Water leak and a pump failure

[Science](), [Statistics]()

Suppose that both warning sensors indicatefailure. What is the risk of a meltdown in that case? Compare this result with the risk of a melt-? down when there is an actual pump failure and water leak. What is the difference? The answers must be expressed as conditional probabilities of the observed variables, P(Meltdown|...). P(Meltdown | PumpFailureWarning, WaterLeakWarning) = 0, 14535 P (Meltdown | PumpFailure, WaterLeak) = 0, 2

The conditional robabilities for the stochastic variables are often estimated by repeated experiments or observations. Why is it sometimes very difficult to get accurate numbers for these? What conditional probabilites in the model of the plant do you think are difficult or impossible to estimate?

What is the risk of melt-? down in the power plant during a day if no observations have been made? What if there is icy weather? It is hard to fully understand all possible factors that can effect or trigger an event and how they interact with each other.

Observations are always a description of the past and is not always accurate in forecasting the future. E. g. Icy weather is not a thing you can measure and p over a wide range of weather conditions including combinations of precipitation, wind and temperature.

Assume that the " IcyWeather" variable is changed to a more accurate " Temperature" variable instead (don't change your model). What are the different alternatives for the domain of this variable? What will happen with the robability distribution of P(WaterLeak | Temperature) in each alternative? The domain decreases in size of possible states as for example precipitation and wind is no longer a part of the estimations. The temperature will be represented as an absolute number or intervals, instead of just true or false. Resulting in a lot more defining of the probabilities of the child nodes with aspect to each value/interval of temperature.

a) What does a probability table in a Bayesian network represent? The probability table shows the probability for all states of the node given the states of the parent nodes.

b) What is a joint probability distribution? Using the chain rule on the structure of the Bayesian network to rewrite the joint distribution as a product of P(child| parent) expressions, calculate manually the particular entry in the joint distribution of P(Meltdown= F, PumpFailureWarning= F, PumpFailure= F, WaterLeakWaring= F, WaterLeak= F, IcyWeather= F). Is this a common state for the nuclear plant to be in? Kedjeregeln ger foljanade:

- P(alla ar falska) = P(icyweather)
- P(pumpfailure)
- P(PW | pumpfailure)
- P(meltdown| pumpfailure, WL)
- P(WL | cyweather)
- P(waterleakw | WL) = 0, 95
- 0, 9
- 0, 95
- 1
- 0, 9
- 0, 95 = 0, 69 Ja, detta ar ett vanligt tillstand.

What is the probability of a meltdown if you know that there is both a water leak and a pump failure? Would knowing the state of any other variable matter? Explain your reasoning! P(Meltdown | PumpFailure, WaterLeak) = 0, 8. No other variables matter. When all the parents values are observed they alone determine the child value.) Calculate manually the probability of a meltdown when you happen to know that PumpFailureWarning= F, WaterLeak= F, WaterLeakWarning= F and IcyWeather= F but you are not really sure about a pump failure.

During the lunch break, the owner tries to show off for his employees by demonstrating the many features of his car stereo. To everyone's disappointment, it doesn't work. How did the owner's chances of urviving the day change after thisobservation? Without knowing whether the radio is working or not, the probability of him surviving is 0, 99001. If the radio is not working the probability is 0, 98116. How does the bicycle change the owner's chances of survival? With the bicycle the probability of surviving is 0. 99505. Small increase. It is possible to model any function in propositional logic with Bayesian Networks. What does this fact say about the complexity of exact inference in Bayesian Networks? What alternatives are there to exact inference? Yes but it might be complex and you might sometimes have to add new nodes.

For example if you want to model an OR-relationship you have to add a new node with truthtable probabilities that match. An alternative to exat inference is probabilistic indifference. Things might not always be true or false with a predefined probability. With probabilistic inference yuou can reuse a full joint distribution as the " knowledge base"

Changes in graph Mr. H-S sleeping (T = 0. 3, F = 0. 7) Mr HS reacts in a competent way: WaterleakWarn. Pumpfailurewarning Mr HS sleeping. The owner had an idea that instead of employing a safety person, to replace the pump with a better one. Is it possible, in your model, to compensate for the lack of Mr H. S. 's expertise with a better pump? Yes, by increasing the probability of the pump not failing with 0. 05. The chance of survival increases to 0. 99713 Mr H. S. fell asleep on one of the plant's couches. When he wakes up he hears someone scream: " There is one or more warning signals beeping in your control room! ". Mr H. S. realizes that he does not have time to fix the error before it is to late (we can assume that he wasn't in the control room at ll). What is the chance of survival for Mr H. S. if he has a car with the same properties as the owner? (notice that this question involves a disjunction which can not be answered by querying the network as is)

Clarification: Maybe something could be added to or modified in the network. By adding a new node called warning, which represents the OR-relationship of WaterLeakWarning and PumpFailureWarning, i. e. Warning is true if WaterLeakWarning is true or if PumpFailureWarning is true or if They are both true and is false if they are both false. P(survives) = 0. 98897 if Warning is observed true. What unrealistic assumptions o you make when creating a Bayesian Network model of a person?

That a persons actions are predictable and that he never gains more experience as time passes, which would effect the probabilities of his actions. Describe how you would model a more dynamic world where for example the " IcyWeather" is more likely to be true the next day if it was true the day before. You only have to consider a limited sequence of days. By adding nodes representing the weather of the previous days. E. g. one node representing the day before, one bubble representing the day before that and so on.