



Bayesian Networks and Decision Graphs (Information Science and Statistics)

By Thomas Dyhre Nielsen, FINN VERNER JENSEN

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This is a brand new edition of an essential work on Bayesian networks and decision graphs. It is an introduction to probabilistic graphical models including Bayesian networks and influence diagrams. The reader is guided through the two types of frameworks with examples and exercises, which also give instruction on how to build these models. Structured in two parts, the first section focuses on probabilistic graphical models, while the second part deals with decision graphs, and in addition to the frameworks described in the previous edition, it also introduces Markov decision process and partially ordered decision problems.

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Bayesian Networks and Decision Graphs (Information Science and Statistics) By Thomas Dyhre Nielsen, FINN VERNER JENSEN **Bibliography**

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Editorial Review

Review

From the reviews:

MATHEMATICAL REVIEWS

"This is indeed an invaluable text for students in information technology, engineering, and statistics. It is also very helpful for researchers in these fields and for those working in industry. The book is self-contained...The book has enough illustrative examples and exercises for the reader. All the illustrations are motivated by real applications. Moreover, the book provides a good balance between pure mathematical treatment and the applied aspects of the subject."

"The Bayesian network (BN), or probabilistic expert system, is technology for automating human-life reasoning under uncertainty in specific contexts. ... the book does an admirable job of concisely explaining a great range of concepts and techniques. ... the book is very well written and to my knowledge nothing else meets its specific goal of quickly equipping the reader with both practical skills and sufficient theoretical background. ... I certainly would not want to try to implement a BN application without reading this book." (David Tritchler, *Sankhya: Indian Journal of Statistics*, Vol. 64 (B Part 3), 2002)

"Professor Jensen is certainly one of the most influential researchers in the field of Bayesian networks and it is not surprising that this book represents a very clear and useful presentation of the main properties and use of graphical models. ... I think that the present volume represents a useful integration of other material and a compact guide for either a student who wants an introduction to the field or a teacher who needs a reference for a course on probabilistic reasoning in AI." (Luigi Portinale, *The Computer Journal*, Vol. 46 (3), 2003)

"This book is an introduction to Bayesian networks at an accessible level for first-year graduate or advanced undergraduate students. ... I found this book to be an excellent introduction to the topic. It is well written, provides broad topic coverage, and is quite accessible to the non-expert. ... I think *Bayesian Networks and Decision Graphs* would make a fine text for an introductory class in Bayesian networks or a useful reference for anyone interested in learning about the field." (David J. Marchette, *Technometrics*, Vol. 45 (2), 2003)

"I can comfortably recommend this book as a primary source for topics related to Bayesian networks and decision graphs. This would be an excellent edition to any personal library." (*Technometrics*, February 2008)

From the reviews of the second edition:

"The present book provides a very readable but also rigorous and comprehensive introduction to the subject. It would make a very good text for a graduate or an advanced undergraduate course. ... Altogether, this is a very useful book for anyone interested in learning Bayesian networks without tears." (Jayanta K. Ghosh, *International Statistical Reviews*, Vol. 76 (2), 2008)

"This book is the second edition of Jensen's *Bayesian Networks and Decision Graphs* ... Each chapter ends with a summary section, bibliographic notes, and exercises. ... provides a readable, self-contained, and above all, practical introduction to Bayesian networks and decision graphs. Its treatment is appropriate not just for statisticians, but also for computer scientists, engineers, and other researchers with appropriate mathematical background. ... highly recommend it as a text or a useful reference for anyone interested in

probabilistic graphical models or decision graphs." (Alyson G. Wilson, *Journal of the American Statistical Association*, Vol. 104 (485), March, 2009)

“Devoted to Bayesian Networks or Graphical Models and Influence Diagrams, covering a full course with nice exercises It is useful as a reference for special topics. ... strongly recommended for readers or user of BNs who are interested in specifying dependency models. ... great importance to practitioners who try to find causality behind call-backs of products or crashes. ... the book can be recommended to anybody working on the interface of operations research, AI, statistics and computer science.” (Hans-J. Lenz, *Statistical Papers*, Vol. 52, 2011)

From the Back Cover

Probabilistic graphical models and decision graphs are powerful modeling tools for reasoning and decision making under uncertainty. As modeling languages they allow a natural specification of problem domains with inherent uncertainty, and from a computational perspective they support efficient algorithms for automatic construction and query answering. This includes belief updating, finding the most probable explanation for the observed evidence, detecting conflicts in the evidence entered into the network, determining optimal strategies, analyzing for relevance, and performing sensitivity analysis.

The book introduces probabilistic graphical models and decision graphs, including Bayesian networks and influence diagrams. The reader is introduced to the two types of frameworks through examples and exercises, which also instruct the reader on how to build these models.

The book is a new edition of *Bayesian Networks and Decision Graphs* by Finn V. Jensen. The new edition is structured into two parts. The first part focuses on probabilistic graphical models. Compared with the previous book, the new edition also includes a thorough description of recent extensions to the Bayesian network modeling language, advances in exact and approximate belief updating algorithms, and methods for learning both the structure and the parameters of a Bayesian network. The second part deals with decision graphs, and in addition to the frameworks described in the previous edition, it also introduces Markov decision processes and partially ordered decision problems. The authors also

1. provide a well-founded practical introduction to Bayesian networks, object-oriented Bayesian networks, decision trees, influence diagrams (and variants hereof), and Markov decision processes.
2. give practical advice on the construction of Bayesian networks, decision trees, and influence diagrams from domain knowledge.
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3. give several examples and exercises exploiting computer systems for dealing with Bayesian networks and decision graphs.
4. present a thorough introduction to state-of-the-art solution and analysis algorithms.

The book is intended as a textbook, but it can also be used for self-study and as a reference book.

Finn V. Jensen is a professor at the department of computer science at Aalborg University, Denmark.

Thomas D. Nielsen is an associate professor at the same department.

About the Author

Finn V. Jensen is professor of computer science at the University of Aalborg.

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