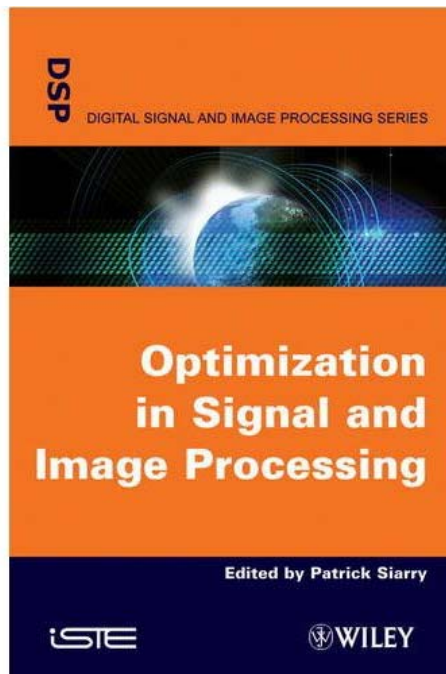# PATRICK SIARRY (EDITOR)
OPTIMIZATION IN SIGNAL AND IMAGE PROCESSING

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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.

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