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The Cross-Entropy Method: A Unified Approach To Combinatorial Optimization, Monte-Carlo Simulation And Machine Learning (Information Science And Statistics)

Synopsis

Rubinstein is the pioneer of the well-known score function and cross-entropy methods. Accessible to a broad audience of engineers, computer scientists, mathematicians, statisticians and in general anyone, theorist and practitioner, who is interested in smart simulation, fast optimization, learning algorithms, and image processing.

Book Information

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Customer Reviews

From the reviews: "Rarely have I seen such a dense and straight to the point pedagogical monograph on such a modern subject. This excellent book, on the simulated cross-entropy method (CEM) pioneered by one of the authors (Rubinstein), is very well written..." Computing Reviews, Stochastic Programming November, 2004 "...I wholeheartedly recommend this book to anybody who is interested in stochastic optimization or simulation-based performance analysis of stochastic systems." Gazette of the Australian Mathematical Society, vol. 32 (3) 2005 "This book describes the cross-entropy method for a range of optimization problems. Ã¢â ¬Â| It is a substantial contribution to stochastic optimization and more generally to the stochastic numerical methods theory." (V.V.Fedorov, Short Book Reviews, Vol. 25 (1), 2005) "Since the CE method is a young and developing field, there is no book available in this area where the two authors are the pioneers. Therefore, it is quite a unique book and it may become a classic reference in the CE method literature." Technometrics, February 2005 "This book is a comprehensive introduction to the

cross-entropy method which was invented in 1997 by the first author Ã¢â ¬Â| . The book is Ã¢â ¬Â| written for advanced undergraduate students and engineers who want to apply the method. The authors made an effort to avoid formal mathematical

Ã¢â ¬Å“definition-lemma-theorem-proofÃ¢â ¬â„¢ style, aiming to promote the ideas and not burden the reader with too much technical detail. My impression is that they were quite successful." (J. Zerovnik, Journal of the Operational Research Society, Vol. 57 (12), 2006) "This book is a comprehensive review of the cross-entropy (CE) method and its various applications, in particular for rare-event simulation and combinatorial optimisation. Ã¢â ¬Â| Each chapter is copiously illustrated by numerical examples. Ã¢â ¬Â| we highly recommend this book to anybody curious about simulation methods, or more generally about applied probability. The principle behind the CE method is remarkably simple and intellectually appealing, and the authors do a very good job of explaining how it works, and why it works well." (Nicolas Chopin, Journal of Applied Statistics, Vol. 33 (8), 2006) "The authors have produced a routine Ã¢â ¬Â| that identifies cases where CE codes not perform well, and thus alerts one when other methods may be more appropriate. Having FACE available to test CE performance enhances the attractiveness of both CE and this book. Ã¢â ¬Â| In summary, this book is a good introduction to CE for those who want to use the method, in particular, for optimization situations." (David E. Booth, Technometrics, Vol. 50 (1), 2008) "This book is a good introduction to the cross-entropy (CE) method, an approach to combinatorial optimization and rare-event simulation based on minimizing the cross-entropy Ã¢â ¬Â| between a sampling distribution and an unknown target distribution. It is intended to be Ã¢â ¬Å“accessible to advanced undergraduate students and engineers who simply want to apply the CE method in their work, while at the same time accentuating the unifying and novel ideas behind the CE method.Ã¢â ¬â„¢" (David Bulger, Zentralblatt MATH, Vol. 1140, 2008)

Editorial Reviews This book is a comprehensive and accessible introduction to the cross-entropy (CE) method. The book is based on an advanced undergraduate course on the CE method, given at the Israel Institute of Technology (Technion) for the last three years. It is aimed at a broad audience of engineers, computer scientists, mathematicians, statisticians and in general anyone, theorist and practitioner, who is interested in smart simulation, fast optimization, learning algorithms, image processing, et cetera. The aim of this book to is to present a text in which the CE method which was accessible to advanced undergraduate students and engineers who simply want to apply the CE method in their work, while at the same time accentuating the unifying and novel mathematical ideas behind the CE method, so as to stimulate further research at a postgraduate level. The

emphasis in this book is placed on concepts rather than on mathematical completeness.

The cross entropy method (CE) is a modern technique attacking optimization and estimation problems by simulation. It has been introduced by the first author and it is elaborated thoroughly in this book. The reader will find a lucid introductory chapter into the subject followed by the core of the book consisting of a chapter where CE returns an iterative algorithm for adaptive importance sampling simulation, and a chapter where CE is transformed into a randomized algorithm for solving combinatorial optimization problems. The book concludes with several chapters with applications including detailed numerical results and some Matlab codes.I read the book with great pleasure because it is a well written exposition of a fascinating method containing many illustrative examples and realistic applications. I think that it is appropriate for both practitioners and theorists in simulation and optimization. While reading the book I got encouraged to apply CE to several other problems because the CE basics seems so simple while the results are marvellous. I am interested specifically in rare event simulation so I focused on reading the simulation part where I found many inspiring new ideas. In fact, I applied CE to a reliability problem and obtained results far better than existing methods. The simulation chapter is the most mathematically oriented, for instance it gives a proof of convergence and it contains recent developments in simulation of rare events with heavy tails.I can recommend this book to everyone who likes to learn new ways for solving estimation and optimization problems.

The cross-entropy method is an exciting new technique for rare event simulation and stochastic optimization.The book unfortunately is a 99% copy and paste of the public available tutorials and papers. I bought the book before looking in the internet, so do not do the same mistake by me.Furthermore it is quite disappointing if every chapter is written in a highly redundant manner(which follows automatically if every chapter is a paper on its own).The topic and method is great but the book doesnt add much what the papers wont tell.

This book provides an excellent introduction to the Cross-Entropy (CE) method, which is a new and interesting method for the estimation of rare event probabilities and combinatorial optimisation.The book contains all of the material required by a practitioner or researcher to get started with the CE method. The fact that accompanying Matlab code is freely available renders this field especially accessible to new-comers.The book has a strong practical flavour, and is easy to read. It will be of interest to anybody working in the field of Monte-Carlo simulation and/or stochastic optimisation.

Although Cross Entropy is a relatively new methodology in optimization, there has seen an "explosion" of new articles offering theoretical extensions and new applications in the last few years. Hence, this book comes just in time to review the state of the art and help "new comers" enter this field. The method is presented in a clear, easy-to-follow manner and the best part of the book, in my opinion, is the focus on several areas of application where tough problems were already solved with CE. I have recently used this book to support a novel CE application to project management and found it extremely useful. I think it should become a standard piece in the "tool-box" of both scholars and practicionairs interested in optimization.

This is a great book intended for practitioners and "light" theoreticians. It contains precise explanations that show how to use the cross entropy method efficiently for both estimation of rare events and for optimization. The code is valuable and covers a large variety of applications. The book is deductive and easy to follow, and not cluttered with too much notations.I really liked the applications chapters - easy to follow and show what all the fuss is about. Seems like the kind of book you'd like to have around if you're actually solving optimization problems.

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