1. Record Nr. UNINA9910478911203321

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Titolo	Bayesian Learning for Neural Networks [[electronic resource] /] / by Radford M. Neal
Pubbl/distr/stampa	New York, NY : , : Springer New York : , : Imprint : Springer, , 1996
ISBN	1-4612-0745-2
Edizione	[1st ed. 1996.]
Descrizione fisica	1 online resource (204 p.)
Collana	Lecture Notes in Statistics, , 0930-0325 ; ; 118
Disciplina	006.3
Soggetti	Probabilities Statistics Artificial intelligence Computer simulation Probability Theory and Stochastic Processes Statistics for Engineering, Physics, Computer Science, Chemistry and Earth Sciences Artificial Intelligence Simulation and Modeling
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Bibliographic Level Mode of Issuance: Monograph
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	1 Introduction -- 1.1 Bayesian and frequentist views of learning -- 1.2 Bayesian neural networks -- 1.3 Markov chain Monte Carlo methods -- 1.4 Outline of the remainder of the book -- 2 Priors for Infinite Networks -- 2.1 Priors converging to Gaussian processes -- 2.2 Priors converging to non-Gaussian stable processes -- 2.3 Priors for nets with more than one hidden layer -- 2.4 Hierarchical models -- 3 Monte Carlo Implementation -- 3.1 The hybrid Monte Carlo algorithm -- 3.2 An implementation of Bayesian neural network learning -- 3.3 A demonstration of the hybrid Monte Carlo implementation -- 3.4 Comparison of hybrid Monte Carlo with other methods -- 3.5 Variants of hybrid Monte Carlo -- 4 Evaluation of Neural Network Models -- 4.1 Network architectures, priors, and training procedures -- 4.2 Tests of the behaviour of large networks -- 4.3 Tests of Automatic Relevance Determination -- 4.4 Tests of Bayesian models on real data sets -- 5 Conclusions and Further Work -- 5.1 Priors for complex models -- 5.2

Hierarchical Models — ARD and beyond -- 5.3 Implementation using hybrid Monte Carlo -- 5.4 Evaluating performance on realistic problems -- A Details of the Implementation -- A.1 Specifications -- A.1.1 Network architecture -- A.1.2 Data models -- A.1.3 Prior distributions for parameters and hyperparameters -- A.1.4 Scaling of priors -- A.2 Conditional distributions for hyperparameters -- A.2.1 Lowest-level conditional distributions -- A.2.2 Higher-level conditional distributions -- A.3 Calculation of derivatives -- A.3.1 Derivatives of the log prior density -- A.3.2 Log likelihood derivatives with respect to unit values -- A.3.3 Log likelihood derivatives with respect to parameters -- A.4 Heuristic choice of stepsizes -- A.5 Rejection sampling from the prior -- B Obtaining the software.

Sommario/riassunto

Artificial "neural networks" are widely used as flexible models for classification and regression applications, but questions remain about how the power of these models can be safely exploited when training data is limited. This book demonstrates how Bayesian methods allow complex neural network models to be used without fear of the "overfitting" that can occur with traditional training methods. Insight into the nature of these complex Bayesian models is provided by a theoretical investigation of the priors over functions that underlie them. A practical implementation of Bayesian neural network learning using Markov chain Monte Carlo methods is also described, and software for it is freely available over the Internet. Presupposing only basic knowledge of probability and statistics, this book should be of interest to researchers in statistics, engineering, and artificial intelligence.