

## HW5Q2

Data = (Basketball, 6, 150, 4, 10, Drinking)

$$P(m|data) = P(\text{Basketball}|m) \cdot P(6\text{ft tall}|m) \cdot P(150\text{lbs}|m) \cdot P(4\text{in hair}|m) \cdot P(10\text{in foot size}|m) \cdot P(\text{Drinking}|m) \cdot P(m)$$

$$P(m|data) = \frac{2}{5} \cdot \frac{1}{5} \cdot \frac{3}{5} \cdot \frac{2}{5} \cdot \frac{1}{5} \cdot \frac{4}{5} \cdot \frac{5}{9} = .0017$$

$$P(f|data) = P(\text{Basketball}|f) \cdot P(6\text{ft tall}|f) \cdot P(150\text{lbs}|f) \cdot P(4\text{in hair}|f) \cdot P(10\text{in foot size}|f) \cdot P(\text{Drinking}|f) \cdot P(f)$$

$$P(f|data) = \frac{2}{4} \cdot \frac{2}{4} \cdot \frac{0}{4} \cdot \frac{0}{4} \cdot \frac{0}{4} \cdot \frac{1}{4} \cdot \frac{1}{9} = 0.00$$

$$P(m|data) = \frac{0.0017}{0.0017 + 0.00} = 1 \quad P(f|data) = \frac{0.00}{0.0017 + 0.00} = 0$$

Since  $P(m|data) > P(f|data)$ , the data provided will be classified as a male.

# HW5 Q4

Vanilla perceptron:  
 $w^{(t+1)} = w^t + y_i x_i$

Modified perceptron  
 $w^{(t+1)} = w^t + \eta y_i x_i$

$$\Delta w = w^{(t+1)} - w^{(t)}$$

$$\Delta w_{\text{vanilla}} = (w^t + y_i x_i) - w^t = y_i x_i$$

$$\Delta w_{\text{modified}} = (w^t + \eta y_i x_i) - w^t = \eta y_i x_i$$

Since the direction of the weight update depends only on the sign of the dot product  $y_i x_i$  and not the magnitude, both perceptrons will converge to the same decision boundary. Therefore, the modified perceptron will perform the same number of iterations as the vanilla perceptron.