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University of Pretoria

Uncertainty Modelling in Artificial Intelligence

Presented by the Department of Statistics, University of Pretoria

Bayesian networks provide a powerful decision-making platform to reason under uncertainty. It has a long history of providing successful artificial intelligence (AI) solutions ranging from medical diagnosis to spam filtering to policy assessment. Inherent in Bayesian networks is a graphical representation of the model structure, combined with a probabilistic engine in order to account for uncertainty.

One of the greatest challenges (and probably the reason for relative slow development of Bayesian network applications in industry) is the development of the software as it requires a powerful user interface. In this **Uncertainty Modelling in Artificial Intelligence** course we use the commercially available software Bayesialab as the modelling platform and thereby focus on the methodology of Bayesian networks rather than the software development. Course attendees will have access to the Bayesialab educational licence for three months after the course.

Shifting knowledge to insight

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Course content

- Introduction
- Context
  - Motivation for Bayesian networks
  - Analytical modelling
- Theory
  - Probability theory
  - Causal networks
  - Bayesian networks
- Practical (in BayesiaLab software)
  - Constructing a Bayesian network (nodes, arcs and probabilities)
  - Inference in Bayesian networks
  - Bayesian network analysis (performance, sensitivity analysis and explanation)
  - Examples
- Bayesian network modelling (in BayesiaLab software)
- How to construct a Bayesian network with expert knowledge.
  - Structure design, quantification and documentation
  - How to use the model outputs
- How to construct a Bayesian network with data (machine learning)
  - Import data
  - Structural learning
  - Unsupervised and supervised learning
  - Machine learned Bayesian network workflow
- Communication
- How do I communicate the model output with clients?
  - BayesiaLab Web simulator and visualisation (3D and virtual reality)
  - Formulation of research questions
  - Report writing
- Case Studies
  - Policy assessment and impact analysis
  - Probabilistic structural equation modelling
  - Body measurements

Learning outcomes

After successfully completing this course, you will be able to

- understand the motivation for using Bayesian networks as an AI technique
- understand the basic probability theory principles and reasoning used in a Bayesian network
- construct a Bayesian network
- perform inference and post-inference analysis on a Bayesian network
- understand how to construct a Bayesian network from expert knowledge and from data
- visualise output in order to communicate results to the end-user, and
- understand and explore application areas in diverse domains.

Course fees

R8 050 per delegate (VAT incl.)
Course fees include all course material, refreshments and other materials.

Course fees must be paid in full 14 days prior to course start dates. Proof of payment can be submitted to enrolments@enterprises.up.ac.za.

Who should enrol?

This course is focused on industry and applied use of Bayesian networks. Applied researchers and developers in the following fields will benefit from this course: data science, econometrics, marketing, business intelligence, policy and decision management, risk management, engineering, environmental science and biostatistics.

Admission requirements

Prospective delegates should at least have a keen interest in quantitative modelling, an undergraduate degree and basic Excel skills. No previous programming skills are required.

Accreditation and certification

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Registration and enquiries

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