

Preface to the 4th Edition, by C.H. Chen

Largely motivated by the rapid progress in pattern recognition and computer vision, as shown by a large number of journal and conference publications and the program of the latest ICPR (International Conference on Pattern Recognition), the 4th edition of the Handbook is published one year ahead of six year interval from the 3rd edition. The year 2010 also marks the 80th birthday of the late Prof. King-Sun Fu, for which this Handbook series is dedicated to.

As in the previous editions, the book consists of five parts, with all thirty-three chapters being new. Part 1 Basic Methods in Pattern Recognition Part 2 Basic Methods in Computer Vision and Image Processing, Part 3 Recognition Applications Part 4 Computer Vision and Pattern Recognition in Life Sciences and Human ID Part 5. System and Technology.

Chapter 1.1 of **Part 1** by F. D. Torre presents a unified approach to component analysis for pattern recognition, making use of least-squares weighted kernel reduced rank regression (LS-WKRRR). Chapter 1.2 by V. Gunes, et al. introduces and explains several essential concepts and components for building multiple classifier systems. Chapter 1.3 by H. Bunke and K. Riesen deals with graph based object representation and introduces a novel approach for graph embedding in vector space. Chapter 1.4 by E. Granger, et al. shows that match tracking parameter of fuzzy ARTMAP neural networks with particle swarm optimization can produce a significantly lower generalization error than with other match tracking strategies. Chapter 1.5 by T.A. Duong, et al. presents a bio-inspired approach to object recognition by taking a global view of an object that considers the shape feature as the logical building block and the color feature, if available, as additional information. Though Part 1 covers disjoint methods in pattern recognition, it reflects the divergent approaches to pattern recognition as the present time.

Chapter 2.1 of **Part 2** by L. Zhang, et al. introduces the concepts and basic types of probabilistic graphical methods, which are shown to perform important computer vision tasks such as facial expression recognition and image segmentation. Chapter 2.2 by C. Lei and Y. H. Yang presents a region-tree based

framework for general image discrete labeling problems with application to stereo matching and optical estimation.

Chapter 2.3 by T. Bouwmans, et al. has a comprehensive survey of the statistical background modeling in the context of moving object (foreground) detection. Chapter 2.4 by K. Kanatani, et al. presents a rigorous mathematical treatment of algorithms for 3-D reconstruction from two views. Chapter 2.5 by E. Rahtu and J. Heikkila considers affine invariance in feature extraction using normalization and invariant approaches with particular reference to multiscale framework that offers systematic tool to alleviate some of the basic problems encountered with traditional invariant techniques. Chapter 2.6 by N. Ohmishi, et al. presents an algorithm for detecting the dominant plane by using Independent Component Analysis for robot navigation. Chapter 2.7 by S. Tari considers creating a field within the shape domain with emergent structures capturing the parts automatically and the field is computed by minimizing an energy which captures both local and global as well as both region and boundary based interactions among shape points.

Thus Part 2 has covered an expanded set of topics in computer vision.

Chapter 3.1 of **Part 3** by G. Moser, et al. presents for the combined optical and synthetic aperture radar remote sensing image data a novel region-based semiparametric classification technique. Chapter 3.2 by L. Bruzzone and C. Persello has a comprehensive presentation of support vector machine for remote sensing classification. Chapter 3.3 by M. I. Shah and C.Y. Suen provides a comprehensive survey of word searching techniques to detect and locate instances of the given template/query images in the document image databases. Chapter 3.4 by C. L. He, et al. presents a novel rejection criterion that employs linear discriminant analysis to optimize the criterion for rejection in handwriting recognition. Chapter 3.5 by M. Liwicki and H. Bunke evaluates recognition techniques for whiteboard notes written in Roman scripts including the hidden Markov model (HMM)-based recognizer and the bidirectional long short-term memory networks. Chapter 3.6 by J. Kim and E. Andre investigates the automatic emotion recognition using physiological signals with physiological features extracted from various analysis domains for classification of four musical emotions using an extended linear discriminant analysis. Chapter 3.7 by F. Shih considers automatic solar flare detection with solar images observed by a telescope in the Big Bear Solar Observatory. Though Part 3 covers only a limited number of application areas it certainly reflects the emergence of many potential pattern recognition applications.

Chapter 4.1 of **Part 4** by Y. Feng and P.C. Yuen discusses the threats to biometric authentication systems and security enhancing schemes for biometric

recognition systems. Chapter 4.2 by S. Sarker, et al. presents a framework of the problem of recognition of continuous sign language, i.e. signs in sentences and not isolated signs or finger-spelled signs, by using combined manual and non-manual information. Chapter 4.3 by P. Manandhar, et al. considers the automated intra-vascular ultrasound image segmentation (IVUS) for diagnosis of coronary heart disease by using active contour model algorithm with special reference to tracking the change in guidewire position such that its effect on IVUS can be minimized. Chapter 4.4 by V. Gervasio and J.A. Jorge employs the interactive technique to improve the capability of active contour model in the segmentation of medical images. Chapter 4.5 by V. Meas-Yedid, et al. addresses the issues of both cell segmentation and spot detection for the images of biological objects. Chapter 4.6 by E. Zaharia and D. Maroulis presents the evolutionary genetic algorithms to automate the procedures of gridding microarray images and segmenting microarray spots, which are both challenging problems normally requiring human intervention. Chapter 4.7 deals with the multi-class protein folds recognition by using error-correcting output coding and ensemble classifier (support vector machine or flexible neural nets). Part 4 thus presents largely chapters that employ pattern recognition and computer vision techniques in life science problems.

Chapter 5.1 of **Part 5** by M.D. Levine and Y. Yu describes a 3D facial reconstruction system with the ability to recover a 3D human face from a single 2D frontal natural or standard image by using separately computed stages of shape reconstruction and texture recovery. Chapter 5.2 by J. Zhou and H. Peng formulates the automatic annotation as a pattern recognition problem with special focus on annotating fruitfly gene expression pattern images during embryogenesis and considering applications for multi-objective vs. mutual-exclusive annotation, and ROI vs. entire image annotation. Chapter 5.3 by Z. Ying and R. Naidu presents the dual energy computed tomography technology and associated Automated Threat Detection techniques in the context of checked baggage screening. Chapter 5.4 by M. Sun, et al. deals with assessment of food intake and physical activity by addressing the issue in food dimension measurement using spectral sensors and image processing models and algorithms, and presenting an effective computational method to characterize walking and jogging, Chapter 5.5 by E. Vallasques, et al. has a very detailed survey of watermarking systems employing evolutionary computation techniques that automatically set user-defined parameters of watermarking tasks and a case study is also presented. Chapter 5.6 by B. Lu and X. Wang presents a framework of large scale classification problems, such as a large scale Japanese patent classification problem, that has three independent components: decomposing

training data sets, training component or modular classifiers in parallel and combining trained component classifiers. Chapter 5.7 by G.B. Garibotto presents the main algorithms for human tracking around the 3D model based framework in an effort to implement an intelligent visual surveillance system. The topics covered in Part 5 again reflect the diversified activities in systems and technology.

The one sentence description of each chapter clearly is highly inadequate to present the excellent contributions by all authors. We should let each chapter to speak for itself and thus the readers are strongly encouraged to go over individual chapters in detail. The handbook is indeed very rich in information about the vibrant activities in theory, applications and technology in pattern recognition and computer vision.

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