

PROCEEDINGS OF SPIE

# ***Fourth International Workshop on Pattern Recognition***

**Xudong Jiang  
Zhenxiang Chen  
Guojian Chen**  
*Editors*

**28–30 June 2019  
Nanjing, China**

*Organized by*  
School of Information Science and Engineering, Southeast University (China)

*Sponsored by*  
Southeast University (China)

*Published by*  
SPIE

**Volume 11198**

Proceedings of SPIE 0277-786X, V. 11198

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Fourth International Workshop on Pattern Recognition, edited by Xudong Jiang, Zhenxiang Chen, Guojian Chen,  
Proc. of SPIE Vol. 11198, 1119801 · © 2019 SPIE · CCC code: 0277-786X/19/\$21 · doi: 10.1117/12.2541878

Proc. of SPIE Vol. 11198 1119801-1

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at [SPIDigitalLibrary.org](http://SPIDigitalLibrary.org).

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Fourth International Workshop on Pattern Recognition*, edited by Xudong Jiang, Zhenxiang Chen, Guojian Chen, Proceedings of SPIE Vol. 11198 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

ISSN: 0277-786X  
ISSN: 1996-756X (electronic)

ISBN: 9781510631137  
ISBN: 9781510631144 (electronic)

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA  
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

[SPIE.org](http://SPIE.org)

Copyright © 2019, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$21.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at [copyright.com](http://copyright.com). Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/19/\$21.00.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL  
LIBRARY**

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

# Contents

vii	<i>Authors</i>
ix	<i>Conference Committee</i>
xiii	<i>Introduction</i>

---

## **SESSION 1 IMAGE PROCESSING**

---

11198 02	<b>Effective region-based chroma subsampling method for Bayer CFA images [11198-25]</b>
11198 03	<b>Detection of imitation from authentic shoe apparel using integrated image processing techniques [11198-10]</b>
11198 04	<b>Recaptured image detection based on convolutional neural networks with local binary patterns coding [11198-26]</b>
11198 05	<b>A progressive approach for single image super-resolution [11198-29]</b>
11198 06	<b>MBNet: multi-scale bilinear convolutional neural networks for fine-grained visual classification towards real-time tasks [11198-5]</b>
11198 07	<b>Raw pork and beef quality determination through pH level and lipid oxidation patterns and image processing [11198-33]</b>
11198 08	<b>Improved threshold function image denoising method [11198-31]</b>

---

## **SESSION 2 CLASSIFICATION AND CLUSTERING**

---

11198 09	<b>SE-dual path networks combined with a navigator for fine-grained classification [11198-30]</b>
11198 0A	<b>Research on Hadoop-based massive short text clustering algorithm [11198-9]</b>
11198 0B	<b>PolSAR image classification based on complex-valued convolutional neural network and Markov random field [11198-37]</b>
11198 0C	<b>Unsupervised classification of PolSAR image based on tensor product graph diffusion [11198-11]</b>
11198 0D	<b>Attention-based multi-scale transfer ResNet for skull fracture image classification [11198-27]</b>

- 11198 OE     **Flight trajectory clustering based on a novel distance from a point to a segment set** [11198-15]
- 11198 OF     **Caries lesion detection tool using near infrared image processing and decision tree learning**  
[11198-34]
- 11198 OG     **Video-based detection and classification of driving postures by feature distance extraction  
and BP neural network** [11198-23]
- 11198 OH     **A new method for constructing ensemble polynomial regression model in privacy preserving  
distributed environment** [11198-19]

---

**SESSION 3     PATTERN RECOGNITION AND DETECTION**

---

- 11198 OI     **Facial expression recognition based on conjugate gradient extreme learning machine** [11198-  
40]
- 11198 OJ     **Heart beat classification and matching recognition based on hierarchical dynamic time  
warping** [11198-28]
- 11198 OK     **Swine grunt analysis through intensity and frequency isolation with thermography using Adafruit  
AMG8833 IR thermal camera breakout for swine stress detection and reduction** [11198-38]
- 11198 OL     **Multi-scale binary geometric feature description and matching for accurate registration of  
point clouds** [11198-13]
- 11198 OM     **Extracting stroke errors from digital ink characters by beginning learners of Chinese as a  
foreign language based on accurate stroke matching** [11198-6]
- 11198 ON     **Effective vision- and SoC-based fall detection for the elderly** [11198-24]
- 11198 OO     **Scale-variant traffic sign detection** [11198-22]
- 11198 OP     **An efficient approach combined with harmonic and shift invariance for piano music multi-  
pitch detection** [11198-14]
- 11198 OQ     **Replay attack detection by channel frequency response difference enhancement** [11198-39]
- 11198 OR     **Customization and optimization of SSD-based neural network model for detection of external  
force damage on transmission lines** [11198-8]

---

**SESSION 4     DATA ANALYSIS**

---

- 11198 OS     **Retrospective convolution and static sample synthesis for instantaneous change detection**  
[11198-43]
- 11198 OT     **Second-order convolutional network for crowd counting** [11198-3]

- 11198 0U     **Research on the influence of node deployment in cluster for modeling efficiency** [11198-41]
- 11198 0V     **Second glance framework (secG): enhanced ulcer detection with deep learning on a large wireless capsule endoscopy dataset** [11198-20]
- 11198 0W     **Roaming of oblique photography model in unity3D** [11198-16]
- 11198 0X     **Multi-parameter geometric measurement of piston based on laser projection** [11198-7]
- 11198 0Y     **Radio frequency sensing based environmental monitoring technology** [11198-44]
- 11198 0Z     **A design framework for adaptive e-learning environment** [11198-42]
- 11198 10     **Prediction accuracy analysis with logistic regression and CART decision tree** [11198-2]
- 11198 11     **An integrated deep-learning and geometric approach to 1D barcode** [11198-4]
- 11198 12     **Group binary weight networks** [11198-32]
- 11198 13     **Exploring data sampling techniques for imbalanced classification problems** [11198-21]



# Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Bai, Hao, 0M  
Balbin, Jessie Jaye R., 03, 07, 0F  
Banhaw, Renalyn L., 0F  
Bilal, Hazrat, 0T  
Borja, Carlo Reese F., 07  
Cao, Guo, 05  
Cao, Xu, 0C  
Catapang, Justin Llyod, 0K  
Chan, Yu-Sheng, 0N  
Chen, Chao, 0S  
Chen, Jian, 0I  
Chen, Tianping, 0B  
Cheng, Jen-Shun, 0N  
Chi, Yingying, 0R  
Chien, Wei-Che, 02  
Chung, Kuo-Liang, 02, 0N  
Cui, Wenpeng, 0R  
de Dios, Neil Leander A., 07  
Deng, Kai, 0P  
Deng, Tingqiang, 06  
Ding, Hui, 0E  
Du, Cuibing, 0S  
Feng, Fan, 0L  
Gao, Hewei, 0V  
Garcia, Ramon, 0K  
Ge, Hailong, 0X  
Gu, Xiaoqing, 0Z  
Guo, Kailing, 12  
Guo, Xingchen, 0Q  
He, Jie, 0G  
Hong, Haifeng, 13  
Hong, Wenjing, 0H  
Huan, Jiajia, 13  
Huang, Mengtao, 08  
Huang, Yuzhi, 0P  
Ibarra, Joseph Bryan G., 07  
Jiang, Junxin, 11  
Jiang, Rifeng, 0D  
Lee, Yu-Ling, 02  
Li, Chunguo, 06  
Li, Meilin, 0C  
Li, Rui, 06  
Li, Xuanxi, 0Z  
Li, Xuesong, 05  
Li, Zhanjun, 0H  
Liang, Yongbo, 05  
Liao, Chi-Huang, 0N  
Liao, Rutian, 06  
Liu, De-Hao, 0N  
Liu, Gang, 0D, 0P  
Liu, Li-Ting, 0N  
Liu, Rui, 0R  
Liu, Si, 0J  
Liu, Yang, 06  
Liu, Yuxiang, 0U  
Long, Xin, 0U  
Ma, Jie, 0L  
Ma, Qian, 0C  
Ma, Qingzeng, 0X  
Ma, Xinqiang, 0X  
Ma, Yuanyuan, 0E  
Mandilli, Emmanuelle Allyanna, 0K  
Martin, Christian Raye O., 0F  
Mordido, McTroy John S., 03  
Ning, Dunbo, 0D  
Pangilinan, Paul Nicko G., 07  
Pelayo, Jhohn Ramses B., 03  
Peng, Yang, 0U, 0W  
Qian, Ying, 10  
Qin, Mingying, 04  
Qin, Xianxiang, 0B, 0C  
Qing, Zepeng, 0A  
Quan, Siwen, 0L  
Rivera, Joanne Lorie R., 0F  
Salapantan, Abegail, 0K  
Sen, Liu, 0X  
Shao, Yan, 0H  
Shi, Yuliang, 0A  
Sui, Yu, 13  
Sun, Jiachi, 0C  
Tacderas, Ivan Hur Y., 03  
Tang, Hui, 0G  
Tornea, Jucel Adelyn F., 03  
Valiente, Leonardo D., 03, 0K  
Victorino, Jeffrey R. R., 0F  
Wang, Chuyi, 0D  
Wang, Di, 10  
Wang, Guangyue, 0W  
Wang, Lu, 08  
Wang, Luyang, 0T  
Wang, Peng, 0B  
Wang, Sen, 0V  
Wang, Sijuan, 0O  
Wang, Xiaoxue, 0Z  
Wang, Yang, 0J  
Wei, Cheng, 0X  
Wei, Lin, 0G  
Xiao, Yingchao, 0E

Xiao, Yunzhe, 11  
Xing, Xiaofen, 12  
Xing, Yuxiang, 0V  
Xu, Kai, 11  
Xu, Qiucheng, 0E  
Xu, Xiangmin, 12  
Yan, Miguel Francis B., 07  
Yang, Liu, 09  
Yang, Luxi, 06  
Yang, Yicai, 12  
Yang, Yingming, 10  
Yang, Zhe, 06  
Yin, Baoqun, 0T  
Yin, Yuting, 04  
You, Zhiqiang, 0O  
Yu, Chao-Liang, 02  
Yu, Kun, 0L  
Yu, Wangsheng, 0B  
Yu, Yibiao, 0Q  
Yuan, Yidong, 0R  
Zhai, Qiang, 0T  
Zhan, Enqi, 0J  
Zhang, Haifeng, 0R  
Zhang, Hao, 0V  
Zhang, Jun, 0G  
Zhang, Li, 0V  
Zhang, Maojun, 0U, 0W  
Zhang, Pengfei, 0W  
Zhang, Sheng, 0S  
Zhang, Xiaohui, 13  
Zhang, Xi-Wen, 0M  
Zhang, Xudong, 10  
Zhang, Yang, 0Y  
Zhao, Qiang, 0A  
Zhao, Zhiyang, 0Y  
Zheng, Jianbin, 0J  
Zheng, Youfeng, 0G  
Zhong, Jin, 09  
Zhu, Nan, 04  
Zhu, Xianxun, 0Y  
Zou, Huanxin, 0B, 0C  
Zuo, Jiancun, 0Y

# Conference Committee

## *International Advisory Committees*

**Yiu-ming Cheung**, Hong Kong Baptist University  
(Hong Kong, China)

**Xiaoyi Jiang**, Westfälische Wilhelms-Universität Münster (Germany)

## *Conference Chairs*

**Xudong Jiang**, Nanyang Technological University  
(Singapore)

**Zhenxiang Chen**, University of Jinan (China)

## *Program Chairs*

**Pedro Furtado**, Universidade de Coimbra (Portugal)

**Masayuki Arai**, Teikyo University (Japan)

**Kin Choong Yow**, University of Regina (Canada)

**Aythami Morales**, Universidad Autonoma de Madrid  
(Spain)

**Kin Hong Wong**, The Chinese University of Hong Kong  
(Hong Kong, China)

## *Local Organizing Chair*

**Chuan Zhang**, Southeast University (China)

## *Technical Committees*

**Yibiao Yu**, Soochow University (China)

**Kai Xu**, National University of Defense Technology (China)

**Ying Qian**, East China Normal University (China)

**Xinqiang Ma**, Shandong Academy of Science (China)

**Flordeliza L. Valiente**, Mapua University (Philippines)

**Febus Reidj G. Cruz**, Mapua University (Philippines)

**Ramon G. Garcia**, Mapua University (Philippines)

**Xi-wen Zhang**, Beijing Language And Culture University (China)

**Nan Zhu**, Xi'an Technological University (China)

**Godfried Toussaint**, New York University Abu Dhabi  
(United Arab Emirates)

**Fabrice Meriaudeau**, Université Bourgogne (France)

**Kuo-Liang Chung**, National Taiwan University of Science and  
Technology (Taiwan, China)

**Jorge Henriques**, Universidade de Coimbra (Portugal)  
**Jiande Sun**, Shandong Normal University (China)  
**Xiwen Zhang**, Beijing Language and Culture University (China)  
**Bok-Min Goi**, Universiti Tunku Abdul Rahman (Malaysia)  
**Reinhard Klette**, Auckland University of Technology (New Zealand)  
**Changli Li**, Hohai University (China)  
**Jibin Yang**, Army Engineering University (China)  
**Filippo Neri**, Università degli Studi di Napoli Federico II (Italy)  
**Zhe Jin**, Universiti Tunku Abdul Rahman (Malaysia)  
**Abdul Jalil**, International Islamic University (Pakistan)  
**Qiu Chen**, Kogakuin University (Japan)  
**Mohamed Arezki Mellal**, M'Hamed Bougara University (Algeria)  
**Beom-Seok Oh**, Nanyang Technological University (Singapore)  
**Lei Meng**, Nanyang Technological University (Singapore)  
**Andrew B.J. Teoh**, Yonsei University (Republic of Korea)  
**Sijiang Liu**, Nanjing University of Posts and Telecommunications  
(China)  
**Wei Jia**, HeFei University of Technology (China)  
**Shuai Zhao**, Big Switch Networks Inc. (United States)  
**Mohammad Reza Khosravi**, Shiraz University of Technology (Iran)  
**Jessie R. Balbin**, Mapua University (Philippines)  
**Julius T. Sese**, Mapua University (Philippines)  
**Birjodh Tiwana**, LinkedIn Inc. (United States)  
**Nav Kesher**, Facebook, Inc. (United States)  
**Lishan Jia**, Civil Aviation University of China (China)  
**Wudhichai Assawinchaichote**, King Mongkut's University of  
Technology Thonburi (KMUTT) (Thailand)  
**Mayukha Pal**, University of Hyderabad Campus (India)  
**Nitikarn Nimsuk**, Thammasat University (Thailand)  
**Yungang Zhu**, Jilin University (China)  
**Yamid Fabián Hernández Julio**, Universidad del Sinú - Elías Bechara  
Zainúm (Colombia)  
**Zain Anwar Ali**, Nanjing University of Aeronautics and Astronautics  
(China)  
**Lei Cui**, Curtin University (Australia)  
**Osama Halabi**, Qatar University (Qatar)  
**Ngaiming Kwok**, The University of New South Wales (Australia)  
**Wornchanok Chaiyasoonthorn**, Faculty of Administration and  
Management King Mongkut's Institute of Technology  
Ladkrabang (Thailand)  
**Singha Chaveesuk**, Faculty of Administration and Management  
King Mongkut's Institute of Technology Ladkrabang (Thailand)

*Session Chairs*

- 1 Computer Aided Education  
**Ahmed Abdelgawad**, Central Michigan University (United States)
- 2 Education Technology  
**Pijonkin Anton Pavlovich**, Southern Federal University  
(Russian Federation)
- 3 Machine Learning and Applications  
**Jessie R. Balbin**, Mapua University (Philippines)
- 4 Pattern Recognition and Classification  
**Min Chen**, University of Washington Bothell (United States)
- 5 Computer Vision  
**Chuan Zhang**, Southeast University (China)
- 6 Data Analysis  
**Jin Wang**, Valdosta State University (United States)



## Introduction

In recent years, pattern recognition has become a hot research branch thanks to the recent advances of deep machine learning driven by big data. In light of the fast-paced advancements in pattern recognition taking place all over the world, it is of great interest to keep an eye on state-of-the-art research and development and to facilitate collaboration in multidisciplinary research areas. With this end in view, it was a great pleasure for me to invite you to participate in the 4th International Workshop on Pattern Recognition held during June 28-30, 2019 in Nanjing, China.

The aim of the conference is to address and deliberate on the latest technical status and recent trends in the research, developments and applications of pattern recognition. This conference has been designed with the view of providing an opportunity for scientists, engineers, industrialists, students and other professionals from all over the world to interact and exchange their new ideas and research outcomes for future collaboration.

This year, IWPR has solicited 59 submitted papers from various countries all over the world. The proceedings of IWPR 2019 contain 38 selected papers from the conference that have been presented at the conference either orally or via poster sessions. They provide up-to-date, comprehensive and worldwide state-of-the-art knowledge and techniques in this field. Each contributed paper was rigorously peer-reviewed by international reviewers who were drawn from the organizing and advisory committee members and external reviewers in related fields from all over the world. The proceedings cover the following specific areas: pattern recognition, target detection, image transformation and analysis, image detection technology and application, image processing and application, signal analysis and processing, and computer science and engineering.

On behalf of the organizing committee, we'd like to express our heartfelt gratitude to all the reviewers for their great professionalism and efforts. Also, thanks to all the participants and sponsors for their valuable contributions and support of IWPR 2019.

**General Chairs**  
**Xudong Jiang**

