



Hidden Markov Processes: Theory and Applications to Biology (Princeton Series in Applied Mathematics)

By M. Vidyasagar

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This book explores important aspects of Markov and hidden Markov processes and the applications of these ideas to various problems in computational biology. The book starts from first principles, so that no previous knowledge of probability is necessary. However, the work is rigorous and mathematical, making it useful to engineers and mathematicians, even those not interested in biological applications. A range of exercises is provided, including drills to familiarize the reader with concepts and more advanced problems that require deep thinking about the theory. Biological applications are taken from post-genomic biology, especially genomics and proteomics.

The topics examined include standard material such as the Perron-Frobenius theorem, transient and recurrent states, hitting probabilities and hitting times, maximum likelihood estimation, the Viterbi algorithm, and the Baum-Welch algorithm. The book contains discussions of extremely useful topics not usually seen at the basic level, such as ergodicity of Markov processes, Markov Chain Monte Carlo (MCMC), information theory, and large deviation theory for both i.i.d and Markov processes. The book also presents state-of-the-art realization theory for hidden Markov models. Among biological applications, it offers an in-depth look at the BLAST (Basic Local Alignment Search Technique) algorithm, including a comprehensive explanation of the underlying theory. Other applications such as profile hidden Markov models are also explored.

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Editorial Review

Review

"This book will serve as a solid and invaluable reference."--**Byung-Jun Yoon, *Quarterly Review of Biology***

From the Back Cover

"This book provides a terrific introduction to an important and widely studied field--Markov processes (including hidden Markov processes)--with a particular view toward applications to problems in biology. With a wonderful balance of rigor, intuition, and choice of topics, the book gives a unique treatment of the subject for those interested in both fundamental theory and important applications."--**Sanjeev Kulkarni, Princeton University**

"Vidyasagar uses sound scholarship to address hidden Markov processes and their application to problems in computational biology, in particular to genomics and proteomics. The well-organized book examines topics not often covered, such as realization theory and order determination for hidden Markov processes, and also looks at significant properties such as ergodicity and mixing. This work will be useful to systems researchers as well as computational biologists."--**Steve Marcus, University of Maryland**

About the Author

M. Vidyasagar is the Cecil and Ida Green Chair in Systems Biology Science at the University of Texas, Dallas. His many books include *Computational Cancer Biology: An Interaction Network Approach* and *Control System Synthesis: A Factorization Approach*.

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