Computational Biology: Assignment #7

Due on Monday, May 5, 2014
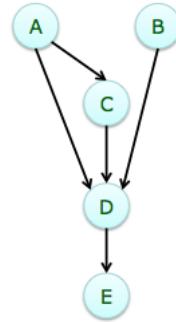
Jianyang Zeng 1:30pm

Weiyi Chen

Problem 1

Bayesian Networks (20 points)

(1)

(2)

14: 1 for A, 1 for B, 2 for C, 8 for D, 2 for E.

(3)

Given the condition a is conditionally independent of (b, c) given d,

$$P(A|D)P(B, C|D) = P(A, B, C|D)$$

We have

$$P(A, B|D) = \sum_c P(A, B, c|D) = \sum_c P(A|D)P(B, c|D) = P(A|D)\sum_c P(B, c|D) = P(A|D)P(B|D)$$

Therefore a is conditionally independent of b given d.

Problem 2

Maximum Likelihood (ML) and Maximum a Posteriori (MAP) Approaches for Parameter Learning (20 points).

(1)

$$L_p = p(1 - p)^2$$

$$L_{0.3} = 0.147 > L_{0.6} = 0.096$$

Therefore MLE estimate of $p = 0.3$

2)

$$L'_p = p(1 - p)^2 P(p)$$

$$L'_{0.3} = 0.0441 < L'_{0.6} = 0.0672$$

Therefore MAP estimate of $p = 0.6$

---

(3)

Proportion of heads to the total number of flips tends to 0.5, the MLE would be 0.6 as this is closer to 0.5.

(4)

The effect of the prior becomes negligible. Therefore, the MAP estimate will be the same as the MLE.