

Homework: 4 CS 170. Introduction to Artificial Intelligence

For each question, be sure to show all work. Clearly state any assumptions you are making.

1) A professor wants to know if his students are getting enough sleep. Each class, the professor observes whether the students sleep in class, and whether their eyes are red. The professor has the following domain theory:

- The prior probability of getting enough sleep, with no observations is 0.7
- The probability of getting enough sleep on night t is 0.8 given that the students got enough sleep the previous night, and 0.3 if not.
- The probability of having red eyes is 0.2 if the students got enough sleep, 0.7 if not.
- The probability of sleeping in class is 0.1 if the student got enough sleep, 0.3 if not.

Formulate this information as a hidden Markov Model (HMM) **that has only a single observation variable**. Give the complete probability tables for the model.

2) For the HMM in the previous problem, with the following observation states,

Z1 = not red eyes, not sleeping in class

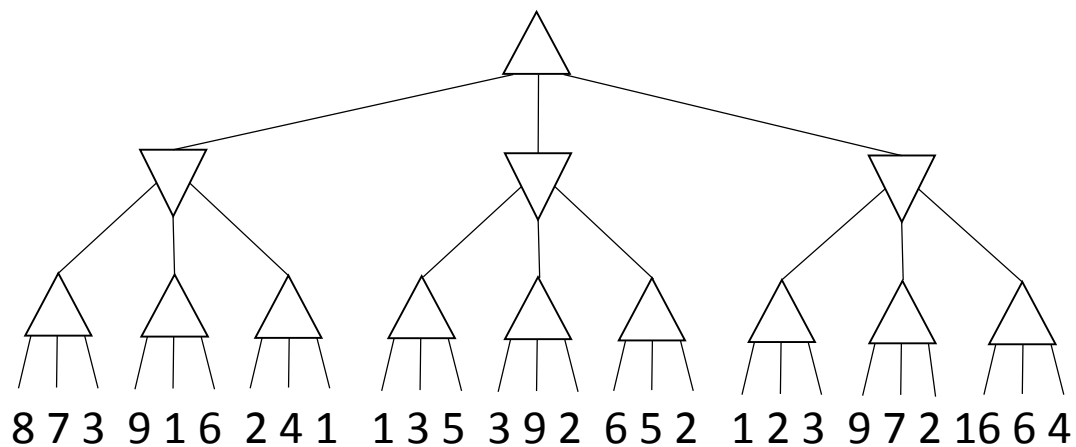
Z2 = red eyes, not sleeping in class

Z3 = red eyes, sleeping in class

Compute the state estimation, i.e. probability of enough sleep, given these observations for T1, T2, T3

3) Use the particle filtering algorithm with $N = 10$ to estimate the probability of the state ("enough sleep") with the same observations from the previous problem. Show your work, including the steps of the algorithm for each component of the filtering process: 1) Propagating; 2) Weighting; and 3) Resampling

4) Fill in the internal node values in the following game tree, after traversal by the MiniMax algorithm with Alpha-Beta pruning. Indicate which leaf nodes do not require evaluation due to pruning.



5) Consider the grayscale simple image below. A) Propose a method for detecting corners (e.g. through filters or Harris corner detection) and use it to detect the corners in the image. Show your work and indicate where the corners appear based on the approach you propose. B) Explain the limitation(s) of the approach (lets assume they exist) for this image and/or other images, and offer a suggestion on how to side step the limitation(s).

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