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Ritu Tiwari · Mario F. Pavone ·
Ranjith Ravindranathan Nair
Editors

Proceedings of International Conference on Computational Intelligence

ICCI 2021

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Preface

This proceedings contains the papers presented at the 2nd International Conference on Computational Intelligence (ICCI 2021) organized by Indian Institute of Information Technology, Pune, India, and technically supported by Soft Computing Research Society during 27–28 December 2021. ICCI 2021 invited ideas, developments, applications, experiences, and evaluations in the broad area of computational intelligence from academicians, research scholars, and scientists and had served as a platform for the researchers to exchange research evidence, personal scientific views, and innovative ideas on the issues related to the broad area of computational intelligence.

The topics covered include artificial intelligence, neural network, deep learning techniques, fuzzy theory and systems, rough sets, self-organizing maps, machine learning, chaotic systems, multi-agent systems, computational optimization ensemble classifiers, reinforcement learning, decision trees, support vector machines, hybrid learning, statistical learning, metaheuristics algorithms: evolutionary and swarm-based algorithms like genetic algorithms, genetic programming, differential evolution, particle swarm optimization, firefly algorithm, memetic algorithms, machine vision, Internet of Things, robotics and control, vehicular systems, medical imaging, digital solutions to combat COVID-19 like pandemic, image processing, image segmentation, data clustering, sentiment analysis, big data, blockchain technology, computer networks, signal processing, supply chain management, web and text mining, distributed systems, bioinformatics, embedded systems, expert system, forecasting, pattern recognition, planning and scheduling, system modelling, time series analysis, human–computer interaction, web mining, natural language processing, multimedia systems, and quantum computing.

The conference had received an excellent response from the scientific and research community and had witnessed the submission of a large number of research papers with authors from different countries in diverse application fields of computational intelligence. In order to maintain the highest technical quality of the research papers, a rigorous peer-review process had been followed in true spirit that resulted in around 30% acceptance rate of papers. The accepted papers were categorized so as to fit into four different technical tracks, which include robotics and control, machine learning, signal/image processing and IoT, and modelling and simulation.

ICCI 2021 is a flagship event of the Soft Computing Research Society, India. The two-day International Conference on Computational Intelligence 2021 started with the inaugural function. Mr. Vikas Chandra Rastogi, IAS, Principal Secretary, Department of Higher and Technical Education, Government of Maharashtra, was the Chief Guest in the inaugural session, and Prof. Rajendra Sahu, Director, ABV-IIITM Gwalior, was the Guest of Honour in the session. Other eminent dignitaries present in the inaugural ceremony include Dr. Anupam Shukla, Director, IIIT Pune, and Honorary Chair of ICCI 2021; Prof. J. C. Bansal, General Secretary, SCRS; Prof. S. N. Sapali, Registrar, IIIT Pune; Prof. Ritu Tiwari, General Chair, ICCI 2021; Dr. Mario F. Pavone, General Chair, ICCI 2021; and Dr. Ranjith Ravindranathan Nair, General Chair, ICCI 2021.

The conference witnessed keynote addresses from eminent speakers, namely Prof. Valentina Emilia Balas, Aurel Vlaicu University of Arad, Romania; Prof. Satyandra K. Gupta, University of Southern California, USA; Prof. Tomohiro Shibata, Kyushu Institute of Technology, Japan; Dr. Xin-She Yang, Middlesex University, London; Prof. Amit Konar, Jadhavpur University; and Dr. Krishnanand Kaipa, Old Dominion University, Virginia, USA.

Pune, India — Dr. Ritu Tiwari
Catania, Italy — Dr. Mario. F. Pavone
Pune, India — Dr. Ranjith Ravindranathan Nair

Contents

About the Editors

Prof. Ritu Tiwari is currently working as a Professor in Department of Computer Science and Engineering at Indian Institute of Information Technology (IIIT) Pune. Before joining IIIT Pune, she was Associate Professor in Department of Information and Communication Technology at ABV—Indian Institute of Information Technology and Management (IIITM) Gwalior. She has 12 years of teaching and research experience. Her field of research includes Robotics, Artificial Intelligence, Soft Computing and Applications. She has published 05 books and more than 80 research papers in various national and international journals/conferences and is the reviewer for many international journals/conferences. Dr. Tiwari has received Young Scientist Award from Chhattisgarh Council of Science and Technology in the year 2006. She also received Gold Medal in her Post Graduation from NIT Raipur.

Prof. Mario F. Pavone is currently working as an Associate Professor in Computer Science at the Department of Mathematics and Computer Science, University of Catania, Italy. Prof. Pavone is focused on the design and development of Meta heuristics applied in several research areas, such as in Combinatorial Optimization; Computational Biology; Network Sciences and Social Networks. Prof. Pavone was visiting professor with fellowship at the Faculty of Sciences, University of Angers, France in 2016. From August 2017, Prof. Pavone is a member of the IEEE Task Force on the Ethical and Social Implications of Computational Intelligence, for the IEEE Computational Intelligence Society (IEEE CIS). Since February 2015, Prof. Pavone is the Vice-Chair of the Task Force on Interdisciplinary Emergent Technologies for the IEEE Computational Intelligence Society (Emergent Technologies Technical Committee—ETTC), whose main aim is to promote the interdisciplinary study of emergent computation in bio-informatics, bio-physics, interdisciplinary domains of economy, medicine, and industry. Prof. Pavone also served as the Chair of the Task Force on Artificial Immune Systems for the IEEE Computational Intelligence Society (IEEE CIS). Prof. Pavone is a member of several Editorial Boards for international journals, as well as member of many Program Committees in international conferences and workshops. Prof. Pavone has also an extensive experience of organizing successful workshops, symposium, conferences and summer schools.

Prof. Pavone was also Invited Speaker for several international conferences, and Editor of many special issues in: Artificial Life, Engineering Applications of Artificial Intelligence (EAAI), Applied Soft Computing (ASOC), BMC Immunology, Natural Computing, and Memetic Computing. Etc. Prof. Pavone is the co-founder of Tao Science Research center, and the Scientific Director of ANTs Lab—Advanced New Technologies research laboratory. Prof. Pavone was visiting professor at the School of Computer Science, University of Nottingham, UK and a visiting researcher at the IBM-KAIST Bio-Computing Research Center, Department of Bio and Brain Engineering, at the Korea Advanced Institute of Science and Technology (KAIST) in 2009 and 2006, respectively.

Dr. Ranjith Ravindranathan Nair is working as an Assistant Professor in the Department of Electronics and Communication Engineering, Indian Institute of Information Technology (IIIT) Pune. Dr. Nair received his Ph.D in control and automation from the Department of Electrical Engineering, Indian Institute of Technology Kanpur in 2017. After completing his Ph.D., he was working as a postdoctoral fellow in Intelligent Systems and Control Lab at IIT Kanpur itself, in the project funded by Abu Dhabi National Oil Corporation, Gas Research Centre. As a part of the Ph.D. programme, Dr. Nair was involved in research projects sponsored by ISRO and Department of Electronics and Information Technology, Government of India. Prior to joining for Ph.D. programme, he was working with Larsen and Tubro InfoTech Ltd. Chennai. Dr. Nair has many publications to his credit in IEEE Journals and Tier-I IEEE international conferences in Control Sciences. He has published a book titled *Intelligent Control of Robotic Systems*, Taylor and Francis Publication, CRC Press, which has received the award for Best Book in reference category for Engineering at the Book and Digital Product Awards 2020 organized by the Taylor and Francis Group. Dr. Nair has also received Best Paper Award in ACODS 2012, International Conference held at IISC, Bangalore in Feb 2012. He is serving as Associate Editor for IEEE RO MAN from 2019–2021. His primary research interests include Multi-Robotic systems, Cyber-Physical systems, Non-linear control systems, Multi-Agent systems and Intelligent Control.

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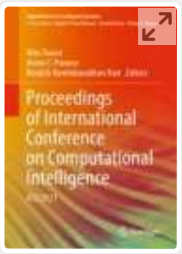

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Automated Identification of Tachyarrhythmia from Different Datasets of Heart Rate Variability Using a Hybrid Deep Learning Model

Manoj Kumar Ojha, Sulochana Wadhwani, Arun Kumar Wadhwani & Anupam Shukla

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Abstract

Automatic identification of abnormal and irregular heart rhythms is necessary to reduce mortality. Tachyarrhythmia is a type of abnormally fast heartbeat that can be detected using electrocardiogram (ECG) signals. In the elderly, life-threatening tachyarrhythmia such as ventricular fibrillation (VFIB), atrial fibrillation (AFIB), and atrial flutter (AFL) can lead to sudden cardiac arrest. Here,

we present a hybrid deep learning (HDL) model for automatic identification of tachyarrhythmia rhythms from heart rate variability (HRV) datasets based on a one-dimensional convolution neural network (1D CNN) and a long-term short-term memory (LSTM) model. In this study, we used the HRV database with five-second windows as input data for our HDL model. Four different statistical parameters have been used to determine the model efficiency: The average accuracy is 99.19%, the average precision is 91.75%, the recall is 93.63%, and the F1 score is 92.71%. The overall accuracy of the experiment was 98.4%. This model outperformed other state-of-the-art models. As a result, this method can be useful in clinical systems of cardiological care.

Keywords

AFIB **AFL** **VFIB** **HRV** **CNN** **LSTM**

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