CSCI567 Fall 2013 - Assignment 6
Due date/time: Mon., Dec. 9, 2013, 3:15pm

November 27, 2013

Algorithm Component

1 Bayes net

The following problems use the lecture slides on Bayes net.

1.1 Causal Reasoning (2 pts)

On slide# 14, the question unanswered there is what is Prob (JohnCalls = True | Burglary =True)? Compute this probability and report it here.

1.2 Diagnostic Reasoning (3 pts)

On slide# 15, the question unanswered there is what is Prob (Burglary = True | JohnCalls = True)?. Compute this probability and report it here.

1.3 Explaining away (5 pts)

On slide# 16, I have given the two probabilities and show the effect of explaining away. In this question, we are going to check to see if the following has the effect of explaining away.

- What is P(Earthquake = True | alarm = True)?
- What is P(Earthquake = True | alarm = True, Burglary = True)?

Show you intermediate steps of calculating the probabilities. Do you observe "explaining away", ie, P(Earthquake = True | alarm = True) is less than P(Earthquake = True | alarm = True , Burglary = True)?

Programming Component

2 Hidden Markov Models (15 pts)

Consider the following hidden Markov model. The model's state variable S has 10 possible values $1, 2, 3, 4, \ldots, 9$ and 10. The observation random variable O has 8 values $a, b, c, d, \ldots, g$ and h (we will number them from 1 to 8). In the attached file (hw6data.mat) to this homework, you will find four variables i) $pi0$: probability of initial states; ii) $transP$: transition probabilities (note that, the row sums to 1, meaning that each row corresponds to a state at time t and each column corresponding to a state at time $t+1$. iii) $obsP$: observation probabilities, which is $P(O|S)$. Use the Viterbi algorithm to compute the most likely state path that corresponds to the following observation

$$\mathbf{o} = f\ d\ e\ d\ g\ c\ b\ h$$

namely, $\mathbf{s}^* = \arg\max P(\mathbf{s}|\mathbf{o})$. Report the $\mathbf{s}^*$ you have found. Your answer would reveal a famous mathematical result.

Note Please implement your own Viterbi algorithm in Matlab and submit the code to Blackboard. Name the code as runViterbi(). It should load the data file and return the Viterbi path in an array. Your code should run in standalone and need only to read the data file hw6data.mat

Due Date and Time

The due date/time is **Dec 9, 2013, 3:15pm**. A single two-day extension or two one-day extensions are allowed, combining with your previous requests. Other late submissions will get at most half the credit.

Collaboration

For the algorithm part of the assignment, you can collaborate. However, each has to turn in his/her own write-up.

For the coding part of the assignment, you may collaborate in groups of up to 4. Each group needs to submit to blackboard only once. Group members share the same credits.

Blackboard Submission Instructions

You are required to submit both runnable Matlab code files, and a formatted report (PDF) via the blackboard system.

Pack your writeup report (in PDF format, do not forget listing all your team members on the programming part), and the Matlab file for doing Viterbi decoding into a single zipped file.

Upload the single zip archive file *containing a single folder*. **The name of the zip file should be your abcd_hw6_AB.zip** where abcd is the last 4 digits of your USC ID and AB is your initials. **The folder should be named as results**. If you are working in a group, only one student from the group should upload the files. Please use the uploading student's ID number for the folder name.

The folder should contain all your .m files and also an PDF report named *HW6Algorithm.pdf.* (for the algorithm part)/ Additionally, if you are submitting the coding part for the group, your folder should also contain *HW6Programming.pdf.* The report should contain the names and USC student IDs of all the group members. It should answer all programming questions — make you mark clearly each question you are answering. Since you will have plots, you will need to refer to the plots (such as "Please see Fig. 1" — LaTeX does not place plots next to texts so you need to number the plots and refer that way.)