A spam classifier based on Bayes network

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INTRODUCTION

THE BAYESIAN APPROACH

- Bayes rule:

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{P(B|A)P(A)}{P(B)}$$

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- This has led to two different interpretations of the theorem.

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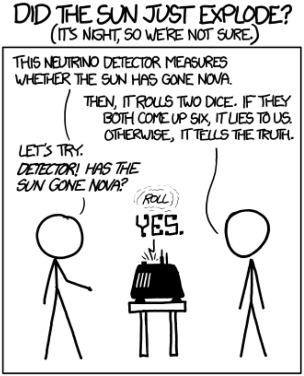
- $P(B|A)P(A)$ is the *prior* probability
- $P(B) = \sum_{a \in A} P(B|A = a)P(A = a)$ is the *total* probability

THE BAYESIAN APPROACH

Frequentists vs. Bayesians



from http://xkcd.com/1132, see also
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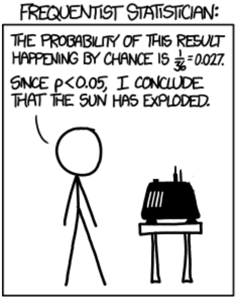

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The frequentist relies on the theoretical probability of the events.

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The bayesian observes the past events occurred, and adapts the probability accordingly.

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A Bayes network is a way to describe causal relationships between events.

- Nodes = events
- (Directed) Edges = causal relationship

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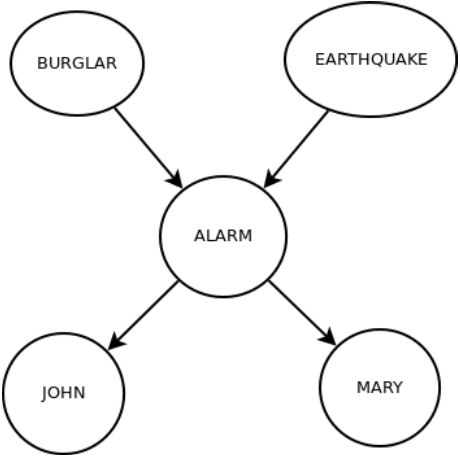
A Bayes network is a way to describe causal relationships between events.

- Nodes = events
- (Directed) Edges = causal relationship
- Two nodes are connected by an edge: the child of an arc is influenced by its ancestor in a probabilistic way

AN EXAMPLE



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  then we say that B and C are *conditionally independent*.
- Note that *conditional independence* $\neq$ *independence*
- Explaining away: if we know that one possible cause of the event has happened, this may *explain away* the event, being all the other causes less probable once we know the one that happened.

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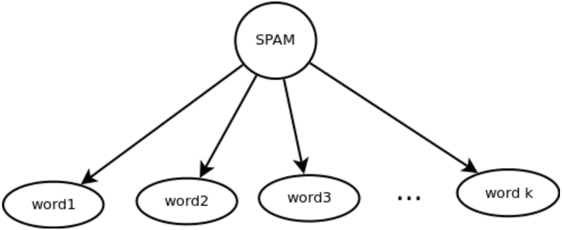
- It is called *naive*, since it's often unrealistic, but it yields good results.
- In spam classification:



SPAMBAYES

Python, to use Ply and BeautifulSoup
dataset: SpamAssassin archive

FRAME 1