Preface

The constantly changing landscape of Image Processing makes it challenging for experts and practitioners to stay apprized of the field's most up-to-date research. That is why Information Science Reference is pleased to offer this three-volume reference collection that will empower students, researchers, and academicians with a strong understanding of critical issues within Image Processing by providing both broad and detailed perspectives on cutting-edge theories and developments in the field. This collection is designed to act as a single reference source on conceptual, methodological, technical, and organizational issues, as well as provide insight into emerging trends and future opportunities within the discipline.

Image Processing: Concepts, Methodologies, Tools, and Applications is organized into six distinct sections that provide comprehensive coverage of important topics. The sections are (1) Fundamental Concepts and Theories, (2) Development and Design Methodologies, (3) Tools and Technologies, (4) Utilization and Application, (5) Organizational and Social Implications, and (6) Emerging Trends. The following paragraphs provide a summary of what readers may expect from this invaluable reference tool.

Section 1, Fundamental Concepts and Theories, serves as a foundation for this extensive reference with chapters addressing overall knowledge of Image Processing and current trends in the field. The section begins with *Image Analysis* by Detlev Droege, which describes techniques in eye tracking systems. Other chapters in this section cover topics ranging from visual saliency and reconstruction to computer vision and 3D modeling. Notable contributions include Radu Dobrescu and Dan Popescu's investigation of software platforms for three levels of Image Processing in their chapter *Real-Time Primary Image Processing,* as well as *Object Recognition with a Limited Database Using Shape Space Theory*, in which Yuexing Han, Bing Wang, Hideki Koike, and Masanori Idesawa set the groundwork for various computer vision applications. The final chapter of this section, *Salient Region Detection for Biometric Watermarking* by Ma Bin, Li Chun-lei, Wang Yun-hong, and Bai Xiao, forms a bridge between theory and methodology by investigating the specific case of biometric authentication.

Section 2, Development and Design Methodologies, builds on the framework established in the first section in order to model techniques for the effective utilization of Image Processing technologies. Several chapters in this section focus on a graph-based approach to evaluating methods of computer vision, including *Hypergraph Based Visual Segmentation and Retrieval* by Yuchi Huang and *Graph Matching Techniques for Computer Vision* by Mario Vento and Pasquale Foggia. Implications range from largely theoretical concerns, such as the texture-based image partitioning described in *Image Processing Applications Based on Texture and Fractal Analysis* by Radu Dobrescu and Dan Popescu, to more practical considerations, as in *Optical Coherence Tomography Image Interpretation and Image Processing Methodologies*, where Simon D. Thackray, Christos V. Bourantas, Poay H. Loh, Vasilios D. Tsakanikas, and Dimitrios I. Fotiadis apply the same basic principles to medical imaging and the detection of microstructures. The latter, empirical chapters in this section effectively segue into section three, which covers specific technologies used in Image Processing.

Section 3, Tools and Technologies, focuses primarily on Image Processing applications in robotics, computer vision, and machine learning. One example, *Inexpensive, Simple and Quick Photorealistic 3DCG Modeling* by Ippei Torii, Yousuke Okada, Manabu Onogi, and Naohiro Ishii, introduces a method of 3D image capture using a projector and Web cameras. *Visual Positioning in a Smartphone* by Laura Ruotsalainen and Heidi Kuusniemi uses the camera built into most contemporary mobile devices as an alternate method of location tracking by processing visual clues within photos and video taken from the camera. The final chapters in this section investigate Image Processing tools as they are used in the medical field, such as *Surgeon Assistive Augmented Reality Model with the use of Endoscopic Camera for Line of Vision Calculation* by Anastasia Daskalaki, Kostas Giokas, and Dimitris Koutsouris and *Image Processing for Localization and Parameterization of the Glandular Ducts of Colon in Inflammatory Bowel Diseases* by Stanislaw Osowski, Michal Kruk, Robert Koktysz, and Jaroslaw Kurek, both of which describe life-saving medical imaging technologies.

Section 4, Utilization and Application, applies the concepts and theories presented in the previous three sections to specific cases and scenarios making use of Image Processing techniques. In particular, this section elaborates on the medical imaging applications described in the final chapters of section three. *Computational Intelligence Techniques for Pattern Recognition in Biomedical Image Processing Applications* by D. Jude Hemanth and J. Anitha, *Statistical Analysis for Radiologists' Interpretations Variability in Mammograms* by Ahmad Taher Azar, and *Adaptive Intelligent Systems for Recognition of Cancerous Cervical Cells Based on 2D Cervical Cytological Digital Images* by Bernadetta Kwintiana Ane and Dieter Roller all make use of image analysis and pattern recognition in evaluating medical images. Other fields referenced in this section include precision agriculture, forensic anthropology, traffic analytics, space weather, and additional diverse areas of interest. This section's penultimate chapter, *Object Recognition via Contour Points Reconstruction Using Hurwitz - Radon Matrices* by Dariusz Jakóbczak describes a technique of machine vision used extensively in facial recognition, which leads effectively into the opening chapters of the following section.

Section 5, Organizational and Social Implications, narrows the focus to Image Processing applications with a particular influence on the human experience, such as surveillance networks and human-computer interfaces. The first chapters in this section concentrate on sensor networks and security applications, such as *Using Line Cameras for Monitoring and Surveillance Sensor Networks* by Jiang Yu Zheng and *Facial Image Processing in Computer Vision* by Moi Hoon Yap and Hassan Ugail. These chapters evaluate and explore processes of image analysis such as traffic monitoring, intrusion detection, object tracking, and facial recognition, technologies used primarily to ensure the safety of social interactions. The latter half of this section explores human interaction with mobile robots, a prime example being *Learning Robot Vision for Assisted Living*, in which Wenjie Yan, Elena Torta, David van der Pol, Nils Meins, Cornelius Weber, Raymond H. Cuijpers, and Stefan Wermter explore techniques in computer vision that will allow a robotic caretaker to effectively navigate complex indoor environments. Machine vision is a pervasive theme in this section, with applications in both primary topic areas.

Section 6, Emerging Trends, concludes the book with a look at how the field of Image Processing may evolve with the development of new applications and techniques. The section opens with *Advances in Region-of-Interest Video and Image Processing*, Dan Grois and Ofer Hadar's re-evaluation of some of the field's fundamental concepts, taking into consideration the widespread dissemination of advanced digital devices. Additional chapters in this section describe cutting edge application of Image Processing techniques, such as *Adapted Approach for Fruit Disease Identification using Images* by Shiv Ram Dubey and Anand Singh Jalal; *Visual Behavior Based Bio-Inspired Polarization Techniques in Computer Vi-*

sion and Robotics by Abd El Rahman Shabayek, Olivier Morel, and David Fofi; and *Image Processing for Solar Cell Analysis, Diagnostics and Quality Assurance Inspection* by Michael G. Mauk. The final chapter, *Replicating the Role of the Human Retina for a Cortical Visual Neuroprosthesis* by Samuel Romero, Christian Morillas, Antonio Martínez, Begoña del Pino, Francisco Pelayo, and Eduardo Fernández presents an inspiring vision of the future of Image Processing, exploring one of many methods by which these valuable techniques can be used to improve users' quality of life.

As a comprehensive collection of research on current findings related to the development of interdisciplinary technologies, *Image Processing: Concepts, Methodologies, Tools, and Applications* provides researchers, administrators, and all audiences with a complete understanding of the latest advances, applications, and concepts in Image Processing. Although the primary organization of the contents in this multi-volume work is based on its six sections, offering a progression of coverage on the important concepts, methodologies, technologies, applications, social issues, and emerging trends, the reader can also identify specific content by utilizing the extensive indexing system found at the end of each volume. Given the vast number of issues concerning usage, successes and failures, policies, strategies, and applications of Image Processing in countries around the world, *Image Processing: Concepts, Methodologies, Tools, and Applications* addresses the demand for a resource that encompasses the most pertinent research on the technologies being employed to globally bolster the knowledge and implementation of Image Processing.