

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, Lancaster, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Friedemann Mattern

ETH Zurich, Zurich, Switzerland

John C. Mitchell

Stanford University, Stanford, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

C. Pandu Rangan

Indian Institute of Technology Madras, Chennai, India

Bernhard Steffen

TU Dortmund University, Dortmund, Germany

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbrücken, Germany

More information about this series at <http://www.springer.com/series/7412>

Xiao Bai · Edwin R. Hancock
Tin Kam Ho · Richard C. Wilson
Battista Biggio · Antonio Robles-Kelly (Eds.)

Structural, Syntactic, and Statistical Pattern Recognition

Joint IAPR International Workshop, S+SSPR 2018
Beijing, China, August 17–19, 2018
Proceedings

Editors

Xiao Bai
Beihang University
Beijing
China

Edwin R. Hancock
University of York
York
UK

Tin Kam Ho
IBM Research – Thomas J. Watson
Research
Yorktown Heights, NY
USA

Richard C. Wilson
University of York
Heslington, York
UK

Battista Biggio
University of Cagliari
Cagliari
Italy

Antonio Robles-Kelly
Data 61 - CSIRO
Canberra, ACT
Australia

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-319-97784-3 ISBN 978-3-319-97785-0 (eBook)
<https://doi.org/10.1007/978-3-319-97785-0>

Library of Congress Control Number: 2018950098

LNCS Sublibrary: SL6 – Image Processing, Computer Vision, Pattern Recognition, and Graphics

© Springer Nature Switzerland AG 2018

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

This volume contains the papers presented at the joint IAPR International Workshops on Structural and Syntactic Pattern Recognition (SSPR 2018) and Statistical Techniques in Pattern Recognition (SPR 2018). S+SSPR 2018 was jointly organized by Technical Committee 1 (Statistical Pattern Recognition Technique, chaired by Battista Biggio) and Technical Committee 2 (Structural and Syntactical Pattern Recognition, chaired by Antonio Robles-Kelly) of the International Association of Pattern Recognition (IAPR). It was held in Fragrance Hill, a beautiful suburb of Beijing, China, during August 17–19, 2018.

In S+SSPR 2018, 49 papers contributed by authors from a multitude of different countries were accepted and presented. There were 30 oral presentations and 19 poster presentations. Each submission was reviewed by at least two and usually three Program Committee members. The accepted papers cover the major topics of current interest in pattern recognition, including classification, clustering, dissimilarity representations, structural matching, graph-theoretic methods, shape analysis, deep learning, and multimedia analysis and understanding. Authors of selected papers were invited to submit an extended version to a Special Issue on “Recent Advances in Statistical, Structural and Syntactic Pattern Recognition,” to be published in *Pattern Recognition Letters* in 2019.

We were delighted to have three prominent keynote speakers: Prof. Edwin Hancock from the University of York, who was the IAPR TC1 Pierre Devijver Award winner in 2018, Prof. Josef Kittler from the University of Surrey, and Prof. Xilin Chen from the University of the Chinese Academy of Sciences.

The workshops (S+SSPR 2018) were hosted by the School of Computer Science and Engineering, Beihang University. We acknowledge the generous support from Beihang University, which is one of the leading comprehensive research universities in China, covering engineering, natural sciences, humanities, and social sciences. We also wish to express our gratitude for the financial support provided by the Beijing Advanced Innovation Center for Big Data and Brain Computing (BDBC), also based in Beihang University.

Finally, we would like to thank all the Program Committee members for their help in the review process. We also wish to thank all the local organizers. Without their contributions, S+SSPR 2018 would not have been successful. Finally, we express our appreciation to Springer for publishing this volume. More information about the workshops and organization can be found on the website: <http://ssspr2018.buaa.edu.cn/>.

August 2018

Xiao Bai
Edwin Hancock
Tin Kam Ho
Richard Wilson
Battista Biggio
Antonio Robles-Kelly

Organization

Program Committee

Gady Agam	Illinois Institute of Technology, USA
Ethem Alpaydin	Bogazici University, Turkey
Lu Bai	University of York, UK
Xiao Bai	Beihang University, China
Silvia Biasotti	CNR - IMATI, Italy
Manuele Bicego	University of Verona, Italy
Battista Biggio	University of Cagliari, Italy
Luc Brun	GREYC, France
Umberto Castellani	University of Verona, Italy
Veronika Cheplygina	Eindhoven University of Technology, The Netherlands
Francesc J. Ferri	University of Valencia, Spain
Pasi Fränti	University of Eastern Finland, Finland
Giorgio Fumera	University of Cagliari, Italy
Michal Haindl	Institute of Information Theory and Automation of the CAS, China
Edwin Hancock	University of York, UK
Laurent Heutte	Université de Rouen, France
Tin Kam Ho	IBM Watson, USA
Atsushi Imiya	MIT Chiba University, Japan
Jose M. Iñesta	Universidad de Alicante, Spain
Francois Jacquenet	Laboratoire Hubert Curien, France
Xiuping Jia	The University of New South Wales, Australian Defence Force Academy, Australia
Xiaoyi Jiang	University of Münster, Germany
Tomi Kinnunen	University of Eastern Finland, Finland
Jesse Krijthe	Leiden University, The Netherlands
Adam Krzyzak	Concordia University, Canada
Mineichi Kudo	Hokkaido University, Japan
Arjan Kuijper	TU Darmstadt, Germany
James Kwok	The Hong Kong University of Science and Technology, SAR China
Xuelong Li	Chinese Academy of Sciences, China
Xianglong Liu	Beihang University, China
Marco Loog	Delft University of Technology, The Netherlands
Bin Luo	Anhui University, China
Mauricio Orozco-Alzate	Universidad Nacional de Colombia, Colombia
Nikunj Oza	NASA, USA
Tapio Pahikkala	University of Turku, Finland

Marcello Pelillo	University of Venice, Italy
Filiberto Pla	Jaume I University, Spain
Marcos Quiles	Federal University of Sao Paulo, Brazil
Peng Ren	China University of Petroleum, China
Eraldo Ribeiro	Florida Institute of Technology, USA
Antonio Robles-Kelly	CSIRO, Australia
Jairo Rocha	University of the Balearic Islands, Spain
Luca Rossi	Aston University, UK
Samuel Rota Bulò	Fondazione Bruno Kessler, Italy
Punam Kumar Saha	University of Iowa, USA
Carlo Sansone	University of Naples Federico II, Italy
Frank-Michael Schleif	University of Bielefeld, Germany
Francesc Serratos	Universitat Rovira i Virgili, Spain
Ali Shokoufandeh	Drexel University, USA
Humberto Sossa	CIC-IPN, Mexico
Salvatore Tabbone	Université de Lorraine, France
Kar-Ann Toh	Yonsei University, South Korea
Ventzeslav Valev	Institute of Mathematics and Informatics Bulgarian Academy of Sciences, Bulgaria
Mario Vento	Università degli Studi di Salerno, Italy
Wenwu Wang	University of Surrey, UK
Richard Wilson	University of York, UK
Terry Windeatt	University of Surrey, UK
Jing-Hao Xue	University College London, UK
De-Chuan Zhan	Nanjing University, China
Lichi Zhang	Shanghai Jiao Tong University, China
Zhihong Zhang	Xiamen University, China
Jun Zhou	Griffith University, Australia

Contents

Classification and Clustering

Image Annotation Using a Semantic Hierarchy	3
<i>Abdessalem Bouzaïeni and Salvatore Tabbone</i>	
Malignant Brain Tumor Classification Using the Random Forest Method	14
<i>Lichi Zhang, Han Zhang, Islem Rekik, Yaozong Gao, Qian Wang, and Dinggang Shen</i>	
Rotationally Invariant Bark Recognition.	22
<i>Václav Remeš and Michal Haindl</i>	
Dynamic Voting in Multi-view Learning for Radiomics Applications.	32
<i>Hongliu Cao, Simon Bernard, Laurent Heutte, and Robert Sabourin</i>	
Iterative Deep Subspace Clustering	42
<i>Lei Zhou, Shuai Wang, Xiao Bai, Jun Zhou, and Edwin Hancock</i>	
A Scalable Spectral Clustering Algorithm Based on Landmark-Embedding and Cosine Similarity	52
<i>Guangliang Chen</i>	

Deep Learning and Neural Networks

On Fast Sample Preselection for Speeding up Convolutional Neural Network Training	65
<i>Frédéric Rayar and Seiichi Uchida</i>	
UAV First View Landmark Localization via Deep Reinforcement Learning . . .	76
<i>Xinran Wang, Peng Ren, Leijian Yu, Lirong Han, and Xiaogang Deng</i>	
Context Free Band Reduction Using a Convolutional Neural Network.	86
<i>Ran Wei, Antonio Robles-Kelly, and José Álvarez</i>	
Local Patterns and Supergraph for Chemical Graph Classification with Convolutional Networks	97
<i>Évariste Daller, Sébastien Bougleux, Luc Brun, and Olivier Lézoray</i>	
Learning Deep Embeddings via Margin-Based Discriminate Loss	107
<i>Peng Sun, Wenzhong Tang, and Xiao Bai</i>	

Dissimilarity Representations and Gaussian Processes

Protein Remote Homology Detection Using Dissimilarity-Based Multiple Instance Learning.	119
<i>Antonelli Mensi, Manuele Bicego, Pietro Lovato, Marco Loog, and David M. J. Tax</i>	
Local Binary Patterns Based on Subspace Representation of Image Patch for Face Recognition.	130
<i>Xin Zong</i>	
An Image-Based Representation for Graph Classification	140
<i>Frédéric Rayar and Seiichi Uchida</i>	
Visual Tracking via Patch-Based Absorbing Markov Chain	150
<i>Ziwei Xiong, Nan Zhao, Chenglong Li, and Jin Tang</i>	
Gradient Descent for Gaussian Processes Variance Reduction.	160
<i>Lorenzo Bottarelli and Marco Loog</i>	

Semi and Fully Supervised Learning Methods

Sparsification of Indefinite Learning Models.	173
<i>Frank-Michael Schleif, Christoph Raab, and Peter Tino</i>	
Semi-supervised Clustering Framework Based on Active Learning for Real Data	184
<i>Ryosuke Odate, Hiroshi Shinjo, Yasufumi Suzuki, and Masahiro Motobayashi</i>	
Supervised Classification Using Feature Space Partitioning.	194
<i>Ventzeslav Valev, Nicola Yanev, Adam Krzyżak, and Karima Ben Suliman</i>	
Deep Homography Estimation with Pairwise Invertibility Constraint	204
<i>Xiang Wang, Chen Wang, Xiao Bai, Yun Liu, and Jun Zhou</i>	

Spatio-temporal Pattern Recognition and Shape Analysis

Graph Time Series Analysis Using Transfer Entropy	217
<i>Ibrahim Caglar and Edwin R. Hancock</i>	
Analyzing Time Series from Chinese Financial Market Using a Linear-Time Graph Kernel	227
<i>Yuhang Jiao, Lixin Cui, Lu Bai, and Yue Wang</i>	

A Preliminary Survey of Analyzing Dynamic Time-Varying Financial Networks Using Graph Kernels.	237
<i>Lixin Cui, Lu Bai, Luca Rossi, Zhihong Zhang, Yuhang Jiao, and Edwin R. Hancock</i>	
Few-Example Affine Invariant Ear Detection in the Wild.	248
<i>Jianming Liu, Yongsheng Gao, and Yue Li</i>	
Line Voronoi Diagrams Using Elliptical Distances	258
<i>Aysylu Gabdulkhakova, Maximilian Langer, Bernhard W. Langer, and Walter G. Kropatsch</i>	
Structural Matching	
Modelling the Generalised Median Correspondence Through an Edit Distance	271
<i>Carlos Francisco Moreno-García and Francesc Serratosa</i>	
Learning the Sub-optimal Graph Edit Distance Edit Costs Based on an Embedded Model.	282
<i>Pep Santacruz and Francesc Serratosa</i>	
Ring Based Approximation of Graph Edit Distance.	293
<i>David B. Blumenthal, Sébastien Bougleux, Johann Gamper, and Luc Brun</i>	
Graph Edit Distance in the Exact Context	304
<i>Mostafa Darwiche, Romain Raveaux, Donatello Conte, and Vincent T'Kindt</i>	
The VF3-Light Subgraph Isomorphism Algorithm: When Doing Less Is More Effective	315
<i>Vincenzo Carletti, Pasquale Foggia, Antonio Greco, Alessia Saggese, and Mario Vento</i>	
A Deep Neural Network Architecture to Estimate Node Assignment Costs for the Graph Edit Distance	326
<i>Xavier Cortés, Donatello Conte, Hubert Cardot, and Francesc Serratosa</i>	
Error-Tolerant Geometric Graph Similarity	337
<i>Shri Prakash Dwivedi and Ravi Shankar Singh</i>	
Learning Cost Functions for Graph Matching	345
<i>Rafael de O. Werneck, Romain Raveaux, Salvatore Tabbone, and Ricardo da S. Torres</i>	

Multimedia Analysis and Understanding

Matrix Regression-Based Classification for Face Recognition	357
<i>Jian-Xun Mi, Quanwei Zhu, and Zhiheng Luo</i>	
Plenoptic Imaging for Seeing Through Turbulence	367
<i>Richard C. Wilson and Edwin R. Hancock</i>	
Weighted Local Mutual Information for 2D-3D Registration in Vascular Interventions	376
<i>Cai Meng, Qi Wang, Shaoya Guan, and Yi Xie</i>	
Cross-Model Retrieval with Reconstruct Hashing	386
<i>Yun Liu, Cheng Yan, Xiao Bai, and Jun Zhou</i>	
Deep Supervised Hashing with Information Loss	395
<i>Xueni Zhang, Lei Zhou, Xiao Bai, and Edwin Hancock</i>	
Single Image Super Resolution via Neighbor Reconstruction	406
<i>Zhihong Zhang, Zhuobin Xu, Zhiling Ye, Yiqun Hu, Lixin Cui, and Lu Bai</i>	
An Efficient Method for Boundary Detection from Hyperspectral Imagery . . .	416
<i>Suhad Lateef Al-Khafaji, Jun Zhou, and Alan Wee-Chung Liew</i>	

Graph-Theoretic Methods

Bags of Graphs for Human Action Recognition	429
<i>Xavier Cortés, Donatello Conte, and Hubert Cardot</i>	
Categorization of RNA Molecules Using Graph Methods.	439
<i>Richard C. Wilson and Enes Algul</i>	
Quantum Edge Entropy for Alzheimer’s Disease Analysis	449
<i>Jianjia Wang, Richard C. Wilson, and Edwin R. Hancock</i>	
Approximating GED Using a Stochastic Generator and Multistart IPFP	460
<i>Nicolas Boria, Sébastien Bogleux, and Luc Brun</i>	
Offline Signature Verification by Combining Graph Edit Distance and Triplet Networks.	470
<i>Paul Maergner, Vinaychandran Pondenkandath, Michele Alberti, Marcus Liwicki, Kaspar Riesen, Rolf Ingold, and Andreas Fischer</i>	
On Association Graph Techniques for Hypergraph Matching	481
<i>Giulia Sandi, Sebastiano Vascon, and Marcello Pelillo</i>	

Directed Network Analysis Using Transfer Entropy Component Analysis. . . .	491
<i>Meihong Wu, Yangbin Zeng, Zhihong Zhang, Haiyun Hong, Zhuobin Xu, Lixin Cui, Lu Bai, and Edwin R. Hancock</i>	
A Mixed Entropy Local-Global Reproducing Kernel for Attributed Graphs. . . .	501
<i>Lixin Cui, Lu Bai, Luca Rossi, Zhihong Zhang, Lixiang Xu, and Edwin R. Hancock</i>	
Dirichlet Densifiers: Beyond Constraining the Spectral Gap	512
<i>Manuel Curado, Francisco Escolano, Miguel Angel Lozano, and Edwin R. Hancock</i>	
Author Index	523