Guyon, Xavier
Random fields on a lattice. Modelling, statistics and applications. (Champs aléatoires sur un réseau. Modélisations, statistique et applications.) (French) Zbl 0758.62037

Here is a somewhat condensed table of contents: Chapter 1, Second order models on $Z^d$ [Spectral representations; various notions of regularity; ARMA and Markovian CAR models; identification of rational spectra; nonstationary models; multidimensional Gaussian Markov fields; mixing for linear fields].

Chapter 2, Gibbs fields and Markov fields [Gibbs fields; Markov fields and associated Gibbs potentials; Gaussian specifications; Gibbs models in image analysis].

Chapter 3, Limit theorems and parametric estimation for random fields [The ergodic theorem; strong law and convergence in mean square; central limit theorems; quasi-likelihood estimation; a.s. model identification for weakly dependent fields].

Chapter 4, Estimation for second order models [Empirical estimators and data tapering; quasi-likelihood Gaussian estimation; the Markovian Gaussian case; intrinsic models; nonparametric estimation of the spectrum].

Chapter 5, Estimation for Gibbs fields [Description of some methods; consistency; asymptotic laws and tests; the case of partial observation].

Chapter 6, Stochastic algorithms [Dynamics of a nonhomogeneous Markov chain; simulation algorithms, Gibbs sampler and Metropolis dynamic; simulated annealing; sampling and optimization under constraints; birth and death process dynamics; Gibbs sampler in the Gaussian case; stochastic algorithms for Gibbs models estimation; stochastic algorithms in image analysis].

There are exercises for each chapter. The level of preparation suggested is that of students in the third cycle of applied mathematics.

Reviewer: L. Weiss (Ithaca)

MSC:
62M40 Random fields; image analysis
62-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to statistics
62M30 Inference from spatial processes
60G60 Random fields

Keywords:
spectral representations; limit theorems; empirical estimators; notions of regularity; ARMA; Markovian CAR models; rational spectra; nonstationary models; multidimensional Gaussian Markov fields; mixing for linear fields; Gibbs fields; Markov fields; Gibbs potentials; Gaussian specifications; image analysis; parametric estimation; ergodic theorem; strong law; convergence in mean square; central limit theorems; quasi-likelihood estimation; a.s. model identification; weakly dependent fields; second order models; data tapering; intrinsic models; nonparametric estimation; consistency; partial observation; nonhomogeneous Markov chain; simulation algorithms; Gibbs sampler; Metropolis dynamic; simulated annealing; optimization under constraints; birth and death process; stochastic algorithms