

KC Santosh
Ravindra Hegadi
Umapada Pal (Eds.)

Communications in Computer and Information Science

1576

Recent Trends in Image Processing and Pattern Recognition

4th International Conference, RTIP2R 2021
Msida, Malta, December 8–10, 2021
Revised Selected Papers

Editorial Board Members

Joaquim Filipe 

Polytechnic Institute of Setúbal, Setúbal, Portugal

Ashish Ghosh

Indian Statistical Institute, Kolkata, India

Raquel Oliveira Prates 

Federal University of Minas Gerais (UFMG), Belo Horizonte, Brazil

Lizhu Zhou

Tsinghua University, Beijing, China


More information about this series at <https://link.springer.com/bookseries/7899>

KC Santosh · Ravindra Hegadi ·
Umapada Pal (Eds.)

Recent Trends in Image Processing and Pattern Recognition

4th International Conference, RTIP2R 2021
Msida, Malta, December 8–10, 2021
Revised Selected Papers

Editors

KC Santosh 
University of South Dakota
Vermillion, SD, USA

Ravindra Hegadi
Central University of Karnataka
Gulbarga, India

Umapada Pal 
Indian Statistical Institute
Kolkata, India

ISSN 1865-0929 ISSN 1865-0937 (electronic)
Communications in Computer and Information Science
ISBN 978-3-031-07004-4 ISBN 978-3-031-07005-1 (eBook)
<https://doi.org/10.1007/978-3-031-07005-1>

© Springer Nature Switzerland AG 2022

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

Preface

It is our great pleasure to introduce this collection of research papers in Springer's Communication in Computer and Information Science (CCIS) series from the fourth International Conference on Recent Trends in Image Processing and Pattern Recognition (RTIP2R 2021). Initially we aimed to hold RTIP2R 2021 in-person at the University of Malta, Malta, during December 8–10, 2021, in collaboration with the 2AI: Applied Artificial Intelligence Research Lab, University of South Dakota (USA), and the Central University of Karnataka (India). Due to the unprecedented impact of COVID-19 and related travel restrictions, the RTIP2R 2021 team decided to hold the event virtually, making it possible for authors, scholars, and academicians to present their research studies online, with an average audience size of 40–50 per day.

As announced in the call for papers, RTIP2R 2021 attracted current and/or recent research on image processing, pattern recognition, and computer vision with several different applications, such as document understanding, biometrics, medical imaging, and image analysis in agriculture. Altogether, we received 84 submissions and selected 36 papers for conference presentations. For publication, unlike in the past, the conference chairs decided not include no-show papers as well as those papers that were not revised in accordance with the chairs' reports. Taking this into account, the conference chairs decided to move forward with 33 papers for publication. As a result, the acceptance rate for this volume is 39.29%. On average, each paper selected for conference presentation received at least three reviews with the exception of the few submissions that had desk rejections.

In brief, the event was a great platform bringing together research scientists, academics, and industry practitioners. We categorized the papers into five different tracks: a) Healthcare: medical imaging and informatics; b) Computer vision and pattern recognition; c) Document analysis and recognition; d) Signal processing and machine learning; and e) Satellite imaging and remote sensing.

The conference was full of innovative ideas, and we are grateful to the following keynote speakers for their insightful talks: Sally McClean (Ulster University, UK), Ajith Abraham (Machine Intelligence Research Labs, USA), Neeraj Kumar (Thapar Institute of Engineering & Technology, India), and Girijesh Prasad (Ulster University, UK). We would like to thank everyone who contributed to the success of RTIP2R 2021.

January 2022

KC Santosh
Ravindra Hegadi
Umapada Pal

Organization

Honorary Chairs

Carl James Debono	University of Malta, Malta
Sally McClean	Ulster University, UK
Oge Marques	Florida Atlantic University, USA
Linlin Shen	Shenzhen University, China
Umapada Pal	Indian Statistical Institute, India

General Chairs

Lalit Garg	University of Malta, Malta
KC Santosh	University of South Dakota, USA

Program Chairs

Ravindra Hegadi	Central University of Karnataka, India
Hubert Cecotti	California State University, Fresno, USA
M.-R. Bouguelia	Halmstad University, Sweden
Vitoantonio Bevilacqua	Polytechnic University of Bari, Italy
Mickael Coustaty	La Rochelle University, France
Robertas Damasevicius	Kaunas University of Technology, Lithuania
Ram Bilas Pachori	IIT, Indore, India
Nilanjan Dey	JIS University, India

Workshop Chairs

Hanan Salam	New York University Abu Dhabi, UAE
Rajesh Kumar	Institute of Forensic Science, India
Nibaran Das	Jadavpur University, India

Special Track Chairs

Loveleen Gaur	Amity University, India
Fernando Ortiz-Rodriguez	Universidad Autonoma de Tamaulipas, Mexico

Publication Chairs

Mufti Mahmud
Karm Veer Arya

Nottingham Trent University, UK
ABV-IIITM, Gwalior, India

Local Chairs

Michel Camilleri
Peter Xuereb
Emeka Chukwu
Sameer Kumar Jasra

University of Malta, Malta
University of Malta, Malta
University of Malta, Malta
University of Malta, Malta

Conference Treasurer

Ravindra Hegadi

Central University of Karnataka, India

Publicity Chairs

Sameer Antani
Valentina Emilia Balas
Giancarlo Fortino
Szilard Vajda
Justin Smith
Sema Candemir
Shivaramkrishnan Rajaraman
Sanju Tiwari
Mamoun Alazab
Laurent Wendling
Xianqing Mao
Virach Sornlertlamvanich
Thanaruk Theeramunkong
Patrice Boursier
Satish K Singh
Kaushik Roy
M. A. Jabbar
Geetha A. Kiran

National Library of Medicine, USA
Aurel Vlaicu University of Arad, Romania
Università della Calabria, Italy
Central Washington State University, USA
Saint Luke's Health System, USA
Ohio State University, USA
National Library of Medicine, USA
Universidad Autonoma de Tamaulipas, Mexico
Charles Darwin University, Australia
Université Paris Cité, France
University of Luxembourg, Luxembourg
Musashino University, Japan
SIIT, Thammasat University, Thailand
International Medical University, Malaysia
IIIT Allahabad, India
West Bengal State University, India
Vardhaman College of Engineering, India
Malnad College of Engineering, India

Technical Program Committee

Haroon Lone
Anabik Pal
Saïd Mahmoudi
Gaurav Garg

University of South Dakota, USA
National Institutes of Health, USA
University of Mons, Belgium
Ulster University, UK

Sunil Aryal	Deakin University, Australia
Alice Othmani	University of Paris Est-Creteil, France
Sandeep Gupta	Università degli Studi di Trento, Italy
Himadri Mukherjee	New York University Abu Dhabi, UAE
Ameni Boumaiza	Hamad Bin Khalifa University, Qatar
Deepak Garg	Bennett University, India
Oubbati Omar Sami	University of Laghouat, Algeria
Nilanjan Dey	JIS University, India
Kaushik Roy	West Bengal State University, India
Mallikarjun Hangarge	Karnatak Arts, Science and Commerce College, Bidar, India
Debnath Bhattacharya	KL University, India
Thippa Reddy Gadekallu	Vellore Institute of Technology, India
Vijay Prakash	Thapar Institute of Engineering & Technology, Patiala, India
Tarun K. Sharma	Shobhit University, India
Robert Splinter	University of North Carolina at Charlotte, USA, and Advanced BioInformatics, Malta
Vedika Gupta	Bharati Vidyapeeth's College of Engineering, India
K. B. Ramesh	RV College of Engineering, India
Ayush Goyal	Texas A & M University Kingsville, Texas
Ghanapriya Singh	NIT, Uttarakhand, India
Hari Prabhat Gupta	IIT BHU, India
Iyyakutti Iyappan	IIT Indore, India
Jose E. Medina Pagola	Universidad de las Ciencias Informaticas, Cuba
Jose Ruiz Shulcloper	Universidad de las Ciencias Informaticas, Cuba
Millie Pant	IIT Roorkee, India
Nandana Mihindukulasooriya	IBM, USA
Onur Dogan	Izmir Bakircay University, Turkey
Piyush Joshi	University of Birmingham, UK
Ravinder M.	IGDTUW, India
Rudresh Dwivedi	Pandit Deendayal Petroleum University, India
Sailesh Iyer	Rai University, India
Sanjeevi Kumar Padmanaban	Aalborg University, Esbjerg, Denmark
Shikha Mehta	JIIT Noida, India
Surya Prakash Agnihotri	IIT Indore, India
Shishir Shandilya	VIT Bhopal University, India
Syed Sadaf Ali	IIT Indore, India
Yusniel Hidalgo Delgado	Universidad de las Ciencias Informaticas, Cuba

Contents

Healthcare: Medical Imaging and Informatics

Cleaning Highly Unbalanced Multisource Image Dataset for Quality Control in Cervical Precancer Screening	3
<i>Zhiyun Xue, Peng Guo, Sandeep Angara, Anabik Pal, Jose Jeronimo, Kanan T. Desai, Olusegun K. Ajenifuja, Clement A. Adepiti, Silvia D. Sanjose, Mark Schiffman, and Sameer Antani</i>	
Detection of Male Fertility Using AI-Driven Tools	14
<i>Debasmita Ghosh Roy and P. A. Alvi</i>	
An Empirical Study of Vision Transformers for Cervical Precancer Detection	26
<i>Sandeep Angara, Peng Guo, Zhiyun Xue, and Sameer Antani</i>	
CheXNet for the Evidence of Covid-19 Using 2.3K Positive Chest X-rays	33
<i>KC Santosh and Supriti Ghosh</i>	
An Enhanced Deep Convolution Neural Network Model to Diagnose Alzheimer’s Disease Using Brain Magnetic Resonance Imaging	42
<i>Milon Biswas, Md. Kawsher Mahbub, and Md. Abdul Mozid Miah</i>	
Automatic Knee Osteoarthritis Stages Identification	53
<i>Dattatray I. Navale, Darshan D. Ruikar, Dattatray D. Sawat, Parshuram M. Kamble, Kavita V. Houde, and Ravindra S. Hegadi</i>	
Stacked Dark COVID-Net: A Multi-class Multi-label Classification Approach for Diagnosing COVID-19 Using Chest X-Ray Images	61
<i>H. Anila Glory, S. Meghana, J. S. Kesav Kumar, and V. S. Shankar Sriram</i>	
Image Augmentation for Improving Automated Eligibility-Classification for Cervical Precancer Ablation Treatment	76
<i>Peng Guo, Zhiyun Xue, Jose Jeronimo, Julia C. Gage, Kanan T. Desai, Brian Befano, Francisco García, Mark Schiffman, and Sameer Antani</i>	
Osteoarthritis Detection Using Densely Connected Neural Network	85
<i>Sushma Chaugule and V. S. Malemath</i>	
Generic Foreign Object Detection in Chest X-rays	93
<i>KC Santosh, Shotabdi Roy, and Siva Allu</i>	

Mammogram Mass Classification: A CNN-Based Technique Applied to Different Age Groups	105
<i>Sk Md Obaidullah, Himadri Mukherjee, Ankita Dhar, Teresa Goncalves, KC Santosh, and Kaushik Roy</i>	
Computer Vision and Pattern Recognition	
Complex Object Detection Using Light-Field Plenoptic Camera	119
<i>Edgar S. Correa, Carlos A. Parra, Pedro R. Vizcaya, Francisco Carlos Calderon, and Julian D. Colorado</i>	
Real-Time Face Recognition for Organisational Attendance Systems	134
<i>Divyagna Bavikadi, A. Manjunatha, Abhishek Pol, Akshat Kadam, Prajakta Kulkarni, Aparna Singh, P. M. Kamble, and Ravindra Hegadi</i>	
Harnessing Sustainable Development in Image Recognition Through No-Code AI Applications: A Comparative Analysis	146
<i>Nico Kling, Chantal Runte, Sajal Kabiraj, and Christian-Andreas Schumann</i>	
Evaluating Performance of Adam Optimization by Proposing Energy Index	156
<i>Mohan Bhandari, Pramod Parajuli, Pralhad Chapagain, and Loveleen Gaur</i>	
An Alignment-Free Fingerprint Template Protection Technique Based on Minutiae Triplets	169
<i>Afeeza Ali, Vivek Singh Baghel, and Surya Prakash</i>	
Early Prediction of Complex Business Processes Using Association Rule Based Mining	183
<i>Naveed Khan, Zeeshan Tariq, Aftab Ali, Sally McClean, Paul Taylor, and Detlef Nauck</i>	
A Framework for Masked-Image Recognition System in COVID-19 Era	195
<i>Vijay Prakash, Lalit Garg, Elena Fomicheva, Sergio Vega Pineda, Alex Navia Santos, and Seema Bawa</i>	
A Deep-Learning Based Automated COVID-19 Physical Distance Measurement System Using Surveillance Video	210
<i>Masum Shah Junayed and Md Baharul Islam</i>	
Face Mask Detection Using Deep Hybrid Network Architectures	223
<i>Aryan Vikas Jain, Shubham Chakrabarti, and Lalit Garg</i>	

A Super Feature Transform for Small-Size Image Forgery Detection	234
<i>M. S. Greeshma and V. R. Bindu</i>	

Document Analysis and Recognition

UHTelHwCC: A Dataset for Telugu Off-line Handwritten Character Recognition	249
<i>Rakesh Kummari and Chakravarthy Bhagvati</i>	

Inflectional and Derivational Hybrid Stemmer for Sentiment Analysis: A Case Study with Marathi Tweets	263
<i>Rupali S. Patil and Satish R. Kolhe</i>	

Adaptive Threshold-Based Database Preparation Method for Handwritten Image Classification	280
<i>Parshuram M. Kamble, Darshan D. Ruikar, Kavita V. Houde, and Ravindra S. Hegadi</i>	

A Graph-Based Holistic Recognition of Handwritten Devanagari Words: An Approach Based on Spectral Graph Embedding	289
<i>Mohammad Idrees Bhat, B. Sharada, and Manish Kumar Sinha</i>	

Signal Processing and Machine Learning

Imagined Object Recognition Using EEG-Based Neurological Brain Signals	305
<i>Rajkumar Saini, Sameer Prabhu, Richa Upadhyay, Sumit Rakesh, Prakash Chandra Chippa, Hamam Mokayed, Marcus Liwicki, and Foteini Liwicki</i>	

A Fast and Efficient K-Nearest Neighbor Classifier Using a Convex Envelope	320
<i>Hermann Yepdjio and Szilárd Vajda</i>	

Single Channel Speech Enhancement Using Masking Based on Sinusoidal Modeling	330
<i>Rantu Buragohain, R. Aditya Reddy, Yenduri Venkatesh, Gudmalwar Ashishkumar Prabhakar, and Ch. V. Rama Rao</i>	

Extraction of Temporal Features on Fibonacci Space for Audio Based Vehicle Classification	338
<i>Amandeep Sinha, S. Hemanth Kumar, Gudmalwar Ashishkumar Prabhakar, and Ch V. Rama Rao</i>	

An Improved Technique for Preliminary Diagnosis of COVID-19
via Cough Audio Analysis 346
Tanya Pandhi, Teghdeep Kapoor, and Bharat Gupta

Satellite Imaging and Remote Sensing

Agricultural Field Analysis Using Satellite Hyperspectral Data
and Autoencoder 363
*Pranesh Kulkarni, Medha Wyawahare, Atharva Karwande, Tejas Kolhe,
Soham Kamble, and Akshay Joshi*

Development of NDVI Prediction Model Using Artificial Neural Networks 376
Sandeep V. Gaikwad, Amol D. Vibhute, and Karbhari V. Kale

Time Series Forecasting of Soil Moisture Using Satellite Images 385
K. V. Arya and Suggula Jagadeesh

Author Index 399