

Probabilistic reasoning in AILog.

Deadline: 23 December 2011

In this exercise, you will learn how to define a Bayesian network using AILog and use the network to answer some simple queries. Please read http://artint.info/code/ailog/ailog_man_16.html gives an overview of how to specify probabilistic knowledge using AILog. Consult http://artint.info/code/ailog/ailog_code/ch14/leaving.ail for an example of the ‘leaving’ network.

1. Read the following story:

Mr. Holmes receives a telephone call from his neighbor Dr. Watson stating that he hears a burglar alarm sound from the direction of Mr. Holmes house. if there is a burglar present (which could happen once every ten years), the alarm is known to go off 95% of the time. Preparing to rush home, Mr. Holmes recalls that Dr. Watson is known to be a tasteless practical joker. There’s a 40% chance that Watson is joking and the alarm is in fact off. However, if the alarm is on, Holmes expects Watson to call 80% of the time. He decides to first call his other neighbor, Mrs. Gibbons, who, despite occasional drinking problems, is far more reliable. She will have heard the alarm in 99% of the cases and is thought to erroneously report an alarm when it is in fact off in only 4% of the cases.

Mr. Holmes remembers having read in the instruction manual of his alarm system that the device is sensitive to earthquakes and can be triggered by one accidentally in 1 every five cases. A burglary and an earthquake can be seen as independent causes. Other causes which will trigger the alarm do not exist. The incidence rate for earthquakes is about once every 10 years. He realizes that if an earthquake had occurred, it would definitely be on the news. So, he turns on his radio and waits around for a newscast. Of course, sometimes the newscast can be mistaken. This will happen only once per 5000 broadcasts.

2. Draw a Bayesian network (BN) that captures the independencies in the story.

3. Write down the corresponding conditional probability tables (CPTs) and fill them with the respective values.
4. Write an AILog program which defines the probabilistic knowledge associated with the network.
5. Use AILog to answer the following queries:
 - (a) the prior probability of a burglary
 - (b) the probability of a burglary given that Watson called
 - (c) the probability of a burglary given that Gibbons also reports it
 - (d) the probability of a burglary given that the newscast reported an earthquake; explain why the probabilities change the way they do.
 - (e) write down the most probable explanation for the observed evidence
6. Submit your assignment consisting of the BN and its CPTs, the AILog program and the AILog output for the queries.