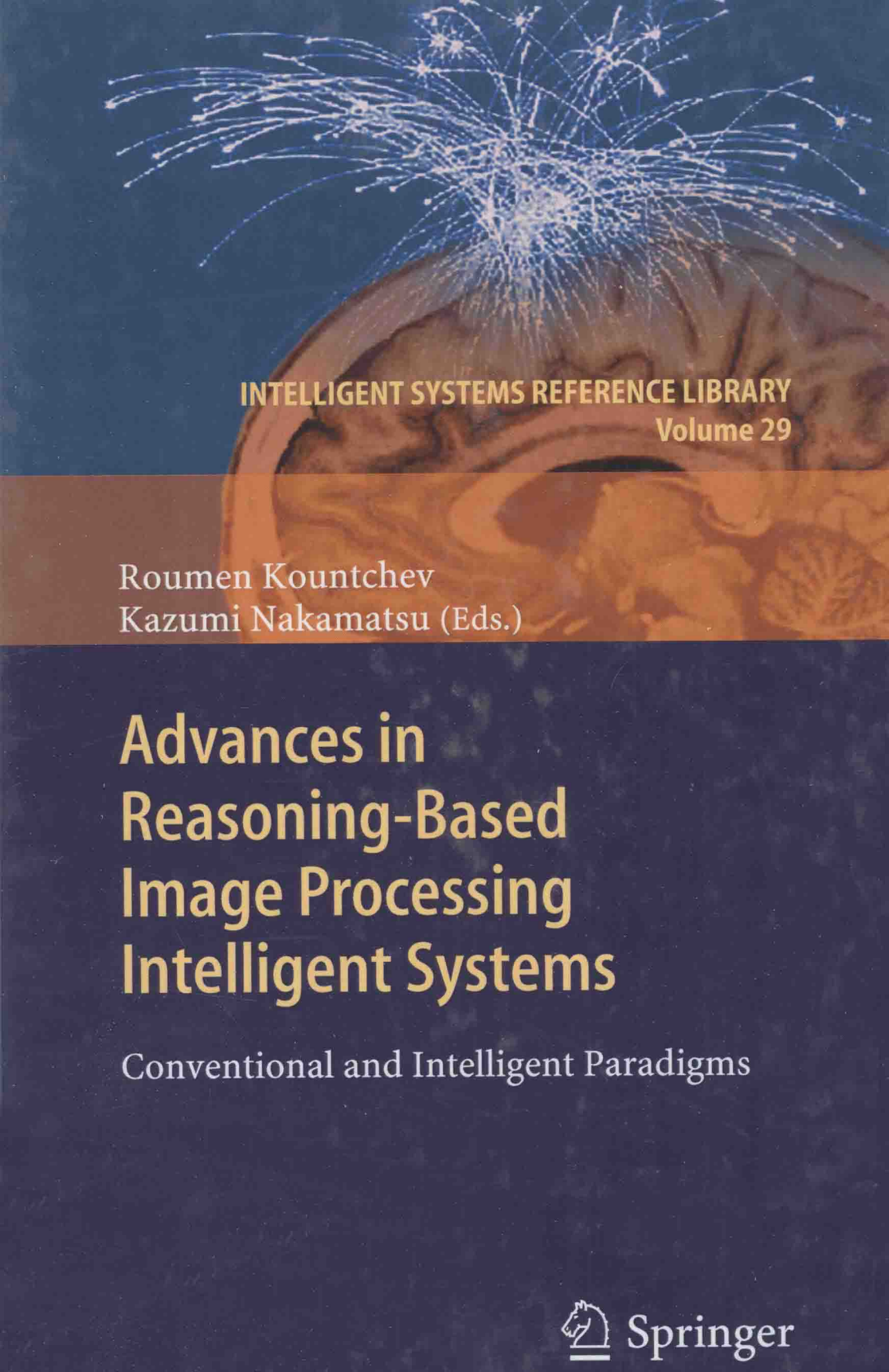




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Advances in Reasoning-Based Image Processing Intelligent Systems

Conventional and Intelligent Paradigms

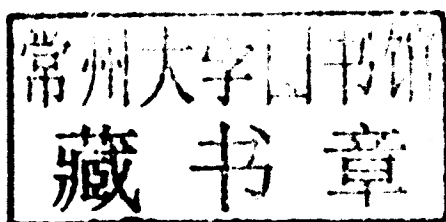


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Conventional and Intelligent Paradigms



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Part I

Intelligent Image Processing

Chapter 1

Advances in Reasoning-Based Image Processing and Pattern Recognition

Conventional and Intelligent Paradigms

The book puts special stress on the contemporary techniques for reasoning-based image processing and analysis: learning based image representation and advanced video coding; intelligent image processing and analysis in medical vision systems; similarity learning models for image reconstruction; visual perception for mobile robot motion control, simulation of human brain activity in the analysis of video sequences; shape-based invariant features extraction; essential of paraconsistent neural networks, creativity and intelligent representation in computational systems.

The book comprises 14 chapters. Each chapter is a small monograph, representing recent investigations of authors in the area. The topics of the chapters cover wide scientific and application areas and complement each-other very well. The chapters' content is based on fundamental theoretical presentations, followed by experimental results and comparison with similar techniques. In some chapters are included examples and tests, which facilitate the learning of the material and help the individual training of students and researchers. The size of the chapters is well-balanced which permits a thorough presentation of the investigated problems. The authors are from universities and R&D institutions all over the world; some of the chapters are prepared by international teams. The book will be of use for university and PhD students, researchers and software developers working in the area of digital image and video processing and analysis.

Organization

The book is divided into 2 parts, as follows:

Part I: Intelligent Image Processing

1.1 Introduction

In the last decade significant developments have been made in intelligent image processing, based on the use of large image databases, and the rules for their classification, through analyzing visual apperception mechanisms. A large number of new approaches for computer intelligence have been created, such as: structure evaluation of the image quality, based on vision models, artificial neural networks, fuzzy logic, evolutionary computation, expert systems, etc.

The basic trends in the image intelligent processing and analysis comprise:

- Data structures for image compression and analysis, based on various linear and non-linear models for image representation;
- Low level image processing: image acquisition by sensors;
- Preprocessing: noise suppression and enhancement of some object features, relevant to image understanding;
- Image restoration;
- Image segmentation: edge and region extraction to separate objects from the image background;
- Object description and classification: shape and texture representation and description;
- Motion analysis and 3D vision;
- Image and video retrieval;
- Intelligent data and video systems.

The chapters, included in this book depict the achievements of the authors in these scientific areas.

1.2 Performance Analysis and Comparison of the Dirac Video Codec with H.264/ MPEG-4, Part 10

The chapter presents the Dirac video codec, which is a hybrid motion-compensated state-of-the-art video codec that uses modern techniques such as wavelet transforms and arithmetic coding. It is an open technology designed to avoid patent infringement and can be used without the payment of license fees. It is well suited to the business model of public service broadcasters since it can be easily recreated for new platforms. Dirac is aimed at applications ranging from HDTV (high definition television) to web streaming. H.264, MPEG-4 part-10 or AVC, is the latest digital video codec standard which has proven to be superior to earlier standards in terms of compression ratio, quality, bit rates and error resilience. However unlike Dirac, it requires the payment of patent fees. The objective of this chapter is to analyze the Dirac video codec (encoder and decoder), based on several input test sequences, and to compare its performance with H.264/MPEG-4 Part 10 AVC. Analysis has been done on Dirac and H.264 using QCIF, CIF and SDTV video test sequences as input and the results recorded graphically for various parameters, including compression ratio, bit rate, PSNR, SSIM and MSE. In these tests, encoding and decoding has been performed for quality factor ranging from 0 - 10 and for lossless compression. Apart from this, comparison between Dirac and H.264's performance has been analyzed at various constant 'target' bit rates ranging from 10 KBps to 200 KBps. The test results indicate that Dirac's performance is comparable to that of H.264.

1.3 Linear and Non-linear Inverse Pyramidal Image Representation: Algorithms and Applications

In the chapter is presented one specific approach for image representation, known as Inverse Pyramid Decomposition (IPD), and its main applications. The chapter