Preface

Visual pattern recognition systems have wide applications in surveillance, video gaming, human–robot interaction, and virtual reality. High computational complexity, abundance of pattern features, sensitivity to size and shape variations, and poor performance against complex backgrounds are prominent issues related to robust recognition of visual patterns. A collection of computational intelligence algorithms addressing these issues in visual pattern recognition is provided in this book. The book is positioned as a reference in the field of computer vision and pattern recognition.

Image feature extraction, feature selection, and classification are different stages in visual pattern recognition. Efficiency of pattern recognition algorithm depends on the individual efficiencies of these stages. The focus of Part II of the book is on feature selection and classification aspects, whereas Part III focuses on feature extraction algorithms. The main application area considered is hand posture recognition. In addition, the book discusses the utility of the algorithms in other visual as well as nonvisual pattern recognition tasks including face recognition, general object recognition, and cancer/tumor classification. The feature selection and classification algorithms presented in Part II are useful for predictive gene identification and classification of cancer/tumor. The experiments with gene expression-based cancer and tumor datasets have shown the utility of the algorithms in multi-feature classification problems in biomedical field.

The book contains eight chapters, divided into three parts. Part I (Chaps. 1–3) contains the necessary background to understand the material presented. Chapter 1 introduces the book with a discussion on various research issues in the field. Chapter 2 describes the computational intelligence tools utilized. A comprehensive survey of the related literature is provided in Chap. 3. Part II (Chaps. 4–6) focuses on computational intelligence algorithms for pattern recognition. Two fuzzy-rough set-based feature selection and classification algorithms applicable to visual as well as nonvisual pattern recognition tasks are presented in Chaps. 4 and 5. The algorithms are named as fuzzy-rough single cluster (FRSC) and multi-cluster (FRMC) classification algorithms. The FRSC and FRMC algorithms are discriminative and fast in feature selection and classification of multiple feature datasets. Applications include image pattern recognition and cancer classification. Chapter 6 describes a boosting-based fuzzy-rough multi-cluster (BFRMC) classification algorithm, combining the fuzzy-rough approach with genetic

algorithm based on iterative rule learning and boosting. Part III (Chaps. 7 and 8) presents algorithms for hand posture recognition using neurobiologically inspired approaches. Computational model of visual cortex-based algorithms are presented in Chap. 7, addressing the problems in hand posture recognition. The visual cortex model-based features have invariance with respect to appearance and size of the hand, and provide good inter-class discrimination. Chapter 8 presents an attention-based segmentation and recognition (ASR) algorithm combining the model of visual cortex with a Bayesian model of visual attention, addressing the complex background problem in hand posture recognition.

The book provides performance comparisons for the algorithms outlined, with existing standard methods in machine learning.

Singapore, January 2014

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http://www.springer.com/978-981-287-055-1

Computational Intelligence in Multi-Feature Visual Pattern Recognition
Hand Posture and Face Recognition using Biologically Inspired Approaches
Pisharady, P.; Vadakkepat, P.; Poh, L.A.
2014, XIII, 138 p. 50 illus., 25 illus. in color., Hardcover
ISBN: 978-981-287-055-1