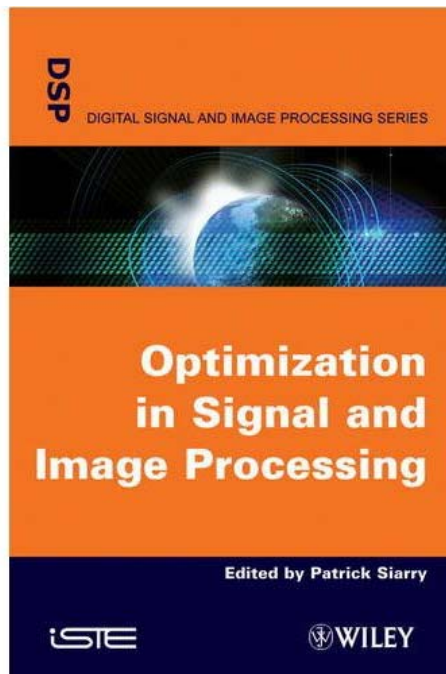


## PATRICK SIARRY (EDITOR) OPTIMIZATION IN SIGNAL AND IMAGE PROCESSING



**Wiley-ISTE**  
ISBN-13: 978-1-8482-1044-8  
Hardcover  
352 pages  
2009

The book *Optimization in Signal and Image Processing* has been written for researchers, university lecturers and engineers working at research laboratories, universities or in the private sector. This book is also destined to be used in the education and training of Ph.D. students as well as postgraduate and undergraduate students studying signal processing, applied mathematics and computer science. It studies some theoretical tools that are used in this field: artificial evolution and the Parisian approach, wavelets and fractals, information criteria, learning and quadratic programming, Bayesian formalism, probabilistic modeling, the Markovian approach, hidden Markov models and metaheuristics (genetic algorithms, ant colony algorithms, cross-entropy, particle swarm optimization, estimation of distribution algorithms (EDA) and artificial immune systems). Theoretical approaches are illustrated by varied applications that are relevant to signals or images. Some examples are also included in the book: analysis of 3D scenarios in robotics, detection of different aggregates in mammographic images, processing of hand-written numbers, tuning of sensors used in surveillance or exploration, underwater acoustic imagery, face recognition systems, detection of traffic signs, image registration of retinal angiography, estimation of physiological signals and tuning cochlear implants.

*Chapter 1* deals with the benefits of modelization and optimization in the analysis of images. In *Chapter 2* Pierre Collet and Jean Louchet present the so-called “Parisian” approach of evolutionary algorithms and how these algorithms are used in applications when processing signals and images. *Chapter 3* describes the use of wavelets and fractals when analyzing signals or images. *Chapter 4* deals with the information criteria and their applications when processing signals and images. *Chapter 5*, written by Gaëlle Loosli and Stéphane Canu, presents an aspect of optimization that can currently be encountered within signals and images, for example in shape recognition, i.e. learning processes. *Chapter 6* describes the problem of planning within time and space the use of sensors with the aim of optimizing the exploration and surveillance of a specific zone; given the rather low number of available sensors as well as their capacity, this zone is large. *Chapter 7* deals with a surveillance system such as a maritime patrol aircraft that needs to locate a moving target. *Chapter 8* presents segmentation methods of images which exploit both the Markovian modeling of images and the Bayesian formalism. *Chapter 9* was written by Sébastien Aupetit, Nicolas Monmarché and Mohamed Slimane and describes the use of hidden Markov models (HMM) for the recognition of images. In *Chapter 10* Guillaume Dutilleux and Pierre Charbonnier use different metaheuristics inspired by biology for the automatic detection of traffic signs. The majority of metaheuristics were initially created for the processing of problems that arise when dealing with discrete optimization. *Chapter 11*, written by Johann Dréo, Jean-Claude Nunes and Patrick Siarry, looks at their adaptation to applications with continuous variables, which are encountered frequently, especially in the field of signals and images. *Chapter 12*, written by Amine Naït-Ali and Patrick Siarry, describes the

introduction of a genetic algorithm used for the estimation of physiological signals, the Brainstem Auditory Evoked Potentials. *Chapter 13*, written by Pierre Collet, Pierrick Legrand, Claire Bourgeois-République, Vincent Péan and Bruno Frachet, presents an evolutionary algorithm that allows for the adjustment of parameters for a cochlear implant.

### Table of Contents

Chapter 1.	Modeling and optimization in image analysis <i>Jean Louchet</i> .....	1
Chapter 2.	Artificial evolution and the Parisian approach: applications in the processing of signals and images <i>Pierre Collet, Jean Louchet</i> .....	15
Chapter 3.	Wavelets and fractals for signal and image analysis <i>Abdeljalil Ouahabi, Djedjiga Aït Aouit</i> .....	45
Chapter 4.	Information criteria: examples of applications in signal and image processing <i>Christian Olivier, Olivier Alata</i> .....	79
Chapter 5.	Quadratic programming and machine learning. Large scale problems and sparsity <i>Gaëlle Loosli, Stéphane Canu</i> .....	111
Chapter 6.	Probabilistic modeling of policies and application to optimal sensor management <i>Frédéric Dambreville, Francis Celeste, Cécile Simonin</i> .....	137
Chapter 7.	Optimizing emissions for tracking and pursuit of mobile targets <i>Jean-Pierre Le Cadre</i> .....	169
Chapter 8.	Bayesian inference and Markov models <i>Christophe Collet</i> .....	195
Chapter 9.	The use of hidden Markov models for image recognition: learning with artificial ants, genetic algorithms and particle swarm optimization <i>Sébastien Aupetit, Nicolas Monmarche, Mohamed Slimane</i> .....	219
Chapter 10.	Biological metaheuristics for road sign detection <i>Guillaume Dutilleux, Pierre Charbonnier</i> .....	245
Chapter 11.	Metaheuristics for continuous variables. The registration of retinal angiography images <i>Johann Dréo, Jean-Claude Nunes, Patrick Siarry</i> .....	269
Chapter 12.	Joint estimation of dynamics and shape of physiological signals through genetic algorithms <i>Amine Naït-Ali, Patrick Siarry</i> .....	301
Chapter 13.	Using interactive evolutionary algorithms to help fit cochlear implants <i>Pierre Collet, Pierrick Legrand, Claire Bourgeois-Republique, Vincent Pean, Bruno Frachet</i> .....	329