

Founding Editors

Gerhard Goos

Karlsruhe Institute of Technology, Karlsruhe, Germany

Juris Hartmanis

Cornell University, Ithaca, NY, USA

Editorial Board Members

Elisa Bertino

Purdue University, West Lafayette, IN, USA

Wen Gao

Peking University, Beijing, China

Bernhard Steffen 

TU Dortmund University, Dortmund, Germany

Gerhard Woeginger 

RWTH Aachen, Aachen, Germany

Moti Yung

Columbia University, New York, NY, USA

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

Alberto Del Bimbo · Rita Cucchiara ·
Stan Sclaroff · Giovanni Maria Farinella ·
Tao Mei · Marco Bertini ·
Hugo Jair Escalante · Roberto Vezzani (Eds.)

Pattern Recognition

ICPR International Workshops and Challenges

Virtual Event, January 10–15, 2021
Proceedings, Part VI

Editors

Alberto Del Bimbo 
Dipartimento di Ingegneria
dell'Informazione
University of Firenze
Firenze, Italy

Stan Sclaroff 
Department of Computer Science
Boston University
Boston, MA, USA

Tao Mei
Cloud & AI, JD.COM
Beijing, China

Hugo Jair Escalante 
Computational Sciences Department
National Institute of Astrophysics,
Optics and Electronics (INAOE)
Tonantzintla, Puebla, Mexico

Rita Cucchiara 
Dipartimento di Ingegneria “Enzo Ferrari”
Università di Modena e Reggio Emilia
Modena, Italy

Giovanni Maria Farinella 
Dipartimento di Matematica e Informatica
University of Catania
Catania, Italy

Marco Bertini 
Dipartimento di Ingegneria
dell'Informazione
University of Firenze
Firenze, Italy

Roberto Vezzani 
Dipartimento di Ingegneria “Enzo Ferrari”
Università di Modena e Reggio Emilia
Modena, Italy

ISSN 0302-9743 ISSN 1611-3349 (electronic)

Lecture Notes in Computer Science

ISBN 978-3-030-68779-3 ISBN 978-3-030-68780-9 (eBook)

<https://doi.org/10.1007/978-3-030-68780-9>

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

© Springer Nature Switzerland AG 2021

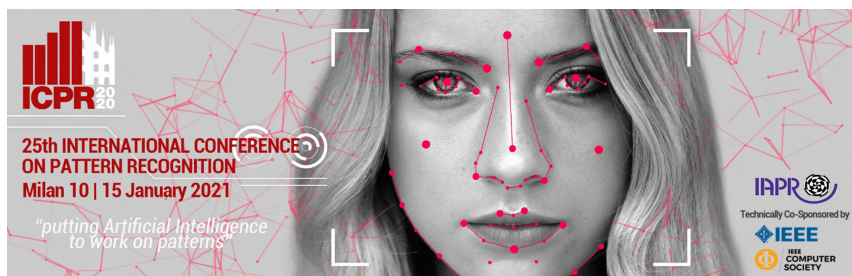
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission 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, expressed 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

Foreword by General Chairs



It is with great pleasure that we welcome you to the post-proceedings of the 25th International Conference on Pattern Recognition, ICPR2020 Virtual-Milano. ICPR2020 stands on the shoulders of generations of pioneering pattern recognition researchers. The first ICPR (then called IJCPR) convened in 1973 in Washington, DC, USA, under the leadership of Dr. King-Sun Fu as the General Chair. Since that time, the global community of pattern recognition researchers has continued to expand and thrive, growing evermore vibrant and vital. The motto of this year's conference was *Putting Artificial Intelligence to work on patterns*. Indeed, the deep learning revolution has its origins in the pattern recognition community – and the next generations of revolutionary insights and ideas continue with those presented at this 25th ICPR. Thus, it was our honor to help perpetuate this longstanding ICPR tradition to provide a lively meeting place and open exchange for the latest pathbreaking work in pattern recognition.

For the first time, the ICPR main conference employed a two-round review process similar to journal submissions, with new papers allowed to be submitted in either the first or the second round and papers submitted in the first round and not accepted allowed to be revised and re-submitted for second round review. In the first round, 1554 new submissions were received, out of which 554 (35.6%) were accepted and 579 (37.2%) were encouraged to be revised and resubmitted. In the second round, 1696 submissions were received (496 revised and 1200 new), out of which 305 (61.4%) of the revised submissions and 552 (46%) of the new submissions were accepted. Overall, there were 3250 submissions in total, and 1411 were accepted, out of which 144 (4.4%) were included in the main conference program as orals and 1263 (38.8%) as posters (4 papers were withdrawn after acceptance). We had the largest ICPR conference ever, with the most submitted papers and the most selective acceptance rates ever for ICPR, attesting both the increased interest in presenting research results at ICPR and the high scientific quality of work accepted for presentation at the conference.

We were honored to feature seven exceptional Keynotes in the program of the ICPR2020 main conference: David Doermann (Professor at the University at Buffalo), Pietro Perona (Professor at the California Institute of Technology and Amazon Fellow

at Amazon Web Services), Mihaela van der Schaar (Professor at the University of Cambridge and a Turing Fellow at The Alan Turing Institute in London), Max Welling (Professor at the University of Amsterdam and VP of Technologies at Qualcomm), Ching Yee Suen (Professor at Concordia University) who was presented with the IAPR 2020 King-Sun Fu Prize, Maja Pantic (Professor at Imperial College UK and AI Scientific Research Lead at Facebook Research) who was presented with the IAPR 2020 Maria Petrou Prize, and Abhinav Gupta (Professor at Carnegie Mellon University and Research Manager at Facebook AI Research) who was presented with the IAPR 2020 J.K. Aggarwal Prize. Several best paper prizes were also announced and awarded, including the Piero Zamparoni Award for the best paper authored by a student, the BIRPA Best Industry Related Paper Award, and Best Paper Awards for each of the five tracks of the ICPR2020 main conference.

The five tracks of the ICPR2020 main conference were: (1) Artificial Intelligence, Machine Learning for Pattern Analysis, (2) Biometrics, Human Analysis and Behavior Understanding, (3) Computer Vision, Robotics and Intelligent Systems, (4) Document and Media Analysis, and (5) Image and Signal Processing. The best papers presented at the main conference had the opportunity for publication in expanded format in journal special issues of *IET Biometrics* (tracks 2 and 3), *Computer Vision and Image Understanding* (tracks 1 and 2), *Machine Vision and Applications* (tracks 2 and 3), *Multimedia Tools and Applications* (tracks 4 and 5), *Pattern Recognition Letters* (tracks 1, 2, 3 and 4), or *IEEE Trans. on Biometrics, Behavior, and Identity Science* (tracks 2 and 3).

In addition to the main conference, the ICPR2020 program offered workshops and tutorials, along with a broad range of cutting-edge industrial demos, challenge sessions, and panels. The virtual ICPR2020 conference was interactive, with real-time live-streamed sessions, including live talks, poster presentations, exhibitions, demos, Q&A, panels, meetups, and discussions – all hosted on the Underline virtual conference platform.

The ICPR2020 conference was originally scheduled to convene in Milano, which is one of the most beautiful cities of Italy for art, culture, lifestyle – and more. The city has so much to offer! With the need to go virtual, ICPR2020 included interactive **virtual tours** of Milano during the conference coffee breaks, which we hoped would introduce attendees to this wonderful city, and perhaps even entice them to visit Milano once international travel becomes possible again.

The success of such a large conference would not have been possible without the help of many people. We deeply appreciate the vision, commitment, and leadership of the ICPR2020 Program Chairs: Kim Boyer, Brian C. Lovell, Marcello Pelillo, Nicu Sebe, René Vidal, and Jingyi Yu. Our heartfelt gratitude also goes to the rest of the main conference organizing team, including the Track and Area Chairs, who all generously devoted their precious time in conducting the review process and in preparing the program, and the reviewers, who carefully evaluated the submitted papers and provided invaluable feedback to the authors. This time their effort was considerably higher given that many of them reviewed for both reviewing rounds. We also want to acknowledge the efforts of the conference committee, including the Challenge Chairs, Demo and Exhibit Chairs, Local Chairs, Financial Chairs, Publication Chair, Tutorial Chairs, Web Chairs, Women in ICPR Chairs, and Workshop Chairs. Many thanks, also, for the efforts of the dedicated staff who performed the crucially important work

behind the scenes, including the members of the ICPR2020 Organizing Secretariat. Finally, we are grateful to the conference sponsors for their generous support of the ICPR2020 conference.

We hope everyone had an enjoyable and productive ICPR2020 conference.

Rita Cucchiara
Alberto Del Bimbo
Stan Sclaroff

Preface

The 25th International Conference on Pattern Recognition Workshops (ICPRW 2020) were held virtually in Milan, Italy and rescheduled to January 10 and January 11 of 2021 due to the Covid-19 pandemic. ICPRW 2020 included timely topics and applications of Computer Vision, Image and Sound Analysis, Pattern Recognition and Artificial Intelligence. We received 49 workshop proposals and 46 of them have been accepted, which is three times more than at ICPRW 2018. The workshop proceedings cover a wide range of areas including Machine Learning (8), Pattern Analysis (5), Healthcare (6), Human Behavior (5), Environment (5), Surveillance, Forensics and Biometrics (6), Robotics and Egovision (4), Cultural Heritage and Document Analysis (4), Retrieval (2), and Women at ICPR 2020 (1). Among them, 33 workshops are new to ICPRW. Specifically, the ICPRW 2020 volumes contain the following workshops (please refer to the corresponding workshop proceeding for details):

- CADL2020 – Workshop on Computational Aspects of Deep Learning.
- DLPR – Deep Learning for Pattern Recognition.
- EDL/AI – Explainable Deep Learning/AI.
- (Merged) IADS – Integrated Artificial Intelligence in Data Science, IWCR – IAPR workshop on Cognitive Robotics.
- ManifLearn – Manifold Learning in Machine Learning, From Euclid to Riemann.
- MOI2QDN – Metrification & Optimization of Input Image Quality in Deep Networks.
- IML – International Workshop on Industrial Machine Learning.
- MMDLCA – Multi-Modal Deep Learning: Challenges and Applications.
- IUC 2020 – Human and Vehicle Analysis for Intelligent Urban Computing.
- PATCAST – International Workshop on Pattern Forecasting.
- RRPR – Reproducible Research in Pattern Recognition.
- VAIB 2020 – Visual Observation and Analysis of Vertebrate and Insect Behavior.
- IMTA VII – Image Mining Theory & Applications.
- AIHA 2020 – Artificial Intelligence for Healthcare Applications.
- AIDP – Artificial Intelligence for Digital Pathology.
- (Merged) GOOD – Designing AI in support of Good Mental Health, CAIHA – Computational and Affective Intelligence in Healthcare Applications for Vulnerable Populations.
- CARE2020 – pattern recognition for positive teChnology And eldeRly wEllbeing.
- MADiMa 2020 – Multimedia Assisted Dietary Management.
- 3DHU 2020 – 3D Human Understanding.
- FBE2020 – Facial and Body Expressions, micro-expressions and behavior recognition.
- HCAU 2020 – Deep Learning for Human-Centric Activity Understanding.
- MPRSS - 6th IAPR Workshop on Multimodal Pattern Recognition for Social Signal Processing in Human Computer Interaction.

- CVAUI 2020 – Computer Vision for Analysis of Underwater Imagery.
- MAES – Machine Learning Advances Environmental Science.
- PRAConBE - Pattern Recognition and Automation in Construction & the Built Environment.
- PRRS 2020 – Pattern Recognition in Remote Sensing.
- WAAMI - Workshop on Analysis of Aerial Motion Imagery.
- DEEPRETAIL 2020 - Workshop on Deep Understanding Shopper Behaviours and Interactions in Intelligent Retail Environments 2020.
- MMForWild2020 – MultiMedia FORensics in the WILD 2020.
- FGVRID – Fine-Grained Visual Recognition and re-Identification.
- IWBDAF – Biometric Data Analysis and Forensics.
- RISS – Research & Innovation for Secure Societies.
- WMWB – TC4 Workshop on Mobile and Wearable Biometrics.
- EgoApp – Applications of Egocentric Vision.
- ETTAC 2020 – Eye Tracking Techniques, Applications and Challenges.
- PaMMO – Perception and Modelling for Manipulation of Objects.
- FAPER – Fine Art Pattern Extraction and Recognition.
- MANPU – coMics ANalysis, Processing and Understanding.
- PATRECH2020 – Pattern Recognition for Cultural Heritage.
- (Merged) CBIR – Content-Based Image Retrieval: where have we been, and where are we going, TAILOR – Texture Analysis, cLassificatiOn and Retrieval, VIQA – Video and Image Question Answering: building a bridge between visual content analysis and reasoning on textual data.
- W4PR - Women at ICPR.

We would like to thank all members of the workshops' Organizing Committee, the reviewers, and the authors for making this event successful. We also appreciate the support from all the invited speakers and participants. We wish to offer thanks in particular to the ICPR main conference general chairs: Rita Cucchiara, Alberto Del Bimbo, and Stan Sclaroff, and program chairs: Kim Boyer, Brian C. Lovell, Marcello Pelillo, Nicu Sebe, Rene Vidal, and Jingyi Yu. Finally, we are grateful to the publisher, Springer, for their cooperation in publishing the workshop proceedings in the series of Lecture Notes in Computer Science.

December 2020

Giovanni Maria Farinella
Tao Mei

Challenges

Competitions are effective means for rapidly solving problems and advancing the state of the art. Organizers identify a problem of practical or scientific relevance and release it to the community. In this way the whole community can contribute to the solution of high-impact problems while having fun. This part of the proceedings compiles the best of the competitions track of the *25th International Conference on Pattern Recognition (ICPR)*.

Eight challenges were part of the track, covering a wide variety of fields and applications, all of this within the scope of ICPR. In every challenge organizers released data, and provided a platform for evaluation. The top-ranked participants were invited to submit papers for this volume. Likewise, organizers themselves wrote articles summarizing the design, organization and results of competitions. Submissions were subject to a standard review process carried out by the organizers of each competition. Papers associated with seven out the eight competitions are included in this volume, thus making it a representative compilation of what happened in the ICPR challenges.

We are immensely grateful to the organizers and participants of the ICPR 2020 challenges for their efforts and dedication to make the competition track a success. We hope the readers of this volume enjoy it as much as we have.

November 2020

Marco Bertini
Hugo Jair Escalante

ICPR Organization

General Chairs

Rita Cucchiara	Univ. of Modena and Reggio Emilia, Italy
Alberto Del Bimbo	Univ. of Florence, Italy
Stan Sclaroff	Boston Univ., USA

Program Chairs

Kim Boyer	Univ. at Albany, USA
Brian C. Lovell	Univ. of Queensland, Australia
Marcello Pelillo	Univ. Ca' Foscari Venezia, Italy
Nicu Sebe	Univ. of Trento, Italy
René Vidal	Johns Hopkins Univ., USA
Jingyi Yu	ShanghaiTech Univ., China

Workshop Chairs

Giovanni Maria Farinella	Univ. of Catania, Italy
Tao Mei	JD.COM, China

Challenge Chairs

Marco Bertini	Univ. of Florence, Italy
Hugo Jair Escalante	INAOE and CINVESTAV National Polytechnic Institute of Mexico, Mexico

Publication Chair

Roberto Vezzani	Univ. of Modena and Reggio Emilia, Italy
-----------------	--

Tutorial Chairs

Vittorio Murino	Univ. of Verona, Italy
Sudeep Sarkar	Univ. of South Florida, USA

Women in ICPR Chairs

Alexandra Branzan Albu	Univ. of Victoria, Canada
Maria De Marsico	Univ. Roma La Sapienza, Italy

Demo and Exhibit Chairs

Lorenzo Baraldi	Univ. Modena Reggio Emilia, Italy
Bruce A. Maxwell	Colby College, USA
Lorenzo Seidenari	Univ. of Florence, Italy

Special Issue Initiative Chair

Michele Nappi	Univ. of Salerno, Italy
---------------	-------------------------

Web Chair

Andrea Ferracani	Univ. of Florence, Italy
------------------	--------------------------

Corporate Relations Chairs

Fabio Galasso	Univ. Roma La Sapienza, Italy
Matt Leotta	Kitware, Inc., USA
Zhongchao Shi	Lenovo Group Ltd., China

Local Chairs

Matteo Matteucci	Politecnico di Milano, Italy
Paolo Napoletano	Univ. of Milano-Bicocca, Italy

Financial Chairs

Cristiana Fiandra	The Office srl, Italy
Vittorio Murino	Univ. of Verona, Italy

Contents – Part VI

MAES - Machine Learning Advances Environmental Science

Finding Relevant Flood Images on Twitter Using Content-Based Filters.	5
<i>Björn Barz, Kai Schröter, Ann-Christin Kra, and Joachim Denzler</i>	
Natural Disaster Classification Using Aerial Photography Explainable for Typhoon Damaged Feature	15
<i>Takato Yasuno, Masazumi Amakata, and Masahiro Okano</i>	
Environmental Time Series Prediction with Missing Data by Machine Learning and Dynamics Reconstruction	26
<i>Francesco Camastra, Vincenzo Capone, Angelo Ciarabella, Tony Christian Landi, Angelo Riccio, and Antonino Staiano</i>	
Semi-Supervised Learning for Grain Size Distribution Interpolation.	34
<i>Konstantin Kobs, Christian Schäfer, Michael Steininger, Anna Krause, Roland Baumhauer, Heiko Paeth, and Andreas Hotho</i>	
Location-Specific vs Location-Agnostic Machine Learning Metamodels for Predicting Pasture Nitrogen Response Rate	45
<i>Christos Pylaniadis, Val Snow, Dean Holzworth, Jeremy Bryant, and Ioannis N. Athanasiadis</i>	
Pattern Classification from Multi-beam Acoustic Data Acquired in Kongsfjorden	55
<i>Giovanni Giacalone, Giosué Lo Bosco, Marco Barra, Angelo Bonanno, Giuseppa Buscaino, Riko Noormets, Christopher Nuth, Monica Calabrò, Gualtiero Basilone, Simona Genovese, Ignazio Fontana, Salvatore Mazzola, Riccardo Rizzo, and Salvatore Aronica</i>	
Unsupervised Classification of Acoustic Echoes from Two Krill Species in the Southern Ocean (Ross Sea)	65
<i>Ignazio Fontana, Giovanni Giacalone, Riccardo Rizzo, Marco Barra, Olga Mangoni, Angelo Bonanno, Gualtiero Basilone, Simona Genovese, Salvatore Mazzola, Giosué Lo Bosco, and Salvatore Aronica</i>	
Multi-Input ConvLSTM for Flood Extent Prediction	75
<i>Leo Muckley and James Garforth</i>	

Developing a Segmentation Model for Microscopic Images of Microplastics Isolated from Clams.	86
<i>Ji Yeon Baek, Maria Krishna de Guzman, Ho-min Park, Sanghyeon Park, Boyeon Shin, Tanja Cirkovic Velickovic, Arnout Van Messen, and Wesley De Neve</i>	
A Machine Learning Approach to Chlorophyll <i>a</i> Time Series Analysis in the Mediterranean Sea	98
<i>F. Mattei and M. Scardi</i>	
Plankton Recognition in Images with Varying Size	110
<i>Jaroslav Bureš, Tuomas Eerola, Lasse Lensu, Heikki Kälviäinen, and Pavel Zemčík</i>	
Environment Object Detection for Marine ARGO Drone by Deep Learning	121
<i>Angelo Ciaramella, Francesco Perrotta, Gerardo Pappone, Pietro Aucelli, Francesco Peluso, and Gaia Mattei</i>	
Unsupervised Learning of High Dimensional Environmental Data Using Local Fractality Concept	130
<i>Mikhail Kanevski and Mohamed Laib</i>	
Spatiotemporal Air Quality Inference of Low-Cost Sensor Data; Application on a Cycling Monitoring Network	139
<i>Jelle Hofman, Tien Huu Do, Xuening Qin, Esther Rodrigo, Martha E. Nikolaou, Wilfried Philips, Nikos Deligiannis, and Valerio Panzica La Manna</i>	
How Do Deep Convolutional SDM Trained on Satellite Images Unravel Vegetation Ecology?	148
<i>Benjamin Deneu, Alexis Joly, Pierre Bonnet, Maximilien Servajean, and François Munoz</i>	
ManifLearn - Manifold Learning in Machine Learning, from Euclid to Riemann	
Latent Space Geometric Statistics	163
<i>Line Kühnel, Tom Fletcher, Sarang Joshi, and Stefan Sommer</i>	
Improving Neural Network Robustness Through Neighborhood Preserving Layers	179
<i>Bingyuan Liu, Christopher Malon, Lingzhou Xue, and Erik Kruus</i>	
Metric Learning on the Manifold of Oriented Ellipses: Application to Facial Expression Recognition	196
<i>Mohamed Daoudi, Naima Otberdout, and Juan-Carlos Álvarez Paiva</i>	

MANPU - The 4th International Workshop on coMics Analysis, Processing and Understanding

An OCR Pipeline and Semantic Text Analysis for Comics	213
<i>Rita Hartel and Alexander Dunst</i>	

Manga Vocabulometer, A New Support System for Extensive Reading with Japanese Manga Translated into English	223
<i>Jin Kato, Motoi Iwata, and Koichi Kise</i>	

Automatic Landmark-Guided Face Image Generation for Anime Characters Using C ² GAN	236
<i>Junki Oshiba, Motoi Iwata, and Koichi Kise</i>	

Text Block Segmentation in Comic Speech Bubbles	250
<i>Christophe Rigaud, Nhu-Van Nguyen, and Jean-Christophe Burie</i>	

MMDLCA - Multi-modal Deep Learning: Challenges and Applications

Hierarchical Consistency and Refinement for Semi-supervised Medical Segmentation	267
<i>Zixiao Wang, Hai Xu, Youliang Tian, and Hongtao Xie</i>	

BVTNet: Multi-label Multi-class Fusion of Visible and Thermal Camera for Free Space and Pedestrian Segmentation	277
<i>Vijay John, Ali Boyali, Simon Thompson, and Seiichi Mita</i>	

Multimodal Emotion Recognition Based on Speech and Physiological Signals Using Deep Neural Networks	289
<i>Ali Bakhshi and Stephan Chalup</i>	

Cross-modal Deep Learning Applications: Audio-Visual Retrieval.	301
<i>Cong Jin, Tian Zhang, Shouxun Liu, Yun Tie, Xin Lv, Jianguang Li, Wencai Yan, Ming Yan, Qian Xu, Yicong Guan, and Zhenggougou Yang</i>	

Exploiting Word Embeddings for Recognition of Previously Unseen Objects.	314
<i>Karan Sharma, Hemanth Dandu, Arun C. S. Kumar, Vinay Kumar, and Suchendra M. Bhandarkar</i>	

Automated Segmentation of Lateral Ventricle in MR Images Using Multi-scale Feature Fusion Convolutional Neural Network	330
<i>Fei Ye, Zhiqiang Wang, Kai Hu, Sheng Zhu, and Xieping Gao</i>	

Visual Word Embedding for Text Classification	339
<i>Ignazio Gallo, Shah Nawaz, Nicola Landro, and Riccardo La Grassainst</i>	

CC-LSTM: Cross and Conditional Long-Short Time Memory for Video Captioning.	353
<i>Jiangbo Ai, Yang Yang, Xing Xu, Jie Zhou, and Heng Tao Shen</i>	
An Overview of Image-to-Image Translation Using Generative Adversarial Networks	366
<i>Xin Chen and Caiyan Jia</i>	
Fusion Models for Improved Image Captioning	381
<i>Marimuthu Kalimuthu, Aditya Mogadala, Marius Mosbach, and Dietrich Klakow</i>	
From Bottom to Top: A Coordinated Feature Representation Method for Speech Recognition	396
<i>Lixia Zhou and Jun Zhang</i>	
MMForWild2020 - MultiMedia FORensics in the WILD 2020	
Increased-Confidence Adversarial Examples for Deep Learning Counter-Forensics	411
<i>Wenjie Li, Benedetta Tondi, Rongrong Ni, and Mauro Barni</i>	
Defending Neural ODE Image Classifiers from Adversarial Attacks with Tolerance Randomization	425
<i>Fabio Carrara, Roberto Caldelli, Fabrizio Falchi, and Giuseppe Amato</i>	
Analysis of the Scalability of a Deep-Learning Network for Steganography “Into the Wild”.	439
<i>Hugo Ruiz, Marc Chaumont, Mehdi Yedroudj, Ahmed Oulad Amara, Frédéric Comby, and Gérard Subsol</i>	
Forensics Through Stega Glasses: The Case of Adversarial Images	453
<i>Benoît Bonnet, Teddy Furon, and Patrick Bas</i>	
LSSD: A Controlled Large JPEG Image Database for Deep-Learning-Based Steganalysis “Into the Wild”.	470
<i>Hugo Ruiz, Mehdi Yedroudj, Marc Chaumont, Frédéric Comby, and Gérard Subsol</i>	
Neural Network for Denoising and Reading Degraded License Plates	484
<i>Gianmaria Rossi, Marco Fontani, and Simone Milani</i>	
The Forchheim Image Database for Camera Identification in the Wild.	500
<i>Benjamin Hadwiger and Christian Riess</i>	

Nested Attention U-Net: A Splicing Detection Method for Satellite Images	516
<i>János Horváth, Daniel Mas Montserrat, Edward J. Delp, and János Horváth</i>	
Fingerprint Adversarial Presentation Attack in the Physical Domain	530
<i>Stefano Marrone, Roberto Casula, Giulia Orrù, Gian Luca Marcialis, and Carlo Sansone</i>	
Learning to Decipher License Plates in Severely Degraded Images	544
<i>Paula Kaiser, Franziska Schirmacher, Benedikt Lorch, and Christian Riess</i>	
Differential Morphed Face Detection Using Deep Siamese Networks.	560
<i>Sobhan Soleymani, Baaria Chaudhary, Ali Dabouei, Jeremy Dawson, and Nasser M. Nasrabadi</i>	
In-Depth DCT Coefficient Distribution Analysis for First Quantization Estimation	573
<i>Sebastiano Battiato, Oliver Giudice, Francesco Guarnera, and Giovanni Puglisi</i>	
MOI2QDN - Workshop on Metrification and Optimization of Input Image Quality in Deep Networks	
On the Impact of Rain over Semantic Segmentation of Street Scenes.	597
<i>Simone Zini and Marco Buzzelli</i>	
The Impact of Linear Motion Blur on the Object Recognition Efficiency of Deep Convolutional Neural Networks	611
<i>José A. Rodríguez-Rodríguez, Miguel A. Molina-Cabello, Rafaela Benítez-Rochel, and Ezequiel López-Rubio</i>	
Performance of Deep Learning and Traditional Techniques in Single Image Super-Resolution of Noisy Images	623
<i>Karl Thurnhofer-Hemsi, Guillermo Ruiz-Álvarez, Rafael Marcos Luque-Baena, Miguel A. Molina-Cabello, and Ezequiel López-Rubio</i>	
The Effect of Noise and Brightness on Convolutional Deep Neural Networks.	639
<i>José A. Rodríguez-Rodríguez, Miguel A. Molina-Cabello, Rafaela Benítez-Rochel, and Ezequiel López-Rubio</i>	
Exploring the Contributions of Low-Light Image Enhancement to Network-Based Object Detection.	655
<i>Yuen Peng Loh</i>	

Multi-level Fusion Based Deep Convolutional Network for Image Quality Assessment	670
<i>Qianyu Guo and Jing Wen</i>	
CNN Based Predictor of Face Image Quality	679
<i>Andrii Yermakov and Vojtech Franc</i>	
MPRSS - 6th IAPR Workshop on Multimodal Pattern Recognition for Social Signal Processing in Human Computer Interaction	
Explainable Model Selection of a Convolutional Neural Network for Driver's Facial Emotion Identification	699
<i>Amany A. Kandeel, Hazem M. Abbas, and Hossam S. Hassanein</i>	
Artificial Kindness The Italian Case of Google Mini Recognition Patterns . . .	714
<i>Concetta Papapicco</i>	
Fingerspelling Recognition with Two-Steps Cascade Process of Spotting and Classification	728
<i>Masanori Muroi, Naoya Sogi, Nobuko Kato, and Kazuhiro Fukui</i>	
CNN Depression Severity Level Estimation from Upper Body vs. Face-Only Images	744
<i>Dua'a Ahmad, Roland Goecke, and James Ireland</i>	
Range-Doppler Hand Gesture Recognition Using Deep Residual-3DCNN with Transformer Network	759
<i>Gaurav Jaswal, Seshan Srirangarajan, and Sumantra Dutta Roy</i>	
Introducing Bidirectional Ordinal Classifier Cascades Based on a Pain Intensity Recognition Scenario	773
<i>Peter Bellmann, Ludwig Lausser, Hans A. Kestler, and Friedhelm Schwenker</i>	
Personalized k-fold Cross-Validation Analysis with Transfer from Phasic to Tonic Pain Recognition on X-ITE Pain Database	788
<i>Youssef Wally, Yara Samaha, Ziad Yasser, Steffen Walter, and Friedhelm Schwenker</i>	
ODANet: Online Deep Appearance Network for Identity-Consistent Multi-person Tracking	803
<i>Guillaume Delorme, Yutong Ban, Guillaume Sarrazin, and Xavier Alameda-Pineda</i>	
Author Index	819