HW3-695

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1.

(1) MAP Learning: Maximum a Posteriori. H_{MAP} = arg max P(h|D), h belongs to H

I.e. to find the most probable hypothesis h for a given data set D.

(2) Support Vector Machine: to find an optimal decision surface (I.e. a hyperplane) by maximizing the margin to classify instances.

(3) Bias-Variation Trade-offs: choose a proper hypothesis space to get the smallest error by finding a tradeoff between variance and bias.

2.

From the first test, we know

P(cancer) = 0.008 p(~cancer) = 0.992 (~ means not)

P(+|cancer) = 0.98 p(-|cancer) = 0.02

P(+|~cancer) = 0.03 p(-|~cancer) = 0.97

For the second test, the result is positive.

h_{MAP}(cancer) = argmax p(cancer|+) = p(+|cancer)*p(cancer) = 0.98*0.008 = 0.00784

h_{MAP}(~cancer) = argmax p(~cancer|+) = p(+|~cancer)*p(~cancer) = 0.03*0.992 = 0.02976

Thus, h_{MAP} = ~cancer

3.

(a) P+ = 3/6 = 1/2 p- = 3/6 = ½

Entropy(s) = -p+ * $\log_2$p+ - p- * $\log_2$p- = -½*(-1) - ½ *(-1) = 1

(b) a2: [3+, 3-]

E(a2) = 1

T: [2+, 2-] F[1+, 1-]

E(T) = 1 E(F) = 1

Gain(S, a2) = 1 - (4/6*1 + 2/6*1) = 0

4.

<Outlook = sunny, Temperature = mild, Humidity = normal, wind = strong>

Vnb = arg max p(Vj) * Product(p(ai|Vj))

P(yes)*p(sunny|yes)*p(mild|yes)*p(normal|yes)*p(strong|yes) = 9/14 * 2/9 * 4/9 * 6/9 * 3/9 = 0.014

P(no)*p(sunny|no)*p(mild|no)*p(normal|no)*p(strong|no) = 5/14 * 3/5 * 2/5 * 1/5 * 3/5 = 0.0103

Vnb = 0.014 output: yes