Lecture Notes in Computer Science 13022

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

Huimin Ma · Liang Wang · Changshui Zhang ·
Fei Wu · Tieniu Tan · Yaonan Wang ·
Jianhuang Lai · Yao Zhao (Eds.)

Pattern Recognition and Computer Vision

4th Chinese Conference, PRCV 2021
Beijing, China, October 29 – November 1, 2021
Proceedings, Part IV

Springer

Editors
Huimin Ma
University of Science and Technology Beijing
Beijing, China

Changshui Zhang
Tsinghua University
Beijing, China

Tieniu Tan
Chinese Academy of Sciences
Beijing, China

Jianhuang Lai
Sun Yat-Sen University
Guangzhou, Guangdong, China

Liang Wang
Chinese Academy of Sciences
Beijing, China

Fei Wu
Zhejiang University
Hangzhou, China

Yaonan Wang
Hunan University
Changsha, China

Yao Zhao
Beijing Jiaotong University
Beijing, China

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-88012-5 ISBN 978-3-030-88013-2 (eBook)
https://doi.org/10.1007/978-3-030-88013-2

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

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 4th Chinese Conference on Pattern Recognition and Computer Vision (PRCV 2021) held in Beijing, China!

PRCV was established to further boost the impact of the Chinese community in pattern recognition and computer vision, which are 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 China Society of Image and Graphics (CSIG), the Chinese Association for Artificial Intelligence (CAAI), the China Computer Federation (CCF), and the Chinese Association of Automation (CAA).

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, 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 2021 was hosted by University of Science and Technology Beijing, Beijing Jiaotong University, and the Beijing University of Posts and Telecommunications. We received 513 full submissions. Each submission was reviewed by at least three reviewers selected from the Program Committee and other qualified researchers. Based on the reviewers' reports, 201 papers were finally accepted for presentation at the conference, including 30 oral and 171 posters. The acceptance rate was 39.2%. PRCV took place during October 29 to November 1, 2021, and the proceedings are published in this volume in Springer's Lecture Notes in Computer Science (LNCS) series.

We are grateful to the keynote speakers, Larry Davis from the University of Maryland, USA, Yoichi Sato from the University of Tokyo, Japan, Michael Black from the Max Planck Institute for Intelligent Systems, Germany, Songchun Zhu from Peking University and Tsinghua University, China, and Bo Xu from the Institute of Automation, Chinese Academy of Sciences, China.

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 have been possible. Special thanks also go to all of the sponsors

and the organizers of the special forums; their support helped to make the conference a success. We are also grateful to Springer for publishing the proceedings.

October 2021

Tieniu Tan
Yaonan Wang
Jianhuang Lai
Yao Zhao
Huimin Ma
Liang Wang
Changshui Zhang
Fei Wu

Organization

Steering Committee Chair

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

Steering Committee

Xilin Chen	Institute of Computing Technology, Chinese Academy of Sciences, China
Chenglin Liu	Institute of Automation, Chinese Academy of Sciences, China
Yong Rui	Lenovo, China
Hongbing Zha	Peking University, China
Nanning Zheng	Xi'an Jiaotong University, China
Jie Zhou	Tsinghua University, China

Steering Committee Secretariat

Liang Wang	Institute of Automation, Chinese Academy of Sciences, China

General Chairs

Tieniu Tan	Institute of Automation, Chinese Academy of Sciences, China
Yaonan Wang	Hunan University, China
Jianhuang Lai	Sun Yat-sen University, China
Yao Zhao	Beijing Jiaotong University, China

Program Chairs

Huimin Ma	University of Science and Technology Beijing, China
Liang Wang	Institute of Automation, Chinese Academy of Sciences, China
Changshui Zhang	Tsinghua University, China
Fei Wu	Zhejiang University, China

Organizing Committee Chairs

Xucheng Yin	University of Science and Technology Beijing, China
Zhanyu Ma	Beijing University of Posts and Telecommunications, China
Zhenfeng Zhu	Beijing Jiaotong University, China
Ruiping Wang	Institute of Computing Technology, Chinese Academy of Sciences, China

Sponsorship Chairs

Nenghai Yu	University of Science and Technology of China, China
Xiang Bai	Huazhong University of Science and Technology, China
Yue Liu	Beijing Institute of Technology, China
Jinfeng Yang	Shenzhen Polytechnic, China

Publicity Chairs

Xiangwei Kong	Zhejiang University, China
Tao Mei	JD.com, China
Jiaying Liu	Peking University, China
Dan Zeng	Shanghai University, China

International Liaison Chairs

Jingyi Yu	ShanghaiTech University, China
Xuelong Li	Northwestern Polytechnical University, China
Bangzhi Ruan	Hong Kong Baptist University, China

Tutorial Chairs

Weishi Zheng	Sun Yat-sen University, China
Mingming Cheng	Nankai University, China
Shikui Wei	Beijing Jiaotong University, China

Symposium Chairs

Hua Huang	Beijing Normal University, China
Yuxin Peng	Peking University, China
Nannan Wang	Xidian University, China

Doctoral Forum Chairs

Xi Peng	Sichuan University, China
Hang Su	Tsinghua University, China
Huihui Bai	Beijing Jiaotong University, China

Competition Chairs

Nong Sang	Huazhong University of Science and Technology, China
Wangmeng Zuo	Harbin Institute of Technology, China
Xiaohua Xie	Sun Yat-sen University, China

Special Issue Chairs

Jiwen Lu	Tsinghua University, China
Shiming Xiang	Institute of Automation, Chinese Academy of Sciences, China
Jianxin Wu	Nanjing University, China

Publication Chairs

Zhouchen Lin	Peking University, China
Chunyu Lin	Beijing Jiaotong University, China
Huawei Tian	People's Public Security University of China, China

Registration Chairs

Junjun Yin	University of Science and Technology Beijing, China
Yue Ming	Beijing University of Posts and Telecommunications, China
Jimin Xiao	Xi'an Jiaotong-Liverpool University, China

Demo Chairs

Xiaokang Yang	Shanghai Jiaotong University, China
Xiaobin Zhu	University of Science and Technology Beijing, China
Chunjie Zhang	Beijing Jiaotong University, China

Website Chairs

Chao Zhu	University of Science and Technology Beijing, China
Zhaofeng He	Beijing University of Posts and Telecommunications, China
Runmin Cong	Beijing Jiaotong University, China

Finance Chairs

Weiping Wang	University of Science and Technology Beijing, China
Lifang Wu	Beijing University of Technology, China
Meiqin Liu	Beijing Jiaotong University, China

Program Committee

Jing Dong	Chinese Academy of Sciences, China
Ran He	Institute of Automation, Chinese Academy of Sciences, China
Xi Li	Zhejiang University, China
Si Liu	Beihang University, China
Xi Peng	Sichuan University, China
Yu Qiao	Chinese Academy of Sciences, China
Jian Sun	Xi'an Jiaotong University, China
Rongrong Ji	Xiamen University, China
Xiang Bai	Huazhong University of Science and Technology, China
Jian Cheng	Institute of Automation, Chinese Academy of Sciences, China
Mingming Cheng	Nankai University, China
Junyu Dong	Ocean University of China, China
Weisheng Dong	Xidian University, China
Yuming Fang	Jiangxi University of Finance and Economics, China
Jianjiang Feng	Tsinghua University, China
Shenghua Gao	ShanghaiTech University, China
Maoguo Gong	Xidian University, China
Yahong Han	Tianjin University, China
Huiguang He	Institute of Automation, Chinese Academy of Sciences, China
Shuqiang Jiang	Institute of Computing Technology, China Academy of Science, China
Lianwen Jin	South China University of Technology, China
Xiaoyuan Jing	Wuhan University, China
Haojie Li	Dalian University of Technology, China
Jianguo Li	Ant Group, China
Peihua Li	Dalian University of Technology, China
Liang Lin	Sun Yat-sen University, China
Zhouchen Lin	Peking University, China
Jiwen Lu	Tsinghua University, China
Siwei Ma	Peking University, China
Deyu Meng	Xi'an Jiaotong University, China
Qiguang Miao	Xidian University, China
Liqiang Nie	Shandong University, China
Wanli Ouyang	The University of Sydney, Australia
Jinshan Pan	Nanjing University of Science and Technology, China
Nong Sang	Huazhong University of Science and Technology, China
Shiguang Shan	Institute of Computing Technology, Chinese Academy of Sciences, China
Hongbin Shen	Shanghai Jiao Tong University, China
Linlin Shen	Shenzhen University, China
Mingli Song	Zhejiang University, China
Hanli Wang	Tongji University, China
Hanzi Wang	Xiamen University, China
Jingdong Wang	Microsoft, China

Nannan Wang	Xidian University, China
Jianxin Wu	Nanjing University, China
Jinjian Wu	Xidian University, China
Yihong Wu	Institute of Automation, Chinese Academy of Sciences, China
Guisong Xia	Wuhan University, China
Yong Xia	Northwestern Polytechnical University, China
Shiming Xiang	Chinese Academy of Sciences, China
Xiaohua Xie	Sun Yat-sen University, China
Jufeng Yang	Nankai University, China
Wankou Yang	Southeast University, China
Yang Yang	University of Electronic Science and Technology of China, China
Yilong Yin	Shandong University, China
Xiaotong Yuan	Nanjing University of Information Science and Technology, China
Zhengjun Zha	University of Science and Technology of China, China
Daoqiang Zhang	Nanjing University of Aeronautics and Astronautics, China
Zhaoxiang Zhang	Institute of Automation, Chinese Academy of Sciences, China
Weishi Zheng	Sun Yat-sen University, China
Wangmeng Zuo	Harbin Institute of Technology, China

Reviewers

Bai Xiang
Bai Xiao
Cai Shen
Cai Yinghao
Chen Zailiang
Chen Weixiang
Chen Jinyu
Chen Yifan
Cheng Gong
Chu Jun
Cui Chaoran
Cui Hengfei
Cui Zhe
Deng Hongxia
Deng Cheng
Ding Zihan
Dong Qiulei
Dong Yu
Dong Xue
Duan Lijuan
Fan Bin
Fan Yongxian
Fan Bohao
Fang Yuchun
Feng Jiachang
Feng Jiawei
Fu Bin
Fu Ying
Gao Hongxia
Gao Shang-Hua
Gao Changxin
Gao Guangwei
Gao Yi
Ge Shiming
Ge Yongxin
Geng Xin
Gong Chen
Gong Xun
Gu Guanghua
Gu Yu-Chao
Guo Chunle
Guo Jianwei
Guo Zhenhua
Han Qi
Han Linghao
He Hong
He Mingjie
He Zhaofeng
He Hongliang
Hong Jincheng
Hu Shishuai
Hu Jie
Hu Yang
Hu Fuyuan
Hu Ruyun
Hu Yangwen
Huang Lei
Huang Sheng
Huang Dong
Huang Huaibo
Huang Jiangtao
Huang Xiaoming
Ji Fanfan
Ji Jiayi
Ji Zhong
Jia Chuanmin
Jia Wei
Jia Xibin
Jiang Bo
Jiang Peng-Tao
Kan Meina
Kang Wenxiong

Lei Na
Lei Zhen
Leng Lu
Li Chenglong
Li Chunlei
Li Hongjun
Li Shuyan
Li Xia
Li Zhiyong
Li Guanbin
Li Peng
Li Ruirui
Li Zechao
Li Zhen
Li Ce
Li Changzhou
Li Jia
Li Jian
Li Shiying
Li Wanhua
Li Yongjie
Li Yunfan
Liang Jian
Liang Yanjie
Liao Zehui
Lin Zihang
Lin Chunyu
Lin Guangfeng
Liu Heng
Liu Li
Liu Wu
Liu Yiguang
Liu Zhiang
Liu Chongyu
Liu Li
Liu Qingshan
Liu Yun
Liu Cheng-Lin
Liu Min
Liu Risheng
Liu Tiange
Liu Weifeng
Liu Xiaolong
Liu Yang
Liu Zhi
Liu Zhou
Lu Shaoping
Lu Haopeng
Luo Bin
Luo Gen
Ma Chao
Ma Wenchao
Ma Cheng
Ma Wei
Mei Jie
Miao Yongwei
Nie Liqiang
Nie Xiushan
Niu Xuesong
Niu Yuzhen
Ouyang Jianquan
Pan Chunyan
Pan Zhiyu
Pan Jinshan
Peng Yixing
Peng Jun
Qian Wenhua
Qin Binjie
Qu Yanyun
Rao Yongming
Ren Wenqi
Rui Song
Shen Chao
Shen Haifeng
Shen Shuhan
Shen Tiancheng
Sheng Lijun
Shi Caijuan
Shi Wu
Shi Zhiping
Shi Hailin
Shi Lukui
Song Chunfeng
Su Hang
Sun Xiaoshuai
Sun Jinqiu
Sun Zhanli
Sun Jun
Sun Xian
Sun Zhenan
Tan Chaolei
Tan Xiaoyang
Tang Jin
Tu Zhengzheng
Wang Fudong
Wang Hao
Wang Limin
Wang Qinfen
Wang Xingce
Wang Xinnian
Wang Zitian
Wang Hongxing
Wang Jiapeng
Wang Luting
Wang Shanshan
Wang Shengke
Wang Yude
Wang Zilei
Wang Dong
Wang Hanzi
Wang Jinjia
Wang Long
Wang Qiufeng
Wang Shuqiang
Wang Xingzheng
Wei Xiu-Shen
Wei Wei
Wen Jie
Wu Yadong
Wu Hong
Wu Shixiang
Wu Xia
Wu Yongxian
Wu Yuwei
Wu Xinxiao
Wu Yihong
Xia Daoxun
Xiang Shiming
Xiao Jinsheng
Xiao Liang
Xiao Jun
Xie Xingyu
Xu Gang
Xu Shugong
Xu Xun

Xu Zhenghua
Xu Lixiang
Xu Xin-Shun
Xu Mingye
Xu Yong
Xue Nan
Yan Bo
Yan Dongming
Yan Junchi
Yang Dong
Yang Guan
Yang Peipei
Yang Wenming
Yang Yibo
Yang Lu
Yang Jinfu
Yang Wen
Yao Tao
Ye Mao
Yin Ming
Yin Fei
You Gexin
Yu Ye
Yu Qian
Yu Zhe
Zeng Lingan
Zeng Hui
Zhai Yongjie
Zhang Aiwu
Zhang Chi
Zhang Jie
Zhang Shu
Zhang Wenqiang
Zhang Yunfeng
Zhang Zhao
Zhang Hui
Zhang Lei
Zhang Xuyao
Zhang Yongfei
Zhang Dingwen
Zhang Honggang
Zhang Lin
Zhang Mingjin
Zhang Shanshan
Zhang Xiao-Yu
Zhang Yanming
Zhang Yuefeng
Zhao Cairong
Zhao Yang
Zhao Yuqian
Zhen Peng
Zheng Wenming
Zheng Feng
Zhong Dexing
Zhong Guoqiang
Zhou Xiaolong
Zhou Xue
Zhou Quan
Zhou Xiaowei
Zhu Chaoyang
Zhu Xiangping
Zou Yuexian
Zuo Wangmeng

Contents - Part IV

Special Session: New Advances in Visual Perception and Understanding