

DS 2500 Mar 20

notes part 2 (of 2)

Bayes Nets

- compute conditional probabilities with multiple random variables:
 - $P(ABC|XYZ) = P(ABCXYZ) / P(XYZ)$
- bayes net motivation, definition
- computing conditional probabilities
 - via spreadsheet ("computer" method)

(enjoy Bayes Nets?

see "Probabilistic Graphical Models" Daphne Koller & Coursera course)

WHAT ARE BAYES NETS
GOOD FOR?

source: <https://sites.pitt.edu/~druzdzel/psfiles/cbmi99a.pdf>

Bayesian Network (Bayes Net)



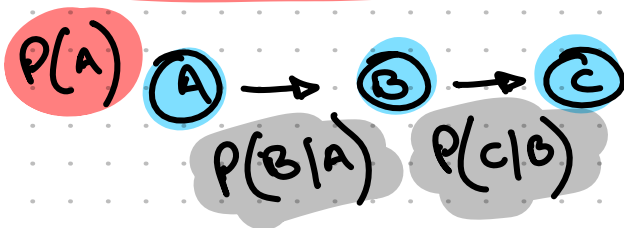
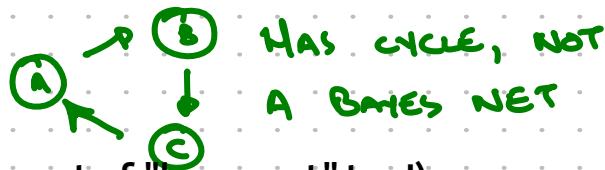
(formally):

A directed, **acyclic** graph which represents conditional distributions / independences between a set of random variables.

each node represents a random variable

directed edges represent conditional distributions

any node without inward edges has prob specified (its part of "Bayes net" too!)



(informally):

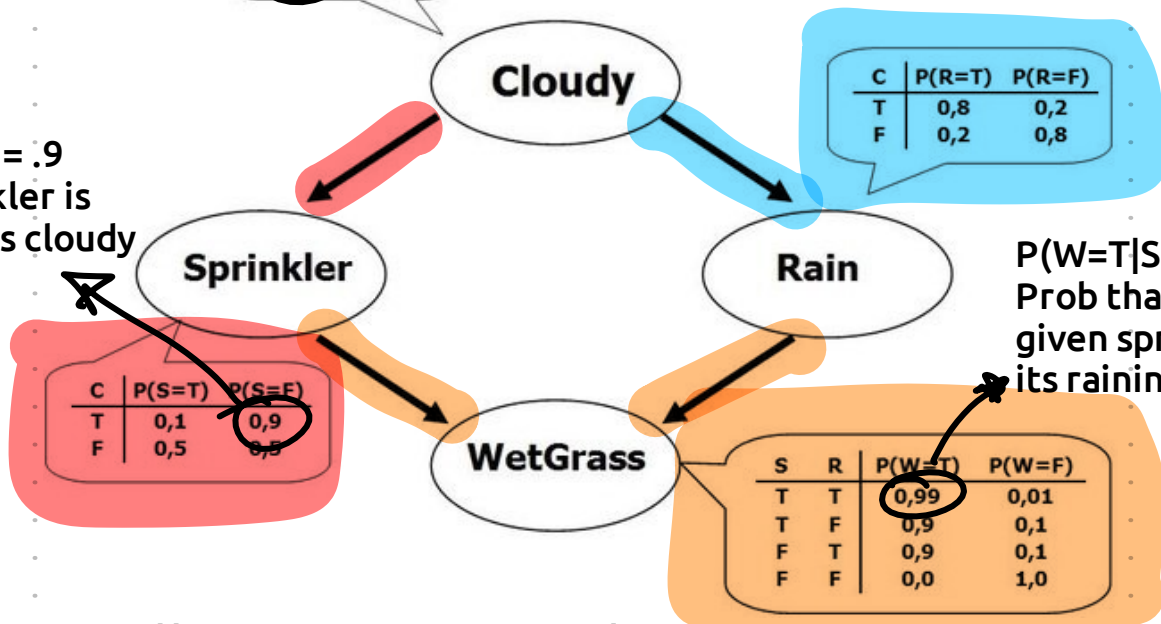
a network which describes how random variables influence each other. can be used to compute conditional probabilities of interest

ANATOMY OF BAYES NET

Prob Cloudy = True is 50%

	P(C=T)	P(C=F)
	0,5	0,5

$P(S=F|C=T) = .9$
Prob sprinkler is off given it's cloudy out is 90%

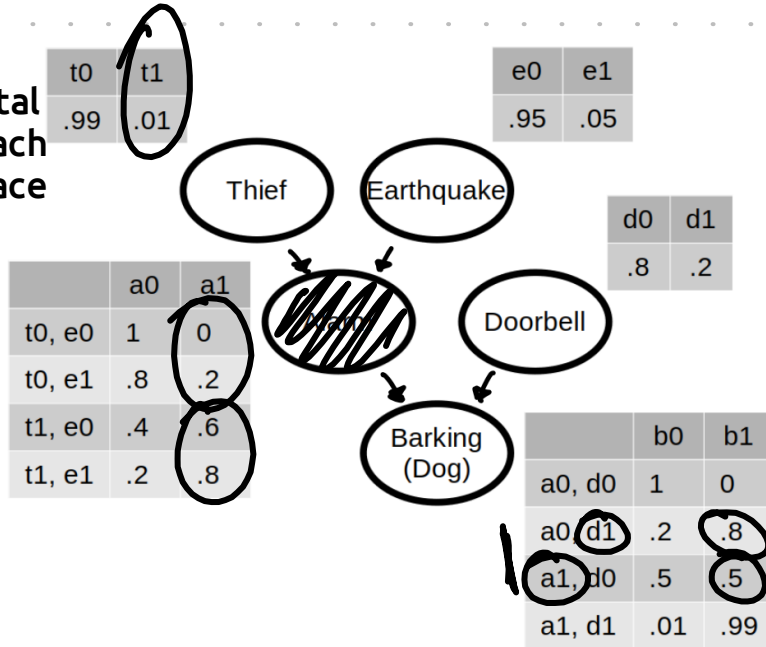


$P(W=T|S=T, R=T) = .99$
Prob that grass is wet given sprinkler is on and its raining is 99%

BAYES NET NOTATION (OUR CONVENTION)

Each random variable is denoted with a capital letter (T for Thief). Each outcome in sample space has its own lowercase letter :

t0 = no thief
t1 = thief



(quick) ICA 2:

what's prob of earthquake?

$$P(e_1) = .05$$

given a thief in house, but no earthquake, what's prob alarm goes off?

$$P(a_1 | t_1, e_0) = .6$$

interpretation question:

- is alarm better at detecting thieves or earthquakes?

- which sound bothers the dog more, the alarm or doorbell?

THIEVES
DOORBELL

In Class Assignment 3:

Estimate / intuit the four probabilities below. Except for the first, you needn't compute a precise number, but tell if it is greater / lesser / equal to the prob immediately above it.

What is the prob of thief? $P(t_1) = .01$

Given that alarm is going off, what is prob of thief? $P(t_1 | a_1) > P(t_1)$

Given that alarm is going off & dog is barking, what is prob of thief?

Given that alarm is going off, dog is barking & earthquake, what is prob of thief? $P(t_1 | a_1, b_1, e_1) \stackrel{?}{=} P(t_1 | a_1)$

$$P(t_1 | a_1, b_1, e_1) < P(t_1 | a_1, b_1)$$