# A spam classifier based on Bayes network

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Sistemi Intelligenti

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# Introduction

# FRAME 1

- Item A
- Item B
    - Subitem 1
    - Subtem 2
- Item C

# Frame 2

# FRAME 3

# The Bayesian approach

- Bayes rule:

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

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

# The Bayesian approach

Reshaping the formula:

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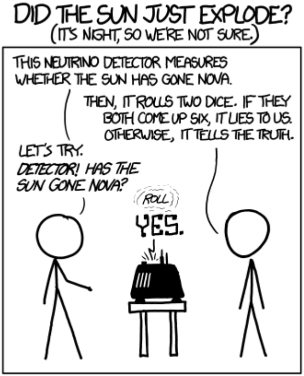
- $P(B|A)$ is the *likelihood*
- $P(B|A)P(A)$ is the *prior* probability
- $P(B) = \sum_{a \in A} P(B|A=a)P(A=a)$ is the *total* probability

# The Bayesian approach

Frequentists vs. Bayesians




from http://xkcd.com/1132, see also
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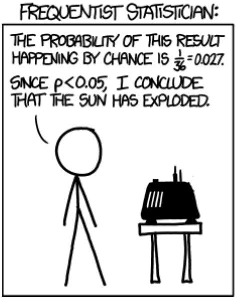
# The Bayesian approach

## Frequentists vs. Bayesians

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The frequentist relies on the theoretical probability of the events.

# THE BAYESIAN APPROACH

Frequentists vs. Bayesians


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

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- This is also only for the second page

# 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.

# CONDITIONAL INDEPENDENCE

¡1-¿If

$$P(A|B,C) = P(A|B)$$

then we say that $B$ and $C$ are *conditionally independent*. ¡2-¿ Note that *conditional independence* $\neq$ *independence*

# Naive Bayes

If, in a spam mail, we read the words “buy replica”, likely we’ll also read “watches”. This suggests to us to try all the possible subsets of words: this is $O(2^{|mail|})\dots$
Hence, we assume that every word is independent with respect to all the other ones, and each word brings its own contribute to the “spamminess” of the mail without being part of some longer locution. Surprisingly, this works very well in practice, and fast, since it can be done in linear time. This approach is called *naive*.

# SPAMBAYES

Python, to use Ply and BeautifulSoup
dataset: SpamAssassin archive

# FRAME 1