Li

Markov Random Field Modeling in Image Analysis

Markov random field (MRF) theory provides a basis for modeling contextual constraints in visual processing and interpretation. It enables us to develop optimal vision algorithms systematically when used with optimization principles. This book presents a comprehensive study on the use of MRFs for solving computer vision problems. Various vision models are presented in a unified framework, including image restoration and reconstruction, edge and region segmentation, texture, stereo and motion, object matching and recognition, and pose estimation. This third edition includes the most recent advances and has new and expanded sections on topics such as: Bayesian Network; Discriminative Random Fields; Strong Random Fields; Spatial-Temporal Models; Learning MRF for Classification. This book is an excellent reference for researchers working in computer vision, image processing, statistical pattern recognition and applications of MRFs. It is also suitable as a text for advanced courses in these areas.

Markov random field (MRF) theory provides a basis for modeling contextual constraints in visual processing and interpretation. It enables systematic development of optimal vision algorithms when used with optimization principles. This detailed and thoroughly enhanced third edition presents a comprehensive study / reference to theories, methodologies and recent developments in solving computer vision problems based on MRFs, statistics and optimisation. It treats various problems in low- and high-level computational vision in a systematic and unified way within the MAP-MRF framework. Among the main issues covered are: how to use MRFs to encode contextual constraints that are indispensable to image understanding; how to derive the objective function for the optimal solution to a problem; and how to design computational algorithms for finding an optimal solution. Easy-to-follow and coherent, the revised edition is accessible, includes the most recent advances, and has new and expanded sections on such topics as: • Discriminative Random Fields (DRF) • Strong Random Fields (SRF) • Spatial-Temporal Models • Total Variation Models • Learning MRF for Classification (motivation + DRF) • Relation to Graphic Models • Graph Cuts • Belief Propagation Features: • Focuses on the application of Markov random fields to computer vision problems, such as image restoration and edge detection in the low-level domain, and object matching and recognition in the high-level domain • Presents various vision models in a unified framework, including image restoration and reconstruction, edge and region segmentation, texture, stereo and motion, object matching and recognition, and pose estimation • Uses a variety of examples to illustrate how to convert a specific vision problem involving uncertainties and constraints into essentially an optimization problem under the MRF setting • Introduces readers to the basic concepts, important models and various special classes of MRFs on the regular image lattice and MRFs on relational graphs derived from images • Examines the problems of parameter estimation and function optimization • Includes an extensive list of references This broad-ranging and comprehensive volume is an excellent reference for researchers working in computer vision, image processing, statistical pattern recognition and applications of MRFs. It has been class-tested and is suitable as a textbook for advanced courses relating to these areas.
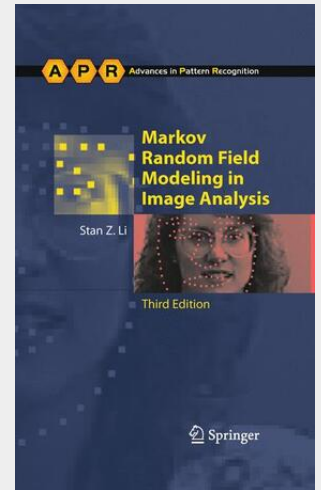
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