Systèmes de raisonnement probabilistes

Philippe LERAY
philippe.leray@univ-nantes.fr

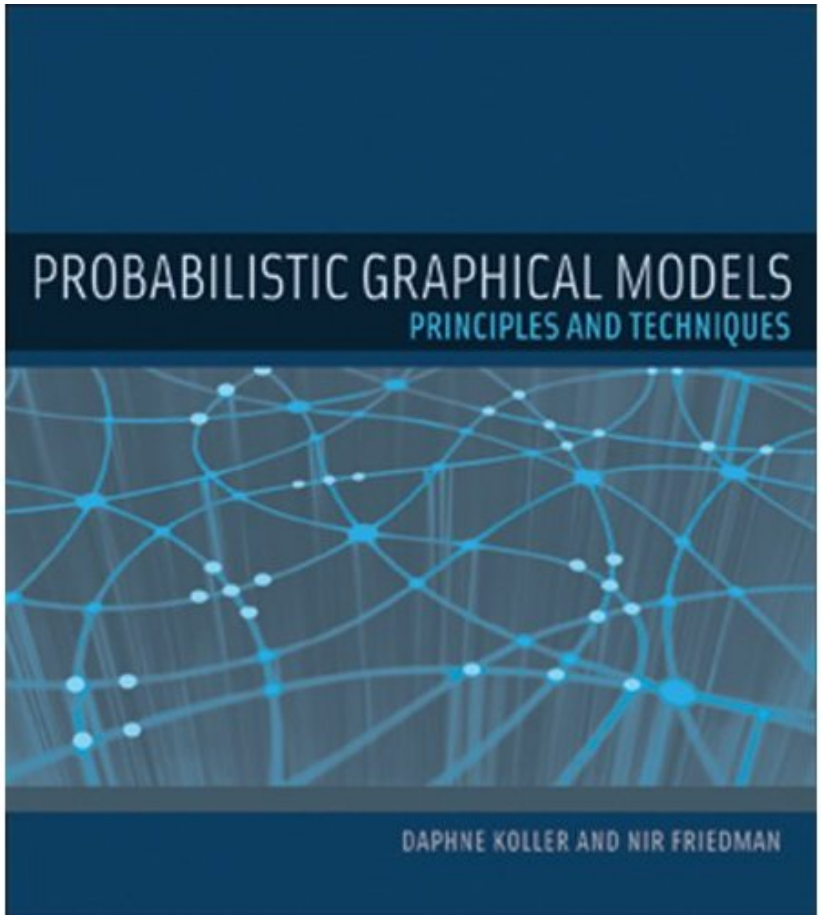
DUKe (Data User Knowledge) Research group
Laboratoire des Sciences du Numérique de Nantes – UMR 6004
Site de l'Ecole Polytechnique de l'université de Nantes







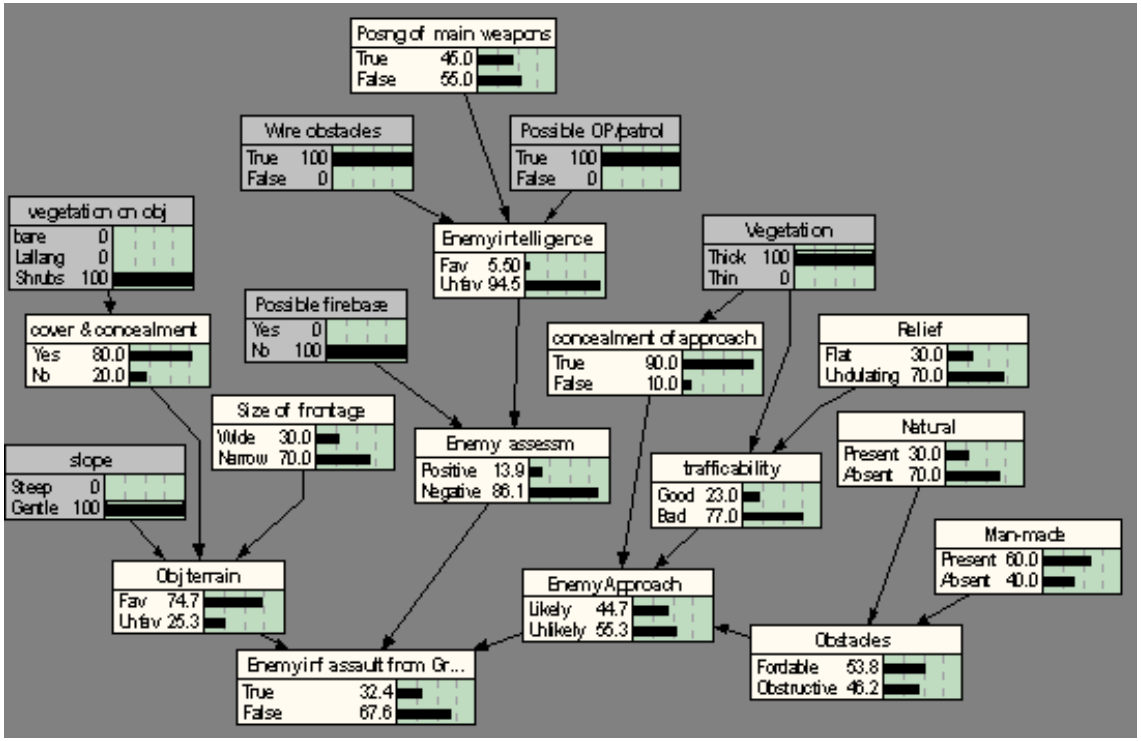
Introduction



Probabilistic Graphical Models

- Marriage between Graph theory and Probability theory
- Powerful framework for representing complex domains using probability distributions
- Numerous applications in machine learning, computer vision, natural language processing, computational biology, ...

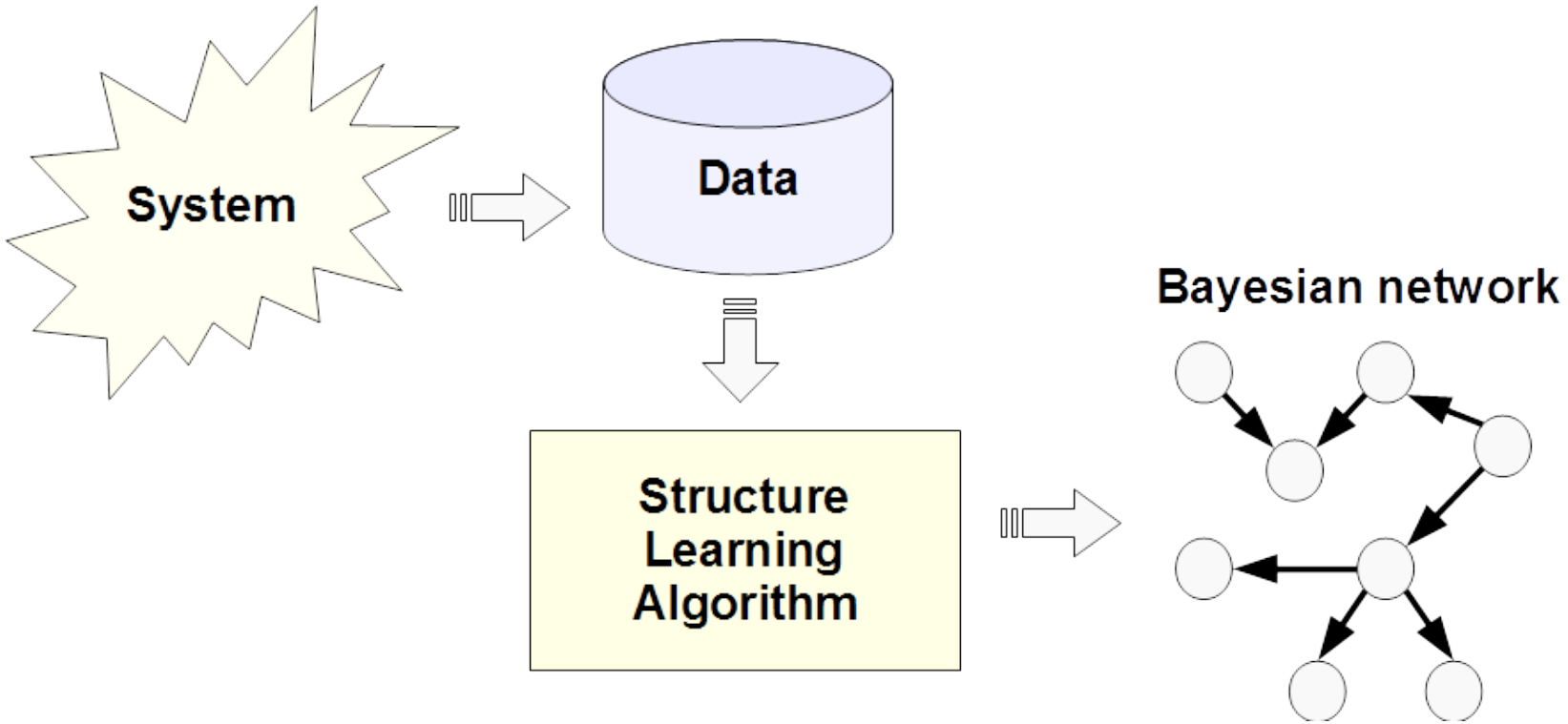
Bayesian networks for knowledge modeling and reasoning



Advantages

- Modeling uncertain relationships
- Reasoning from incomplete observations

Bayesian networks for knowledge discovery

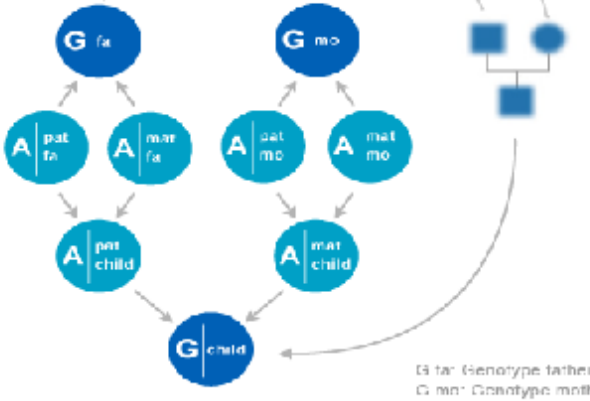


Advantages

- Structure learning from data
- Graphical interpretation

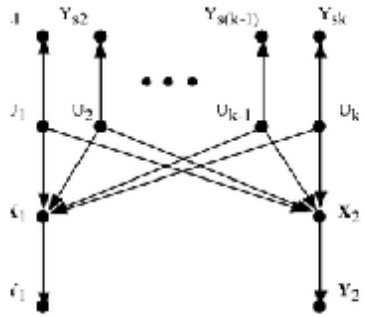
Bayesian networks applications

Victim identification system



G fa: Genotype father
G mo: Genotype mother
G child: Genotype child
A pat: Paternal Mother Allele
A mat: Maternel Mother Allele

Turbo-codes (GSM, ...)



Noisy information bits (visible)

Information bits (hidden)

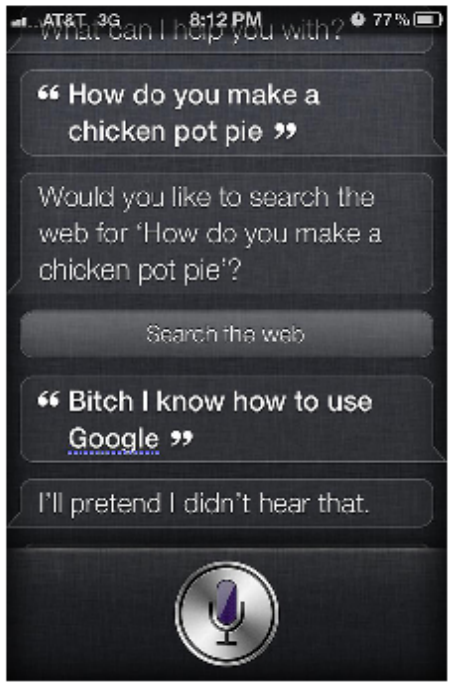
Codeword Fragments (hidden)

Noisy codeword Fragments (visible)

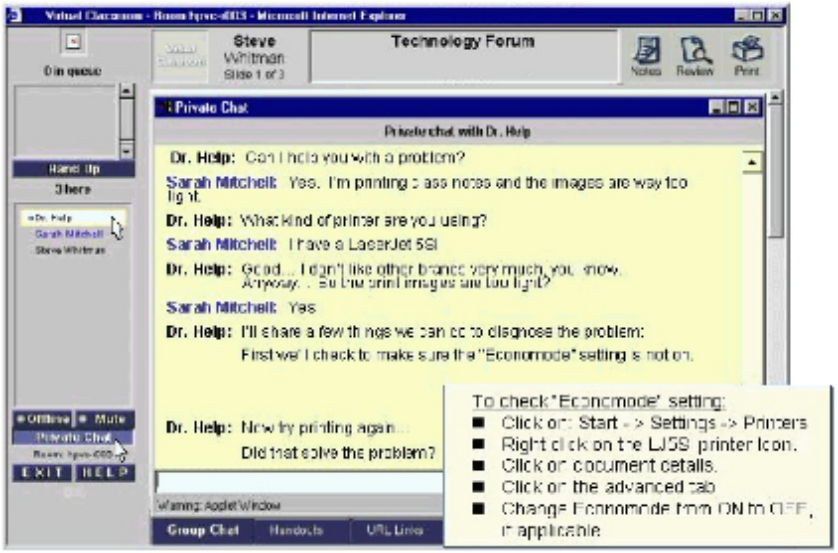
Anti Spam



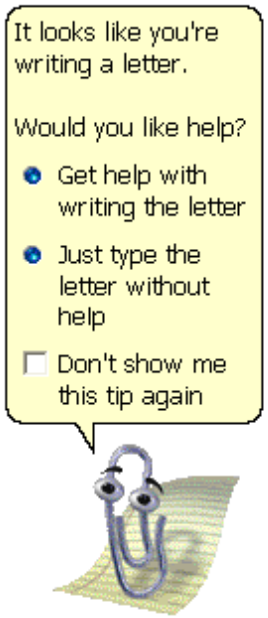
Assistant iPhone SIRI



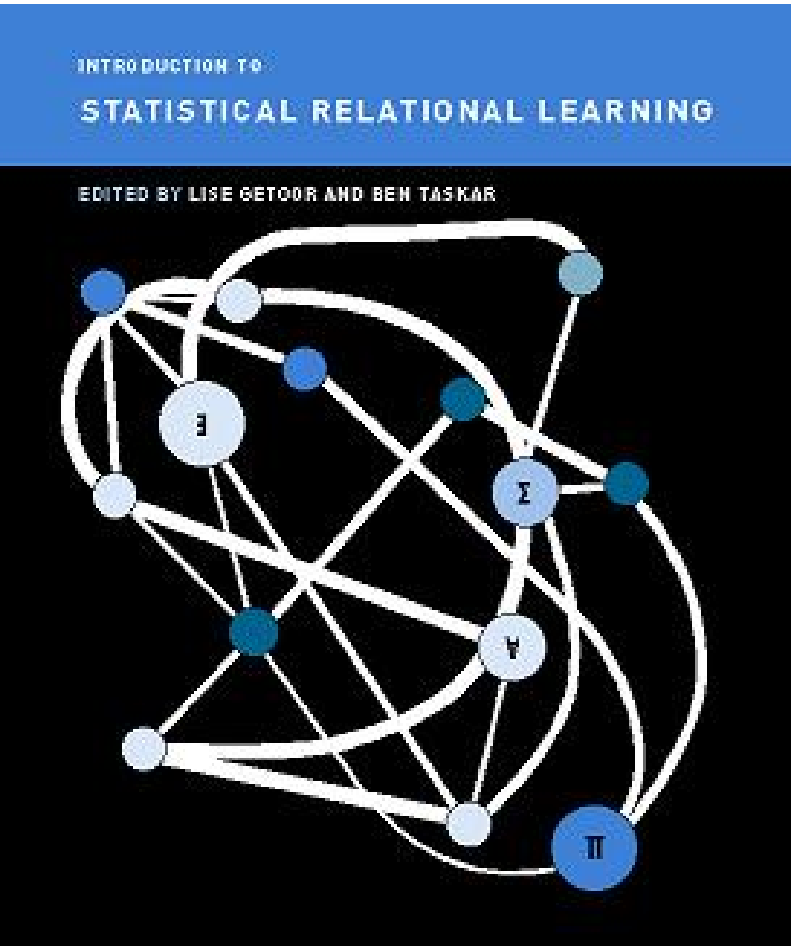
After-sale services



MS Office assistant



Some other PGMs



Several extensions or specific models

- BN for classification
- extensions to continuous or mixed data : Continuous Linear Gaussian BNs
- extensions to temporal modelling : dynamic BNs
- extensions to relational data : Probabilistic relational models
- ...

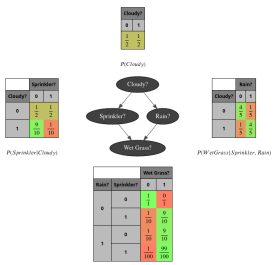
Syllabus

Organization : 8 CM+ 4 TD

- definition
- inference
- learning
- some extensions ? (DBN, PRM)

Personal work and evaluation

- one final exam
- one practical work report



One Python library to use on Google Colab

- https://pyagrum.readthedocs.io/