Softwares for probabilistic graphical models

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Overview of softwares for PGMs (BNs)

- Academic software environments (with GUI)
- Libraries
  - C, MATLAB, R, Python
- Languages
- Commercial systems

Bayesian network software environments

- SEBANN, Software Environment for Bayesian and Neural Networks, 1996-2004:
  - BN: exact inference (PPTC), stochastic (Gibbs), structure learning and Bayesian inference (DAG/PDAG/ordering-based)
  - MLPs: hybrid MCMC
  - Transfer learning: BN-to-MLP
  - Explainable AI: NLP integration
  - Péter Antal, Geert Fannes
- Bayesian Knowledge Discoverer, 1998
  - http://projects.kmi.open.ac.uk/bkd/
- Packages by ~2000
  - https://www.cs.ubc.ca/~murphyk/Bayes/old.bnsoft.html
- Packages by 2015
  - http://teklis.com/10-free-and-open-source-bayesian-network-software/
- GeNIe Modeler
  - https://www.bayesfusion.com/genie/
- MSBNX
  - Microsoft
- BNJ
- BayANet
  - http://www.cs.man.ac.uk/~gbrown/bayes_nets/
- ShinyBN, 2019
  - Chen, J., Zhang, R., Dong, X. et al. shinyBN: an online application for interactive Bayesian network inference and visualization. BMC Bioinformatics 20, 711 (2019).

Libraries for PGMs/BNs(/Bayesian NNs)

- BNet/SEBANN/BNF
  - C++
- DBN:
  - MATLAB
- pyBBN
  - Python: https://pypi.org/project/pybbn/
- pgmpy
  - Python: https://pgmpy.org/
- libpgm
  - Python: https://pythonhosted.org/libpgm/
- pomegranate
  - python

Bayesian network libraries (R)

https://cran.r-project.org/web/views/gR.html

- …
- **Bayesian Networks/Probabilistic expert systems**
- abn A graphical modelling formulation is used to construct Bayesian regression models for analyses of multivariate data.
- bnlearn Bayesian network structure learning via constraint-based (also known as 'conditional independence') and score-based algorithms. This package implements the Grow-Shrink (GS) algorithm, the Incremental Association (IAMB) algorithm, the Interleaved-IAMB (Inter-IAMB) algorithm, the Fast-IAMB (Fast-IAMB) algorithm, the Max-Min Parents and Children (MMPC) algorithm and the Hill-Climbing (HC) greedy search algorithm for both discrete and Gaussian networks, along with many score functions and conditional independence tests. Some utility functions (model comparison and manipulation, random data generation, arc orientation testing) are also included.
- gRain A package for probability propagation in graphical independence networks, also known as probabilistic expert systems (which includes Bayesian networks as a special case). Link: doi:10.18637/jss.v046.i10
- RHugin The Hugin Decision Engine (HDE) is commercial software produced by HUGIN EXPERT A/S for building and making inference from Bayesian belief networks. The RHugin package provides a suite of functions allowing the HDE to be controlled from within the R environment for statistical computing. The RHugin package can thus be used to build Bayesian belief networks, enter and propagate evidence, and to retrieve beliefs. Additionally, the RHugin package can read and write hkb and NET files, making it easy to work simultaneously with both the RHugin package and the Hugin GUI. A licensed copy of the HDE (or the trial version) is required for the RHugin package to function, hence the target audience for the package is Hugin users who would like to take advantage of the statistical and programmatic capabilities of R. Notice: RHugin is NOT on CRAN.
  Link: http://rhugin.r-forge.r-project.org/
- sparsebn Fast methods for learning sparse Bayesian networks from high-dimensional data using coordinate descent and sparse regularization. Designed to handle mixed experimental and observational data with thousands of variables with either continuous or discrete observations.

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Languages for probabilistic/causal modeling

- Bayesian inference
  - Bayesian inference Using Gibbs Sampling (BUGS, WinBUGS, 1989-)
  - https://www.mrc-bsu.cam.ac.uk/software/bugs/
- PRogramming in Statistical Modeling, PRISM
  - https://rjida.meijo-u.ac.jp/prism/
- OpenBEL (abandoned)
- Stan
  - https://mc-stan.org/
- PyMC3
  - https://docs.pymc.io/

Commercial decision support systems

- HUGIN
- Netica
- Bayesia: BayesLab