
Preface

Pattern recognition has persisted as an active research area for more than four decades. It is a combination of two basic ideas: real-world data often occurs in terms of some recurring *patterns* and computers can be taught to recognize these patterns *automatically*. Initially, pattern recognition methods were built mainly upon data analysis techniques of mathematical statistics, but over the years those were extended by such related disciplines as artificial intelligence, machine learning, optimization, data mining, and others. The diverse application areas of pattern recognition range from image analysis to character recognition and speech processing.

A sharp increase in the computing power of modern computers, accompanied by a decrease in the data storage costs, has triggered the development of extremely powerful algorithms that can analyze complex patterns in large amounts of data within a very short period of time. Consequently, it has become possible to apply pattern recognition techniques to new tasks characterized by tight real-time requirements (e.g., person identification) and/or high complexity of raw data (e.g., clustering trajectories of mobile objects). The main goal of this book is to cover some of the latest application domains of pattern recognition while presenting novel techniques that have been developed or customized in those domains. The book is divided into four parts, which are briefly described below.

Part I presents some of the latest face recognition techniques. In Chapter 1, Bourbakis and Kakumanu describe a Local-Global Graph (LGG) based method for detecting faces and recognizing facial expressions in real-world outdoor images with varying illumination. Chapter 2 by Jiang and Chen presents an overview of common facial image processing techniques such as glasses removal, facial expression synthesis, restoration of damaged or incomplete images, and caricature generation. A general statistical framework for modeling and processing head pose information in 2D images is presented by Okada and von der Malsburg in Chapter 3.

Part II deals with pattern recognition in spatio-temporal data. In Chapter 4, Abufadel et al. present a 4D spatiotemporal segmentation algorithm for

fully automatic segmentation of cardiac magnetic resonance (MR) sequences. Elnekave et al. introduce in Chapter 5 a new similarity measure between mobile trajectories and then evaluate it by clustering spatio-temporal data.

Several graph-based methods of pattern recognition are covered by Part III. Thus, in Chapter 6, Bunke et al. introduce hypergraphs as a generalization of graphs for object representation in structural pattern recognition. A novel algorithm for feature-driven emergence of model graphs is presented by Westphal et al. in Chapter 7.

Finally, Part IV covers some novel applications of pattern recognition techniques. In Chapter 8, a wavelet-based statistical method is used by He et al. for automated writer identification in Chinese handwritings. The book is concluded by Chapter 9, where Gimel'farb and Zhou apply a Generic Markov–Gibbs Model for structural analysis and synthesis of stochastic and periodic image textures.

We believe that the chapters included in our volume will provide a useful background for researchers and practitioners in pattern recognition and related areas. Our additional goal is to encourage more applications of pattern recognition techniques to novel and yet unexplored tasks.

October 2007

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Applied Pattern Recognition

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2008, XII, 246 p. 110 illus., 51 illus. in color., Hardcover

ISBN: 978-3-540-76830-2