

*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>

Jian-Huang Lai · Cheng-Lin Liu  
Xilin Chen · Jie Zhou · Tieniu Tan  
Nanning Zheng · Hongbin Zha (Eds.)

# Pattern Recognition and Computer Vision

First Chinese Conference, PRCV 2018  
Guangzhou, China, November 23–26, 2018  
Proceedings, Part IV

*Editors*

Jian-Huang Lai  
Sun Yat-sen University  
Guangzhou, China

Cheng-Lin Liu  
Institute of Automation  
Chinese Academy of Sciences  
Beijing, China

Xilin Chen  
Institute of Computing Technology  
Chinese Academy of Sciences  
Beijing, China

Jie Zhou  
Tsinghua University  
Beijing, China

Tieniu Tan  
Institute of Automation  
Chinese Academy of Sciences  
Beijing, China

Nanning Zheng  
Xi'an Jiaotong University  
Xi'an, China

Hongbin Zha  
Peking University  
Beijing, China

ISSN 0302-9743

ISSN 1611-3349 (electronic)

Lecture Notes in Computer Science

ISBN 978-3-030-03340-8

ISBN 978-3-030-03341-5 (eBook)

<https://doi.org/10.1007/978-3-030-03341-5>

Library of Congress Control Number: 2018959435

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

Welcome to the proceedings of the First Chinese Conference on Pattern Recognition and Computer Vision (PRCV 2018) held in Guangzhou, China!

PRCV emerged from CCPR (Chinese Conference on Pattern Recognition) and CCCV (Chinese Conference on Computer Vision), which are both the most influential Chinese conferences on pattern recognition and computer vision, respectively. Pattern recognition and computer vision are closely inter-related and the two communities are largely overlapping. The goal of merging CCPR and CCCV into PRCV is to further boost the impact of the Chinese community in these two core areas of artificial intelligence and further improve the quality of academic communication. Accordingly, PRCV is co-sponsored by four major academic societies of China: the Chinese Association for Artificial Intelligence (CAAI), the China Computer Federation (CCF), the Chinese Association of Automation (CAA), and the China Society of Image and Graphics (CSIG).

PRCV aims at providing an interactive communication platform for researchers from academia and from industry. It promotes not only academic exchange, but also communication between academia and industry. In order to keep track of the frontier of academic trends and share the latest research achievements, innovative ideas, and scientific methods in the fields of pattern recognition and computer vision, international and local leading experts and professors are invited to deliver keynote speeches, introducing the latest advances in theories and methods in the fields of pattern recognition and computer vision.

PRCV 2018 was hosted by Sun Yat-sen University. We received 397 full submissions. Each submission was reviewed by at least two reviewers selected from the Program Committee and other qualified researchers. Based on the reviewers' reports, 178 papers were finally accepted for presentation at the conference, including 24 oral and 154 posters. The acceptance rate is 45%. The proceedings of the PRCV 2018 are published by Springer.

We are grateful to the keynote speakers, Prof. David Forsyth from University of Illinois at Urbana-Champaign, Dr. Zhengyou Zhang from Tencent, Prof. Tamara Berg from University of North Carolina Chapel Hill, and Prof. Michael S. Brown from York University.

We give sincere thanks to the authors of all submitted papers, the Program Committee members and the reviewers, and the Organizing Committee. Without their contributions, this conference would not be a success. Special thanks also go to all of the sponsors and the organizers of the special forums; their support made the conference a success. We are also grateful to Springer for publishing the proceedings and especially to Ms. Celine (Lanlan) Chang of Springer Asia for her efforts in coordinating the publication.

We hope you find the proceedings enjoyable and fruitful reading.

September 2018

Tieniu Tan  
Nanning Zheng  
Hongbin Zha  
Jian-Huang Lai  
Cheng-Lin Liu  
Xilin Chen  
Jie Zhou

# Organization

## Steering Chairs

Tieniu Tan	Institute of Automation, Chinese Academy of Sciences, China
Hongbin Zha	Peking University, China
Jie Zhou	Tsinghua University, China
Xilin Chen	Institute of Computing Technology, Chinese Academy of Sciences, China
Cheng-Lin Liu	Institute of Automation, Chinese Academy of Sciences, China
Long Quan	Hong Kong University of Science and Technology, SAR China
Yong Rui	Lenovo Group

## General Chairs

Tieniu Tan	Institute of Automation, Chinese Academy of Sciences, China
Nanning Zheng	Xi'an Jiaotong University, China
Hongbin Zha	Peking University, China

## Program Chairs

Jian-Huang Lai	Sun Yat-sen University, China
Cheng-Lin Liu	Institute of Automation, Chinese Academy of Sciences, China
Xilin Chen	Institute of Computing Technology, Chinese Academy of Sciences, China
Jie Zhou	Tsinghua University, China

## Organizing Chairs

Liang Wang	Institute of Automation, Chinese Academy of Sciences, China
Wei-Shi Zheng	Sun Yat-sen University, China

## Publicity Chairs

Huimin Ma	Tsinghua University, China
Jian Yu	Beijing Jiaotong University, China
Xin Geng	Southeast University, China

## International Liaison Chairs

Jingyi Yu	ShanghaiTech University, China
Pong C. Yuen	Hong Kong Baptist University, SAR China

## Publication Chairs

Zhouchen Lin	Peking University, China
Zhenhua Guo	Tsinghua University, China

## Tutorial Chairs

Huchuan Lu	Dalian University of Technology, China
Zhaoxiang Zhang	Institute of Automation, Chinese Academy of Sciences, China

## Workshop Chairs

Yao Zhao	Beijing Jiaotong University, China
Yanning Zhang	Northwestern Polytechnical University, China

## Sponsorship Chairs

Tao Wang	iQIYI Company, China
Jinfeng Yang	Civil Aviation University of China, China
Liang Lin	Sun Yat-sen University, China

## Demo Chairs

Yunhong Wang	Beihang University, China
Junyong Zhu	Sun Yat-sen University, China

## Competition Chairs

Xiaohua Xie	Sun Yat-sen University, China
Jiwen Lu	Tsinghua University, China

## Website Chairs

Ming-Ming Cheng	Nankai University, China
Changdong Wang	Sun Yat-sen University, China

## Finance Chairs

Huicheng Zheng	Sun Yat-sen University, China
Ruiping Wang	Institute of Computing Technology, Chinese Academy of Sciences, China

## Program Committee

Haizhou Ai	Tsinghua University, China
Xiang Bai	Huazhong University of Science and Technology, China



Xiaochun Cao	Institute of Information Engineering, Chinese Academy of Sciences, China
Hong Chang	Institute of Computing Technology, China
Songcan Chen	Chinese Academy of Sciences, China
Xilin Chen	Institute of Computing Technology, China
Hong Cheng	University of Electronic Science and Technology of China, China
Jian Cheng	Chinese Academy of Sciences, China
Ming-Ming Cheng	Nankai University, China
Yang Cong	Chinese Academy of Science, China
Dao-Qing Dai	Sun Yat-sen University, China
Junyu Dong	Ocean University of China, China
Yuchun Fang	Shanghai University, China
Jianjiang Feng	Tsinghua University, China
Shenghua Gao	ShanghaiTech University, China
Xinbo Gao	Xidian University, China
Xin Geng	Southeast University, China
Ping Guo	Beijing Normal University, China
Zhenhua Guo	Tsinghua University, China
Huiguang He	Institute of Automation, Chinese Academy of Sciences, China
Ran He	National Laboratory of Pattern Recognition, China
Richang Hong	Hefei University of Technology, China
Baogang Hu	Institute of Automation, Chinese Academy of Sciences, China
Hua Huang	Beijing Institute of Technology, China
Kaizhu Huang	Xi'an Jiaotong-Liverpool University, China
Rongrong Ji	Xiamen University, China
Wei Jia	Hefei University of Technology, China
Yunde Jia	Beijing Institute of Technology, China
Feng Jiang	Harbin Institute of Technology, China
Zhiguo Jiang	Beihang University, China
Lianwen Jin	South China University of Technology, China
Xiao-Yuan Jing	Wuhan University, China
Xiangwei Kong	Dalian University of Technology, China
Jian-Huang Lai	Sun Yat-sen University, China
Hua Li	Institute of Computing Technology, Chinese Academy of Sciences, China
Peihua Li	Dalian University of Technology, China
Shutao Li	Hunan University, China
Wu-Jun Li	Nanjing University, China
Xiu Li	Tsinghua University, China
Xuelong Li	Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences, China
Yongjie Li	University of Electronic Science and Technology of China, China
Ronghua Liang	Zhejiang University of Technology, China
Zhouchen Lin	Peking University, China

Cheng-Lin Liu	Institute of Automation, Chinese Academy of Sciences, China
Huafeng Liu	Zhejiang University, China
Huaping Liu	Tsinghua University, China
Qingshan Liu	Nanjing University of Information Science and Technology, China
Wenyin Liu	Guangdong University of Technology, China
Wenyu Liu	Huazhong University of Science and Technology, China
Yiguang Liu	Sichuan University, China
Yue Liu	Beijing Institute of Technology, China
Guoliang Lu	Shandong University, China
Jiwen Lu	Tsinghua University, China
Yue Lu	East China Normal University, China
Bin Luo	Anhui University, China
Ke Lv	Chinese Academy of Sciences, China
Huimin Ma	Tsinghua University, China
Zhanyu Ma	Beijing University of Posts and Telecommunications, China
Deyu Meng	Xi'an Jiaotong University, China
Qiguang Miao	Xidian University, China
Zhenjiang Miao	Beijing Jiaotong University, China
Weidong Min	Nanchang University, China
Bingbing Ni	Shanghai Jiaotong University, China
Gang Pan	Zhejiang University, China
Yuxin Peng	Peking University, China
Jun Sang	Chongqing University, China
Nong Sang	Huazhong University of Science and Technology, China
Shiguang Shan	Institute of Computing Technology, Chinese Academy of Sciences, China
Linlin Shen	Shenzhen University, China
Wei Shen	Shanghai University, China
Guangming Shi	Xidian University, China
Fei Su	Beijing University of Posts and Telecommunications, China
Jian Sun	Xi'an Jiaotong University, China
Jun Sun	Fujitsu R&D Center Co., Ltd., China
Zhengxing Sun	Nanjing University, China
Xiaoyang Tan	Nanjing University of Aeronautics and Astronautics, China
Jinhui Tang	Nanjing University of Science and Technology, China
Jin Tang	Anhui University, China
Yandong Tang	Shenyang Institute of Automation, Chinese Academy of Sciences, China
Chang-Dong Wang	Sun Yat-sen University, China
Liang Wang	National Laboratory of Pattern Recognition, China
Ruiping Wang	Institute of Computing Technology, Chinese Academy of Sciences, China
Shengjin Wang	Tsinghua University, China
Shuhui Wang	Institute of Computing Technology, Chinese Academy of Sciences, China

Tao Wang	iQIYI Company, China
Yuanquan Wang	Hebei University of Technology, China
Zengfu Wang	University of Science and Technology of China, China
Shikui Wei	Beijing Jiaotong University, China
Wei Wei	Northwestern Polytechnical University, China
Jianxin Wu	Nanjing University, China
Yihong Wu	Institute of Automation, Chinese Academy of Sciences, China
Gui-Song Xia	Wuhan University, China
Shiming Xiang	Institute of Automation, Chinese Academy of Sciences, China
Xiaohua Xie	Sun Yat-sen University, China
Yong Xu	South China University of Technology, China
Zenglin Xu	University of Electronic and Technology of China, China
Jianru Xue	Xi'an Jiaotong University, China
Xiangyang Xue	Fudan University, China
Gongping Yang	Shandong University, China
Jie Yang	ShangHai JiaoTong University, China
Jinfeng Yang	Civil Aviation University of China, China
Jufeng Yang	Nankai University, China
Qixiang Ye	Chinese Academy of Sciences, China
Xinge You	Huazhong University of Science and Technology, China
Jian Yin	Sun Yat-sen University, China
Xu-Cheng Yin	University of Science and Technology Beijing, China
Xianghua Ying	Peking University, China
Jian Yu	Beijing Jiaotong University, China
Shiqi Yu	Shenzhen University, China
Bo Yuan	Tsinghua University, China
Pong C. Yuen	Hong Kong Baptist University, SAR China
Zheng-Jun Zha	University of Science and Technology of China, China
Daoqiang Zhang	Nanjing University of Aeronautics and Astronautics, China
Guofeng Zhang	Zhejiang University, China
Junping Zhang	Fudan University, China
Min-Ling Zhang	Southeast University, China
Wei Zhang	Shandong University, China
Yanning Zhang	Northwestern Polytechnical University, China
Zhaoxiang Zhang	Institute of Automation, Chinese Academy of Sciences, China
Qijun Zhao	Sichuan University, China
Huicheng Zheng	Sun Yat-sen University, China
Wei-Shi Zheng	Sun Yat-sen University, China
Wenming Zheng	Southeast University, China
Jie Zhou	Tsinghua University, China
Wangmeng Zuo	Harbin Institute of Technology, China

## Contents – Part IV

### Object Detection and Tracking

Asymmetric Two-Stream Networks for RGB-Disparity Based Object Detection . . . . .	3
<i>Ruizhi Lu, Jianhuang Lai, and Xiaohua Xie</i>	
Crack Detection for Concrete Architecture Images Using Feature Enhancement Filtering and Shape Guided Active Contour Model . . . . .	16
<i>Xiaomin Xie, Tingting Wang, Bo Liu, Kui Li, and Lin Zhang</i>	
Domain Attention Model for Domain Generalization in Object Detection. . . .	27
<i>Weixiong He, Huicheng Zheng, and Jianhuang Lai</i>	
Exploring Multi-scale Deep Feature Fusion for Object Detection. . . . .	40
<i>Quan Zhang, Jianhuang Lai, Xiaohua Xie, and Junyong Zhu</i>	
Infrared Small Target Detection Using Multiscale Gray and Variance Difference . . . . .	53
<i>Jinyan Gao, Yulan Guo, Zaiping Lin, and Wei An</i>	
A Local Top-Down Module for Object Detection with Multi-scale Features . . . . .	65
<i>Shihua Huang, Lu Wang, Peiyu Yang, and Qingxu Deng</i>	
Parallel Connecting Deep and Shallow CNNs for Simultaneous Detection of Big and Small Objects. . . . .	78
<i>Canlong Zhang, Dongcheng He, Zhixin Li, and Zhiwen Wang</i>	
Penalty Non-maximum Suppression in Object Detection . . . . .	90
<i>Wenqing Zhao and Hai Yan</i>	
Self-Paced Densely Connected Convolutional Neural Network for Visual Tracking . . . . .	103
<i>Daohui Ge, Jianfeng Song, Yutao Qi, Chongxiao Wang, and Qiguang Miao</i>	
A Saliency-Based Object Tracking Method for UAV Application . . . . .	115
<i>Jinyu Yang, Wenrui Ding, Chunlei Liu, and Zechen Ha</i>	
Research on Real-Time Vehicle Detection Algorithm Based on Deep Learning . . . . .	126
<i>Wei Yang, Ji Zhang, Zhongbao Zhang, and Hongyuan Wang</i>	

Vehicle Detection Based on Separable Reverse Connected Network . . . . .	138
<i>Enze Yang, Linlin Huang, and Jian Hu</i>	
Online Multiple Person Tracking Using Fully-Convolutional Neural Networks and Motion Invariance Constraints . . . . .	150
<i>Nan Wang, Qi Zou, Yaping Huang, and Qiulin Ma</i>	
Conductive Particles Detection in the TFT-LCD Manufacturing Process with U-ResNet . . . . .	162
<i>Kangping Chen and Eryun Liu</i>	
A New Monocular 3D Object Detection with Neural Network . . . . .	174
<i>Weijie Hong, Yiguang Liu, Yunan Zheng, Ying Wang, and Xuelei Shi</i>	
SalNet: Edge Constraint Based End-to-End Model for Salient Object Detection . . . . .	186
<i>Le Han, Xuelong Li, and Yongsheng Dong</i>	
Gated Feature Pyramid Network for Object Detection . . . . .	199
<i>Xuemei Xie, Quan Liao, Lihua Ma, and Xing Jin</i>	
Learning Non-local Representation for Visual Tracking . . . . .	209
<i>Peng Zhang and Zengfu Wang</i>	
Discriminative Visual Tracking Using Multi-feature and Adaptive Dictionary Learning. . . . .	221
<i>Penggen Zheng, Jin Zhan, Huimin Zhao, and Jujian Lv</i>	
Oscillation Detection and Parameter-Adaptive Hedge Algorithm for Real-Time Visual Tracking . . . . .	233
<i>Bolin Lv, Xiaolong Zhou, and Shengyong Chen</i>	
Asymmetrical Reverse Connection and Smooth-NMS for Object Detection . . . . .	245
<i>Juan Peng, Zhicheng Wang, Xuan Lv, Gang Wei, Jingjing Fei, and Hongwei Zhang</i>	
External Damage Risk Detection of Transmission Lines Using E-OHEM Enhanced Faster R-CNN . . . . .	260
<i>Lei Qu, Kuixiang Liu, Qi He, Jun Tang, and Dong Liang</i>	
Parallel Search by Reinforcement Learning for Object Detection . . . . .	272
<i>Ye Huang, Chaochen Gu, Kaijie Wu, and Xinping Guan</i>	
A Novel Visual Tracking Method Based on Moth-Flame Optimization Algorithm . . . . .	284
<i>Huanlong Zhang, Xiujiao Zhang, Xiaoliang Qian, Yibin Chen, and Fang Wang</i>	

Learning Soft-Consistent Correlation Filters for RGB-T Object Tracking . . . .	295
<i>Yulong Wang, Chenglong Li, and Jin Tang</i>	

**Performance Evaluation and Database**

A Touching Character Database from Tibetan Historical Documents to Evaluate the Segmentation Algorithm . . . . .	309
<i>Quanchao Zhao, Long-long Ma, and Lijuan Duan</i>	
Nighttime FIR Pedestrian Detection Benchmark Dataset for ADAS . . . . .	322
<i>Zhewei Xu, Jiajun Zhuang, Qiong Liu, Jingkai Zhou, and Shaowu Peng</i>	
How Many Labeled License Plates Are Needed? . . . . .	334
<i>Changhao Wu, Shugong Xu, Guocong Song, and Shunqing Zhang</i>	
Evaluation of Lightweight Local Descriptors for Level Ground Navigation with Monocular SLAM . . . . .	347
<i>Weiya Chen, Yulin Wan, Shiqi Ou, and Zhidong Xue</i>	
Establishing a Large Scale Dataset for Image Emotion Analysis Using Chinese Emotion Ontology. . . . .	359
<i>Lifang Wu, Mingchao Qi, Heng Zhang, Meng Jian, Bowen Yang, and Dai Zhang</i>	

**Remote Sensing**

Attention-Based Convolutional Networks for Ship Detection in High-Resolution Remote Sensing Images . . . . .	373
<i>Xiaofeng Ma, Wenyuan Li, and Zhenwei Shi</i>	
An Improved Camouflage Target Detection Using Hyperspectral Image Based on Block-Diagonal and Low-Rank Representation . . . . .	384
<i>Fei Li, Xiuwei Zhang, Lei Zhang, Yanning Zhang, Dongmei Jiang, and Genping Zhao</i>	
Hyperspectral Band Selection with Convolutional Neural Network . . . . .	396
<i>Rui Cai, Yuan Yuan, and Xiaoqiang Lu</i>	
Integrating Convolutional Neural Network and Gated Recurrent Unit for Hyperspectral Image Spectral-Spatial Classification . . . . .	409
<i>Feng Zhou, Renlong Hang, Qingshan Liu, and Xiaotong Yuan</i>	
Disparity-Based Robust Unstructured Terrain Segmentation . . . . .	421
<i>Pengbo Zhang, Xinzhu Ma, Zhihui Wang, Haojie Li, and Zhongxuan Luo</i>	

<b>Author Index . . . . .</b>	<b>433</b>
-------------------------------	------------