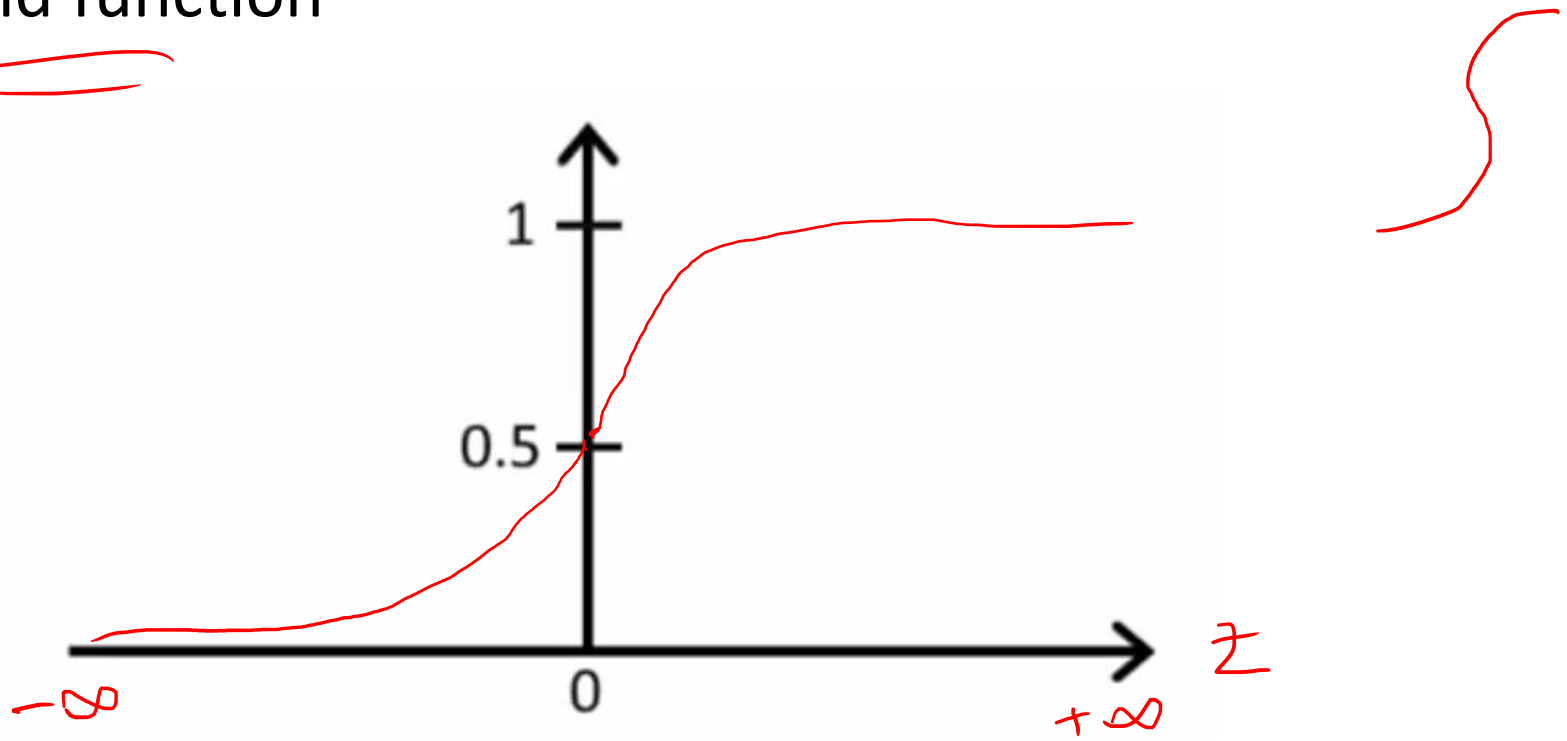
Linear Regression for Classification? An Example of Diagnosing Cancer



- Problems:
  - Threshold may not perform optimally
  - The values can be much smaller/larger than the expected value (0/1)

Logistic Regression

- Want $0 \leq h_\theta(x) \leq 1$
- $h_\theta(x) = \theta^T x$
- Logistic/sigmoid function



Interpretation of Hypothesis Output

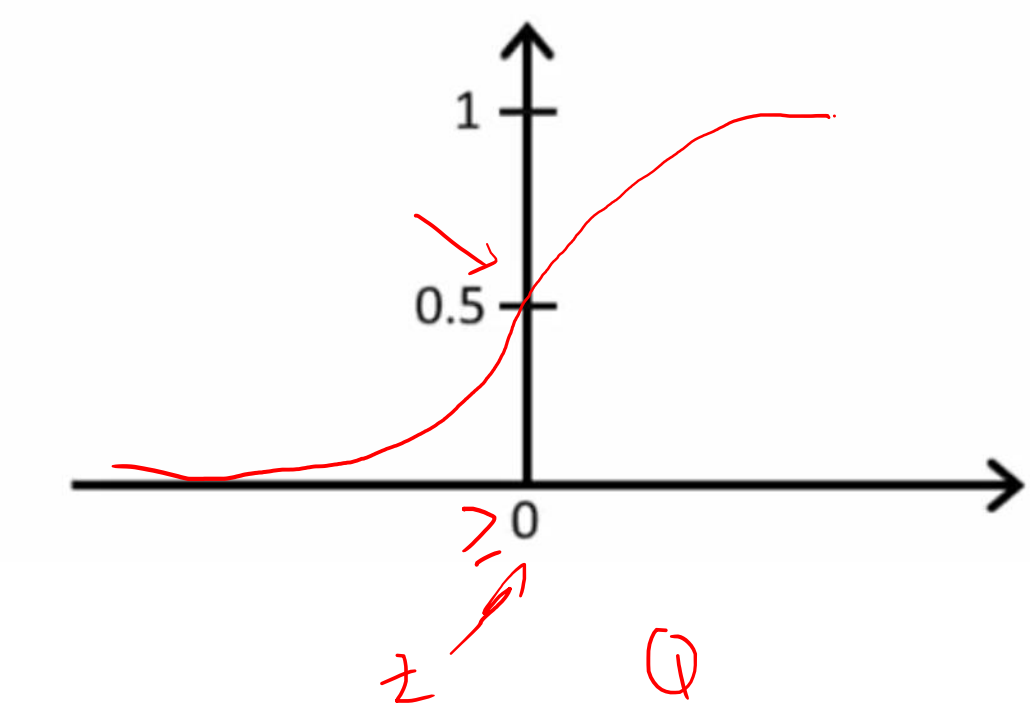
- $h(x)$= estimated probability that y=1 on input x
- If $h(x) = 0.7$
- It means that the patient has 70% chance of tumor being malignant

$$P(y = 0|x; \theta) + P(y = 1|x; \theta) = 1$$

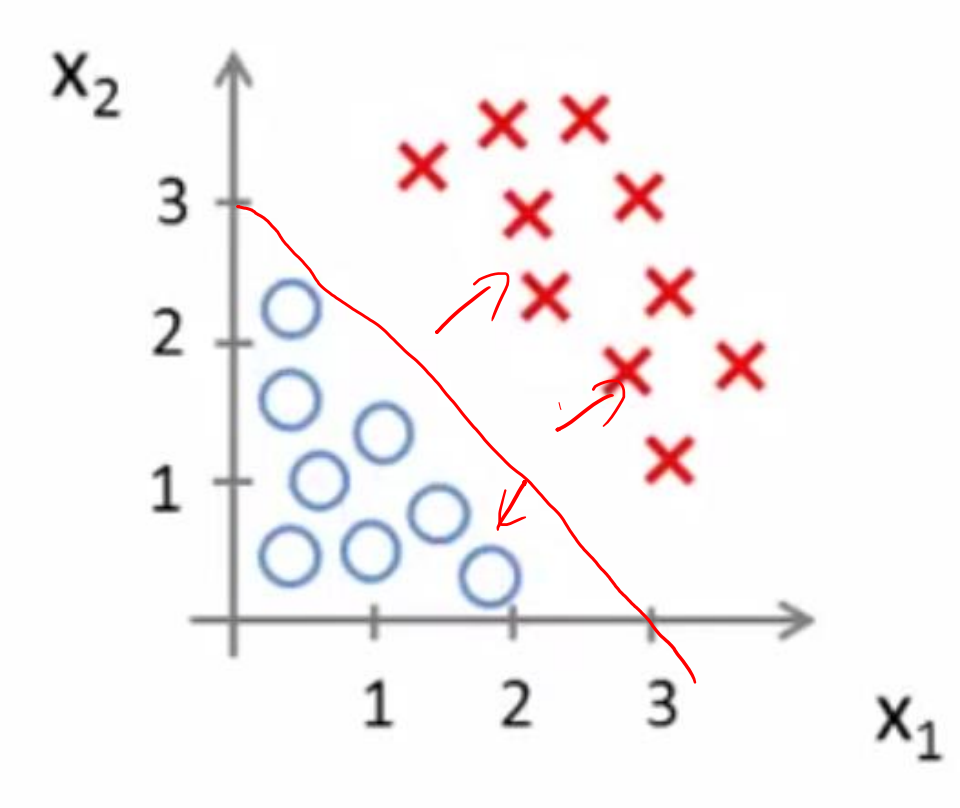
Logistic Regression

- $h(x) = g(\theta^T x)$
- $g(z) = \frac{1}{1+e^{-z}}$

- Suppose predict "y=1" if $h(x) \geq 0.5$
- Predict "y=0" if $h(x) < 0.5$



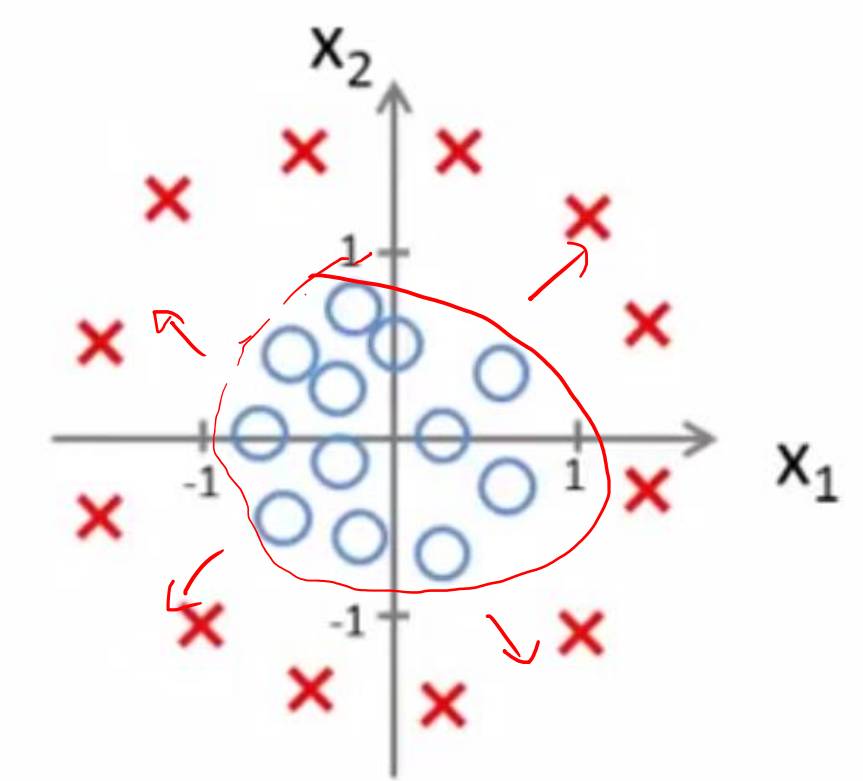
Decision Boundary



- $h(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2)$

- Predict y=1 if $-3 + x_1 + x_2 \geq 0$
- Predict y=0 if $-3 + x_1 + x_2 < 0$

Decision Boundary – Example II



- Non linear decision boundary
- $h(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_1^2 + \theta_4 x_2^2)$
- Predict y=1 if $-1 + x_1^2 + x_2^2 \geq 0$
- Predict y=0 if $-1 + x_1^2 + x_2^2 < 0$