Assignment 5: Bayesian Networks

Due Wednesday, 7 June 2023, 11:30pm

Design a small Bayesian network modeling a domain of your own choice, and run a few tests on it using SAMIAM.[1]

Domain Find a domain you find interesting. Here are some suggestions: diagnosing some malfunction (car, computer, application), medical diagnostics (causes and symptoms), plot prediction for TV shows, e-mail spam classifier, or weather forecast. Model this domain using 6–8 variables (nodes), with at least three layers of nodes. Supply all the values in conditional probability tables (CPTs).

You should adhere to the following design guidelines:

- Your network structure should reflect causal and probabilistic dependencies.
- Your CPT values should be reasonable (not randomly chosen). If you are finding it hard to come up with intuitive conditional probabilities for a certain node, it might be an indicator of wrong network structure, such as a symptom being a parent of a cause rather than the cause being the parent of the symptom.
- You should assume that your Bayesian network will be implemented in a real-life application. Therefore, you should to be able to explain how one could determine the CPT values in practice (e.g., some values could be provided by a domain expert and some could be estimated from data).
- When adding a variable, think of the role of that variable: is it an *evidence* variable (something we can observe), a *query* variable (something we want to know), or neither (something that helps us build a good network)?

Test cases Find two test cases for your network, that involve fixing the values of some evidence variables and computing (using SAMIAM) posterior probabilities of a few other variables of interest.

Submit You are expected to submit a 2-slide presentation at SUCourse+:

(a) One slide presenting a diagram of the network and the CPT tables.

(b) One slide describing the two test cases, and presenting the posterior probabilities you computed.

Demos You are expected to make a demo of your Bayesian network, and provide explanations to our questions during the demo. The demos are planned for the 8th or the 9th of June and will be scheduled later on.

Grading We will grade your solutions based on your demo (including your presentation) and your explanations to our questions during the demo. Note that simply making a demo without a presentation or simply submitting a presentation without a demo will be graded as 0.

[1] `http://reasoning.cs.ucla.edu/samiam/`