Markov Models For Pattern Recognition From Theory To Applications Advances In Computer Vision And Pattern Recognition

Advances in Handwriting Recognition contains selected key papers from the 6th International Workshop on Frontiers in Handwriting Recognition (IWFHR '98), held in Taejon, Korea from 12 to 14, August 1998. Most of the papers have been expanded or extensively revised to include helpful discussions, suggestions or comments made during the workshop. Contents:On-Line Hand Writing Recognition by Discrete HMM with Fast Learning (H Yasuda et al.)Diacritical Processing Using Efficient Accounting Procedures in a Forward Search (G Seni & J Seybold)A Handwritten Form Reader Architecture (C Cracknell & A C Downton)Combining Different Classifiers and Level of Knowledge: A First Step Towards an Adaptive Recognition System (D Ollivier et al.)Architecture for Handwritten Text Recognition Systems (G Kim et al.)Search Algorithms for the Recognition of Cursive Phrases Without World Segmentation (C Scagliola)A Method for the Determination of Features Used in Human Reading of Cursive Handwriting (L Schomaker & E

Segers)Global Methods for Stroke Segmentation (Y Nakajima et al.)An Advanced Segmentation Technique for Cursive Word Recognition (G Dimauro et al.)Document Understanding Based on Maximum a Posteriori Probability Estimation (T Akagi & H Mizutani)Combining Shape Matrices and HMMs for Hand-Drawn Pictogram Recognition (S Muller et al.)and other papers Readership: Researchers and graduate students in computer science and electrical engineering. Keywords:Handwriting Recognition;Character Recognition;Document Analysis and Recognition;OCR (Optical Character Recognition);Online Recognition;Offline Recognition;Pen-Computing

First of all, we want to congratulate two new research communities from M- ico and Brazil that have recently joined the Iberoamerican community and the International Association for Pattern Recognition. We believe that the series of congresses that started as the "Taller Iberoamericano de Reconocimiento de Patrones (TIARP)", and later became the "Iberoamerican Congress on Pattern Recognition (CIARP)", has contributed to these groupconsolidatione?orts. We hope that in the near future all the Iberoamerican countries will have their own groups and associations to promote our areas of interest; and that these congresses will serve as the forum for scienti?c research exchange, sharing of - pertise and

new knowledge, and establishing contacts that improve cooperation between research groups in pattern recognition and related areas. CIARP 2004 (9th Iberoamerican Congress on Pattern Recognition) was the ninthinaseriesofpioneeringcong ressesonpatternrecognitionintheIberoam- ican community. As in the previous year, CIARP 2004 also included worldwide participation. It took place in Puebla, Mexico. The aim of the congress was to promote and disseminate ongoing research and mathematical methods for pattern recognition, image analysis, and applications in such diverse areas as computer vision, robotics, industry, health, entertainment, space exploration, telecommunications, data mining, document analysis,and natural languagep- cessing and recognition, to name a few.

Both pattern recognition and computer vision have experienced rapid progress in the last twenty-five years. This book provides the latest advances on pattern recognition and computer vision along with their many applications. It features articles written by renowned leaders in the field while topics are presented in readable form to a wide range of readers. The book is divided into five parts: basic methods in pattern recognition, basic methods in computer vision and image processing, recognition applications, life science and human identification, and systems and technology. There are eight new

chapters on the latest developments in life sciences using pattern recognition as well as two new chapters on pattern recognition in remote sensing. Hidden Markov models (HMMs) originally emerged in the domain of speech recognition. In recent years, they have attracted growing interest in the area of computer vision as well. This book is a collection of articles on new developments in the theory of HMMs and their application in computer vision. It addresses topics such as handwriting recognition, shape recognition, face and gesture recognition, tracking, and image database retrieval. This book is also published as a special issue of the International Journal of Pattern Recognition and Artificial Intelligence (February 2001). Contents: Introduction: A Simple Complex in Artificial Intelligence and Machine Learning (B H Juang)An Introduction to Hidden Markov Models and Bayesian Networks (Z Chahramani)Multi-Lingual Machine Printed OCR (P Natarajan et al.)Using a Statistical Language Model to Improve the Performance of an HMM-Based Cursive Handwriting Recognition System (U-V Marti & H Bunke)A 2-D HMM Method for Offline Handwritten Character Recognition (H-S Park et al.)Data-Driven Design of HMM Topology for Online Handwriting Recognition (J J Lee et al.)Hidden Markov Models for Modeling and Recognizing Gesture Under Variation (A D Wilson & A F Bobick)Sentence Lipreading Using Hidden Markov

Model with Integrated Grammar (K Yu et al.)Tracking and Surveillance in Wide-Area Spatial Environments Using the Abstract Hidden Markov Model (H H Bui et al.)Shape Tracking and Production Using Hidden Markov Models (T Caelli et al.)An Integrated Approach to Shape and Color-Based Image Retrieval of Rotated Objects Using Hidden Markov Models (S Müller et al.) Readership: Graduate students of computer science, electrical engineering and related fields, as well as researchers at academic and industrial institutions.
Keywords:Hidden Markov Models;Gesture Recognitoin;Bayesian Networks;Optical Character Recognition;Handwriting Character Recognition;Cartography;Shape Extraction;Image Feature Extraction.

There is no royal road to science, and only those who do not dread the fatiguing climb of its steep paths have a chance of gaining its luminous summits. Karl Marx A Universal Genius of the 19th Century Many scientists from all over the world during the past two years since the MLDM 2007 have come along on the stony way to the sunny summit of science and have worked hard on new ideas and applications in the area of data mining in pattern r- ognition. Our thanks go to all those who took part in this year's MLDM. We appre- ate their submissions and the ideas shared with the Program Committee. We received over 205 submissions from

all over the world to the International Conference on - chine Learning and Data Mining, MLDM 2009. The Program Committee carefully selected the best papers for this year's program and gave detailed comments on each submitted paper. There were 63 papers selected for oral presentation and 17 papers for poster presentation. The topics range from theoretical topics for classification, clustering, association rule and pattern mining to specific data-mining methods for the different multimedia data types such as image mining, text mining, video mining and Web mining. Among these topics this year were special contributions to subtopics such as attribute discre- zation and data preparation, novelty and outlier detection, and distances and simila- ties. This book constitutes the refereed proceedings of the 7th IAPR TC3 International Workshop on Artificial Neural Networks in Pattern Recognition, ANNPR 2016, held in Ulm, Germany, in September 2016. The 25 revised full papers presented together with 2 invited papers were carefully reviewed and selected from 32 submissions for inclusion in this volume. The workshop will act as a major forum for international researchers and practitioners working in all areas of neural network- and machine learning-based pattern recognition to present and discuss the latest research, results, and ideas in these areas. Part of a two-volume set, this book constitutes the refereed proceedings of the Third Iberian

Conference on Pattern Recognition and Image Analysis, IbPRIA 2007, held in Girona, Spain in June 2007. It covers pattern recognition, human language technology, special architectures and industrial applications, motion analysis, image analysis, biomedical applications, shape and texture analysis, 3D, and image coding and processing.

Motion-based recognition deals with the recognition of an object and/or its motion, based on motion in a series of images. In this approach, a sequence containing a large number of frames is used to extract motion information. The advantage is that a longer sequence leads to recognition of higher level motions, like walking or running, which consist of a complex and coordinated series of events. Unlike much previous research in motion, this approach does not require explicit reconstruction of shape from the images prior to recognition. This book provides the state-of-the-art in this rapidly developing discipline. It consists of a collection of invited chapters by leading researchers in the world covering various aspects of motion-based recognition including lipreading, gesture recognition, facial expression recognition, gait analysis, cyclic motion detection, and activity recognition. Audience: This volume will be of interest to researchers and post- graduate students whose work involves computer vision, robotics and image processing. This fully updated new edition of a uniquely

accessible textbook/reference provides a general introduction to probabilistic graphical models (PGMs) from an engineering perspective. It features new material on partially observable Markov decision processes, graphical models, and deep learning, as well as an even greater number of exercises. The book covers the fundamentals for each of the main classes of PGMs, including representation, inference and learning principles, and reviews real-world applications for each type of model. These applications are drawn from a broad range of disciplines, highlighting the many uses of Bayesian classifiers, hidden Markov models, Bayesian networks, dynamic and temporal Bayesian networks, Markov random fields, influence diagrams, and Markov decision processes. Topics and features: Presents a unified framework encompassing all of the main classes of PGMs Explores the fundamental aspects of representation, inference and learning for each technique Examines new material on partially observable Markov decision processes, and graphical models Includes a new chapter introducing deep neural networks and their relation with probabilistic graphical models Covers multidimensional Bayesian classifiers, relational graphical models, and causal models Provides substantial chapter-ending exercises, suggestions for further reading, and ideas for research or programming projects Describes classifiers such as

Gaussian Naive Bayes, Circular Chain Classifiers, and Hierarchical Classifiers with Bayesian Networks Outlines the practical application of the different techniques Suggests possible course outlines for instructors This classroom-tested work is suitable as a textbook for an advanced undergraduate or a graduate course in probabilistic graphical models for students of computer science, engineering, and physics. Professionals wishing to apply probabilistic graphical models in their own field, or interested in the basis of these techniques, will also find the book to be an invaluable reference. Dr. Luis Enrique Sucar is a Senior Research Scientist at the National Institute for Astrophysics, Optics and Electronics (INAOE), Puebla, Mexico. He received the National Science Prize en 2016.

Handwriting Recognition has become a very important research area which is attracting more and more scientists. In fact, the extraordinary advances in the field of data acquisition technology and the promising results of the research, nowadays make possible the development of commercial systems for processing and recognition of handwritten documents.This book contains the results of the activity of the most important academic and industrial research groups working in this area. The new issues arising in the field are focused and involve both theoretical and practical aspects related to handwriting recognition and document processing

systems. The contributions of eminent experts point out the more interesting challenges for the scientific community ranging from acquisition and preprocessing of handwritten documents, to recognition of handwritten digits and words, to the design of multi-expert systems and the exploitation of the contextual knowledge to improve system performance.

This report summarizes the major research work accomplished under the contract, including the topics of cluster analysis, time-series segmentation, image segmentation, and related software development. A list of technical reports written under the project is given. A list of programs in a software package developed under the project is also given. (Author).

A new spatio-temporal method for identifying 3D objects found in 2D image sequences is presented. The Hidden Markov Model technique is used as a spatio-temporal classification algorithm to identify 3D objects by the temporal changes in observed shape features. A new information theoretic argument is developed that proves identifying objects based on image sequences can lead to higher classification accuracies than single look methods. A new distance measure is proposed that analyzes the performance of Hidden Markov Models in a multi-class pattern recognition problem. A three class problem identifying moving light display objects provides

experimental verification of the sequence processing argument. Individual frames of a MLD image sequence contain very little spatial information. The single look classification rate for the moving light display imagery was observed to be near 50%. In contrast, the Hidden Markov Model classification rate was above 93 %. The alternate nearest neighbor multiple frame technique classification rate was 20% below the Hidden Markov Models. A one sided t-test revealed a highly statistically significant difference between the Hidden Markov Model and multiple frame technique at a 0. 01 level of significance. A five class problem consisting of tactical military ground vehicles is considered to provide verification using imagery with both spatial and temporal information. Results confirmed the new spatio-temporal pattern recognition method produces superior results by accessing the temporal information in the image sequences. A prototype automatic target recognition system is demonstrated. Hidden Markov model, Pattern recognition, Motion analysis, Signal processing.

Contents:A Connectionist Approach to Speech Recognition (Y Bengio)Signature Verification Using a "Siamese" Time Delay Neural Network (J Bromley et al.)Boosting Performance in Neural Networks (H Drucker et al.)An Integrated Architecture for Recognition of Totally Unconstrained Handwritten Numerals (A Gupta et al.)Time-Warping Network: A

Neural Approach to Hidden Markov Model Based Speech Recognition (E Levin et al.)Computing Optical Flow with a Recurrent Neural Network (H Li & J Wang)Integrated Segmentation and Recognition through Exhaustive Scans or Learned Saccadic Jumps (G L Martin et al.)Experimental Comparison of the Effect of Order in Recurrent Neural Networks (C B Miller & C L Giles)Adaptive Classification by Neural Net Based Prototype Populations (K Peleg & U Ben-Hanan)A Neural System for the Recognition of Partially Occluded Objects in Cluttered Scenes: A Pilot Study (L Wiskott & C von der Malsburg)and other papers Readership: Computer scientists and engineers.

Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online. Pages: 254. Chapters: Artificial neural network, Supervised learning, Hidden Markov model, Pattern recognition, Reinforcement learning, Principal component analysis, Self-organizing map, Overfitting, Cluster analysis, Granular computing, Rough set, Mixture model, Expectation-maximization algorithm, Radial basis function network, Types of artificial neural networks, Learning to rank, Forward-backward algorithm, Perceptron, Category utility, Neural modeling fields, Dominance-based rough set approach, Principle of maximum entropy, Non-negative matrix factorization, Concept learning, K-means clustering, Structure mapping engine, Viterbi

algorithm, Cross-validation, Hierarchical temporal memory, Activity recognition, Algorithmic inference, Formal concept analysis, Gradient boosting, Information bottleneck method, Nearest neighbor search, Simultaneous localization and mapping, Markov decision process, Gittins index, K-nearest neighbor algorithm, General Architecture for Text Engineering, Reasoning system, Concept drift, Uniform convergence, Conceptual clustering, Multi-armed bandit, Multilinear subspace learning, Conditional random field, DBSCAN, Feature selection, Learning with errors, Weka, Evolutionary algorithm, Iris flower data set, Binary classification, OPTICS algorithm, Partially observable Markov decision process, Constrained Conditional Models, Group method of data handling, Learning classifier system, Random forest, Statistical classification, Analogical modeling, Bregman divergence, Backpropagation, Temporal difference learning, Loss function, Curse of dimensionality, Alternating decision tree, Evolutionary multi-modal optimization, Stochastic gradient descent, Kernel principal component analysis, Explanation-based learning, K-medoids, RapidMiner, Transduction, Variable-order Markov model, Kernel adaptive filter, Classification... This unique compendium presents the major methods of recognition and learning used in syntactic pattern recognition from the 1960s till 2018. Each method is introduced firstly in a formal way.

Then, it is explained with the help of examples and its algorithms are described in a pseudocode. The survey of the applications contains more than 1,000 sources published since the 1960s. The open problems in the field, the challenges and the determinants of the future development of syntactic pattern recognition are discussed.This must-have volume provides a good read and serves as an excellent source of reference materials for researchers, academics, and postgraduate students in the fields of pattern recognition, machine perception, computer vision and artificial intelligence. This book discusses how to combine type-2 fuzzy sets and graphical models to solve a range of real-world pattern recognition problems such as speech recognition, handwritten Chinese character recognition, topic modeling as well as human action recognition. It covers these recent developments while also providing a comprehensive introduction to the fields of type-2 fuzzy sets and graphical models. Though primarily intended for graduate students, researchers and practitioners in fuzzy logic and pattern recognition, the book can also serve as a valuable reference work for researchers without any previous knowledge of these fields. Dr. Jia Zeng is a Professor at the School of Computer Science and Technology, Soochow University, China. Dr. Zhi-Qiang Liu is a Professor at the School of Creative Media, City University of Hong Kong, China.

Hidden Markov Models (HMMs), although known for decades, have made a big career nowadays and are still in state of development. This book presents theoretical issues and a variety of HMMs applications in speech recognition and synthesis, medicine, neurosciences, computational biology, bioinformatics, seismology, environment protection and engineering. I hope that the reader will find this book useful and helpful for their own research. The first edition, published in 1973, has become a classicreference in the field. Now with the second edition, readers willfind information on key new topics such as neural networks andstatistical pattern recognition, the theory of machine learning,and the theory of invariances. Also included are worked examples,comparisons between different methods, extensive graphics, expandedexercises and computer project topics. An Instructor's Manual presenting detailed solutions to all theproblems in the book is available from the Wiley editorialdepartment.

Observing the environment and recognising patterns for the purpose of decision making is fundamental to human nature. This book deals with the scientific discipline that enables similar perception in machines through pattern recognition (PR), which has application in diverse technology areas. This book is an exposition of principal topics in PR using an algorithmic approach. It provides a thorough

introduction to the concepts of PR and a systematic account of the major topics in PR besides reviewing the vast progress made in the field in recent times. It includes basic techniques of PR, neural networks, support vector machines and decision trees. While theoretical aspects have been given due coverage, the emphasis is more on the practical. The book is replete with examples and illustrations and includes chapter-end exercises. It is designed to meet the needs of senior undergraduate and postgraduate students of computer science and allied disciplines. Connectionist Speech Recognition: A Hybrid Approach describes the theory and implementation of a method to incorporate neural network approaches into state of the art continuous speech recognition systems based on hidden Markov models (HMMs) to improve their performance. In this framework, neural networks (and in particular, multilayer perceptrons or MLPs) have been restricted to well-defined subtasks of the whole system, i.e. HMM emission probability estimation and feature extraction. The book describes a successful five-year international collaboration between the authors. The lessons learned form a case study that demonstrates how hybrid systems can be developed to combine neural networks with more traditional statistical approaches. The book illustrates both the advantages and limitations of neural networks in the framework of a statistical

systems. Using standard databases and comparison with some conventional approaches, it is shown that MLP probability estimation can improve recognition performance. Other approaches are discussed, though there is no such unequivocal experimental result for these methods. Connectionist Speech Recognition is of use to anyone intending to use neural networks for speech recognition or within the framework provided by an existing successful statistical approach. This includes research and development groups working in the field of speech recognition, both with standard and neural network approaches, as well as other pattern recognition and/or neural network researchers. The book is also suitable as a text for advanced courses on neural networks or speech processing.

This book is the outcome of a NATO Advanced Study Institute on Pattern Recog nition Theory and Applications held in Spa-Balmoral, Belgium, in June 1986. This Institute was the third of a series which started in 1975 in Bandol, France, at the initia tive of Professors K. S. Fu and A. Whinston, and continued in 1981 in Oxford, UK, with Professors K. S. Fu, J. Kittler and L. -F. Pau as directors. As early as in 1981, plans were made to pursue the series in about 1986 and possibly in Belgium, with Professor K. S. Fu and the present editors as directors. Unfortunately, Ie sort en decida autrement: Professor Fu passed away in the spring of 1985. His

sudden death was an irreparable loss to the scientific community and to all those who knew him as an inspiring colleague, a teacher or a dear friend. Soon after, Josef Kittler and I decided to pay a small tribute to his memory by helping some of his plans to materialize. With the support of the NATO Scientific Affairs Division, the Institute became a reality. It was therefore but natural that the proceedings of the Institute be dedicated to him. The book contains most of the papers that were presented at the Institute. Papers are grouped along major themes which hopefully represent the major areas of contem porary research. These are: 1. Statistical methods and clustering techniques 2. Probabilistic relaxation techniques 3. From Markovian to connectionist models 4.

As a baby one of our earliest stimuli is that of human faces. We rapidly learn to identify, characterize and eventually distinguish those who are near and dear to us. We accept face recognition later as an everyday ability. We realize the complexity of the underlying problem only when we attempt to duplicate this skill in a computer vision system. This book is arranged around a number of clustered themes covering different aspects of face recognition. The first section on Statistical Face Models and Classifiers presents reviews and refinements of some well-known statistical models. The next section presents two articles exploring the

use of Infrared imaging techniques and is followed by few articles devoted to refinements of classical methods. New approaches to improve the robustness of face analysis techniques are followed by two articles dealing with real-time challenges in video sequences. A final article explores human perceptual issues of face recognition.

Markov chains and hidden Markov chains have applications in many areas of engineering and genomics. This book provides a basic introduction to the subject by first developing the theory of Markov processes in an elementary discrete time, finite state framework suitable for senior undergraduates and graduates. The authors then introduce semi-Markov chains and hidden semi-Markov chains, before developing related estimation and filtering results. Genomics applications are modelled by discrete observations of these hidden semi-Markov chains. This book contains new results and previously unpublished material not available elsewhere. The approach is rigorous and focused on applications. The era of detailed comparisons of the merits of techniques of pattern recognition and artificial intelligence and of the integration of such techniques into flexible and powerful systems has begun. So confirm the editors of this fourth volume of Pattern Recognition in Practice, in their preface to the book. The 42 quality papers are sourced from a broad range of international specialists involved in

developing pattern recognition methodologies and those using pattern recognition techniques in their professional work. The publication is divided into six sections: Pattern Recognition, Signal and Image Processing, Probabilistic Reasoning, Neural Networks, Comparative Studies, and Hybrid Systems, giving prospective users a feeling for the applicability of the various methods in their particular field of specialization.

The field of pattern recognition has seen enormous progress since its beginnings almost 50 years ago. A large number of different approaches have been proposed. Hybrid methods aim at combining the advantages of different paradigms within a single system. Hybrid Methods in Pattern Recognition is a collection of articles describing recent progress in this emerging field. It covers topics such as the combination of neural nets with fuzzy systems or hidden Markov models, neural networks for the processing of symbolic data structures, hybrid methods in data mining, the combination of symbolic and subsymbolic learning, and so on. Also included is recent work on multiple classifier systems. Furthermore, the book deals with applications in on-line and off-line handwriting recognition, remotely sensed image interpretation, fingerprint identification, and automatic text categorization.

This book constitutes the joint refereed proceedings of the 8th International Workshop on Structural and

Syntactic Pattern Recognition and the 3rd International Workshop on Statistical Techniques in Pattern Recognition, SSPR 2000 and SPR 2000, held in Alicante, Spain in August/September 2000. The 52 revised full papers presented together with five invited papers and 35 posters were carefully reviewed and selected from a total of 130 submissions. The book offers topical sections on hybrid and combined methods, document image analysis, grammar and language methods, structural matching, graph-based methods, shape analysis, clustering and density estimation, object recognition, general methodology, and feature extraction and selection.

Since their first inception, automatic reading systems have evolved substantially, yet the recognition of handwriting remains an open research problem due to its substantial variation in appearance. With the introduction of Markovian models to the field, a promising modeling and recognition paradigm was established for automatic handwriting recognition. However, no standard procedures for building Markov model-based recognizers have yet been established. This text provides a comprehensive overview of the application of Markov models in the field of handwriting recognition, covering both hidden Markov models and Markov-chain or n-gram models. First, the text introduces the typical architecture of a Markov model-based handwriting recognition

system, and familiarizes the reader with the essential theoretical concepts behind Markovian models. Then, the text reviews proposed solutions in the literature for open problems in applying Markov model-based approaches to automatic handwriting recognition.

Markov random field (MRF) theory provides a basis for modeling contextual constraints in visual processing and interpretation. It enables us to develop optimal vision algorithms systematically when used with optimization principles. This book presents a comprehensive study on the use of MRFs for solving computer vision problems. Various vision models are presented in a unified framework, including image restoration and reconstruction, edge and region segmentation, texture, stereo and motion, object matching and recognition, and pose estimation. This third edition includes the most recent advances and has new and expanded sections on topics such as: Bayesian Network; Discriminative Random Fields; Strong Random Fields; Spatial-Temporal Models; Learning MRF for Classification. This book is an excellent reference for researchers working in computer vision, image processing, statistical pattern recognition and applications of MRFs. It is also suitable as a text for advanced courses in these areas.

This volume contains 18 papers of high quality, selected to represent the work that is being developed by Spanish

research groups in pattern recognition and image analysis. It is partly the result of the efforts of the Spanish Association for Pattern Recognition and Image Analysis (AERFAI). It is hoped that this volume will increase awareness of Spanish work in the international scientific community and initiate contacts with research groups worldwide. Contents:Pattern Recognition:Synthesis and Classification of 2-D Shapes from their Landmark Points (N Pérez de la Blanca et al.)Image Analysis and Computer Vision:Projective Invariants to Identify Polyhedric 3D Objects (A Sanfeliu & A Llorens)Non-Supervised Characterization of Galaxies Using Different Approaches (J A García et al.)Analysis and Optimization of the k-Means Algorithm for Remote Sensing Applications (P Montolio et al.)Speech Recognition:Isolated Word Recognition Based on Multilayer Perceptrons (F Casacuberta et al.)Applications in Image Analysis and Computer Vision:Analysis of Gammagraphic Images by Mathematical Morphology (A Dupuy et al.)A New Hybrid Coding Method for Videoconferencing Applications and ISDN (J Zamora et al.)Artificial Vision Applied to Guidance of an Autonomous Robot (M Mazo & D Maravall)and other papers Readership: Computer scientists, computer and electrical engineering. keywords:

The research and development of pattern recognition have proven to be of importance in science, technology, and human activity. Many useful concepts and tools from different disciplines have been employed in pattern recognition. Among them is string matching, which receives much theoretical and practical attention. String matching is also an important topic in combinatorial optimization. This book is devoted to recent advances in pattern recognition and string matching. It consists of twenty eight chapters written by different authors, addressing a broad range of topics such as those from classifica tion, matching, mining, feature selection,

and applications. Each chapter is self-contained, and presents either novel methodological approaches or applications of existing theories and techniques. The aim, intent, and motivation for publishing this book is to pro vide a reference tool for the increasing number of readers who depend upon pattern recognition or string matching in some way. This includes students and professionals in computer science, mathematics, statistics, and electrical engineering. We wish to thank all the authors for their valuable efforts, which made this book a reality. Thanks also go to all reviewers who gave generously of their time and expertise. This thoroughly revised and expanded new edition now includes a more detailed treatment of the EM algorithm, a description of an efficient approximate Viterbi-training procedure, a theoretical derivation of the perplexity measure and coverage of multi-pass decoding based on n-best search. Supporting the discussion of the theoretical foundations of Markov modeling, special emphasis is also placed on practical algorithmic solutions. Features: introduces the formal framework for Markov models; covers the robust handling of probability quantities; presents methods for the configuration of hidden Markov models for specific application areas; describes important methods for efficient processing of Markov models, and the adaptation of the models to different tasks; examines algorithms for searching within the complex solution spaces that result from the joint application of Markov chain and hidden Markov models; reviews key applications of Markov models.

It was an honor and a pleasure to organizethe 13th International Conference on Computer Analysis of Images and Patterns (CAIP 2009) in Mu ?nster, Germany. CAIP has been held biennially since 1985: Berlin (1985), Wismar (1987), Leipzig (1989), Dresden (1991), Budapest (1993), Prague (1995), Kiel (1997), Ljubljana (1999), Warsaw (2001),

Groningen (2003), Paris (2005), and Vienna (2007). Initially, this conference series served as a forum for getting together s- entistsfromEastandWestEurope.Nowadays,CAIPenjoysahi ghinternational visibility and attracts participants from all over the world. For CAIP 2009 we received a record number of 405 submissions. All papers were reviewed by two, and in most cases, three reviewers. Finally, 148 papers were selected for presentation at the conference, resulting in an acceptance rate of 36%. All Program Committee members and additional reviewers listed here deserve a great thanks for their timely and competent reviews. The accepted papers were presented either as oral presentations or posters in a single-track program.In addition, wewereveryhappyto haveAljoscha Smolicand David G. Storkasourinvitedspeakerst opresenttheirworkintwofascinatingareas.With this scienti?c program we hope to continue the tradition of CAIP in providing a forum for scienti?c exchange at a high quality level. A successful conference like CAIP 2009 would not be possible without the support of many institutions and people. First of all, we like to thank all the authors of submitted papers and the invited speakers for their contributions. The Steering Committee members were always there when advice was needed.

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