BCH 571 Bioinformatics for Life Scientists

Lab 10

For this lab, you will implement a dynamic programming algorithm to estimate the state of the coin (Fair or Biased) for the fair bet casino. This will require two arrays (lists), VF_i and VB_i, where VF_i is the maximum probability of the path up to flip i (1-indexed) ends in state F. Likewise, VB_i is the maximum probability of the path up to flip i (1-indexed) ends in state B The main recursion is:

$$\mathrm{VF_i} = \mathrm{P_{x_i}} \max \begin{cases} 0.9\ \mathrm{VF_{i-1}} \\ 0.1\ \mathrm{VB_{i-1}} \end{cases}$$

$$\mathrm{VB_i} = \mathrm{P_{x_i}} \max \begin{cases} 0.9\ \mathrm{VB_{i-1}} \\ 0.1\ \mathrm{VF_{i-1}} \end{cases}$$

where $\mathrm{P_{x_i}}$ is the probability of getting coin flip result x_i. Initialize $VF_0 = VB_0 = 0.5$.

Here is the pseudocode (where strings are 1-indexed):

Provide string x, the sequence of H and T for heads and tails and output string pi, the sequence of coins being used for the maximum probability path.

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FairCasino(x)
  Make arrays VF and VB for length(x)+1 states, 0-indexed
  VF0 ← 0.5
  VB0 ← 0.5
  for i=0 to length(x)
    if (xi = H)
       Px ← 0.75
    else
       Px ← 0.25
    VFi ← 0.5 × max(TP × VFi-1, (1-TP) × VBi-1)
    VBi ← Px × max(TP × VBi-1, (1-TP) × VFi-1)

  Traceback the path through pi (F or B) that gives the maximum probability.
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One goal this week is for you to develop the traceback strategy on your own. However, the pseudocode with the traceback strategy will become available on blackboard at 4:15.

Run the algorithm with the sequence:

x= HHHHTTTTHHHHHHHHTHTHTHTHHHHTHHTTTTHHTHHT

Try also changing TP to see how the results change. (Try 0.5, for example.)