PATTERN RECOGNITION AND IMAGE PROCESSING

Ivan Stanimirović, Ph.D.

ArclerPress

Pattern Recognition and Image Processing

Pattern recognition and image processing are rapidly growing technologies within engineering and computer science. Algorithms for pattern recognition aim to observe the environment, learn to distinguish patterns of interest from their background and make pattern classes. A series of methods are developed to group individual patterns into specific classes according to their common properties, resulting in different pattern classes. Because of emerging applications which are computationally demanding, a wide specter of algorithms is developed to deal with problems such as data mining, classification of multimedia data, and obtaining biometric features like face and fingerprint recognition. Contrast enhancement, labeling of connected components, segmentation and feature detection methods are created based on the existing signal processing algorithms.

Ivan Stanimirović gained his PhD from University of Niš, Serbia in 2013. His work spans from multi-objective optimization methods to applications of generalized matrix inverses in areas such as image processing and computer graphics and visualisations. He is currently working as an Assistant professor at Faculty of Sciences and Mathematics at University of Niš on computing generalized matrix inverses and its applications.

ISBN 978-1-68094-447-1

ArclerPress

Stanimirović

Pattern Recognition and Image Processing

ArclerPress

Pattern Recognition and Image Processing

Editor:

Ivan Stanimirović, Ph.D.

ArclerPress

www.arclerpress.com

Pattern Recognition and Image Processing

Editor: Ivan Stanimirović, Ph.D.

© 2017 Arcler Press LLC
708 3rd Avenue, 6th Floor
New York
NY 10017
United States of America
www.arclerpress.com

No Claim to original U.S. Government works

ISBN: 978-1-68094-447-1

This book contains information obtained from highly regarded resources. Reprinted material sources are indicated. Copyright for individual articles remains with the authors as indicated. A Wide variety of references are listed. Reasonable efforts have been made to publish reliable data and views articulated in the chapters are those of the individual contributors, and not necessarily those of the editors or publishers. Editors or publishers are not responsible for the accuracy of the information in the published chapters or consequences of their use. The publisher believes no responsibility for any damage or grievance to the persons or property arising out of the use of any materials, instructions, methods or thoughts in the book. The editors and the publisher have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission has not been obtained. If any copyright holder has not been acknowledged, please write to us so we may rectify.

Notice: Registered trademark of products or corporate names are used only for explanation and identification without intent of infringement.

Arcler Press LLC publishes wide variety of books and eBooks. For more information about Arcler Press and its products, visit our website at www.arclerpress.com

此为试读,需要完整PDF请访问: www.ertongbook.com

Pattern Recognition and Image Processing

About the Editor

Ivan Stanimirović, Ph.D.

Ivan Stanimirović gained his PhD from University of Niš, Serbia in 2013. His work spans from multi-objective optimization methods to applications of generalized matrix inverses in areas such as image processing and computer graphics and visualisations. He is currently working as an Assistant professor at Faculty of Sciences and Mathematics at University of Niš on computing generalized matrix inverses and its applications.

List of Contributors

Christian Hennig
Department of Statistical Science, University College London, Gower Street, London WC1E 6BT, United Kingdom

Gustaf Kylberg
Vironova AB, Gävlegatan 22, SE-11330 Stockholm, Sweden

Ida-Maria Sintorn
Vironova AB, Gävlegatan 22, SE-11330 Stockholm, Sweden
Uppsala University, Department of Information Technology, Lägerhyddsvägen 20, SE-75105 Uppsala, Sweden

Sebastian Hegenbart
Department of Computer Sciences, University of Salzburg, Jakob-Haringer Strasse 2, 5020 Salzburg, Austria

Andreas Uhl
Department of Computer Sciences, University of Salzburg, Jakob-Haringer Strasse 2, 5020 Salzburg, Austria

Gang Liu
College of Applied Mathematics, Chengdu University of Information Technology

Ting-Zhu
College of Applied Mathematics, Chengdu University of Information Technology
Research Center for Image and Vision Computing/School of Mathematical Sciences, University of Electronic Science and Technology of China

Huang
Research Center for Image and Vision Computing/School of Mathematical Sciences, University of Electronic Science and Technology of China

Xiao-Guang
School of Science, Huaihai Institute of Technology

Lv and Jun Liu
Research Center for Image and Vision Computing/School of Mathematical Sciences, University of Electronic Science and Technology of China

David Pickup
School of Computer Science and Informatics, Cardiff University, Queen's Buildings, 5 The Parade, Roath, Cardiff CF24 3AA, United Kingdom

Xianfang Sun
School of Computer Science and Informatics, Cardiff University, Queen's Buildings, 5 The Parade, Roath, Cardiff CF24 3AA, United Kingdom

Paul L. Rosin
School of Computer Science and Informatics, Cardiff University, Queen's Buildings, 5 The Parade, Roath, Cardiff CF24 3AA, United Kingdom

Ralph R. Martin
School of Computer Science and Informatics, Cardiff University, Queen's Buildings, 5 The Parade, Roath, Cardiff CF24 3AA, United Kingdom

Jose Rivera-Rubio
Imperial College London, South Kensington Campus, London SW7 2AZ, United Kingdom

Ioannis Alexiou
Imperial College London, South Kensington Campus, London SW7 2AZ, United Kingdom

Anil A. Bharath
Imperial College London, South Kensington Campus, London SW7 2AZ, United Kingdom

Siyamalan Manivannan
CVIP, School of Computing, University of Dundee, UK

Wenqi Li
CVIP, School of Computing, University of Dundee, UK

Shazia Akbar
CVIP, School of Computing, University of Dundee, UK

Ruixuan Wang
CVIP, School of Computing, University of Dundee, UK

Jianguo Zhang
CVIP, School of Computing, University of Dundee, UK

Stephen J. McKenna
CVIP, School of Computing, University of Dundee, UK

Michael J.V. Leach
Heriot-Watt University, Edinburgh Campus, Edinburgh, Scotland, United Kingdom

Ed.P. Sparks
Heriot-Watt University, Edinburgh Campus, Edinburgh, Scotland, United Kingdom

Neil M. Robertson
Heriot-Watt University, Edinburgh Campus, Edinburgh, Scotland, United Kingdom

Heinz Hofbauer
University of Salzburg, Department of Computer Sciences, Austria

Andreas Uhl
University of Salzburg, Department of Computer Sciences, Austria

Zhi Jin
Department of Electrical and Electronic Engineering, Xi'an Jiaotong-Liverpool University, Ren Ai Road 111, 215123 Suzhou, People's Republic of China
Department of Electrical Engineering and Electronics, University of Liverpool, Merseyside

Tammam Tillo
Department of Electrical and Electronic Engineering, Xi'an Jiaotong-Liverpool University, Ren Ai Road 111, 215123 Suzhou, People's Republic of China

Jimin Xiao
Department of Electrical and Electronic Engineering, Xi'an Jiaotong-Liverpool University, Ren Ai Road 111, 215123 Suzhou, People's Republic of China

Yao Zhao
BX, Liverpool, UK

Peter Wild
University of Reading, School of Systems Engineering, Whiteknights, Reading RG6 6AY, United Kingdom

Petru Radu
University of Reading, School of Systems Engineering, Whiteknights, Reading RG6 6AY, United Kingdom

Lulu Chen
University of Reading, School of Systems Engineering, Whiteknights, Reading RG6 6AY, United Kingdom

此为试读,需要完整PDF请访问: www.ertongbook.com

James Ferryman
University of Reading, School of Systems Engineering, Whiteknights, Reading RG6 6AY, United Kingdom

Ying-Nong Chen
Department of Computer Science and Information Engineering, National Central University

Chi-Hung Chuang
Department of Applied Informatics, Fo Guang University

Hsin-Min Lee
Department of Computer Science and Information Engineering, National Central University

Chih-Chang Yu
Digital Education Institute, Institute for Information Industry

Kuo-Chin Fan
Department of Computer Science and Information Engineering, National Central University

Mariusz Oszust
Department of Computer and Control EngineeringRzeszow University of Technology

Krzysztof Bartyzel
Department of Computer Image AnalysisJohn Paul II Catholic University of Lublin

Bogdan Smolka
Faculty of Automatic Control, Electronics and Computer ScienceSilesian University of Technology

Damian Kusnik
Faculty of Automatic Control, Electronics and Computer ScienceSilesian University of Technology

A. Tonazzini
Istituto di Scienza e Tecnologie dell'Informazione-CNR, Via G. Moruzzi, 1, 56124 Pisa, Italy

P. Savino
Istituto di Scienza e Tecnologie dell'Informazione-CNR, Via G. Moruzzi, 1, 56124 Pisa, Italy
e-mail: pasquale.savino@isti.cnr.it

E. Salerno
Istituto di Scienza e Tecnologie dell'Informazione-CNR, Via G. Moruzzi, 1, 56124 Pisa, Italy
e-mail: emanuele.salerno@isti.cnr.it

Preface

Pattern recognition and image processing are rapidly growing technologies within engineering and computer science. Algorithms for pattern recognition aim to observe the environment, learn to distinguish patterns of interest from their background and make pattern classes. A series of methods are developed to group individual patterns into specific classes according to their common properties, resulting in different pattern classes. Because of emerging applications which are computationally demanding, a wide specter of algorithms is developed to deal with problems such as data mining, classification of multimedia data, and obtaining biometric features like face and fingerprint recognition. Contrast enhancement, labeling of connected components, segmentation and feature detection methods are created based on the existing signal processing algorithms.

Clustering is a widely used concept in pattern recognition and image processing. It becomes scientific not through uniqueness but through transparent and open communication. Various desirable characteristics of clusterings and various approaches to define a context-dependent truth are listed, and it is discussed what impact these ideas can have on the comparison and the choice of clustering methods in practical applications. This subject is discussed in detail in the first section of this book. The following six chapters of the book present methods for solving problems of pattern and texture recognition. The remaining content of this book focuses on the advances of specific methods and algorithms in the field of image processing. The specific advances discussed in this book include the use of dynamic detection and rejection of liveness-recognition, a system to recognize patterns at cellular and specimen levels, specific scale-adapted features and various techniques to encode visual structure. Advances in solving TV deblurring and denoising problems and the suppression of mixed Gaussian and impulsive noise in color images are also investigated.

Dynamic detection and rejection of liveness-recognition pair outliers for spoofed samples in true multi-modal configuration with its inherent challenge of normalization is investigated. Bootstrap aggregating (bagging) classifiers for fingerprint spoof-detection algorithm are presented. Experiments on the latest face video databases and fingerprint spoofing database illustrate the efficiency of proposed techniques.

A system to recognize patterns at cellular and specimen levels, in images of HEp-2 cells is developed. Ensembles of SVMs were trained to classify cells into six classes based on sparse encoding of texture features with cell pyramids, capturing spatial, multi-scale structure. A similar approach was used to classify specimens into seven classes. Detailed descriptions and extensive experiments with various features and encoding methods are provided.

Specific scale-adapted features are computed in reference to the estimated scale of an image, based on the distribution of scale normalized Laplacian responses in a scale-space representation. Intrinsic-scale-adaption is performed to compute features, independent of the intrinsic texture scale, leading to a significantly increased discriminative power for a large amount of texture classes. In a final step, the rotation- and scale-invariant features are combined in a multi-resolution representation, which improves the classification accuracy in texture classification scenarios with scaling and rotation significantly.

A linear time complexity method for computing a canonical form is suggested. This method is using Euclidean distances between pairs of a small subset of vertices. This approach has comparable retrieval accuracy but lower time complexity than using global geodesic distances, allowing it to be used on higher resolution meshes, or for more meshes to be considered within a time budget.

Vision is one of the most important of the senses, and humans use it extensively during navigation. Different types of image and video frame descriptors that could be used to determine distinctive visual landmarks for localizing a person based on what is seen by a camera that they carry are computed. For each type of descriptor, different techniques to encode visual structure and to search between journeys to estimate a user's position are also tested. The techniques include single-frame descriptors, those using sequences of frames, and both color and achromatic descriptors. The results suggest that appearance-based information could be an additional source of navigational data indoors. This offers a complementary approach to methods based on simultaneous localization and mapping (SLAM) algorithms.

A method of utilising social context and scene context to improve behaviour analysis is developed. It is found that in a crowded scene the application of Mutual Information based social context permits the ability to prevent self-justifying groups and propagate anomalies in a social network, granting a greater anomaly detection capability. Scene context uniformly improves the detection of anomalies in both datasets.

Visual security metrics are deterministic measures with the (claimed) ability to assess whether an encryption method for visual data does achieve its defined goal. These metrics are usually developed together with a particular encryption method in order to provide an evaluation of said method based on its visual output. Therefore, a methodology for assessing the performance of security metrics based on common media encryption scenarios is considered.

New inexact explicit shrinkage formulas for one class of these relevant problems are introduced, whose regularization terms have translation invariant overlapping groups. These results are applied to TV deblurring and denoising problems with overlapping group sparsity. Thus, alternating direction method of multipliers to iteratively solve them is used. It is shown that the choice of interpolation method when rotating textures greatly influences the recognition capability. Lanczos 3 and B-spline interpolation are comparable to rotating the textures prior to image acquisition, whereas the recognition capability is significantly and increasingly lower for the frequently used third order cubic, linear and nearest neighbour interpolation. It is also shown that including generated rotations of the texture samples in the training data improves the classification accuracies. For many of the descriptors, this strategy compensates for the shortcomings of the poorer interpolation methods to such a degree that the choice of interpolation method only has a minor impact.

To enable an appropriate and fair comparison, a new texture dataset is introduced which contains hardware and interpolated rotations of 25 texture classes. An optimisation approach to the design of a binary descriptor is proposed, in which the detected keypoint is described using several, scale-dependent patches. Each such patch is divided into disjoint blocks of pixels, and then, binary tests between blocks' intensities, as well as their gradients, are used to obtain the binary string. Since the number of image patches and their relative sizes influence the descriptor creation pipeline, a simulated annealing algorithm is used to determine them, optimising recall and precision of keypoint matching. The simulated annealing is also used for dimensionality reduction in long binary strings.

A new filter was created by improving the standard Kuwahara filter. It allows more efficient noise reduction without blurring the edges and image preparation for segmentation and further analyses operations. One of the biggest and most common restrictions encountered in filter algorithms is the need for a declarative definition of the filter window size or the number of iterations that an operation should be repeated.

A novel technique designed for the suppression of mixed Gaussian and impulsive noise in color images is proposed. The new denoising scheme is based on a weighted averaging of pixels contained in a filtering block. The main novelty of the proposed solution lies in the new definition of the similarity between the samples of the processing block and a small window centered at the block's central pixel. Instead of direct comparison of pixels, a measure based on the similarity between a given pixel and the samples from the neighborhood of the central pixel is utilized. This measure is defined as the sum of distances in a given color space, between a pixel of the block and a certain number of most similar samples from the filtering window. The main advantage of the proposed scheme is that the new similarity measure is not influenced by the outliers injected into the image by the impulsive noise and the averaging process ensures the effectiveness of the new filter in the reduction of Gaussian noise.

Editor
Ivan Stanimirović, Ph.D.

Contents

List of Contributors xi
Preface xv

Chapter 1 What are the True Clusters? 1
Abstract 1
1. Introduction 1
2. Philosophical Background 2
3. Clustering Aims and Cluster Concepts 4
4. Definitions of True Clusters 6
5. Implications for Cluster Analysis Research and Practice 9
Conclusions 10
References 11

Chapter 2 On the Influence of Interpolation Method on Rotation Invariance in Texture Recognition 13
Abstract 13
1. Introduction 13
2. The Kylberg Sintorn Rotation Dataset 14
3. Lbp-Based Descriptors 17
4. Classification Procedure 18
5. Computational Cost 20
6. Rotation Representation in Classification 21
Conclusions 22
Acknowledgements 22
References 22

Chapter 3 A Scale- and Orientation-Adaptive Extension of Local Binary Patterns for Texture Classification 25
Abstract 25
1. Introduction 25
2. Scale-Adaptive Local Binary Patterns 27
3. Orientation-Adaptive Lbp 30
4. Soa-Lbp In A Multi-Resolution Feature Representation 33
5. Experiments 34
6. Image Data 34
Conclusion 38
Acknowledgments 38
References 38

Chapter 4 Euclidean-Distance-Based Canonical Forms For Non-Rigid 3D Shape Retrieval 41
Abstract 41
1. Introduction 41
2. Related Work 42
3. Preliminaries 43
4. Euclidean Distance Based Canonical Form Computation 44
5. Computational Complexity 46
6. Experiments 46
7. Limitations 54
Conclusions 55
References 55

Chapter 5 Appearance-Based Indoor Localization: A Comparison of Patch Descriptor Performance 57
Abstract 57
1. Introduction 57
2. Visual Paths 58
3. Vision-Based Approaches to Navigation 59
4. Methods: Indexing 61
5. Experiments and Results: Performance Evaluation 64
6. Discussion 67
Conclusion and Future Work 67
Acknowledgements 67
References 67

Chapter 6 An Automated Pattern Recognition System for Classifying Indirect Immunofluorescence Images of Hep-2 Cells And Specimens 71
Abstract 71
1. Introduction 71
2. Related Work 73
3. System Overview 74
4. Local Feature Extraction 74
5. Feature Encoding 75
6. Hep-2 Cell Classification 76
7. Hep-2 Specimen Classification 77
8. Experiment Setup 78
9. Cell Classification Results (Task 1) 79
10. Specimen Classification Results (Task 2) 86
Conclusion And Recommendations 88
Acknowledgements 88
References 88

Chapter 7 Contextual Anomaly Detection In Crowded Surveillance Scenes 91
Abstract 91
1. Introduction 91
2. Method 92
3. Experiment 97
4. Evaluation 100
Conclusion 100
Acknowledgements 101
References 101

Chapter 8 Identifying Deficits of Visual Security Metrics For Images 103
Abstract 103
1. Introduction 103
2. Overview of Security Metrics 105
3. Evaluation Methodology 109
4. Evaluation 112
Conclusion and Future Work 120
Acknowledgments 121
References 121

此为试读,需要完整PDF请访问: www.ertongbook.com