COMP3620 - Tutorial 0
Questions

February 18, 2009

1

An arts, a maths, a statistics, a physics and a philosophy student are asked the same question "What is the probability that the sun will rise tomorrow"? How do you think each person answered and why?

2

What is the next number in the following sequences?

a) 1, 2, ...
b) 1, 2, 3, 4, ...
c) 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, ...
d) 3, 1, 4, 1, 5, 9, 2, 6, 5, 3, ...

Can these have other continuations, other than the obvious ones? How many numbers are enough to be sure of a continuation?

3

Kolmogorov's axioms of probability
Note that countable additivity has been omitted. Let Ω be the sample space and all events are subsets of Ω, then the following hold:

(i) If A and B are events, then $A \cap B$ (intersection), $A \cup B$ (union) and $A \setminus B$ (difference) are also events.
(ii) The sample space Ω and the empty set $\emptyset$ are events.
(iii) There is a function p that assigns reals in the range $[0, 1]$, called probabilities, to each event.
(iv) $p(\Omega) = 1$.
(v) $p(\emptyset) = 0$.
(vi) $p(A \cup B) = p(A) + p(B) - p(A \cap B)$.

Conditional probability
$p(A|B) = \frac{P(A \cap B)}{p(B)}$.

Bayes' rule
Let D be a possible event ($p(D) > 0$) and H_i be a set of mutually exclusive hypotheses ($H_i \cap H_j = \emptyset \forall i \neq j$ and $\cup_{i \in I} = \Omega$). $p(H_i)$ is a priori plausibility of hypothesis H_i, $p(D|H_i)$ is the likelihood of event D under hypothesis H_i. Then we have:

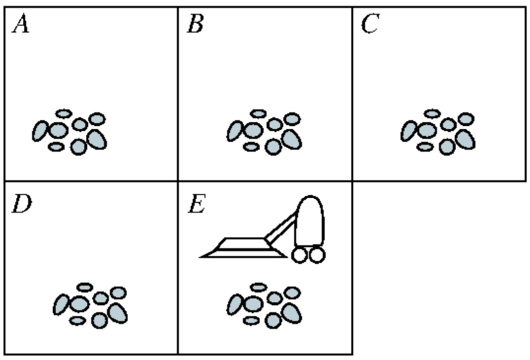
Posterior plausibility of hypothesis H_i is $p(H_i|D) = \frac{p(D|H_i)p(H_i)}{\sum_{i \in I} p(D|H_i)p(H_i)}$

Lets prove Bayes' rule using Kolmogorov's axioms of probability.

Now solve this problem. A disease occurs in 1% of the population. There exists a test for this disease, however it is not always correct. If a person has the disease then the test will return positive 95% of the time. Similarly, if a person does not have the disease then the test will return negative 95% of the time. If you are randomly chosen from the population and test positive, what is the probability that you have the disease? Many medical doctors will say about 95%, but are they right?

4

Consider a modified version of the vacuum cleaner problem from the lectures:



Percepts: curLoc - current location of vacuum, prevLoc - previous location of vacuum, status - Clean or Dirty.
Actions: Left, Right, Down, Up, Suck, NoOp.

Write a function advanced-vacuum-cleaner that guarantees that the vacuum cleans every room. The function takes [curLoc, prevLoc, status] and returns an action.