SGN-6156 Computational Systems Biology II

Exercise 2, April 16, 2008, at 12:15-13:45, in class TC415

This exercise will familiarize you with the hidden Markov models (HMM). Exercises can be done in class (during the exercise session).

1. Exercise 3.4 from (Durbin et al., 1998).
2. Continue the occasionally dishonest casino example from Durbin et al., (1998), page 54. The casino uses a fair (F) and loaded (L) die (which correspond to the hidden state variable). State transition probabilities between F and L are defined as $a_{FF} = 0.95$, $a_{FL} = 0.05$, $a_{LF} = 0.1$ and $a_{LL} = 0.9$. Also assume that $a_{\mathcal{B}F} = a_{\mathcal{B}L} = a_{F\mathcal{E}} = a_{L\mathcal{E}} = 1/2$ for the beginning and end states. The fair die has probability 1/6 for all outcomes, $e_F(i) = 1/6$ for all $i = 1, \ldots, 6$. The loaded die is biased: $e_L(i) = 1/10$ for $i = 1, \ldots, 5$ and $e_L(6) = 1/2$. After observing three rolls $x = (1, 6, 2)$, compute
   (a) the most likely path $\pi^* = \arg\max_\pi P(x, \pi)$ using Viterbi algorithm
   (b) the probability of x, i.e., $P(x) = \sum_\pi P(x, \pi)$, using the forward algorithm