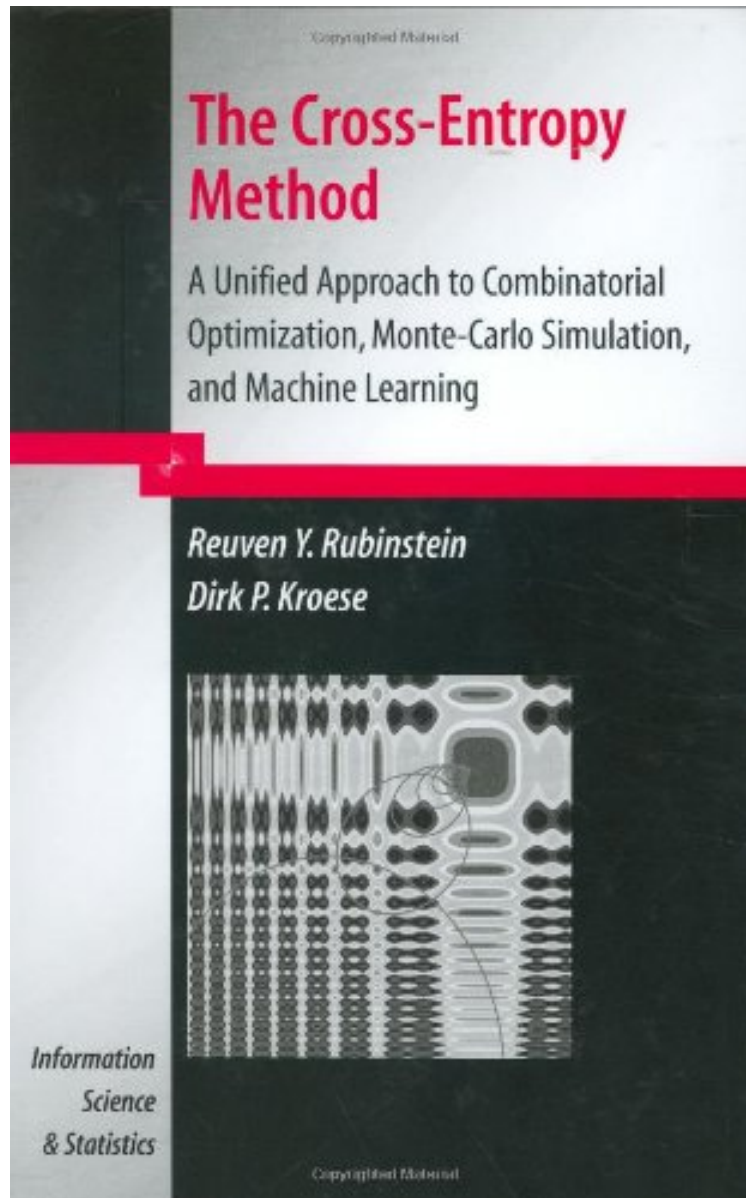


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# The Cross-Entropy Method: A Unified Approach to Combinatorial Optimization, Monte-Carlo Simulation and Machine Learning (Information Science and Statistics)

*Reuven Y. Rubinstein, Dirk P. Kroese*  
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#2018156 in Books Reuven Y Rubenstein 2004-07-28Original language:EnglishPDF # 1 9.21 x .75 x 6.14l, 1.29 #File Name: 038721240X301 pagesThe Cross Entropy Method A Unified Approach to Combinatorial Optimization Monte Carlo Simulation and Machine Learning | File size: 72.Mb

**Reuven Y. Rubinstein, Dirk P. Kroese : The Cross-Entropy Method: A Unified Approach to Combinatorial Optimization, Monte-Carlo Simulation and Machine Learning (Information Science and Statistics)** before purchasing it in order to gauge whether or not it would be worth my time, and all praised *The Cross-Entropy Method: A Unified Approach to Combinatorial Optimization, Monte-Carlo Simulation and Machine Learning (Information Science and Statistics)*:

2 of 5 people found the following review helpful. A great book about a fascinating method  
By Ad Ridder  
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.  
18 of 19 people found the following review helpful. Just read the papers and save your money  
By ghb  
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 doesn't add much what the papers won't tell.  
3 of 4 people found the following review helpful. Cross-entropy method  
By Andre Costa  
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.

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.

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 s, 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. It is a substantial contribution to stochastic optimization and more generally to the stochastic numerical methods theory." (V.V.Fedorov, *Short Books*, 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. The book is written for advanced undergraduate students and engineers who want to apply the method. The authors made an effort to avoid formal mathematical definition-lemma-theorem-proof 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. Each chapter is copiously illustrated by numerical examples. 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 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. 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 between a sampling distribution and an unknown target distribution. It is intended to be 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." (David Bulger, Zentralblatt MATH, Vol. 1140, 2008) From the Publisher Editorial s 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. From the Back Cover The cross-entropy (CE) method is one of the most significant developments in stochastic optimization and simulation in recent years. This book explains in detail how and why the CE method works. The CE method involves an iterative procedure where each iteration can be broken down into two phases: (a) generate a random data sample (trajectories, vectors, etc.) according to a specified mechanism; (b) update the parameters of the random mechanism based on this data in order to produce a "better" sample in the next iteration. The simplicity and versatility of the method is illustrated via a diverse collection of optimization and estimation problems. The book is aimed at a broad audience of engineers, computer scientists, mathematicians, statisticians and in general anyone, theorist or practitioner, who is interested in fast simulation, including rare-event probability estimation, efficient combinatorial and continuous multi-extremal optimization, and machine learning algorithms. Reuven Y. Rubinstein is the Milford Bohm Professor of Management at the Faculty of Industrial Engineering and Management at the Technion (Israel Institute of Technology). His primary areas of interest are stochastic modelling, applied probability, and simulation. He has written over 100 articles and has published five books. He is the pioneer of the well-known score-function and cross-entropy methods. Dirk P. Kroese is an expert on the cross-entropy method. He has published close to 40 papers in a wide range of subjects in applied probability and simulation. He is on the editorial board of Methodology and Computing in Applied Probability and is Guest Editor of the Annals of Operations Research. He has held research and teaching positions at Princeton University and The University of Melbourne, and is currently working at the Department of Mathematics of The University of Queensland. "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 s, Stochastic Programming November, 2004 "It is a substantial contribution to stochastic optimization and more generally to the stochastic numerical methods theory." Short Book s of the ISI, April 2005 "...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