

A4: Bayesian Networks

This module presents Bayesian Networks as graphic tools which are well consolidated and of wide use nowadays to model uncertainty and reason with in intelligent systems. Uncertainty is modelled with probabilities and reasoning is based on Bayes' rule.

It begins by explaining the meaning of the networks to model reasoning with uncertainty, both casual and non-casual, and both from a structural (qualitative) point of view and parametric (quantitative). The next step is to pose questions to the network, in other words, to infer knowledge from observations or data that is being collected. Thus, we can ask, for instance, for the diagnosis of a disease or the most likely explanation for the observed evidence. The algorithms can obtain the exact or an approximate answer, in the latter case probably using Monte Carlo simulation. The network is built by analysing the problem with an expert, but can also be induced from a database. This is a current issue: how to obtain a structure and parameters for the network and for that machine learning methods will be discussed. Finally, by knowing how to build the network and how to use it to perform queries, it will be possible to see its application on decision making and other applications of great interest within Artificial Intelligence: computer vision, automatic classification, filtering of email, etc.