SNS COLLEGE OF ENGINEERING

Kurumbapalayam(Po), Coimbatore – 641 107
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Department of AI &DS

Course Name – 23ADT201 ARTIFICIAL INTELLIGENCE

II Year / III Semester

UNIT 5

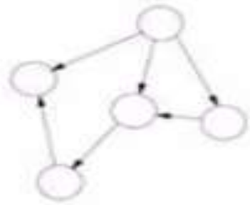
PROBABILISTIC REASONING

Probabilistic reasoning

CASE STUDY:

A case study on probabilistic reasoning in AI is spam email filtering, where probabilistic models assess the likelihood that an email is spam based on features like keywords and sender information. This approach enables filtering with accuracy despite uncertainty in email content.

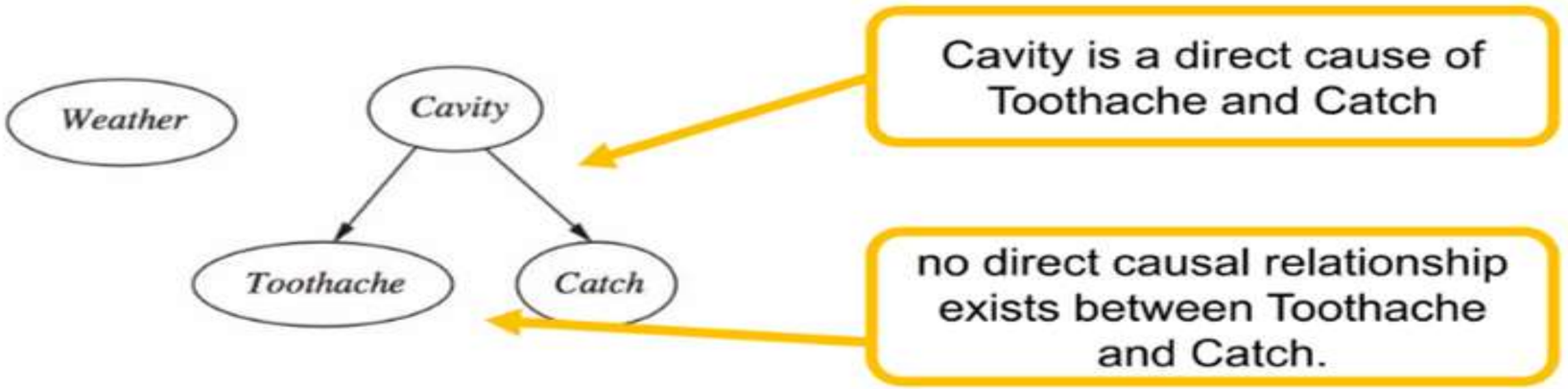
- Bayesian Networks
  - A directed graph in which each node is annotated with quantitative probability information



  - Definition
    - 1. Each node corresponds to a random variable, which may be discrete or continuous
    - 2. A set of directed links or arrows connects pairs of nodes. (If there is an arrow from node X to node Y , X is said to be a *parent* of Y.)
    - 3. The graph has no directed cycle.
    - 4. Each node X_i has a conditional probability distribution $\mathbf{P}(X_i|Parents(X_i))$ that quantifies the effect of the parents on the node.

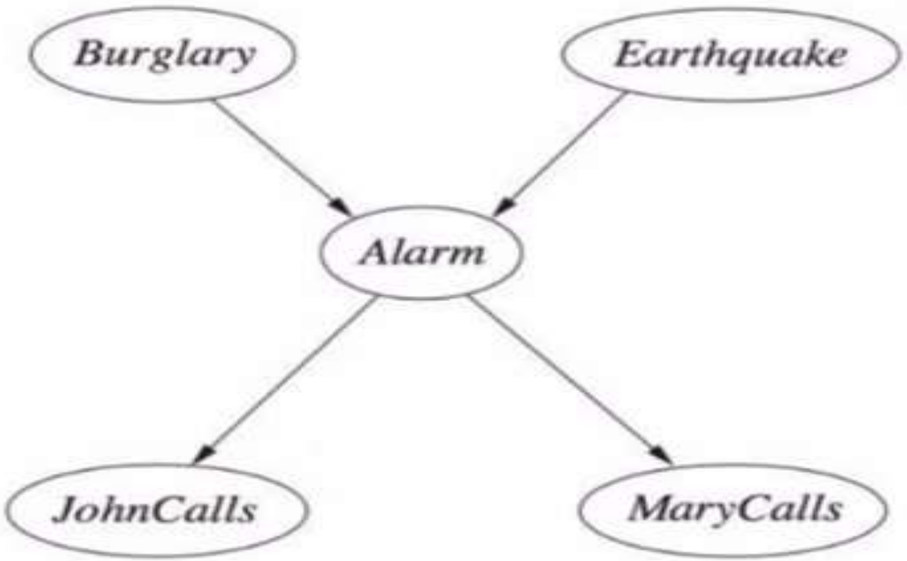
EXAMPLE

- The variables *Toothache* , *Cavity*, *Catch*, and *Weather*
  - *Weather* is independent of the other variables
  - *Toothache* and *Catch* are conditionally independent, given *Cavity*



- The variables *Burglary*, *Earthquake*, *Alarm*, *MaryCalls* and *JohnCalls*
  - New burglar alarm installed at home
  - Fairly reliable at detecting a burglary
  - Responds on occasion to minor earthquakes
  - Two neighbors, John and Mary
  - They call you at work when they hear the alarm
  - John nearly always calls when he hears the alarm
  - But sometimes confuses the telephone ringing
  - Mary likes rather loud music and misses the alarm

Give the evidence of who has or has not called, then estimate the probability of a burglary



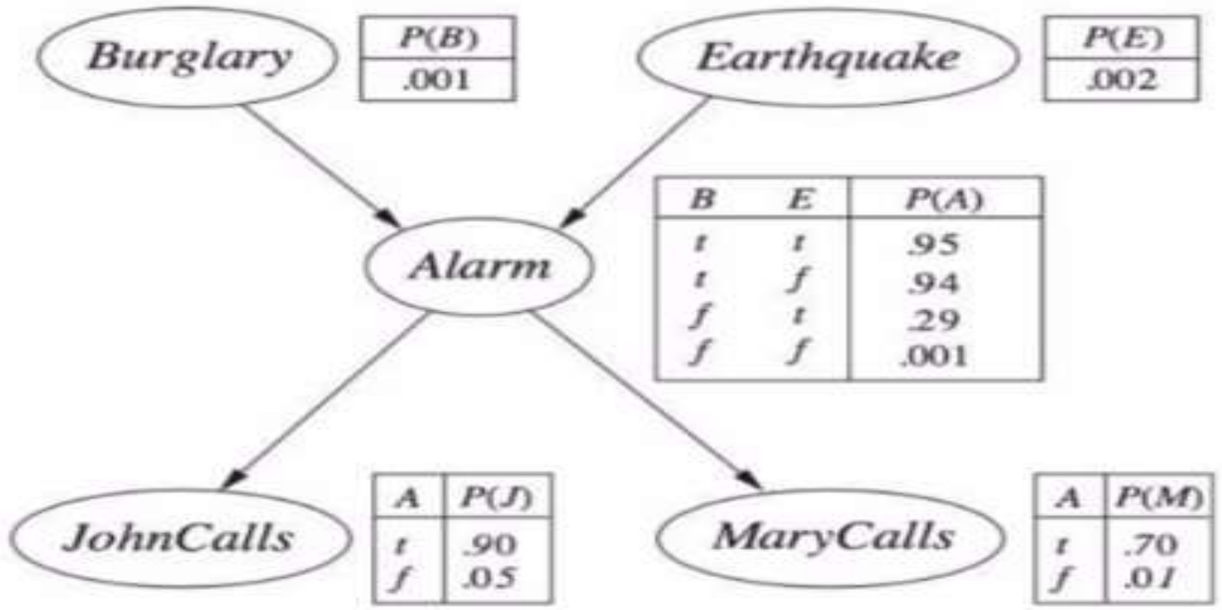
Burglary and Earthquakes directly affect the probability of the alarm's going off

John and Mary call depends only on the alarm

The network represents our assumptions that they do not perceive burglaries directly, they do not notice minor earthquakes, and they do not confer before calling

- Conditional Probability Table(CPT)
  - Each row contains the conditional probability of each node value
  - Conditioning case is a combination of values for the parent nodes
  - Each row must sum to 1
  - The entries represent an exhaustive set of cases for the variable
  - For Boolean variables, The probability of a true value is p, the probability of false must be 1 – p
  - Boolean variable with k Boolean parents contains 2k specifiable probabilities
  - A node with no parents has only one row, representing the prior probabilities of each possible value of the variable

B	*E*	*P*(*A*)
t	*t*	.95
t	*f*	.94
f	*t*	.29
f	*f*	.001


Burglary
P(B)
.001
Earthquake
P(E)
.002
Alarm
B E P(A)
t t .95
t f .94
f t .29
f f .001
JohnCalls
A P(J)
t .90
f .05
MaryCalls
A P(M)
t .70
f .01

THANK YOU