

50.021 - Artificial Intelligence

Homework 9

1 Part 1

If the weather report says it will rain, then with probability 0.8, Dana brings her umbrella. If the weather report says it won't rain, then with probability 0.3, Dana brings her umbrella. In Singapore, the weather report predicts rain with probability 0.8.

1. Draw a Bayesian network corresponding to this problem, using variables U (for umbrella) and P (for predicted rain).
2. Compute (by hand) the joint distribution over U and P
3. check the code in `testcase.py`. Compute $P(P|U = 1)$ and $P(P|U = 0)$ using the code.
4. Really, you are not so interested in whether rain was predicted, but whether it will actually rain. You study the prediction accuracy of weather predictions, and decide to add a new node, R , to your network, modeling whether it will rain today. How will the model look like as Bayesian network?
5. for the new network, what is the right formula for $P(R = 1|P)$ and for $P(R = 1|U)$?
6. What probabilities do you need? Make up any numbers that you need. Then encode this in the Bayes net code and compute the probability of rain given that Dana brings her umbrella or given that the report says rain or given both observed as evidence.

2 Part 2

Encode your rain model from question from the updated monday lectures in the bayesnet code. Explore explaining away by computing:

- $P(B = 1|A = 1)$
- $P(B = 1|A = 1, R = 1)$ – see what observing an additional evidence, namely the radio report about earth quakes tells you about the probability of having been burgled.

- compute both terms for $P(R = 1|E = 0) = 0.0001$, and $P(R = 1|E = 1) =$ a number which is not 1.0 as before but still high, compare what happens as you change this number.