

Preface

This book provides some recent developments and state of the art review in various areas of pattern recognition, image processing, machine learning, data mining and web intelligence, both from theoretical and application points of view. It is a peer-reviewed research monograph under the ISI Platinum Jubilee Series on Statistical Science and Interdisciplinary Research. The book may be considered as an integrated volume to the researchers interested in doing interdisciplinary research where computer science is a component. Since a wide variety of current topics are covered in the book, the readers are expected to have some basic idea of pattern recognition, machine learning, image processing, data mining and web intelligence; but will be able to follow each of the chapters independent of the others. The book contains a total of 15 chapters. The first 5 chapters deal with development of a few methodologies for various tasks of pattern recognition and image processing, along with some theoretical aspects. Chapters 6, 7 and 8 consider text processing and other related tasks. The next four chapters (Chapters 9–12) consider various issues of computer vision from application points of view. The last 3 chapters (Chapters 13–15) describe the classification task of pattern recognition, involving signal processing, case-based reasoning and support vector machines. These chapters are on applications of pattern recognition to speech processing, broker system designing and protein classification.

Chapter 1 deals with the design of a probabilistic multi-class multi-kernel machine based on a kernel combination methodology. The classifier is able to combine diverse sources of information and multiple feature spaces. The methodology follows a well-founded hierarchical Bayesian paradigm that models uncertainty in the parameters via a hierarchy of prior and hyper-prior distributions. Chapter 2 presents an image quality metric which integrates the notions of structural similarity measure mimicking the overall functionality of the human visual system and perceptually important regions based on the characteristics of intermediate

and higher level visual processes. In Chapter 3, a new approach for image entropy reduction is described, which is based on two-dimensional fractional differentiation. Chapter 4 deals with the development of two novel methods for object-background classification using the notion of parallel genetic algorithms. Chapter 5 addresses the issue of bipolarity in spatial domains. It introduces mathematical morphological operations on bipolar fuzzy sets.

Chapter 6 describes the present day scenario of the area of information retrieval. The main focus is on the problem of personalization and context modelling, and on the definition of new paradigms for content representation. An online archiving and retrieving system is developed in Chapter 7. This is followed by the development of a two stage recognition scheme, in Chapter 8, for recognition of handwritten Devanagari words.

Chapter 9 is concerned with a problem of computer vision. It deals with the development of a model based approach for human fall detection from videos in the presence of multiple persons. Chapter 10 shows how multi-temporal SAR data allows mapping earthquake damage in urban areas with an acceptable accuracy, provided the ancillary information defining urban blocks are available. Chapters 11 and 12 describe the designs of safety related systems based on the theories of machine learning.

In Chapter 13, a methodology is developed for signal reconstruction using the notion of non-linear quantization based on logarithmic and Incomplete Beta Function (IBF) which dynamically assign the number of quantization levels exploiting the auditory motivation. Chapter 14 addresses some discovery tasks as correlated with supervised learning. Textual case-based and decision tree induction approaches are considered to these tasks, and the use of multiple representations is explored. The performance evaluation is made on a broker system that discovers and mediates requests, and responses for meteorological and oceanographic data. Finally in Chapter 15, an important bioinformatics problem is considered where a Granular Support Vector Machine (GSVM) is used for prediction of soluble proteins based on over expression in *Escherichia coli*.

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