10th International Conference on Soft Computing : Theories and Applications

December 27-29, 2025

URL: https://www.socta.in/

9789359807348

SOUVENIR CUM BOOK OF ABSTRACTS

Organized by

Dr. B R Ambedkar National Institute of Technology, Jalandhar, Punjab, INDIA

डॉ. बी. आर. अंबेडकर राष्ट्रीय प्रौद्योगिकी संस्थान, जालंधर, पंजाब, भारत

Editors

Dr. Lipo Wang
Dr. Om Prakash Verma
Dr. Anupam Yadav
Dr. Jitendra Rajpurohit
Dr. Tarun K. Sharma

An Event of

Proceedings in

Springer

SPRINGER NATURE

Technically Supported by

Partially Sponsored by

FastCodeAI

Soft Computing: Theories and Applications (SoCTA2025)

December 27 – 29, 2025

Dr B R Ambedkar National Institute of Technology Jalandhar, Panjab, India

Editors:

Dr. Lipo Wang
School of Electrical and Electronics Engineering, Nanyang Technological University, Singapore, Singapore
Dr. Om Prakash Verma
Dr. B R Ambedkar National Institute of Technology, Jalandhar
Dr. Tarun K. Sharma
Shobhit University, Gangoh
Dr. Jitendra Rajpurohit
Symbiosis Institute of Technology, Symbiosis International (Deemed University), Pune

9789359807348

Third Edition 2025

Published by: *Self Published*

E-Publication Website: http://socta.in

Dear Participants and Researchers,

Welcome to the book of abstracts for SoCTA2025! In this compilation, we embark on a journey through the diverse realms of soft computing, exploring its profound importance in addressing real-life challenges.

It is with great pride and enthusiasm that we welcome you to the 10th International Conference on Soft Computing: Theories and Applications (SoCTA2025), being hosted by Malaviya National Institute of Technology Jaipur (MNIT), Punjab, from December 27–29, 2025. This prestigious conference has become a cornerstone for researchers, academicians, and practitioners to converge and exchange pioneering ideas in the ever-evolving field of soft computing and its multidisciplinary applications.

Soft computing has emerged as a crucial domain in addressing complex and dynamic real-world problems, blending computational techniques such as fuzzy logic, neural networks, evolutionary algorithms, and machine learning. SoCTA2025 provides a platform for exploring these advancements and their integration into areas such as data analytics, optimization, artificial intelligence, healthcare, environmental sciences, and smart systems. The focus of this year's conference is on fostering innovative solutions to contemporary challenges through theoretical and practical insights.

This year, SoCTA2025 has received an overwhelming response from researchers across the globe, with a multitude of submissions showcasing cutting-edge research and novel applications. The diversity and quality of contributions reflect the growing relevance of soft computing techniques in addressing societal and industrial needs. These abstracts represent a glimpse into the rigorous research and thought-provoking discussions that the conference promises to offer.

We are honored to host a distinguished lineup of keynote speakers, renowned in the field of soft computing, who will share their invaluable perspectives and inspire the next generation of researchers. The technical sessions, panel discussions, and workshops are carefully curated to provide an enriching experience for participants, fostering collaborations and opening new avenues of exploration.

On behalf of the organizing committee, we extend our heartfelt gratitude to all the authors, reviewers, and session chairs whose dedication and contributions have been instrumental in making SoCTA2025 a success. Our sincere thanks also go to MNIT Jaipur for providing a conducive environment for this academic endeavor and to our sponsors for their unwavering support.

We hope that SoCTA2025 will serve as a catalyst for innovation, learning, and networking. May the discussions and interactions during this conference ignite ideas that contribute to the advancement of soft computing and its impactful applications.

We wish all participants a fruitful and engaging experience at SoCTA2025 in the vibrant city of Jalandhar.

Warm regards,

Organizing Committee - SoCTA2025

SoCTA (Soft Computing: Theories and Applications) is now **10 years** young International conference.

The **objective of SoCTA** is to provide a common platform to researchers, academicians, scientists and industrialists working in the area of soft computing to share and exchange their views and ideas on the theory and application of soft computing techniques in multi-disciplinary areas.

The **aim of the conference** is to highlight the latest advances, problems and challenges and to present the latest research results in the field of soft computing with a link to scientific research and its practical implementation. SoCTA especially encourages the young researchers at the beginning of their career to participate in this conference and invite them to present their work on this platform.

Previous SoCTA conference was successfully organized at the following venues:

SoCTA2016:	Amity University Rajasthan, Jaipur, India.	(December 28-30, 2016)
SoCTA2017:	Bundelkhand University Jhansi, Uttar Pradesh, India.	(December 22-24, 2017)
SoCTA2018:	Dr B R Ambedkar NIT, Jalandhar, Punjab, India.	(December 21-23, 2018)
SoCTA2019:	National Institute of Technology, Patna, Bihar, India.	(December 27-29, 2019)
SoCTA2020:	In Virtual Mode (due to pandemic COVID-19).	(December 25-27, 2020)
SoCTA2021:	Indian Institute of Information Technology Kota, India.	(December 17-19, 2021)
SoCTA2022:	Himachal Pradesh University Summerhill, Shimla, India.	(December 16-18, 2022)
SoCTA2023:	Indian Institute of Information Technology Una, India.	(December 24-26, 2023)
SoCTA2024:	Malaviya NIT Jaipur, India.	(December 27-29, 2022)

10th in the series, SoCTA2025 held at Dr B R Ambedkar National Institute of Technology Jalandhar, Punjab, INDIA in hybrid mode during December 27 – 29, 2025.

SoCTA2025 is organized in technical collaboration with Dr B R Ambedkar NIT, Jalandhar, Punjab, India; Shobhit Deemed University Meerut and Science, Technology, Engineering and Management (STEM) – Research Society.

The conference had 11 keynote lectures presented by eminent academicians and practitioners from different parts of the world. Totally, 100 technical papers under 12 different themes of the conference were presented during the conference in 18 oral presentation sessions. We are thankful to Springer Plc., for giving us opportunity to publish the proceedings in Lecture Notes in Networks and Systems (LNNS). All papers submitted to SoCTA2025 had undergone a peer-review process and subsequently revised before being finally accepted.

The credit of the success of the SoCTA Series, goes to our Mentors, Keynote & Invited Speakers, Chief Guests, Guest of Honor(s), Members of the advisory board (National & International), Program Committee members, Springer Team as a publishing partner (in particular Mr. Aninda Bose, Executive Editor – Interdisciplinary Applied Sciences; Research Publishing – Books), all the Author(s), participants and the reviewer's board. We sincerely appreciate your continued support, encouragement and trust in us. We look forward to have this wonderful support in the coming SoCTA Series as well.

We are glad to inform you that the next in the SoCTA Series i.e. SoCTA2025 is scheduled at Dr B R Ambedkar National Institute of Technology Jalandhar, Punjab, India.
Looking forward to have your significant contribution in SoCTA Series…

It is my pleasure to welcome you to the 10th International Conference on Soft Computing: Theories & Applications (SoCTA 2025), to be held at Dr. B. R. Ambedkar NIT Jalandhar (27–29 December 2025). This Book of Abstracts captures a broad spectrum of high-quality research contributions across soft computing, artificial and machine intelligence, social intelligence, embedded systems, and automation, all focused on advancing indigenous, application-oriented solutions under this year's theme "UDAAN: Upgrading Defense Automation for Advanced National Security." For a decade, SoCTA has served as a trusted forum for cross-disciplinary exchange between academia, industry, and defense practitioners. The papers and abstracts included here reflect both foundational advances and practical innovations from medical imaging and precision agriculture to autonomous systems, multi-sensor fusion, cybersecurity, and defense automation. I congratulate the authors for their scientific rigour and creativity, and extend heartfelt thanks to our invited speakers, session chairs, reviewers, technical committee, sponsors, and the entire organizing team for their dedication to scholarly excellence and smooth execution.

I encourage all participants, especially early-career researchers and student authors to use this platform to forge collaborations, pursue translational research, and accelerate the development of home-grown technologies that address national priorities. This year Drone Olympics has been introduced as an international challenge event, which will give participants hands-on exposure to real-time implementation in scenarios such as disaster management. May the discussions and interactions at SoCTA 2025 spark new ideas, partnerships, and solutions of lasting impact.

Wishing you a rewarding and stimulating conference.

Mrutyunjay Behera
Economic Adviser
Ministry of Education

प्रो. टी. जी. सीताराम
अध्यक्ष
Prof. T. G. Sitharam
FNAE, DGE, FASCE, FICE (UK)
Ph.D. (Univ of Waterloo, Canada), D.Sc
Post Doc (Univ of Texas, @Austin USA)
Chairman

सत्यमेव जयते

अखिल भारतीय तकनीकी शिक्षा परिषद्
(भारत सरकार का एक सांविधिक निकाय)
(शिक्षा मंत्रालय, भारत सरकार)
नेल्सन मंडेला मार्ग, वसंत कुंज, नई दिल्ली–110070
दूरभाष : 011–26131498
ई–मेल : chairman@aicte-india.org
ALL INDIA COUNCIL FOR TECHNICAL EDUCATION
(A STATUTORY BODY OF THE GOVT. OF INDIA)
(Ministry of Education, Govt. of India)
Nelson Mandela Marg, Vasant Kunj, New Delhi-110070
Phone : 011-26131498
E-mail : chairman@aicte-india.org

MESSAGE

I am pleased to extend my warm greetings to all participants of the *10th International Conference on Soft Computing: Theories and Applications (SoCTA-2025)* being organized at Dr. B. R. Ambedkar National Institute of Technology, Jalandhar, from 27–29 December 2025. Over the past decade, SoCTA has evolved into a respected global platform that brings together researchers, innovators, industry professionals, and young scholars to exchange knowledge and explore emerging frontiers in computational intelligence and allied domains.

The themes of this year's conference—spanning Soft Computing, Machine Learning, Quantum Technologies, Computer Vision, Autonomous Systems, and Robotics—reflect the rapidly transforming technological landscape and the increasing role of intelligent systems in shaping national advancements. I am glad to note that SoCTA-2025 continues its tradition of promoting high-quality, application-oriented research with direct relevance to societal progress, sustainable development, and national priorities.

I congratulate the organizers for curating a conference that not only disseminates cutting-edge research but also fosters collaboration, innovation, and capacity building among students, researchers, and practitioners. Initiatives such as these are fully aligned with the vision of AICTE to nurture a vibrant ecosystem of research, entrepreneurship, and technological excellence in India.

I encourage all participants to make the most of the insightful discussions, diverse sessions, and networking opportunities offered by SoCTA-2025. May this conference inspire new ideas, strengthen interdisciplinary partnerships, and contribute meaningfully to India's aspiration of becoming a global leader in science and technology.

My best wishes for a successful, enriching, and impactful conference.

With warm regards.

T. G. Sitharam

(Prof. T.G. Sitharam)

Message for the Book of Abstracts

I am happy to know that the 10th edition of International Conference on Soft Computing Theories and Applications (SoCTA-2025) is being organised to bring researchers together in the areas of soft computing, artificial and machine intelligence, embedded systems, and automation.
I extend my best wishes for the success of this conference, and believe that it shall definitely benefit the participating scholars and researchers.

रजत मूना / Rajat Moona

निदेशक / Director

एवं / and

"सुधीर कु. जैन चेयर" प्रोफेसर / "Sudhir K. Jain Chair" Professor

संगणक विज्ञान एवं अभियांत्रिकी / Computer Science and Engineering

भारतीय प्रौद्योगिकी संस्थान गांधीनगर / Indian Institute of Technology Gandhinagar

विद्याधनं सर्वधन प्रधानम्

डॉ. मनोज सिंह गौड़, निदेशक
Dr. Manoj Singh Gaur, Director

भारतीय प्रौद्योगिकी संस्थान जम्मू
Indian Institute of Technology Jammu
Jagti, NH 44, Nagrota, Jammu - 181221, J&K, India.
P : +91-191-2570381
E : director@iitjammu.ac.in | W : www.iitjammu.ac.in

Message for the Book of Abstracts (Souvenir)

It is my pleasure to welcome all the participants to the 10th International Conference on Soft Computing: Theories & Applications (SoCTA 2025), to be held at Dr. B. R. Ambedkar NIT Jalandhar (27–29 December 2025). This Book of Abstracts captures a broad spectrum of high-quality research contributions across Soft Computing, Artificial and Machine Intelligence, Social Intelligence, Embedded Systems, And Automation, all focused on advancing indigenous, application-oriented solutions under this year's theme "UDAAN: Upgrading Defense Automation for Advanced National Security." For a decade, SoCTA has served as a trusted forum for cross-disciplinary exchange between academia, industry, and defense practitioners. The papers and abstracts included here reflect both foundational advances and practical innovations from medical imaging and precision agriculture to autonomous systems, multi-sensor fusion, cybersecurity, and defense automation. I congratulate the authors for their scientific rigour and creativity, and extend heartfelt thanks to our invited speakers, session chairs, reviewers, technical committee, sponsors, and the entire organizing team for their dedication to scholarly excellence and smooth execution.

All participants, especially early-career researchers and student authors should use this platform to forge collaborations, pursue translational research, and accelerate the development of home-grown technologies that address national priorities. This year we are pleased to introduce DroneOlympics as an international challenge event, which will give participants hands-on exposure to real-time implementation in scenarios such as disaster management. May the discussions and interactions at SoCTA 2025 spark new ideas, partnerships, and solutions of lasting impact.

With best wishes for a stimulating and productive conference,Wishing you a rewarding and stimulating conference.

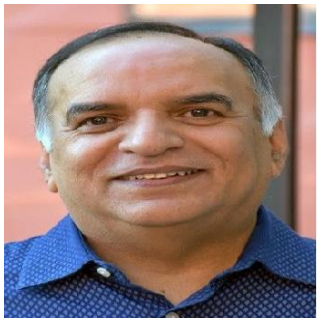
With Regards

(Manoj S Gaur)

भारतीय प्रौद्योगिकी संस्थान रोपड़
INDIAN INSTITUTE OF TECHNOLOGY ROPAR
रूपनगर-140001, पंजाब, भारत
Rupnagar- 140001, Punjab, INDIA
दूरभाष/Tele : +91 - 1881- 231006
ई - मेल / E-mail : director@iitrpr.ac.in

प्रो. राजीव आहूजा
PROF. RAJEEV AHUJA
निदेशक
DIRECTOR

Message



It is my pleasure to welcome you to the 10th International Conference on Soft Computing: Theories & Applications (SoCTA 2025), to be held at Dr. B. R. Ambedkar NIT Jalandhar (27–29 December 2025). This Book of Abstracts captures a broad spectrum of high-quality research contributions across soft computing, artificial and machine intelligence, social intelligence, embedded systems, and automation, all focused on advancing indigenous, application-oriented solutions under this year's theme "UDAAN: Upgrading Defense Automation for Advanced National Security." For a decade, SoCTA has served as a trusted forum for cross-disciplinary exchange between academia, industry, and defense practitioners. The papers and abstracts included here reflect both foundational advances and practical innovations from medical imaging and precision agriculture to autonomous systems, multi-sensor fusion, cybersecurity, and defense automation. I congratulate the authors for their scientific rigour and creativity, and extend heartfelt thanks to our invited speakers, session chairs, reviewers, technical committee, sponsors, and the entire organizing team for their dedication to scholarly excellence and smooth execution.

I encourage all participants, especially early-career researchers and student authors to use this platform to forge collaborations, pursue translational research, and accelerate the development of home-grown technologies that address national priorities. This year we are pleased to introduce DroneOlympics as an international challenge event, which will give participants hands-on exposure to real-time implementation in scenarios such as disaster management. May the discussions and interactions at SoCTA 2025 spark new ideas, partnerships, and solutions of lasting impact.

With best wishes for a stimulating and productive conference,Wishing you a rewarding and stimulating conference.

(RAJEEV AHUJA)

MESSAGE

It is my pleasure to welcome you to the 10th International Conference on Soft Computing: Theories & Applications (SoCTA 2025), to be held at Dr. B. R. Ambedkar NIT Jalandhar (27–29 December 2025). This Book of Abstracts captures a broad spectrum of high-quality research contributions across soft computing, artificial and machine intelligence, social intelligence, embedded systems, and automation, all focused on advancing indigenous, application-oriented solutions under this year's theme "UDAAN: Upgrading Defense Automation for Advanced National Security." For a decade, SoCTA has served as a trusted forum for cross-disciplinary exchange between academia, industry, and defense practitioners. The papers and abstracts included here reflect both foundational advances and practical innovations from medical imaging and precision agriculture to autonomous systems, multi-sensor fusion, cybersecurity, and defense automation. I congratulate the authors for their scientific rigour and creativity, and extend heartfelt thanks to our invited speakers, session chairs, reviewers, technical committee, sponsors, and the entire organizing team for their dedication to scholarly excellence and smooth execution.

I encourage all participants, especially early-career researchers and student authors to use this platform to forge collaborations, pursue translational research, and accelerate the development of home-grown technologies that address national priorities. This year we are pleased to introduce DroneOlympics as an international challenge event, which will give participants hands-on exposure to real-time implementation in scenarios such as disaster management. May the discussions and interactions at SoCTA 2025 spark new ideas, partnerships, and solutions of lasting impact.

With best wishes for a stimulating and productive conference,Wishing you a rewarding and stimulating conference.

Director's Office / निदेशक कार्यालय
Indian Institute of Management Nagpur
भारतीय प्रबंध संस्थान नागपूर
Plot No.1, Sector 20, MIHAN, Nagpur - 441108
प्लॉट नं. १, सेक्टर २०, मिहान, नागपूर - ४४११०८
Phone - 0712-2870301 / ०७१२-२८७०३०१
www.iimnagpur.ac.in

Message

It gives me immense pleasure to extend my heartfelt congratulations on the occasion of the 10th International Conference on Soft Computing Theories and Applications (SoCTA-2025). This landmark edition is not only a celebration of a decade of scholarly excellence but also a tribute to the collective vision, dedication, and collaboration that have shaped SoCTA into a distinguished global forum.

I fondly recall my participation as a Keynote Speaker at SoCTA-2018 held at Dr. B. R. Ambedkar NIT Jalandhar. The warmth of the organizers, the enthusiasm of the participants, and the intellectual vibrancy of the discussions left a lasting impression on me. It is gratifying to see how the conference has grown in scale, depth, and impact since then, continuously fostering innovation, interdisciplinary dialogue, and cutting-edge research in soft computing.

As SoCTA steps into its 10th year, this milestone symbolizes not just continuity but also evolution—an ongoing commitment to advancing knowledge, nurturing young researchers, and addressing complex real-world challenges through the lens of soft computing. The revisiting of contributions from keynote speakers, esteemed guests, and collaborators resonates deeply with the ethos of gratitude and shared achievement.

I commend the organizers of SoCTA-2025 and the host institution, Dr. B. R. Ambedkar NIT Jalandhar, for their unwavering dedication in sustaining this remarkable journey. I am confident that this edition will spark new insights, foster meaningful collaborations, and inspire the next wave of innovation. Thanks to the untiring, dedicated and sincere efforts of the organizers, especially Dr.Om Prakash Verma, Dr.Tarun K. Sharma and Dr.Jitendra Rajpurohit, the SoCTA conferences have been a remarkable success. Many congratulations to them for hosting the conference!

My best wishes for the grand success of SoCTA-2025. May the conference continue to illuminate pathways for research and enrich the global scientific community for many years to come.

Warm regards

Ajit Kumar Verma, Professor,
Western Norway University of Applied Sciences, Haugesund, Norway

प्रो. करुणेश कुमार शुक्ल
निदेशक
Prof. Karunesh K. Shukla
DIRECTOR

मौलाना आज़ाद राष्ट्रीय प्रौद्योगिकी संस्थान
भोपाल 462003 (म.प्र.) भारत
(शिक्षा मंत्रालय, भारत सरकार के अधीन राष्ट्रीय महत्व का संस्थान)
Maulana Azad National Institute of Technology
Bhopal 462003 (M.P.) India
(An Institution of National Importance under Ministry of Education, Govt. of India)

MESSAGE

It is my pleasure to welcome you to the 10th International Conference on Soft Computing: Theories & Applications (SoCTA 2025), to be held at Dr. B. R. Ambedkar NIT Jalandhar (27–29 December 2025). This Book of Abstracts captures a broad spectrum of high-quality research contributions across soft computing, artificial and machine intelligence, social intelligence, embedded systems, and automation, all focused on advancing indigenous, application-oriented solutions under this year's theme "UDAAN: Upgrading Defense Automation for Advanced National Security." For a decade, SoCTA has served as a trusted forum for cross-disciplinary exchange between academia, industry, and defense practitioners. The papers and abstracts included here reflect both foundational advances and practical innovations from medical imaging and precision agriculture to autonomous systems, multi-sensor fusion, cybersecurity, and defense automation. I congratulate the authors for their scientific rigour and creativity, and extend heartfelt thanks to our invited speakers, session chairs, reviewers, technical committee, sponsors, and the entire organizing team for their dedication to scholarly excellence and smooth execution.

I encourage all participants, especially early-career researchers and student authors to use this platform to forge collaborations, pursue translational research, and accelerate the development of home-grown technologies that address national priorities. This year we are pleased to introduce Drone Olympics as an international challenge event, which will give participants hands-on exposure to real-time implementation in scenarios such as disaster management. May the discussions and interactions at SoCTA 2025 spark new ideas, partnerships, and solutions of lasting impact.

With best wishes for a stimulating and productive conference. Wishing you a rewarding and stimulating conference.

(Karunesh Kumar Shukla)

फोन/ Phone (कार्यालय/office) +91-0755-2670900, फैक्स/Fax: +91-0755-2670562
ईमेल/ Email. director@manit.ac.in वेब./ Web.: http://www.manit.ac.in

राष्ट्रीय प्रौद्योगिकी संस्थान पुदुच्चेरी
(शिक्षा मंत्रालय के तहत राष्ट्रीय महत्व का एक संस्थान,भारत सरकार)
तिरुवेट्टाकुड़ी, कारैक्काल - 609 609, केंद्र शासित प्रदेश,पुदुच्चेरी
NATIONAL INSTITUTE OF TECHNOLOGY PUDUCHERRY
(An Institution of National Importance under Ministry of Education, Govt of India)
Thiruvettakudy, Karaikal – 609 609, Union Territory of Puducherry

प्रो.(डॉ.) मकरंद माधव घांगरेकर
निदेशक

Prof.(Dr.) MAKARAND MADHAO GHANGREKAR
Director

Date: December 01, 2025

Message for the Souvenir

It is my pleasure to welcome you to the 10th International Conference on Soft Computing: Theories & Applications (SoCTA 2025), to be held at Dr. B. R. Ambedkar NIT Jalandhar (27–29 December 2025). This Book of Abstracts captures a broad spectrum of high-quality research contributions across soft computing, artificial and machine intelligence, social intelligence, embedded systems, and automation, all focused on advancing indigenous, application-oriented solutions under this year's theme "UDAAN: Upgrading Defense Automation for Advanced National Security." For a decade, SoCTA has served as a trusted forum for cross-disciplinary exchange between academia, industry, and defense practitioners. The papers and abstracts included here reflect both foundational advances and practical innovations spanning from medical imaging and precision agriculture to autonomous systems, multi-sensor fusion, cybersecurity, and defense automation. I congratulate the authors for their scientific rigour and creativity, and extend heartfelt thanks to invited speakers, session chairs, reviewers, technical committee, sponsors, and the entire organizing team for their dedication to scholarly excellence and smooth execution.

I encourage all participants, especially early-career researchers and student authors to use this platform to forge collaborations, pursue translational research, and accelerate the development of home-grown technologies that address national priorities. The introduction of DroneOlympics, as an international challenge event, will give participants hands-on exposure to real-time implementation in scenarios such as disaster management. May the discussions and interactions at SoCTA 2025 spark new ideas, partnerships, and solutions of lasting impact.

With best wishes for a stimulating and productive conference. Wishing all the participants a rewarding and stimulating conference.

Ghangrekar

(Prof. Makarand M. Ghangrekar)

Phone / दूर भाष : 04368-265230 Fax / फैक्स :+91-4368-265230
E-mail / ई-मेल : registrar@nitpy.ac.in Web / वेब : www.nitpy.ac.in

पंडित द्वारका प्रसाद मिश्र
भारतीय सूचना प्रौद्योगिकी,
अभिकल्पन एवं विनिर्माण संस्थान, जबलपुर
(संसदीय अधिनियम द्वारा स्थापित राष्ट्रीय महत्व का संस्थान)

Pandit Dwarka Prasad Mishra
Indian Institute of Information Technology,
Design and Manufacturing, Jabalpur
(An Institute of National Importance Established by an Act of Parliament)

प्रो. भारतेन्दु कुमार सिंह
निदेशक

Jabalpur, dated 28th November 2025

Message

It is a matter of great pleasure that the 10th International Conference on Soft Computing: Theories & Applications (SoCTA 2025), is being organized during 27–29 December 2025 at Dr. B. R. Ambedkar NIT Jalandhar (27–29 December 2025).

This Book of Abstracts captures a broad spectrum of high-quality research contributions across soft computing, artificial and machine intelligence, social intelligence, embedded systems, and automation, all focused on advancing indigenous, application-oriented solutions under this year's theme "UDAAN: Upgrading Defense Automation for Advanced National Security." For a decade, SoCTA has served as a trusted forum for cross-disciplinary exchange between academia, industry, and defense practitioners. The papers and abstracts included here reflect both foundational advances and practical innovations from medical imaging and precision agriculture to autonomous systems, multi-sensor fusion, cyber security, and defense automation. I congratulate the authors for their scientific rigour and creativity, and extend heartfelt thanks to our invited speakers, session chairs, reviewers, technical committee, sponsors, and the entire organizing team for their dedication to scholarly excellence and smooth execution.

I encourage all participants, especially early-career researchers and student authors to use this platform to forge collaborations, pursue translational research, and accelerate the development of home-grown technologies that address national priorities. This year we are pleased to introduce Drone Olympics as an international challenge event, which will give participants hands-on exposure to real-time implementation in scenarios such as disaster management. May the discussions and interactions at SoCTA 2025 spark new ideas, partnerships, and solutions of lasting impact.

With best wishes for a stimulating and productive conference, Wishing you a rewarding and stimulating conference.

BKSingh

Prof. Bhartendu K Singh

भारतीय प्रौद्योगिकी संस्थान रुड़की
रुड़की – 247667(उत्तराखण्ड), भारत

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Roorkee - 247 667 (Uttarakhand), India

T: +91 - 1332–272742, 285500 (O), 9837070794 (O)
F:+91 - 1332 –285815, 273560
E: director@iitr.ac.in,dir_office@iitr.ac.in

प्रो० के० के० पंत
निदेशक

Prof. K.K. Pant
Director

Message

It is my pleasure to welcome you to the 10th International Conference on Soft Computing: Theories & Applications (SoCTA 2025), to be held at Dr. B. R. Ambedkar NIT Jalandhar (27–29 December 2025). This Book of Abstracts captures a broad spectrum of high-quality research contributions across soft computing, artificial and machine intelligence, social intelligence, embedded systems, and automation, all focused on advancing indigenous, application-oriented solutions under this year's theme "UDAAN: Upgrading Defence Automation for Advanced National Security." For a decade, SoCTA has served as a trusted forum for cross-disciplinary exchange between academia, industry, and defence practitioners. The papers and abstracts included here reflect both foundational advances and practical innovations from medical imaging and precision agriculture to autonomous systems, multi-sensor fusion, cybersecurity, and defence automation. I congratulate the authors for their scientific rigour and creativity, and extend heartfelt thanks to our invited speakers, session chairs, reviewers, technical committee, sponsors, and the entire organizing team for their dedication to scholarly excellence and smooth execution.

I encourage all participants, especially early-career researchers and student authors to use this platform to forge collaborations, pursue translational research, and accelerate the development of home-grown technologies that address national priorities. This year there is an introduction of Drone Olympics as an international challenge event, which will give participants hands-on exposure to real-time implementation in scenarios such as disaster management. May the discussions and interactions at SoCTA 2025 spark new ideas, partnerships, and solutions of lasting impact.

I convey my best wishes for a stimulating and productive conference.

Wishing you a rewarding and stimulating conference.

(K K Pant)

Message

I am looking forward to an interesting and successful conference which brings together people from all over the world to exchange and discuss ideas in the field of soft computing. This is the 10th edition of the conference "**International Conferences on Soft Computing: Theories and Applications (SoCTA 2025)**" to be held in hybrid mode during 27 – 29 December 2025 and it is a delight to see the event growing every year.

I take this opportunity to congratulate the organizing committee of SoCTA and all those associated members who have worked hard in organizing this conference for 10 years.

The conference is the perfect forum for researchers to network, collaborate and meet world renowned experts to learn, share and solve problems through discussion. I expect several high-quality deliberations from specialists which will help students and young researchers to learn.

I convey my warm greetings to all the participants and congratulate organizing members for grand success of the event.

All the best,

Aninda Bose
Executive Editor – Interdisciplinary Applied Sciences
Research Publishing – Books

Springer Nature Limited
The Campus, 4 Crinan Street, London N1 9XW
www.springernature.com

Message from the Conveners

It is our great pleasure to welcome you to the **10th International Conference on Soft Computing: Theories and Applications (SoCTA2025)** at Dr B R Ambedkar National Institute of Technology Jalandhar, Punjab, INDIA. Soft Computing methods are increasingly applied to solve problems in diverse domains. Hence SoCTA is appropriately conceived to offer a forum to bring all such applied researchers together under one umbrella.

There is no SoCTA Series without the quality contributions made by the authors. In addition SoCTA2025 is very fortunate to have so many top quality panel, keynote speakers and workshop organizers. We sincerely thank them all.

We are particularly looking forward to the invited talks. We are delighted to have such a strong and varied series of plenary talks at the conference. The underlying philosophy motivating this conference, which has become a flagship forum in the area of Mathematics and Computer Science in general and in the area of Soft Computing in particular, has been to bring together researchers who apply, besides conventional traditional computing techniques, soft and other novel computing paradigms to problems and situations that have hitherto been intractable, complex, highly nonlinear and difficult to solve. Soft Computing is a cutting edge field of research in which one of the main inspirations for problem solving is based on, for example, natural or biological systems that tend to be decentralized, are adaptive and are known to be environmentally aware, and as a result they have survivability, scalability and flexibility properties. In addition to work on traditional serial computers, these researchers also exploit methods of efficiency with parallel computing techniques and tools to achieve high performance computing capabilities in their work.

There are two further key features of this conference series that make this a unique event - i.e. these events are "go-green" environmentally friendly conferences where emphasis is on the quality of academic endeavor rather than spin and gloss; and these events see participation from large number of young researchers and particularly women scientists which is an important aspect if we are to increase female participation in STEM (Science, Technology, Engineering, and Mathematics) areas. Conferences like these are only possible thanks to the hard work of a great many people and the successful organization of SoCTA2025 has required the talents, dedication and time of many volunteers and strong support from program committee.

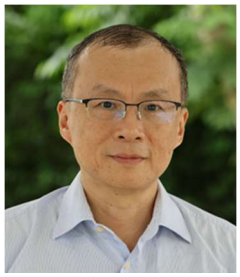
Chairs of each event contributed exceptionally by attracting contributions, getting them reviewed, making accept and reject recommendations, developing the programs and so on. We also thank the National and International advisory committee. Publication of SoCTA2025 proceedings is not a simple task. Committee has contributed immensely. We are as ever grateful to the SpringerNature and Mr. Aninda Bose, Executive Editor for their dedication and professionalism in helping us produce what is an excellent and high-quality proceedings.

We also give our sincere thanks to the competent authorities of MNIT Jaipur, Rajasthan and all our colleagues on the Organizing Committee for their sincere work and support throughout the year. It only remains for us to thank all of you for participating in the conference and helping to make it a success.

We hope that all of you will benefit from the extensive technical program and establish long lasting interactions with fellow delegates at SoCTA2025.

Dr. Tarun K. Sharma and Dr. Om Prakash Verma

Invited Talks



Prof. Lipo Wang
Electrical and Electronic Engineering
Nanyang Technological University,
Singapore

Prof. Lipo Wang is with the School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore. His research focuses on artificial intelligence/machine learning for image and data processing. He has published over 400 papers, holds 2 patents, and has received more than 16,000 citations on Google Scholar. He has delivered over 50 keynote talks worldwide.

He is Editor-in-Chief of the International Journal of Computational Intelligence and Applications, Senior Editor of IEEE Transactions on Systems, Man, and Cybernetics: Systems, and Associate Editor of IEEE Transactions on Neural Networks and Learning Systems. He has also served as Associate Editor or Editorial Board Member of more than 30 international journals, including two other IEEE Transactions, and as Guest Editor for over 10 special issues.

Prof. Wang was a member of the Board of Governors of the International Neural Network Society, the IEEE Computational Intelligence Society (CIS), and the IEEE Biometrics Council. He served as CIS Vice President for Technical Activities and as Chair of the Education Committee of the IEEE Engineering in Medicine and Biology Society (EMBS). He was President of the Asia-Pacific Neural Network Assembly (APNNA, now APNNS) and received the APNNA Excellent Service Award. He was the founding Chair of both the EMBS Singapore Chapter and the CIS Singapore Chapter.

Dr. Swagatam Das
Professor - Electronics and Communication Sciences Unit (ECSU)
ISI Kolkata, India

Title of the Talk: Multi-modal and Non-stationary Optimization with Differential Evolution: Some Recent Approaches and Applications

Swagatam Das earned his B.E. in Electronics and Telecommunications Engineering, M.E. with a specialization in Control Engineering, and Ph.D.(Engineering) degrees from Jadavpur University, India, in the years 2003, 2005, and 2009, respectively. He is currently a professor at the Electronics and Communication Sciences Unit (ECSU) of the Indian Statistical Institute, Kolkata, India. He is also serving as the Professor-in-Charge of the

Computer and Communication Sciences Division (CCSD) of his Institute for the term 2024 - 26. He previously held the position of Professor and Deputy Director at the Institute for Advancing Intelligence (IAI), TCG CREST, Kolkata, India, from April 01, 2023, to March 31, 2024. His research interests encompass deep learning and non-convex optimization, and he has published over 400 research articles in peer-reviewed journals and international conferences. Dr. Das is the founding Co-Editor-in-Chief of Swarm and Evolutionary Computation, an international journal by Elsevier. He has served or is currently serving as an Associate Editor for several prominent journals, including the IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Cybernetics, IEEE Transactions on Evolutionary Computation, Pattern Recognition (Elsevier), Neurocomputing (Elsevier), Information Sciences (Elsevier), IEEE Trans. on Systems, Man, and Cybernetics: Systems, among others. He is a member of the editorial board of Information Fusion (Elsevier), Progress in Artificial Intelligence (Springer), Applied Soft Computing (Elsevier), Engineering Applications of Artificial Intelligence (Elsevier), and so on. Dr. Das has received over 35,500 Google Scholar citations and an H-index of 90 to date. He has actively participated in the program committees and organizing committees of renowned international conferences such as NeurIPS, AAAI, AISTATS, ACM Multimedia, BMVC, IEEE WCCI, GECCO, and more. He currently serves as an ACM Distinguished Speaker. He received the 2012 Young Engineer Award from the Indian National Academy of Engineering (INAE) and the 2015 Thomson Reuters Research Excellence India Citation Award for being the highest-cited researcher in Engineering and Computer Science in India between 2010 and 2014.

Prof. Rajesh Kumar
Professor of Artificial Intelligence,
University of Johannesburg, MNIT Jaipur

Rajesh Kumar (SMIEEE, Fellow IET(UK), Fellow IE(I), Fellow IETE, LMCSI, LMISTE) received the B.Tech. (Hons.) degree in Electrical Engineering from the National Institute of Technology (NIT), Kurukshetra, India, 1994, the M.E. (Hons.) and Ph.D. degrees in Power Systems and Intelligent Systems from the Malaviya National Institute of Technology (MNIT) Jaipur, Rajasthan, India 1997, and 2005 respectively. He was a Postdoctoral Research Fellow with the Department of Electrical and Computer Engineering, National University of Singapore (NUS), Singapore, from 2009 to 2011. Currently, He is working as a Professor of Artificial Intelligence at the Department of Human Anatomy and Physiology, Faculty of Health Sciences, University of Johannesburg, South Africa and a Professor in the Department of Electrical Engineering, and Artificial Intelligence and Data Engineering, MNIT, Jaipur, India. His research interests focus on Intelligent Systems, Data Driven algorithms and Computational Neuroscience, Energy, and Healthcare. He holds 20 patents/patent applications and has published over 750 research articles in international conferences and journals. He has supervised 38 Ph.D. and more than 60 masters theses. He has received several academic, best papers, best theses, and professional awards. He was felicitated with the Career Award for Young Teachers in 2002 by the Government of India. He has delivered over 350 keynotes/expert talks at conferences, faculty development programs, and workshops

Dr. Vaibhav Gupta
IRDE, DRDO
Ministry of Defense, GOI
Dehradun

Dr. Gupta, obtained his M.Sc. in Computer Science from MD University, Rohtak in 2002, M.Phil. Computer Science from Madurai Kamaraj University, Madurai in 2005 and P.hD. in Computer Science Engineering with Specialization in Neural Networks from Uttarakhand Technical University, Dehradun in 2021. DRDO He joined DRDO in 2002 at DRDO Delhi where he played lead role in major routing centre and developed intelligent mail server and routing tables. He joined DRDO premium electro-optical laboratory IRDE Dehradun in June 2005. He started his work in the area of automation and developed AI based algorithms for detection and tracking, Bad weather imaging, generative image reconstruction, passive ranging and super resolution for electro-optical systems. In 2016 he made significant achievement in the development of AI based battle tank detection system using artificial neural network approach for implementation of smart mines. During COVID Pandemic he has developed an intelligent system for fever detection from a safer distance using thermal imager among the crowd instantly for multiple persons. His important contributions includes development of automated VIPERS-HD for human detection during day/night conditions. Successful night trials were also conducted in Ladhak region at -25 celcius. In continuation to this VIPERS-AD (Anti Drone) has been developed with the capability to detect, track and classify miniature size flying object and UAV in the sky even in the pitch dark conditions using trajectory, acoustic and spatial models. As an eminent designer he has pushed himself beyond limits and achieved significant success in the development of AI based DRONE surveillance model to autonomously detect and classify various objects on the ground surface in the battle field region. He has also conceptualized a model for dropping of payload release mechanism using remote control operation or autonomously mounted on Drone. In his recent contributions he has also achieved facial recognition of humans from a substantial height through the optical sensor mounted on a flying Drone. The succesful trials were conducted at Uttrakhand Police Headquaters facility in Dehradun. He has been awarded patent for his contributions and published many research papers in the journals & conferences of high repute. He has been awarded DRDO Laboratory award for his outstanding contributions in the development of AI based systems in the year 2021.

Prof. Arnav Bhavsar

School of Computing and Electrical Engineering
Indian Institute of Technology Mandi
Kamand, Mandi (Himachal Pradesh), India

Dr. Arnav Bhavsar is Professor at Indian Institute of Technology Mandi. He has done his research in Computer Vision, Image and Signal Processing, and Machine Learning. His research work has been published in various international journals(IEEE PAMI, Springer IJCV, Elsevier CVIU) and conferences(e.g. BMVC, ICPR, ICIP, DAGM).He has served as a reviewer for various international journals(IEEE Trans. on Industrial Electronics, Elsevier PRL, Elsevier IVC, Elsevier CVIU, Elsevier Signal Processing, Optical Engineering, Information Fusion).

Dr. Subrahmanyam Murala

Electrical Engineering
IIT Ropar

Dr. Subrahmanyam Murala is an Associate Professor in Electrical Engineering at IIT Ropar, and a Post-Doctoral Research role at the University of Windsor, Canada, from 2012 to 2014. With over ten years of post-PhD research experience, Dr. Murala has significantly impacted the fields of computer vision and artificial intelligence. He established the Computer Vision and Pattern Recognition Laboratory (CVPR Lab), focusing on developing practical solutions for complex computer vision challenges. His research encompasses a range of areas including Computer Vision, Pattern Recognition and Machine Learning.

Dr. Drishti Yadav
Research Associate
University of Luxembourg
Luxembourg

Dr. Yadav, is a Research Associate at the Interdisciplinary Centre for Security, Reliability and Trust (SnT), University of Luxembourg. She received her B.E. (Bachelor of Engineering) degree in Electrical and Electronics Engineering from Chhattisgarh Swami Vivekananda Technical University, Bhilai, India in 2017, and her M.Tech (Master of Technology) degree in Control and Instrumentation Engineering from Dr B. R. Ambedkar National Institute of Technology Jalandhar, India in 2020. She completed her PhD in Computer Science at TU Wien, Vienna, Austria in November 2024, under the supervision of Prof Ezio Bartocci.Dr Yadav works with the Software Verification and Validation (SVV) group. Her research primarily revolves around fault-based testing and verification of safety-critical cyber-physical systems. She is also interested in control systems engineering and optimisation in general, with a soft spot for metaheuristics. She undertook a three-month research visit from February to April 2024 at the Department of Informatics, Systems, and Communication (DISCo), University of Milano-Bicocca, Italy, under the supervision of Prof Leonardo Mariani. She was awarded the "KUWI Grant" of TU Wien in 2024, for diploma and PhD theses and attending specialist courses abroad as part of her research. In 2023, she was recognised as a "TUW Under 30" honouree, listed among TU Wien's 30 most exciting people below 30 years with exceptional achievements. She worked as a University Assistant in the Cyber-Physical Systems (CPS) research group at the Faculty of Informatics, TU Wien, from October 2020 to October 2024. She joined the University of Luxembourg in March 2025.

Dr. Rajeev Kanth
Principal Lecturer (Yliopettaja- in Finnish)
Savonia University of Applied Sciences, Finland

Dr. Rajeev Kanth received a Doctor of Science (D.Sc.) in Information and Communication Technology from the University of Turku, Finland, in 2013. He has been working as a Principal Lecturer (Yliopettaja- in Finnish) at the Savonia University of Applied Sciences, Finland, where he focuses on teaching and research on the Internet of Things (IoT). He has been an Adjunct Professor at the Department of Computing, University of Turku, Finland, and a Visiting Professor at Hebei University of Environmental Engineering, China. He is currently a senior member of the IEEE. Previously, he worked at the Indian Space Research Organization (ISRO), Ahmedabad, India, and the Royal Institute of Technology (KTH), Stockholm, Sweden, where he was a

researcher and a senior research scientist, respectively. He has over 25 years of experience working in academic and research institutions. His current research interests include the Internet of Things, big-data analytics, artificial intelligence, and wireless cloud and edge computing. He has published more than 95 scientific articles in peer-reviewed conference proceedings and refereed computer science and communication technology journals. Some of the recent and ongoing research and development projects are UCNDRONE (funded by the Finnish Ministry of Education), VLEFACT (EU Erasmus Plus-funded project), and AIQUSEC (Business Finland).

The **STEM-Research Society**, a foundation is registered in the year 2020 to support and promote the research in the multidisciplinary domain under the able guidance of renowned academicians and researchers from India and abroad.

The objective of the foundation is Scientific, Technical, Research and Educational in nature. The foundation strives to advance the theory, practice, and application of Science, Technology, and Engineering & Management and maintains a high professional standing among its members. The basic purpose of the STEM-RS is to bring together Researchers, Academicians, Industrialists and Experts from different parts of the country and abroad to exchange the knowledge and ideas at a common platform by organizing National and International events such as Conferences, Seminars and Workshops that unite the Science, Technology, Engineering and Management and topics which are not mentioned here for the empowerment of research and development.

Vision

The STEM-RS foundation will build a dynamic, interactive, global community of researchers, academicians and industrialists to advance excellence in Science, Technology, Engineering and Management.

Mission

The STEM-RS is a foundation of interested peoples worldwide that promotes research for the advancement of society in various spheres and the quality of life.

Values

Being visionary, dynamic, interdisciplinary, inclusive, egalitarian and promoting research in all spheres of human life.

Diversity Statement

Diversity drives innovation. STEM-RS engage all demographic teams worldwide in advancing Science, Technology, Engineering and Management to improve the quality of life.

Please keep visiting the website for recent updates: http://www.stemrs.in/

Organizing Committees

Mentor(s):	Prof. Leo Joskowicz **The Hebrew University of Jerusalem, Israel** Prof. Ajit K. Verma **Western Norway University of Applied Sciences, Norway**
Guest of Honor:	**Dr. Atul Fulzele, IPS** IG, BSF Punjab Frontier
Chief Patron:	**Prof. (Dr.) Bhim Singh** BoG CHairman Dr B R Ambedkar National Institute of Technology Jalandhar
Patron:	**Prof. Binod Kumar Kanaujia** Director Dr B R Ambedkar National Institute of Technology Jalandhar
Co-Patron:	**Prof. K. S. Nagla** HoD - Instrumentation and Control Engineering Dr B R Ambedkar National Institute of Technology Jalandhar
Co-Patron (Executive General Chair):	**Prof. Gaurav Manik** IIT Roorkee
General Chair(s):	**Prof. A.K. Khosla** Dr. B. R. Ambedkar National Institute of Technology Jalandhar **Prof. B. S. Saini** Malaviya National Institute of Technology Jaipur **Dr. Rajesh Kumar** Malaviya National Institute of Technology Jaipur **Prof. Chang Wook AHN** Gwangju Institute of Science and Technology (GIST), Korea
Program Chair(s):	**Dr. Rajesh Singla** Dr. B. R. Ambedkar National Institute of Technology Jalandhar **Dr Ajay Gupta** Dr. B. R. Ambedkar National Institute of Technology Jalandhar **Dr. Rajeev Trehan** Dr. B. R. Ambedkar National Institute of Technology Jalandhar **Dr. Anupam Yadav** Dr. B. R. Ambedkar National Institute of Technology Jalandhar
Organizing Chair(s):	**Dr. Om Prakash Verma** Dr. B. R. Ambedkar National Institute of Technology Jalandhar **Dr. Tarun K Sharma** Shobhit University Gangoh **Dr. Karan Veer** Dr. B. R. Ambedkar National Institute of Technology Jalandhar **Dr. Amit Kumar Singh** Dr. B. R. Ambedkar National Institute of Technology Jalandhar

Organizing Secretary:	**Dr. Anil Kumar Yadav** Dr. B. R. Ambedkar National Institute of Technology Jalandhar **Dr. Deblina Biswas** Dr. B. R. Ambedkar National Institute of Technology Jalandhar **Dr. Mahender Kumar** Dr. B. R. Ambedkar National Institute of Technology Jalandhar
Local Organizing Committee:	**Prof. Dilbag Singh** **Prof. Sharvan Kumar Pahuja** **Er Narinder Singh Bhangal** **Dr Roop Pahuja** **Dr Sheela Tiwari** **Dr Afzal Sikander** **Dr Richa Sharma** **Dr Ravi Verma** **Dr Karan Jain**
Technical Chair(s):	**Dr. Tayyaba Akram** King Fahd University of Petroleum & Minerals **Dr. Azhar Iqbal** Prince Mohammad Bin Fahd University, Saudi Arabia **Prof. A. J. Singh** Himachal Pradesh University, Shimla **Prof. Rajesh Kumar** Malaviya National Institute of Technology, Jaipur **Prof. B.K. Panigrahi** Department of Electrical Engineering, Indian Institute of Technology Delhi **Prof. G. K. Aseri** Amity University Rajasthan **Prof. Montaz Ali** School of Computer Science and Applied Mathematics, University of the Witwatersrand, Johannesburg **Prof. Swagatam Das** Indian Statistical Institute, Kolkata **Dr. Hossain Zolfagharinia** Ryerson University Canada **Dr. Saman Hassanzadeh Amin** Ryerson University Canada **Prof. Edmund Lai** Dept of Information Technology & Software Engineering, Auckland University of Technology **Prof. Linqiang Pan** Huazhong University of Science and Technology, China **Prof. Ahmad Taher Azar** Benha University, Egypt **Prof. S.C. Sharma**

	Indian Institute of Technology Roorkee, India **Prof. Punam Bedi** University of Delhi, India **Prof. Dharma Agrawal** University of Cincinnati, Ohio, U.S.A **Prof. Bharat K. Bhargava** Purdue University, West Lafayette, Indiana **Prof. Mukesh Singhal** University of California, California, U.S.A **Prof. Pradeep Tomar** Gautam Buddha University, Greater Noida **Prof. Deepti Mehrotra** Amity University Uttar Pradesh **Dr. Lalit Garg** University of Malta **Dr. Nilanjan Dey** Techno India College of Technology, Kolkata **Dr. Om Prakash Verma** Dr. B R Ambedkar National Institute of Technology, Jalandhar **Dr. S. R. Arya** Sardar Vallabhbhai National Institute of Technology Surat **Dr. Irshad Ahmad Ansari** PDPM Indian Institute of Information Technology Design and Manufacturing, Jabalpur **Dr. Priyanka Mondal** National Institute of Technology, Patna **Dr. Amit Singh** National Institute of Technology, Patna **Dr. Ajeet Singh Poonia** Bikaner Technical University, Rajasthan, India **Dr. Meenakshi** Amity University Lucknow **Dr. Kamal Kant Hiran** Symbiosis University of Applied Sciences **Dr. R Sivarethinamohan** CHRIST (Deemed to be University), Bengaluru **Dr. Mohit Kumar** Dr. B R Ambedkar National Institute of Technology, Jalandhar
Program Committee:	**Dr. Michael Onyema Edeh** Coal City University, Enugu, Nigeria **Dr. Deepti Kakkar** NIT Jalandhar **Dr. Megha** University of Seville, Spain **Dr. Ashish Raman**

NIT Jalandhar
Dr. Riyaz Ahamed
University of Malaya, Kuala Lumpur, Malaysia
Dr. Sri Devi Ravana
University of Malaya, Kuala Lumpur, Malaysia
Prof. Y. R. Sood
Vice Chancellor, Jaypee University Noida
Dr. Vaibhav Gupta
Sr. Technical Officer, IRDE, DRDO Dehradun,Uttarakhand
Dr. Vimal Kumar
Chaoyang University of Technology, Taiwan
Dr. Pratima Verma
Chaoyang University of Technology, Taiwan
Dr. Nagendra Sharma
Chaoyang University of Technology, Taiwan
Dr. Harendra Pal Singh
University of Delhi
Dr. Saurabh Pratap
Indian Institute of Information Technology Design & Manufacturing Jabalpur, India
Dr. Alka Arya
Indian Institute of Management Kashipur, India
Dr. Nanda Dulal Jana
NIT Durgapur
Dr. Vijayta Fulzele
Shiv Nadar University, India
Dr. Mahamaya Mohanty
Bennett University, India
Dr. Rohit Kumar Singh
International Management Institute Kolkata, India
Dr. Sujeet Singh
Indian Institute of Management Jammu, India
Dr. Jolly Puri
Thapar University, India
Mr. Shailendra Pawanr
Birla Institute of Technology & Science Pilani, India
Dr. Girish Kant Garg
Birla Institute of Technology & Science Pilani, India
Dr. P. L. Verma
Samrat Ashok Technological Institute Vidisha, India
Prof. A. Dalpati Shri Govindram Seksaria Institute of Technology and Science Indore, India
Dr. Devendra kumar Pathak
Indian Institute of Management Kashipur, India
Dr. Nakul Parameswar

Institute of Rural Management Anand
Dr. Shawn Mathew
Institute of Management Technology, Ghaziabad
Prof. Aditya Trivedi
Indian Institute of Information Technology and Management, India
Dr. N.P. Gopalan
National Institute of Technology, Tiruchirappalli
Prof. Jagdish Prasad
Amity University Rajasthan, Jaipur
Prof. Sanjeev Sofat
National Institute of Technology, Patna
Dr. Gaurav Manik
Indian Institute of Technology Roorkee, India
Prof. R.S.Yadav
Motilal Nehru National Institute of Technology Allahabad, Allahabad
Mr. Rabindra Kumar
National Institute of Technology, Patna
Dr. Rajeev Arya
National Institute of Technology, Patna
Dr. Sabyasachi Pramanik
Haldia Institute of Technology
Dr. Sailesh Iyer
Rai University Ahmedabad
Dr. Mohit Agarwal
Sharda University, Noida
Dr. Jitendra Rajpurohit
Manipal University Jaipur
Shashi Bhushan
Amity University Mohali, Panjab
Dr. Manoj Kumar
University of Petroleum & Energy Studies, Dehradun
Dr. Harendra Pal Singh
University of Delhi
Mr. Rabel Guharoy
SITAICS, Rasthriya Raksha University, Gandhinagar, Gujarat
Dr. Sumil Chaudhary
Indrashil University, Mehsana, Gujrat
Dr. Neha Chaudhary
Indrashil University, Mehsana, Gujrat
Dr. Rizwan Khan
ABESIT Ghaziabad
Dr. Sabyasachi Pramanik
Haldia Institute of Technology,West Bengal

Dr. Ihtiram Raza Khan
Jamia Hamdard University, New Delhi
Dr. Sameer Saxena
Manipal University Jaipur
Dr. Ambuj Kumar Agarwal
Sharda University, Greater Noida
Dr. G. L. Saini
Chandigarh University, Punjab
Dr. Sanjay Jain
Amity University Rajasthan
Dr. Muskan Garg
Thapar Institute of Engineering and Technology (Deemed to-be University), Patiala, Punjab
Dr. Sirshendu Das
Indian Institute of Technology Ropar, Punjab
Dr. Vijeta Kumawat
JECRC University, Jaipur
Dr. Rohit Anand
G.B.Pant Government Engineering College, New Delhi
Dr. Nidhi Sindhwani
Amity University, Noida
Dr. Pravesh Kumar Tomar
Rajkiya Engineering College Bijnor (Govt Engg College)
Dr. Aniruddha Dey
Maulana Abaul Kalam Azad University Of Technology. West Bengal
Dr. Mushtaq Ahmed
Indian Institute of Information Technology Kota, India
Dr. Basant Agrawal
Indian Institute of Information Technology Kota
Dr. Amit Garg
Indian Institute of Information Technology Kota
Prof. Tarlochan Kaur
PEC Deemed to be University Chandigarh
Prof.Jwahar Thakur
Himachal Pradesh University, Shimla
Prof Y. P. Verma
UIET PU Chandigarh
Prof. Manoj Sharma
Himachal Pradesh University, Shimla
Dr. Sanjay Kumar Singh
Department of Electronics Engineering Amity University Jaipur Rajstahan, India
Dr. Amrit Singh Sandhu
PEC Deemed to be University Chandigarh

	Dr. Samesh Sood Himachal Pradesh University, Shimla **Dr. Tarun Sharma** Himachal Pradesh University, Shimla **Dr. Kapil** Himachal Pradesh University, Shimla **Dr. Rohan Gupta** Chandigarh University, Gharuan **Dr. Priyanka Kumar** Amrita Vishwa Vidyapeetham, Coimbatore Main Campus **Dr. Rishabh Anand** Coforge Limited
Scientific Committee:	**Prof. Vijay Kumar** University of Missouri–Kansas City, Missouri **Dr. Sebastian Basterrech** Czech Technical University, Prague, Czech Republic **Prof. Manoj Misra** Indian Institute of Technology Roorkee **Prof. Amit Jain** Amity University Rajasthan **Dr. Deepak Kumar Jain** University of Chinese and Academy of Science, Beijing, China **Dr. M. Tanveer** Indian Institutes of Technology Indore **Dr. Nilanjan Dey** Techno India College of Technology, Kolkata **Prof. Rajneesh Sharma** Netaji Subhas Institute of Technology, Delhi **Prof. R. K. Saini** Bundelkhand University, Jhansi **Dr. Tushar Bhardwaj** FIU College of Engineering and Computing, Miami, Florida, USA **Prof. Preetha Bhattacharjee** Computer Scientist –II Adobe, Gautam Buddha Nagar **Prof. Abbas Roozbahani** University of Tehran **Prof. Amlan Chakrabarti** A.K.C.S.I.T, University of Calcutta **Prof. Motahar Reza** N.I.S.T. (Autonomous) Ganjam, Orissa, India **Prof. Santosh Kumar Nanda** Techversant, Thiruvananthapuram, Kerala, India **Prof. Devesh Tiwari** Northeastern University, Boston, Massachusetts

Prof. Aravind Raj Sakthivel
Vellore Institute of Technology Tiruchchirappalli
Ms. Vandita Singh
Sr Database Developer at NRUCFC, Washington D.C.; USA
Prof. Durbadal Mandal
NIT Durgapur, West Bengal, India
Prof. Harish Narayana
National Institute of Technolgy, Goa
Ashim Saha
National Institute of Technology Agartala
Prof. Xiao-Zhi Gao
University of Eastern Finland
Prof. Ravi Prakash Gorthi
LNM-IIT, Jaipur
Prof. Trilochan Panigrahi
National Institute of Technology Goa, India
Prof. M.Sudheep Elayidom
CUSAT, Kochi, Kerala
Prof. Mariusz Nowostawski
Norwegian University of Science and Technology, Norway
Prof. Mariusz Nowostawski
Oppland County, Norway
Prof. Marina Ivasic-Kos
Department of Informatics, University of Rijeka
Prof. Matt Garratt
UNSW Canberra at ADFA
Prof. Mohd. Abdullah Mir
University of Kashmir
Prof. Mazura Mat Din
Universiti Teknologi MARA, Malaysia
Prof. Tanmoy Maity
Indian Institute of Technology (ISM), Dhanbad
Prof. Gregori Vazquez
Technical University of Catalonia, Spain
Prof. Vinay Sharma
Amity Institute of Biotechnology, AUR
Prof. Marco Spruit
Utrecht University, Netherlands
Prof. Achintya
Engineering College, Govt. of Bihar, Sitamarhi, Biha
Prof. Vijayakumar krishnasamy
SRM Institute of Science and Technology, Chinnei
Dr. Manikandan R
Israel Institute of Technology, Israel
Dr. Anish Gupta

	Amity University Uttar Pradesh **Dr. Gustavo Sanchez** JKLU, Jaipur, Rajasthan **Dr. Krishna Kumar Mishra** Chitkara University Chandigarh **Dr. S. B. Goyal** City University of Malaysia, Kuala Lumpur, Malaysia **Dr. Sunil Kumar Jha** Nanjing University of Information Science and Technology, China **Dr. Matt Garratt** UNSW Canberra at ADFA, Australia **Dr. Vinod Patidar** UPES, Dehradun **Dr. Ashok Sharma** Lovely Professional University, Phagwara **Dr. Arun Balodi** Dayananda Sagar University, Bengaluru
Industrial and Entrepreneur Chair(s):	**Mr. Janaki Raman Palaniappan** brunswick.com, USA **Mr. Rajiv Khandelwal** Coforge Limited **Dr. Sheela Tiwari** Dr. B R Ambedkar National Institute of Technology,Jalandhar **Er. Narinder Singh Bhangal** Dr. B R Ambedkar National Institute of Technology,Jalandhar **Mr. Abhishek Kumar** Chief Advisor-Entrepreneurs Association of India- EAI **Dr. S.P. Singh** Research Scientist, PAPRI of JK Organization, Rayagada, India **Dr. Sanjay Yadav** Department of Physico-Mechanical Metrology National Physical Laboratory, New Delhi **Dr. Amod Kumar** Business initiatives and Project Planning, PROCESS INSTN, CSIO-CSIR Chandigarh **Mr. Vimal Kumar** Entrepreneur, Technology Strategist, Market Presence, Trade & Investment Valuation, New Delhi **Dr. Vinita Tiwari** Indian Institute of Information Technology Kota **Dr. Gyan Singh Yadav** Indian Institute of Information Technology Kota
Doctoral Research Symposium Chair(s):	**Dr. Sebastian Basterrech** Czech Technical University, Prague, Czech Republic

	Dr. Pinkey Chauhan Jaypee Institute of Information Technology, Noida, India
Finance Committee:	**Dr. T. K. Sharma** Shobhit University, Gangoh
Registration Committee:	**Mr. Amit Hirawat** Manipal University Jaipur **Dr. Jitendra Rajpurohit** Manipal University Jaipur
Web Administrators:	Dr. T. K. Sharma Shobhit University, Gangoh
Women@SoCTA:	**Dr. Pinkey Chauhan** Jaypee Institute of Information Technology, Noida, India **Dr. Isha Patak Tripathi** Indian Institute of Information Technology Kota **Dr. Priyanka Harjule** Indian Institute of Information Technology Kota **Dr. Sangeeta Singh** National Institute of Technology, Patna **Dr. Divya Prakash** Shobhit University Gangoh **Dr. Hira Zaheer** Jamia Millia Islamia University, Delhi **Dr. Preeti Gupta** Narsee Monjee Deemed to-be University Mumbai
Conference Proceedings and Printing & Publication Committee:	**Dr. Om Prakash Verma** Dr. B. R. Ambedkar National Institute of Technology Jalandhar **Dr. Tarun K Sharma** Shobhit University Gangoh **Dr. Jitendra Rajpurohit** Symbiosis Institute of Technology, Symbiosis International (Deemed University), Pune
Publicity Chair(s):	**Dr. Ashok Kherodia** Indian Institute of Information Technology Kota **Dr. Chetna Sharma** Indian Institute of Information Technology Kota **Mr. Suprativ Saha** Brainware University, Kolkata
Media and Publishing Chair:	**Dr. Amit Kumar** Indian Institute of Information Technology Kota **Dr. Ashish Sharma** Indian Institute of Information Technology Kota
Steering Committee:	**Dr. Om Prakash Verma** National Institute of Technology (NIT) Jalandhar **Dr. Tarun K Sharma** Shobhit University Gangoh

	Dr. Jitendra Rajpurohit Symbiosis Institute of Technology, Symbiosis International (Deemed University), Pune
Ad Hoc Committee:	**Dr. Jitendra Rajpurohit** **Dr. Amit Hirawat** **Dr. Deepak Panwar** Manipal University, Jaipur **Mr. Himanshu Gupta** National Institute of Technology (NIT) Jalandhar

International Advisory Board:

Mufti Mahmud
Nottingham Trent University, UK
Prof. Aboul Ella Hassanien
University of Cairo, Egypt
Prof. Adel Alimi
University of Sfax, Tunisia
Prof. Aditya Ghose
University of Wollongong, Australia
Prof. Ashley Paupiah
Amity Mauritius
Prof. Francesco Marcelloni
University of Pisa, Italy
Prof. Sang-Yong Han
Chung-Ang University, Korea
Prof. André Ponce de Leon F de Carvalho
Univ. of São Paulo, Brazil
Prof. Bruno Apolloni
University of Milano, Italy
Prof. Francisco Herrera
University of Granada, Spain
Prof. Imre J Rudas
Obuda University, Hungary
Prof. Javier Montero
Complutense University of Madrid, Spain
Prof. Jun Wang
Chinese University of Hong Kong, Hong Kong
Prof. Mo Jamshidi
University of Texas at San Antonio, USA

Fabrizio Stasolla
Giustino Fortunato University of Benevento, Italy
Prof. Naren Sukurdeep
Amity Mauritius
Prof. Sebastián Ventura
University of Cordoba, Spain
Prof. Witold Pedrycz
University of Alberta, Canada
Prof. Tomas Buarianek
VSB-Technical University of Ostrava
Prof. Varun Ojha
Swiss Federal Institute of Technology Zurich, Switzerland
Prof. Francois Despaux
Researcher, Universite de Lorraine
Prof. Jan Drhal
Faculty of Electrical Engineering, Czech Technical University, Prague, Czech Republic
Prof. Pavel Kromer
Associate Professor, VSB-Technical University of Ostrava, Ostrava, Czech Republic
Prof. Doan Nhat Quang
Associate Professor, University of Science and Technology, Hanoi, Vietnam
Prof. Lalit Garg
University of Malta
Dr. Niketa Gandhi
Machine Intelligence Research Labs, USA

Prof. Ajit K. Verma
Western University of Applied Sciences, Norway
Dr. Hossain Zolfagharinia
Ryerson University Canada

Prof. (Dr.) Bo Zhang
Wuhan Institute of Technology, China

National Advisory Board:

Prof. Sanghamitra Bandyopadhyay
Indian Statistical Institute, Kolkata
Dr. Swagatam Das
Indian Statistical Institute, Kolkata
Prof. Nirupam Chakraborti
Indian Institute of Technology, Kharagpur
Prof. Kumkum Garg
Manipal University, Jaipur
Prof. R. R. Poznanski
Universiti Teknologi Malaysia
Prof. Jesus Eduardo Lugo
Uiversity of Montreal
Prof. Subrata Ghosh
Harvard University
Prof. Ujjwal Maulik
Jadavpur University, Kolkata
Prof. A. K. Solnki
Bundelkhand University Jhansi
Prof. Aruna Tiwari
Indian Institute of Technology, Indore
Prof. Ashish Verma
Indian Institute of Technology, Guwahati
Prof. Ashok Deshpande
Pune
Prof. D. Nagesh Kumar
Indian Institute of Science., Bangalore
Prof. Debasish Ghose
Indian Institute of Science, Bangalore
Dr. Deepti
National Institute of Hydrology, Roorkee
Prof. Himani Gupta
Indian Institute of Foreign Trade, Delhi
Prof. Kanti S. Swarup

Prof. Ashok Kumar Singh
Department of Science & Technology (DST), New Delhi
Prof. S.K. Sharma
Modern Institute of Technology & Research Centre, Alwar
Dr. Santosh Kumar Pandey
Ministry of Information Technology, New Delhi
Dr. Anand Agarwal
Jaypee Institute of Information Technology
Dr. Anil Kumar Yadav
Bansthali Vidyapith Rajasthan, India
Prof. Anjana Solnki
Bundelkhand University Jhansi
Prof. C. Thangaraj
Indian Institute of Technology, Roorkee
Prof. D. Gnanaraj Thomas
Christian College, Chennai
Prof. Vinod Kumar
Gurukul Kangri University, Haridwar
Prof. Dharmdutt
Saharanpur Campus, Indian Institute of Technology, Roorkee
Prof. Manoj Kumar Tiwari
Indian Institute of Technology, Kharagpur
Prof. Nirupam Chakraborti
Indian Institute of Technology, Kharagpur
Prof. Pankaj Gupta
Delihi University
Prof. Punam Bedi
University of Delhi
Prof. Raju George
Indian Institute of Space Science and Technology,

Indian Institute of Technology, Chennai
Prof. M.P. Biswal
Indian Instituts of Technology, Kharagpur
Prof. N. R. Pal
Indian Statistical Institute, Kolkata
Dr. Ram Ratan
Defence Research and Development Organisation, Delhi
Dr. Himanshu Singh
IRDE Lab, Defence Research and Development Organisation, Dehradun
Mr. Maiya Din
DF&MM, Defence Research and Development Organisation, New Delhi
Dr. Bhanu Pratap singh
LNCT, Bhopal
Prof. Aditya Goel
MANIT, Bhopal
Dr. Kukil Khanikar
IIIT Guwahati

Trivandrum
Prof. Ravindra Gudi
Indian Institute of Technology, Bombay
Dr. Vikas Jha
Kalinga Institute of Industrial Technology, Bhubaneswar
Prof. C. P. Gupta
Rajasthan Technical University,Kota
Dr. Trilok Saini
DEAL, Defence Research and Development Organisation, Dehradun
Dr. Bhupender Singh
DEAL, Defence Research and Development Organisation, Dehradun
Dr. Sachin Taran
DU, Delhi
Dr. Shailendra Ojha
ITM university Gwalior
Dr. Somen Bhattacharjee
IIIT Dharwad

9789359807348

List of Accepted Papers

ID	Title
1	Novel Intellectual activities of software engineer based optimization algorithm
116	Support Vector Machine-Lyapunov Control for Nonlinear Cluster Synchronization
198	Analysis of Multiple Machine Learning Schemes for Breast Cancer Recognition
205	Optimizing ANPR Systems in Smart Cities: A Comparative Study of Detection Methods
234	Designing of Solar-Powered Lightweight Drones for Extended Endurance
252	Safeguarding Vulnerable Agri-Food Networks: An Adaptive ABC-DQN Framework for Resilient Vertex Cover Optimization in Disruption-Prone Supply Chains
265	Comparative Study of GA, PSO, and ACO for Exam Timetable Scheduling
275	Prominent Multiple Object Tracking System Based on Extreme Learning Machine
284	Deep Learning for Facial and Micro-Expression Recognition: A CNN-Based Approach
289	Automated Subtitle Generation in Videos Using AI and FFmpeg
296	Land Cover Classification of High Resolution Remote Sensing Imagery Using Modified UNet Architecture
297	Controlling the Text Game: Game Theoretic Interactions Between LLMs for Controllable Text Generation
299	Improving PCOS Diagnosis with Hybrid Gini-Entropy Random Forest Classifier
317	Machine Learning Applications for Predicting Portfolio Returns in Indian Stock Market
322	Deep Learning-Based Automated Skin Burn Detection and Classification
328	Deep Q-Network Enabled Trust based Routing for Secure VANET Clustering
357	ACO-Driven Optimization for Cluster Head Selection in MANETs
367	Performance Analysis of Machine Learning-Based Network-on-Chip (NoC) Topologies
415	Graph-Based Anomaly Detection in Transaction Networks Using Temporal Graph Neural Networks
426	Next-Gen Smart Card Passive Signal Optimization Using AI
431	Performance Analysis of Machine Learning Models for Appliance Energy Forecasting
433	Smart auto powered Road Lane Detection using regional canny segmentation based Lan-Net CNN for smart driving system
437	From Clickbait to Clarity: A Multi-Model NLP Framework for Clickbait Detection and Headline Generation with Transformer Models and SVO Structures
440	Ensemble Machine Learning Algorithms Performance Comparison for Cardiovascular Disease Prediction
441	Zero Trust in Private Home Networks: A Sociotechnical Perspective on Implementing Enhanced Zero Trust (E-ZTA) with Secure Access Service Edge (SASE) for Home Network Security
442	Deep Genomic Profiling of HPV Strains for Oncogenic Risk Stratification Using Hybrid 1D-CNN–BiLSTM Networks
444	Comparative Life-Cycle Assessment of HDDs vs SSDs: Energy Efficiency and Carbon Footprint in Data-Centric Workloads.
452	A comparative analysis between Deep learning and Classical approach to remove occlusions during Surveillance in Images and Videos
453	Drone Captured Image Analysis of Faulty Antennas In 5G Networks Using AI & ML During Natural Disasters

9789359807348

455	A Comparative Study of Trapdoor Sampling Algorithms for Lattice-Based Cryptography
459	Deep Learning Approach for Amharic Character Recognition with Random Search Hyperparameter Optimization
462	A Two-Phase Transfer Learning Framework for Terrain Analysis
470	Space Debris Size Estimation using Radar Cross Section with Data Driven Algorithms
472	HDC for Continual Federated Learning: Prototype-Based Knowledge Exchange in IoT
481	Predictive Modeling of Stock Prices with ESG Events: An AI Approach for Indian Equity Markets
482	A Committee-Guided Social Algorithm for Few-Feature Selection
505	Multi-Class Dental Structures Detection via Deep Learning Based Instance Segmentation
507	Performance Analysis of Range Sensor for Autonomous Mobile Robots in Indoor Environments
514	Quantifying the Path Dependence Theory in Institutions
516	The Artificial Intelligence in Marketing Management: The Collaboration of Decision-Makers and Machines
517	Fractal-Based Statistical Framework for Detecting Unusual Patterns in Blockchain Transactions
532	Enhancing Clinical Reliability in Diabetic Retinopathy Detection through Fuzzy-Guided Deep Learning
534	Multimodal Skin Disease Classification on Underrepresented Tropical diseases and Skin Types
535	A Sustainable Inventory Framework for Deteriorating Items Considering Inspection, Advanced Payment, and Carbon-Reducing Green Technology Investment
539	Comparative Analysis of Carbon Footprint Predictions for Electronic Product Categories Using Random Forest, Federated Learning, and Contrastive Learning Models
544	Real-Time Intraday Trading Using Renko-MACD Strategy: Design, Implementation and Empirical Evaluation
546	Beyond the Black Box: Counterfactual and Reward-Based Interpretations for Transparent Reinforcement Learning
555	Real-Time Diabetic Retinopathy Detection using Convolutional Neural Networks
560	Advanced Machine Learning Models for Prediction, and Performance Optimization in Renewable Energy
562	A Comparative and Ensemble Learning Approach to Citrus Leaf Disease Classification
566	Detection of Atrial Fibrillation using Photoplethysmography(PPG) signals using Machine Learning
573	A Layered Architecture for enhancing fairness in Reward Distribution in Permissioned Proof-Of-Work Blockchains through effort verification
577	Deep Learning-Driven Smart Image Registration for Improving Polycystic Ovary Syndrome Diagnosis Using Ultrasound Image
579	A Hybrid Differential Privacy-Enhanced Federated Learning Architecture for Sensitive Financial Data using DistilBERT
580	An IoT-Driven Smart Solution for Air Quality Monitor and Waste Management Optimization
583	Novel rapid economic growth by progressive engagement of rural labour in China – based algorithm: Human-inspired optimization

9789359807348

584	Breast Cancer Diagnosis using Quantum Support Vector Machines: A Comparative Study with Classical SVM
591	Data-Centric Approach to PEM Fuel Cell Performance Prediction
593	A comparative study of AI powered detection and classification of brain tumor using MRI images
597	A comprehensive study on Bell-based Frobenius-Tangent-Euler polynomials of complex variable and their applications
598	A Brief Study of Degenerate Poly-Bernoulli Polynomials of the Second Kind
612	Hotspot Temperature Prediction For Cloud Data Centres using Machine Learning
619	Enhancing Braille Recognition Through Image Processing and Conversion Efficiency
622	Benchmarking Voice-Based Parkinson's Severity Prediction and Limits of Contrastive Feature Masking
623	ANN Predicted Multi Optimization of FSW Considerations for Al 6082 Alloy using AHP, and TOPSIS Techniques
624	Preserving Tradition with Technology: A Real-Time Model for Kangayam Bull Detection in Eru Thazhuvudhal
627	Data Science: An Approach in Mechanical Engineering for Predictive Modeling to Reduce Failures in Stainless Steel using Artificial Neural Network
628	Satellite-Based CNN Detection of Corporate Sustainability and Environmental Human Rights Infractions in India, China, and the USA
629	Integration of a Machine Learning Model to Enhance Post-Manufacturing Processes
633	Robust Chronic-Kidney-Disease Prediction Under Missing and Noisy Clinical Data: A Comparative Study of Model--Imputation Pairs
639	Real-Time Physiological Monitoring Using Wearable Sensors for Acute Mountain Sickness Prediction
652	Analysing the Efficiency of SRAM Cell Utilizing FinFET Technology based Reversible Logic: A Performance Evaluation
653	A State-of-the-Art Review on Feature Extraction and Classification Techniques for Motor Imagery EEG Signals for Brain-Computer Interface
672	Evo-RRT*: Evolutionary Programming for enhancing RRT* paths toward time efficient navigation
676	Drone Detection Using Dual Modality with YOLOv8
677	Predicting the Thermal Conductivity of Epoxy–Filler Composites Using Deep Learning for Cryogenic Applications
678	PCA-Enhanced Stacking Ensemble for Multisite Autism Spectrum Disorder Classification Using sMRI and rs-fMRI
679	Deformable-Token Transformers with Diffusion Suppression for Sub-Centimeter Pulmonary Nodule Detection
680	A Robust ORB Pipeline with Depth Filtering for Improved Pose Accuracy
681	Drone Detection Using Noise-Suppressed Acoustic Features in Low-SNR Environments

9789359807348

1 Novel Intellectual activities of software engineer based optimization algorithm

Lenin Kanagasabai
Prasad V. Potluri Siddhartha Institute of Technology
gklenin@gmail.com

Software engineers engross in an extensive assortment of intellectual activities predominantly concentrated on design, developing, and preserving the software structures. These undertakings comprise problem solving, rational thinking, algorithmic plan, software design, analysis, debugging, and constant learning. An important ability, rational thinking is vital for breaking down multifaceted tasks into minor, controllable steps, designing effectual algorithms, and debugging the code. Software design generates the complete assembly and architecture of a software structure, comprising diverse mechanisms interaction and work abilities. It necessitates a profound understanding of numerous design outlines and values. For solving various problems Software engineers design the algorithms, as step-by-step procedures and apply the algorithms to solve the problems. Optimal intellectual activities of software engineer based algorithm are integrated with Taraxacum kok-saghyz algorithm. This integration increases the exploration competence of the procedure. Taraxacum kok-saghyz algorithm is centred on the effectual dispersion mechanism of Taraxacum kok-saghyz seeds. Taraxacum kok-saghyz is a perennial type of plant have yellow flower under the genus Taraxacum. Through the wind diminuendos, Taraxacum kok-saghyz simulates the extended distance dispersion of seeds. In all iterations each element in the swarm modernizes its location. In the course of initialization process, the Taraxacum kok-saghyz algorithm chooses the entity with smallest fitness rate as fresh candidate, viewed as the perfect position for Taraxacum kok-saghyz seed development. In the course of better climate conditions weather rendering to wind swiftness, Taraxacum kok-saghyz seeds will passage to distant areas and in the process this activity stresses the exploration.

116 Support Vector Machine-Lyapunov Control for Nonlinear Cluster Synchronization

Dr. KIRUBA BURI R (University College of Engineering Pattukkottai)*; Dr. Swaminathan K (Dept of ECE, SRM Institute of Science & Technology , Ramapuram Campus, Chennai-600089); Dr. Arivazhagi A (Dept of CSE, University College of Engineering, Kathankudikadu, Ariyalur -621731); Balasankar L (University VOC college of engineering Anna university (thoothukudi campus) Thoothukudi -628008) R, Dr. KIRUBA BURI*; K, Dr. Swaminathan; A, Dr. Arivazhagi ; L, Balasankar

The identifying of clusters and the synchronization of dynamics in interconnected nonlinear systems are the most critical to the stable and optimized operation of a variety of networked applications including power utilities, neural arrays and robot communities. For this purpose, the introduced way in this paper is combining Support Vector Machine (SVM) control with Lyapunov stability criteria to propose a robust cluster synchronization solution in such systems. The idea of the configured application, which is SVM-Lyapunov Cluster Control (SVM-LCC), is that it utilizes the concept of supervised learning in forecasting the condition of a dynamic system and in optimizing the controller. By using SVM we are able to classify and learn new patterns of system behaviour, thus producing control inputs of the highest possible precision. Then with the help of Lyapunov stability theory, the devised control can be proven to be able to formally guarantee the stability of the interconnected nonlinear systems. The proposed algorithms

9789359807348

provided confirmation that the new system not only had faster convergence to the synchronous state but it was also simpler in both terms, computational complexity and the real-time flexibility than the existing system. In theory and application, this method provides a comprehensive synchronies network of different nonlinear networks.

198 Analysis of Multiple Machine Learning Schemes for Breast Cancer Recognition

P, Vijay Anand *; Anand, L
vijayanand.p@cmrit.ac.in*; anandl@srmist.edu.in

This study focuses on analyzing breast cancer data using several machine learning algorithms. The dataset used is the Wisconsin dataset from the UCI repository, consisting of 1,000 records. The research evaluates the performance of four classifiers: Decision Tree, K-Nearest Neighbor (KNN), Random Forest, and Support Vector Machine (SVM). Early identification and diagnosis of breast cancer are crucial to improving survival rates, as breast cancer remains one of the leading causes of cancer-related deaths worldwide. Among these methods, KNN emerged as the most effective, as it outperformed the others based on accuracy and other performance metrics. This finding highlights KNN's potential for reliable breast cancer classification, contributing to enhanced diagnosis and treatment strategies. The results suggest that advanced machine learning techniques, particularly KNN, can play a pivotal role in supporting early diagnosis and improving patient outcomes.

205 Optimizing ANPR Systems in Smart Cities: A Comparative Study of Detection Methods

Anika Mathur, Jyoti Rani"
Manipal University Jaipur
an.mathur17@gmail.com

The widespread use of Automatic Number Plate Recognition Systems (ANPR) in smart cities is increasingly common, primarily in transportation management, security surveillance, and vehicle monitoring. This article presents a comparative examination of three prevalent ANPR methodologies: edge and contour detection, YOLO (you only look once), and faster R-CNN (region-based convolutional neural network). The conventional approach, which uses edge and contour detection, employs Canny edge detection techniques and clustering algorithms to identify the position of license plates. In contrast, the deep learning techniques YOLO and Faster R-CNN employ object detection models to enhance accuracy and robustness. The models are assessed based on key performance metrics like detection accuracy, processing time, and computational resource expenditure. Our findings reveal implicit trade-offs regarding accuracy and real-time performance, offering insights into the optimal ANPR algorithm.

9789359807348

234 Designing of Solar-Powered Lightweight Drones for Extended Endurance

Alisha Bansal (Dr BR Ambedkar National institute of technology)*
Bansal, Alisha*

The endurance of light drones is basically limited by battery capacity, restricting their performance in prolonged missions. This paper provides theoretical analysis of the design of a solar-powered fixed-wing drone with a Maximum Power Point Tracking (MPPT) system employing a boost converter. The system considers the conversion of solar power to drive the drone, with the battery as a backup to achieve greater endurance. A tailored MPPT controller is modeled to maximize power harvesting from flexible solar panels and enhance energy conversion efficiency. The presented concept of drone is based on light airframe, embedded solar panel, and power management system. The presented design analysis shows up to 60% potential endurance enhancement, with the MPPT system exhibiting stable performance across changing solar irradiance conditions. The current work confirms the viability of energy-independent UAV systems in applications such as camera observation, drone surveys, and weather surveillance

252 Safeguarding Vulnerable Agri-Food Networks: An Adaptive ABC-DQN Framework for Resilient Vertex Cover Optimization in Disruption-Prone Supply Chains

Atul Kumar Kumar (Motilal Nehru National Institute of Technology Allahabad, Prayagraj)*; Jaspreet Kaur (Motilal Nehru National Institute of Technology Allahabad, Prayagraj); Tanisha Jain (Motilal Nehru National Institute of Technology Allahabad, Prayagraj); Divya Kumar (Motilal Nehru National Institute of Technology Allahabad, Prayagraj) Kumar, Atul Kumar*; Kaur, Jaspreet ; Jain, Tanisha; Kumar, Divya

Cost-effective monitoring systems that guarantee complete observability of crucial channels are required because agri-food networks are becoming more susceptible to disruptions from pandemics, climate change, and geopolitical crises. In this paper, a hybrid Artificial Bee Colony–Deep Q-Network (ABC-DQN) algorithm is proposed to solve the NP-hard Minimum Vertex Cover (MVC) issue, which is depicted as optimal sensor placement for network monitoring. Our approach minimizes the number of monitoring nodes while dynamically adapting to network interruptions (such as random failures or targeted attacks) by combining swarm intelligence and deep reinforcement learning. The following are some of the major innovations: Scout bee mechanisms to avoid local optima during topology shifts; DQN-enhanced solution generation to predict robust sensor placements under uncertainty; and fitness-guided adaptive mutation to balance coverage (ensuring maximum edges are covered) and cost-efficiency (minimizing nodes).Tested on actual agri-food supply chains, our strategy achieves 15–20% fewer monitoring nodes than conventional approaches while retaining computational scalability, outperforming greedy and genetic algorithms. Because of its dynamic adaptability, the algorithm may be used in real-time in unstable settings like industrial logistics or pharmaceutical cold chains. By offering a computationally effective, flexible MVC solution that improves monitoring capacities in the face of global uncertainties, our work promotes supply chain resilience and supports sustainable food security in high-risk contexts.

9789359807348

265 Comparative Study of GA, PSO, and ACO for Exam Timetable Scheduling

Ritika Singh,Kamakhya Chaturvedi, Amitesh, Divya Kumar
Motilal Nehru National Institute of Technology Allahabad
kamakhya.2024cs11@mnnit.ac.in

Metaheuristic methods have become key tools to tackle the combinatorial complexity of exam scheduling. Our study offers a thorough comparison of three population-based algorithms: Genetic Algorithm (GA), Particle Swarm Optimization (PSO), and Ant Colony Optimization (ACO), utilizing a common fitness function to evaluate each one. We implement each algorithm with a shared fitness function that takes into account room capacity, time-slot clashes, curriculum conflicts, and course unavailability constraints. Experiments were conducted using the ITC-2007 FIS0506-1 benchmark dataset, evaluating each algorithm over 10 to 50 independent runs. GA delivered the best performance with the lowest average fitness (0.087) and highest consistency, outperforming PSO by 12% and ACO by 18%. PSO was the fastest (0.9–4.7 seconds) but slightly less accurate, while ACO explored better at higher iterations but showed more variance. These results highlight a trade-off between quality and speed, pointing to hybrid GA-PSO/ACO approaches as a promising direction for real-world scheduling

275 Prominent Multiple Object Tracking System Based on Extreme Learning Machine

.Shubhangi Pande, Anuradha Purohit, Neeraj Kumar Rathore
SGSITS, INDORE
shubhangi.shanu@gmail.com

The process of concurrently recognizing and tracking many objects inside a video sequence is referred to as multiple object tracking, or MOT for short. It requires locating the objects of interest and tracking their motion across a series of frames in sequence. The MOT has a wide range of potential applications, some of which include video surveillance, autonomous driving, human-computer interaction, and sports analysis. In this study, a unique strategy is presented that makes use of the quick learning capability, high accuracy, and less network computing complexity of Extreme learning machine (ELM), which is used for training purposes, and discrete wavelet transform (DWT), which is utilized for the purposes of feature learning. Both of these capabilities are utilized in order to get optimal results. The ability to effectively monitor many objects is demonstrated using a variety of different video sequences of benchmark datasets such as OTB2013 and MOT20. In order to measure how well the proposed approach tracks, we utilize characteristics like multiple object tracking accuracy (MOTA) and identity switches F1 score (IDFI). The approach that was provided is able to properly track several objects in a video even when there is a lack of ground truth information about some of the objects in the frames, and it generates satisfactory outcomes that validate the overall system.

9789359807348

284 Deep Learning for Facial and Micro-Expression Recognition: A CNN-Based Approach

Priyansh Sharma, Sanju Choudhary
Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur
m210004@skit.ac.in

Facial expression recognition (FER) plays a critical role in enhancing human-computer interactions and has applications across various fields, including healthcare, security, and entertainment. Recent advancements in deep learning, particularly Convolutional Neural Networks (CNNs), have significantly im-proved the accuracy and robustness of FER systems. This paper explores the ap-plication of CNNs for facial expression recognition, focusing on how these net-works automatically extract hierarchical features from facial images to classify emotional states. CNNs excel in handling the complex variations in facial expres-sions, such as lighting conditions, head poses, and occlusions, which are chal-lenges for traditional methods. The paper reviews different CNN architectures, including the use of pre-trained models like VGGNet and ResNet, as well as cus-tom-designed networks tailored for FER. Additionally, the survey covers various FER datasets, training techniques, and evaluation metrics that are commonly used to benchmark CNN-based models. The advantages of CNNs in FER, such as their ability to learn spatial hierarchies and generalize across diverse facial expres-sions, are highlighted. However, challenges remain, including handling real-time recognition and cross-cultural variations in facial expressions. Finally, the paper discusses future research directions, such as integrating multimodal approaches and improving model interpretability, to further enhance the performance and ap-plicability of CNN-based FER systems.

289 Automated Subtitle Generation in Videos Using AI and FFmpeg

Ayen Mishra, Jyoti Rani
Manipal University Jaipur
ayen.229310424@muj.manipal.edu

As video content becomes a bigger part of our lives, the need for accessible and easily understandable videos is becoming more important. In this paper, a proposed system is built that simplifies the process of adding subtitles to videos by automating the entire workflow. The process encompasses video normalization, audio extraction, precise subtitle generation, and the subsequent integration of all elements into a single video that aims at optimizing time efficiency. This approach is both rapid and adaptable, which facilitates scalability through the amalgamation of straightforward yet potent tools such as FFmpeg and AI transcription services. Whether it's a few videos or hundreds, the approach remains efficient. Looking ahead, this work can be extend for tasks such as creating multilingual subtitles or even real time video captioning. Our goal is to bridge the gap between content creators and accessibility, making videos easier to understand for everyone.

9789359807348

296 Land Cover Classification of High Resolution Remote Sensing Imagery Using Modified UNet Architecture

Pankaj Singh, Navin Rajpal , Pramod Kumar Soni
Manipal University Jaipur
pramod.soni@jaipur.manipal.edu

This study introduces a deep learning-based approach for land cover classification utilizing high-resolution satellite imagery, centered around a tailored U-Net architecture. The methodology encompasses several preprocessing stages, including data augmentation, patch generation, normalization, and RGB encoding tailored to specific land cover classes. A curated and preprocessed dataset is used to train an adapted U-Net model aimed at segmenting high-resolution satellite images into specific land cover classes. To address class imbalance and improve segmentation performance, the network leverages a combined loss function—merging Dice loss with categorical focal loss—where each component is weighted according to the frequency of class occurrences. The model is trained to distinguish six categories: buildings, roads, vegetation, water, bare soil, and regions without labels. Experimental analysis reports high recall scores observed for the building and vegetation classes.
Visual assessment of the segmentation maps against annotated references confirms accurate region boundaries and effective class separation across complex urban settings. These outcomes suggest that the approach is dependable even with limited annotated samples and has strong potential for deployment in large-scale land cover mapping.

297 Controlling the Text Game: Game Theoretic Interactions Between LLMs for Controllable Text Generation

Aditi Bhosale, Shubham Phapale, Zaid Ali, Gajanan Sapsod, and Anshul Agarwal
Visvesvaraya National Institute of Technology (VNIT) Nagpur
anshulagarwal@cse.vnit.ac.in

Controlled Text Generation (CTG) through game-theoretic multi-agent systems ensures that AI-generated content aligns with factual accuracy, adheres to ethical norms, and maintains diversity across applications. Traditional methods lack adaptability, often relying on static prompt engineering or model fine-tuning that cannot respond dynamically to evolving requirements or detect subtle constraint violations. We propose a game-theoretic framework that models generation as a strategic interaction between three components: a prompt manager that formulates initial instructions, a content generator that produces text, and an adaptive, non-strategic evaluator that provides feedback. These agents engage in repeated interactions where equilibrium strategies evolve, forming a self-refining system. Extensive experiments show a 16% improvement over static rule-based methods across key evaluation metrics, while preserving control over sentiment, style, and factuality without degrading content quality. These results confirm the practical effectiveness of the proposed approach in balancing competing objectives while maintaining relevance and creativity

9789359807348

299 Improving PCOS Diagnosis with Hybrid Gini-Entropy Random Forest Classifier

Shreya Wanwe , Radha Waman, Dhanashri Wankhede, Sai Watile, Ranjeetsingh Suryawanshi Vishwakarma
Institute of Technology (VIT), Pune
shreya.wanwe23@vit.edu

Polycystic Ovary Syndrome (PCOS) is a very prevalent endocrine disorder in women of reproductive age, which can cause infertility, metabolic and hormonal complications. Preliminary diagnosis and precise detection of PCOS are necessary for effective treatment. This research puts forth an approach based on ML utilizing the Random Forest algorithm for detection and prediction of PCOS. The model is trained on a dataset comprising clinical, hormonal, and lifestyle-related features. Pre - processing of the raw data includes methods like imputing missing values, selection of best features, and normalization to improve model performance. The Random Forest classifier is chosen as it handles complex and high-variance datasets in a robust manner. Evaluation of the model is done using metrics like K-Fold Cross-Validation along with parameters derived using confusion matrix. The proposed demonstrates high accuracy PCOS prediction, highlighting effectiveness of ensemble learning in medical diagnosis.

317 Machine learning applications for predicting portfolio returns in Indian stock market

Modish Kumar, Prashant Sharma, Hemant Kumar Manuj , Dayanand Pandey, Padmini Jindal
University School of Business, Chandigarh University, Mohali, Punjab
modish.005@gmail.com

This study analyses the performance of prediction of returns as per four Fama-French factors (market risk premium, size, value, and momentum) on six Indian portfolios (SV, SN, SG, BV, BN, BG). The study employs models based on advanced machine learning (ML) assembling techniques, namely XGBoost, LightGBM, Random Forest and Support Vector Regression (SVR) along with linear models, Ridge, and Lasso. The outputs from these models are compared with those derived from traditional OLS regression. The purpose is to evaluate the performance of factor-based models using advance machine learning algorithmic approaches. The relative contribution of each factor across models is highlighted using feature importance and SHAP value analysis. This study demonstrates that machine learning based models enhance the prediction accuracy of returns from factor portfolios, in general. However, for the large cap portfolios (BV, BN, BG), linear models like Ridge, Lasso and OLS regression perform better in explaining the variance. For the majority of models, market risk premium emerges as a consistently strong predictor. The study contributes to the existing body of literature by applying asset price theories to modern data-driven modelling in emerging markets.

9789359807348

322 Deep Learning-Based Automated Skin Burn Detection and Classification

Deepika Yadav , Pooja Yadav
MJP Rohilkhand University, Bareilly
pooja.yadav@mjpru.ac.in

Burns are a matter of immense concern to the overall society and it is paramount that a quick analysis be carried out in order to determine the severity of burns leading to treatment planning. This paper introduces a Computer-Aided Classification Auto-detection Framework which classifies burns photos into three categories of severities; first, second, and third-degree burns. The comparison was performed on three deep learning models according to three different Convolutional Neural Network (CNN) models, namely, standard CNN, ResNet-18, and ResNet-50. The models are trained and tested on a preselected existing set of burn images. As the experimental results show, CNN model, ResNet-18 and resNet-50, performed an average classification accuracy of 83, 88 and 94 percent, respectively. ResNet-50 proved to be the best model compared to others in all instances, which registered better feature extraction and generalization performance. The results show that deep residual networks, especially the ResNet-50 have more potential in enhancing reliable and accurate burn classification tools to assist clinical decision making.

328 Deep Q-Network Enabled Trust based Routing for Secure VANET Clustering

Amrit Raj, Deepti Kakkar
Dr B R Ambedkar NIT Jalandhar
kakkard@nitj.ac.in

Vehicular Ad-Hoc Networks (VANETs) are considered as a key to the current Intelligent Transportation Systems (ITS), but they are susceptible to changing topology, interference with adjacent transmissions, and other cyber risks. The present paper suggests a cluster-centered routing design that operates on a Deep Q-Network (DQN) based reinforcement learning plan that can enhance flexibility, credibility, and the quality of communication. The vehicles are arranged in dynamic clusters and the selection of Cluster Heads (CHs) is done based on a multi-factor rating, whereby the residual energy, trustworthiness, and communication delay are combined. Five-dimensional trust model, Signal-to-Interference Ratio (SIR), real-time evaluation, and energy-optimal routing choices can be used to identify malfunctioning nodes and provide resilient connectivity. A CH can have one DQN agent, whereby the agent constantly learns the best routes through adaptive reward models grounded on trust, SIR, energy and latency. The proposed system is tested to three operational conditions namely, Normal, Mallory attack and Denial-of-Service (DoS) attack against five benchmark protocols. The outcomes of the experiments prove that the model proposed can yield a trust accuracy of up to 0.7507, energy efficiency of 0.5975 J, lower average distance of 10.1448 m, and can retain high SIR levels of 35.09 dB in regular conditions, and show strength in adversarial conditions. These results demonstrate the scalability, security and smart routing capabilities of the framework in the next-generation VANET contexts.

9789359807348

357 ACO-Driven Optimization for Cluster Head Selection in MANETs

Harminder Kaur, Chahat Jain, Navneet Kaur, Gurjot Kaur Walia
Guru Nanak Dev Engineering College, Ludhiana
erharminder1989@gmail.com

This work presents a simulation based performance analysis of proposed routing algorithm by using location information usage provided by GPS. Proposed algorithm maximize packet delivery ratio, minimizing end-to-end delay and reduce routing overhead by considering mobile node parameters. These parameters are battery, distance and density, required to send a message toward the cluster head and finally to the base station. In order to evaluate the proposed algorithm, it is simulated upon MATLAB software version R2019b to select an appropriate set of weight coefficients for the effective cluster head election. Simulation is completed while var-ying the number of nodes as 10, 50, 100, 150 and 200 in our proposed network scenario and it is revealed from the routing metrics that proposed routing technique, have been highly effective to maximize packet delivery ratio by providing equal normalization to the weight coefficients for battery and distance, minimize end-to-end delay and reduce routing overhead with more normal-ization to the weight coefficient for density.

367 Performance Analysis of Machine Learning-Based Network-on-Chip (NoC) Topologies

Kavin Raghav S, Kavyadharshini S, Anita J P
Amrita Vishwa Vidyapeetham
cb.en.u4ece22127@cb.students.amrita.edu

The efficiency of Network-on-Chip (NoC) architectures is crucial in modern multi-core processors, as communication bottlenecks significantly im-pact overall system performance. Traditional approaches in evaluating NoC to-pologies rely on analytical models and simulations, which can be time-consuming and computationally expensive. This paper explores the use of machine learning (ML) techniques to predict key NoC performance metrics, such as resource utilization, timing constraints, and power consumption. A comparative analysis of multiple ML models, including linear regression, random forests regression, etc. is conducted to assess prediction accuracy. The evaluation is based on statistical measures such as Mean Squared Error (MSE) and the coefficient of determination (R^2). Additionally, the performance data for each individual topology are also presented to validate the effectiveness of ML-based predictions. The re-sults demonstrate that neural networks achieve the good accuracy, making them a promising tool for NoC design optimization. This research provides insights into leveraging ML for performance estimation, potentially reducing the reliance on traditional simulation-based methods.

9789359807348

415 Graph-Based Anomaly Detection in Transaction Networks Using Temporal Graph Neural Networks

Md Zaka Al Shahariar Tanvir, Samiul Alam, Tanjid Hasan Shuvo, Fatin Anzum, A K M Shafkat Karim
Chandigarh University
mzastanvir.2001@gmail.com

The continuous expansion of digital financial transactions necessitates progressively advanced anomaly detection mechanisms to address emerging fraudulent activities and money laundering operations. Conventional approaches and fixed graph methodologies frequently struggle to identify the temporal char-acteristics inherent in financial criminal behavior. This study introduces T-GAE, an innovative unsupervised Temporal Graph Autoencoder architecture that rep-resents transactional data as continuous-time graphs and utilizes temporal graph neural networks (TGNNs) incorporating memory and attention components for anomaly identification. The proposed framework captures structural relation-ships (such as accounts, merchants, and users) alongside the temporal evolution of transactions. Anomaly identification occurs through reconstruction error anal-ysis, pinpointing departures from typical transactional patterns. Experimental validation with the DGraph dataset (1.2 million transactions) and additional val-idation using the Elliptic dataset reveal that T-GAE significantly outperforms static graph and classic machine learning baselines, yielding a 22% improvement in F1-score and an 18% reduction in false positives relative to static GNNs. This study highlights the criticality of temporal modeling as a means to improve fi-nancial fraud detection.

426 Next-Gen Smart Card Passive Signal Optimization Using AI

Madhurendra Kumar , Savita Kashyap , Anirban Sengupta
C-DAC
madhurendra.java@gmail.com

In recent times, we are facing some time operational challenges in achieving ideal smart card passive signals detection on RFID during system monitoring and display. By using AI Random forest algorithm driven we have addressed this communication issue, enabling dynamic optimization of signal strength and parameters adjustment. Proposed paper will be achieved optimized signal strength during time of weak signal detect according to AI automatic process decision with tuning hardware parameters like antenna size, coil turns, frequency, and reader power. After implement this concept, smart card and RFID communication will be established ideal time monitoring and display system.

431 Performance Analysis of Machine Learning Models for Appliance Energy Forecasting

Mahesh Anandrao Jadhav, Nikhil Pachuri, Vijay Mohan, Sharada Vikram Chougule
Manipal Institute of Technology
jadhav.mitmpl2024@learner.manipal.edu

Energy management is an important component for smart buildings and sustainable development, as it enables the effective use of resources. Accurate forecasting of appliance-level energy demand is important to facilitate optimal operation and planning. This research compares the effectiveness of the

9789359807348

five models (i.e., LightGBM, CatBoost, XGBoost, AdaBoost, and RF) in predicting appliance energy utilization. We used three performance criteria to evaluate the model performance, including MAE (Mean Absolute Error), RMSE (Root Mean Square Error), and R^2 (coefficient of determination). According to the obtained results, LightGBM is the most proper algorithm due to its lowest RMSE (9.83)and highest R^2 (0.9883) and respectively followed by CatBoost and XGBoost Model. Using AdaBoost and Random Forest for prediction yielded less accurate results. The experiments show that LightGBM is an effective method in predicting the appliance-level electricity consumption, which is beneficial to the energy management of smart buildings.

433 Smart auto powered Road Lane Detection using regional canny segmentation based Lan-Net CNN for smart driving system

Nathiya N (Paavai college of engineering)*
N, Nathiya*

Automatic driving system are tremendous growing techniques with support of ar-tificial automation based safe driving system. Throughout lane based vesicle driv-ing system is the important aspect for driving automation to keep the vehicle movement safe on the track. The AI technologies takes part image processing to find the lane detection efficiently. But the traditional methods are create complex patterns n road map due to degradation and particle segment swapping problems to degrade the detection performance leads poor accuracy. To resolve this prob-lem, a Smart Artificial intelligence auto powered Road Lane Detection is pro-posed based on regional canny segmentation using Lan-Net CNN for smart driv-ing system. Initially the Gaussian mixture intent to take the lane camera driving margins from road Lane side to normalize the image and to reduce the distrac-tions. Next to lane point tracking segmentation is carried out by canny edge re-gion of segmentation (CEROS), so find the object moving tracking position. De-pending feature mapping the lane region, LAN-net coevolution neural network is applied to detect the object position keep on region moving index position on tracking position. The proposed system efficiently detect the object tracking lane on roadside unit and to improve the precision rate and accuracy as well compared to the traditional methods with improved f1score with low false positives.

437 From Clickbait to Clarity: A Multi-Model NLP Framework for Clickbait Detection and Headline Generation with Transformer Models and SVO Structures

Mannya Agrawal (Manipal University Jaipur); Bhoomika Gupta (Manipal University Jaipur); Preeti Narooka (Manipal University Jaipur)*; Ankit Vishnoi (Manipal University Jaipur) Agrawal, Mannya ; Gupta, Bhoomika ; Narooka, Preeti*; Vishnoi , Ankit

Clickbait headlines crafted to lure readers into clicking undermine the credibility of online news content and mislead audiences. This paper presents a robust, multi-faceted system for automatic clickbait detection and syntactically-aware headline generation. We leverage a classical Logistic Regression classifier trained on TF-IDF features to detect clickbait with over 95% accuracy on benchmark datasets. In parallel, we explore four distinct headline generation strategies: keyword-based (TF-IDF), phrase-

based (RAKE), abstractive (Transformer-based T5), and structurally grounded (SVO++). The SVO++ pipeline, a novel contribution of this work, uses syntactic parsing to extract subject-verb-object structures, yielding headlines with improved grammatical correctness and reduced sensationalism. An empirical label-change analysis on generated headlines reveals that 21% of SVO++ outputs altered the classifier's original prediction—demonstrating the transformative impact of linguistic structure. Evaluation metrics such as precision, recall, F1-score, and confusion matrices offer insights into classifier behavior, while qualitative comparisons showcase the progression from extractive to human-like headline generation. This work bridges explainability and performance, offering a reproducible pipeline for future research in media moderation and content generation.

440 Ensemble Machine Learning Algorithms Performance Comparison for Cardiovascular Disease Prediction

Suyog Pradip Sawant, Nikhil Pachauri, Ankur Jaiswal, Anirudh Mangore
Manipal Institute of Technology, Manipal
suyog1.mitmpl2024@learner.manipal.edu

Cardiovascular diseases remain among the major causes of mortality globally. A primary element leading to this delay is the inability to identify the condition promptly for effective treatment. The timely and precise prediction of cardiovas-cular disease, along with appropriate treatment, is crucial for preserving patients' lives. This study assessed the performance of various models, including RF, ADABoost, CATBoost, and XGBoost, utilizing machine learning approaches on a comprehensive clinical dataset. The dataset has 11 attributes and 1 output attrib-ute pertaining to the data of 918 patients. This study adhered to a systematic pro-cess. The data underwent pre-processing first. Subsequently, performance was improved with the application of an ANOVA-based feature selection method and optimization strategy on the dataset. Subsequently, models were trained on the updated dataset, and their performance metrics, including accuracy, precision, and recall, were assessed. The findings demonstrate that CatBoost achieves an accu-racy of 83.48%. XGBoost and ADABoost yield substantial results. This study demonstrates that ensemble learning approaches assist medical professionals in the early identification and decision-making for patients with cardiovascular dis-ease (CVD).

441 Zero Trust in Private Home Networks: A Sociotechnical Perspective on Implementing Enhanced Zero Trust (E-ZTA) with Secure Access Service Edge (SASE) for Home Network Security

Urvashi, Parul Agarwal, Kamlesh Kumar Raghuvanshi, Jawed Ahmed
Jamia Hamdard
urvi.bhanu@gmail.com

This study analyzes increasing cybersecurity threats to private networks and smart homes due to the widespread use of IoTs, remote work endpoints, and diminishing perimeter defenses. We propose the first integratio n of Enhanced Zero Trust Architecture (E-ZTA) and Secure Access Service Edge (SASE) applied to IoT home devices, providing a sociotechnical security framework incorporating AI-driven continuous verification and behavioral smart authentication and automated threat containment under cloud-native SWG, CASB, FWaaS, and ZTNA enforcement. Applying the CIC-IoT-2023 dataset, the

9789359807348

model achieved 95.2% detection accuracy, 2.8% false positive rate, and 3.5 seconds rapid threat containment. These results are superior to traditional methods. This study concludes that E-ZTA and SASE together provide a flexible, scalable, and robust solution to cybersecurity for IoT home networks.

442 Deep Genomic Profiling of HPV Strains for Oncogenic Risk Stratification Using Hybrid 1D-CNN–BiLSTM Networks

Arushi Gupta, Ananya Singla
Dr B R Ambedkar NIT Jalandhar
arushig.ic.22@nitj.ac.in

Cervical cancer, primarily caused by high-risk strains of Human Papillomavirus (HPV), remains a major public health concern among women globally. Early identification of oncogenic HPV strains is critical for timely diagnosis and prevention. In this study, we propose a novel deep learning framework for automated classification of HPV nucleotide sequences into high-risk, low-risk, and non-risk categories. The system incorporates a multi-stage preprocessing pipeline, including k-mer decomposition, TF-IDF transformation, dimensionality reduction using truncated singular value decomposition (Truncated SVD), and ADASYN-based class balancing. A hybrid 1D CNN–BLSTM architecture is used to extract both local and long-range sequence features. The model is further optimized using a genetic algorithm and trained using the Adam optimizer, achieving approximately 90% test accuracy. Notably, key oncogenic markers, such as the E6 and E7 gene regions, were found to play a pivotal role in accurate risk stratification. The proposed system offers strong potential for clinical screening, genomic surveillance, and vaccine guidance.

444 "Comparative Life-Cycle Assessment of HDDs vs SSDs: Energy Efficiency and Carbon Footprint in Data-Centric Workloads

Prerna Agarwal, Pranav Shrivastava, Dishant Tayal, Ashdeep Singh Panesar, Sumisdon S Henry, Kareena Tuli
Bennett University
prerna115@gmail.com

Every operation (data analysis, content streaming, etc) held in a service application from banking app to a streaming platform relies on data storage. The rapid growth of these data-centric applications has further driven the development of energy-efficient and green storage technologies, as these physical systems are inherently unsustainable in embodied carbon and resource consumption throughout their life. This review paper compiles and analyzes the comparative life cycle assessment of hard disk drive (HDD) and solid-state drive (SSD) in terms of energy consumption and carbon footprints, evaluating throughout their stages of life from production to disposal. The Life-Cycle Assessment (LCA) results validate that while SSDs exhibit larger carbon footprints than HDDs in production, they offer more efficiency and sustainability on read-heavy workloads, whereas HDDs show marginally better performance under low-intensive tasks, such as archival storage. These findings underline their selection on the basis of workload characteristics, highlighting the trade-offs between operational efficiency and manufacturing impact.

9789359807348

452 A comparative analysis between Deep learning and Classical approach to remove occlusions during Surveillance in Images and Videos

Gunjan Dhiman (Doon University)*
Pakhi _ (Doon University)
Vaibhav Gupta (Irde,Drdo)

This paper addresses visual occlusion in military surveillance, where objects like tanks are hidden by dust or smoke. To simulate battlefield conditions, a synthetic dataset was created by overlaying clean RGB tank images with realistic dust effects. Initial reconstruction using a Hopfield Neural Network retained coarse features but failed to recover fine structural and color details. To improve performance, a Convolutional Autoencoder (CAE) was developed, which significantly enhanced image quality, especially perceptual details. When tested on video sequences, the model generalized well to dynamic inputs. Evaluation using MSE, PSNR, and SSIM confirmed the superior results of the CAE-based method. The proposed approach provides a complete pipeline for restoring both static images and video frames, contributing to real-time defense surveillance applications.

453 Drone Captured Image Analysis of Faulty Antennas In 5G Networks Using AI & ML During Natural Disasters

Ashok kumar
Indian Institute of Information Technology Sonepat
ashok.panwar@gmail.com

Natural disasters pose a significant threat to telecommunications infrastructure, with antennas installed on buildings being particularly vulnerable to collapse. The ability to identify damaged antennas and other hardware quickly is crucial in maintaining network uptime and ensuring the safety of repair crews. This study uses drones and techniques to capture 5G Antenna images and analyze them for faulty antennas during natural disasters. The approach involves using image processing algorithms to detect and classify damaged antennas, providing detailed information for repair crews to act quickly and efficiently. The study also explores the use of AI-powered predictive maintenance to prevent faults from occurring and improve the overall reliability of the network. The results show that the proposed approach can significantly enhance the resilience of 5G networks during natural disasters, providing a more reliable and efficient telecom infrastructure. The use of drones and AI/ML especially YOLOv4 -tiny techniques in this context represents an exciting opportunity for growth and innovation in the telecommunications industry.

455 A Comparative Study of Trapdoor Sampling Algorithms for Lattice-Based Cryptography

Ajay Srivatsan R, Sai Karthik Rajan, Uthara Nair, Sudheesh P
Amrita Vishwa Vidyapeetham
cb.en.u4ece22005@cb.students.amrita.edu

Trapdoor sampling algorithms form the backbone of lattice-based cryptographic constructions by enabling the generation of short, discrete Gaussian-distributed preimages necessary for secure key generation and signature schemes. This paper presents a comprehensive benchmarking study of four

9789359807348

state-of-the-art trapdoor sampling algorithms: Micciancio-Peikert 2012 (MP12), Gentry-Micciancio 2018 (GM18), Zhang-Yang 2022 (ZY22), and the Fast Double-Perturbation (FDP) method. We implement each algorithm and evaluate their performance over 500 independent trials using standardized cryptographic parameters. The evaluation focuses on key metrics such as execution time, which reflects algorithmic efficiency, and the Euclidean norm of the sampled vectors, indicating output compactness and cryptographic strength. Our empirical results highlight inherent trade-offs between computational speed and output quality across the algorithms, with some offering faster sampling at the cost of larger vector norms, while others prioritize compactness with increased runtime. These insights not only deepen the understanding of trapdoor sampling mechanisms but also inform practical considerations for their deployment in post-quantum cryptographic standards and real-world applications.

459 Deep Learning Approach for Amharic Character Recognition with Random Search Hyperparameter Optimization

Biniam Ewnetu Ejigu (Addis Ababa Science and Technology University); Natnael Tilahun Sinshaw (University of Houston); Beakal Gizachew Assefa (Addis Ababa Institute of Technology); Jukka Heikkonen (University of Turku); Rajeev Kanth (Savonia University of Applied Sciences); Sudhir Kumar Mohapatra (University of Turku)* Ejigu, Biniam Ewnetu ; Sinshaw, Natnael Tilahun ; Assefa, Beakal Gizachew ; Heikkonen, Jukka ; Kanth, Rajeev ; Mohapatra, Sudhir Kumar*

Optical Character Recognition (OCR) is an important technology used to digitalize documents. It plays a crucial role in converting scanned, printed, or handwritten documents into digital formats. Despite Amharic's rich liter-ary and historical importance, and its use by over 31 million native speakers and more than 25 million secondary speakers, it remains one of the under-digitized languages. Recognizing both handwritten and machine-printed (MP) Amharic characters poses significant challenges, and existing OCR sys-tems many a times ignore Amharic numerals, punctuation, and labelled characters. To address this gap, this study introduces a Convolutional Neural Network (CNN)-based model for Amharic character recognition. The model is enhanced with automatic hyperparameter optimization. It was trained on 104,177 Amharic character images. These images were pre-processed using binarization and noise removal.The dataset was split into training, valida-tion, and test sets with a ratio of 80:10:10. Hyperparameters were optimized using three techniques: Random Search Optimization (RSO), Bayesian Op-timization (BO), and Hyperband Optimization (HBO). The proposed model achieved an accuracy of 96.02%. It is 3% more than the current state-of-the-art when using RSO. The findings highlight that expanding the dataset and exploring hyperparameter tuning across wider search spaces may further en-hance performance. Future work should also validate the approach on more Amharic datasets to guarantee robustness and generalizability.

462 A Two-Phase Transfer Learning Framework for Terrain Analysis

M. A. Kumar, Bhavya Sharma, Aaryan Saharan, Vishal Sharmah, Naman Malhan
Chandigarh University
bhavya.sharma230403@gmail.com

Terrain classification from satellite and aerial imagery is vital for applications such as environmental monitoring, precision agriculture, disaster management, and autonomous navigation. Traditional

9789359807348

machine learning methods relying on handcrafted features often fail to capture the complexity and variability of remote sensing data. This paper proposes a two-phase transfer learning framework for EuroSAT terrain classification. In Phase 1, a pretrained VGG16 backbone is frozen to extract generic features, while a lightweight classification head learns task-specific patterns. In Phase 2, selective fine-tuning of deeper convolutional layers refines high-level representations. The framework achieves a peak validation accuracy of 91.3%, outperforming training from scratch while reducing training epochs by 60%. Data augmentation and dropout further enhance model robustness. Experimental results confirm that selective fine-tuning and augmentation significantly improve generalization. The proposed approach offers an efficient and reliable solution for remote sensing terrain classification, with strong potential for real-world deployment in resource-constrained environments.

470 Space Debris Size Estimation using Radar Cross Section with Data Driven Algorithms

Suraj Krishna, Sudhir Nadda, Suchismita Pani, Shivani Verma
Amity University
suraj.krishna@s.amity.edu

Growth of Space debris in Earth's orbit has been a matter of grave concern in today's age of ever-growing space activities. It compromises the safety and success of future and current missions. This necessitates accurate detection of size of unknown space debris to estimate its collision impact, trajectory and effective tracking. This paper presents analysis of data driven models to estimate effective size of debris objects using their Radar Cross Section (RCS) from Ground based tracking Radars. Individual estimation models such as, Power law, Exponential, Logarithmic, Polynomial, Cubic spline, Rational, etc. and their hybrid models are studied for accurate size estimation. The hybrid models of Spline show high accuracy in ultimate size prediction with significant less error than individual models and available legacy model on tested data.

472 HDC for Continual Federated Learning: Prototype-Based Knowledge Exchange in IoT

Rozy Kumari Karn (Broadway Infosys Nepal Pvt Ltd); Rammi Das (Amity Online University); Rupesh Karn (New York University)*; Jukka Heikkonen (University of Turku); Rajeev Kanth (Savonia University of Applied Sciences) Karn, Rozy Kumari ; Das, Rammi ; Karn, Rupesh*; Heikkonen, Jukka ; Kanth, Rajeev

Continual Federated Learning (CFL) is increasingly important for Internet of Things (IoT) applications, where distributed devices generate heterogeneous and evolving data. In this work, we introduce a Hyperdimensional Computing (HDC)–based CFL framework that leverages high-dimensional prototypes to support incremental learning across federated clients. Unlike conventional neural network approaches, HDC offers lightweight, robust, and inherently incremental representations that are well suited for dynamic IoT environments. We evaluate the proposed framework on six diverse datasets—MNIST, UNSW-NB15, Wearable, Activities, Accdel, and Wireless—covering image recognition, network intrusion detection, sensor-based activity recognition, and accelerometer data. Across these benchmarks, our results show that HDC -based CFL achieves competitive accuracy across sequential tasks, effectively mitigating catastrophic forgetting. The findings demonstrate that HDC provides a scalable and resilient

9789359807348

alternative for continual federated learning in IoT, highlighting its potential for real-world deployment in resource-constrained and evolving environments.

481 Predictive Modeling of Stock Prices with ESG Events: An AI Approach for Indian Equity Markets

Mahima, Muralikrishna S. N, Prakash K. Aithal, Radhika Kamath
Manipal Institute of Technology
mahima1.mitmpl2024@learner.manipal.edu

Investors are increasingly recognizing the role of Environmental, Social, and Governance (ESG) factors when making decisions that go beyond financial performance. However, there is still a lack of research on how these factors affect share prices in developing economies such as India. This study aims to forecast the stock movements of NIFTY-20 firms between April 2023 and March 2025 using a Long Short-term Memory (LSTM) network that integrates financial indicators with events related to ESG. To capture time-based patterns, ESG data were combined with market variables and organized following the Sustainability Accounting Standards Board (SASB) framework. The performance of the proposed model was then compared with that of the Autoregressive Integrated Moving Average (ARIMA) and Gated Recurrent Unit (GRU) models. The LSTM network enhanced forecast robustness by maintaining consistent performance and more effectively capturing ESG-linked trends, even though the GRU model achieved slightly higher accuracy metrics.

482 A Committee-Guided Social Algorithm for Few-Feature Selection

marc chevallier (LIPN)*; charly clairmont (Synaltic)
chevallier, marc*; clairmont, charly

The feature selection problem is a classic challenge in machine learning. This paper explores a particular case in which the goal is to extract a very small number of features relative to the total number of features. The proposed approach uses a new metaheuristic based on a simple so-called social motion equation. Our method, tested on 17 datasets, outperforms two state-of-the-art approaches, particularly when the number of columns exceeds the number of rows. This type of metaheuristic is computationally expensive. To address this issue, the paper also includes an acceleration method based on machine learning and a committee voting system to reduce the number of individuals to evaluate. This new acceleration technique achieves an average reduction of 29% in the number of fitness function calls, without degrading the results.

505 Multi-Class Dental Structures Detection via Deep Learning Based Instance Segmentation

Anushka Thakur, Rupali Patil, Bipin Upadhyay
KJ Somaiya College of Engineering, Vidyavihar
anushkaathakurr@gmail.com

Precisely identifying dental structures like inferior alveolar nerve (IAN), periapical pathologies and restorative features such as crowns, bridges, fillings is critical for surgical planning and early diagnosis. The main challenge remains here is that traditional radiographic methods often miss subtle pathologies

or overlapping conditions, which is why we need reliable automated detection systems. This paper used YOLOv11 as the main detection framework and compared it against other deep learning models. The dataset used in this study included IAN localization, cavities, implants, periapical lesions, and restorations. The model achieved 99% precision for IAN identification, with 97% and 93% for other pathological categories. However, we are still working on improving consistency across different classes, mainly because some dental structures and rare pathologies do not appear as frequently in the data. What makes our proposed methodology useful is its dual application. It helps the clinicians map anatomy accurately and help patients visualize their pathologies. This could reduce surgical complications and improve diagnostic accuracy in modern dental practice.

507 Performance Analysis of Range Sensor for Autonomous Mobile Robots in Indoor Environments

Gurpreet Singh, Deepam Goyal, Vijay Kumar
Chitkara University, Punjab
gurpreet.ace@gmail.com

Precise distance measurement is a key requirement for reliable mobile robot navigation, particularly in GPS-denied environments where external localization infrastructure is unavailable. Ultrasonic sensors like the popular HC-SR04 have proven a low-cost and easily integrable alternative where precision-ranging and obstacle detection are both required and feasible. Their accuracy and stability are however sensitive to target distance, sampling period, and surrounding conditions. Such limitations are prohibitive in real-time applications where accurate perception is pivotal to secure and efficient navigation. This paper presents a thorough experimental characterization of the HC-SR04 ultrasonic sensor with emphasis on its performance at different distances (10 cm to 210 cm) and sampling periods (10 ms, 50 ms, 100 ms). The methodology involves acquiring of 2000 readings across each distance and sampling period combination and then statistically analyzes the measurements via standard deviation, entropy, kurtosis, and stationarity tests in order to assess measurement consistency and reliability. The findings show that shorter sampling periods (10 ms) result in large measurement discrepancies towards mid to far range distances under the availability of insufficient signal processing time and greater sensitivity to noise. In contrast, sampling periods greater than 50 ms are more accurate and stable without any compromise in the responsiveness of the sensor. This work's findings provide significant insights towards the optimization of ultrasonic sensor configurations in the case of mobile robots towards greater obstacle detection accuracy, navigation precision, and system resilience through low-cost sensor setups.

514 Quantifying the Path Dependence Theory in Institutions

Navya Gubbi Satteshchandra, Anastasios Fountis, Sabina Kohlmann, Christos Lemonakis
Berlin School of Business and Innovation
domhel@hotmail.de

This work has two main aims: The first is to problematize the dominant view of the Institutions as a sort of Governance mechanism and in line with this assumption and the second aim of the article is to understand the role of institutions, as well as the actors with in, the current informalization trends that characterize political economy. Institution may be regarded as a rule. It may be a formal institution or an

9789359807348

informal institution or a norm, enforced by the state, Government or other public agencies or communities. It also focuses on the internalized normative behavior of an individual. The theoretical framework is enhanced via a computational approach as a lens for illustrating the role of institutions and path dependence in economic performance.

516 The Artificial Intelligence in Marketing Management: The Collaboration of Decision-Makers and Machines

Anastasios Fountis
Berlin School of Business and Innovation
a.fountis@post.harvard.edu

This explorative article addresses the connectivity and collaboration between machines and humans in crafting and executing marketing strategies and offers a mathematical framework for computing the Predictive Customer Lifetime Value (CLV). Artificial Intelligence (AI) is rapidly transforming the landscape of marketing. Machine learning algorithms can facilitate operations and support informed decision-making by harnessing vast structured and unstructured data. The AI era is marked by an emphasis on predictive analytics and personalized consumer experiences, whilst leveraging historical data, competitor strategies, and economic trends have become paramount. Commonly, the core areas leveraging machine learning in marketing include shopper fundamentals, consuming experience, decisions, and financial impact. As such, AI has emerged as an indispensable component of a successful marketing strategy.

517 Fractal-Based Statistical Framework for Detecting Unusual Patterns in Blockchain Transactions

P.V. Arunasree, Uma J
Sri Eshwar College of Engineering
arunasree.pv@sece.ac.in

Blockchain networks provide the trust and transparency for decentralized systems, though they are vulnerable to anomalous activities. In recognizing anomalies machine learning models are explored, however often they struggle with pattern generalization and scalability. The paper provides a dual layered statistical framework for detecting unusual patterns using a novel metric that is de-rived from the distribution of transaction values. The proposed system identifies anomalous blocks by visualizing unusual patterns and also records flagged trans-actions. The implemented approach is lightweight and scalable as it adopts fractal-based metrics instead of computationally complex machine learning models providing a practical solution for detecting unusual patterns for real-time applications.

9789359807348

532 Enhancing Clinical Reliability in Diabetic Retinopathy Detection

Khadiza Akter, Anik Paul,Rupam Paul,Riya Sil
Brainware University
riyasil1802@gmail.com

Diabetic Retinopathy (DR) is causing preventable blindness all over the world. Early detection of this has become crucial to prevent permanent vision loss. Various Deep Learning models, especially Convolutional Neural Networks, have shown great performance in classifying Diabetic Retinopathy. However, the prediction has not been widely accepted clinically for some real challenges. These include noisy and low contrast images, poor interpretability, unpredictable behavior in borderline instances, and sensitivity to class distribution. To address and overcome the existing challenges, our study proposes a Hybrid Fuzzy-Optimized Deep Learning Framework for DR detection. We utilized a pretrained CNN to extract features from fundus images and predict class probabilities. Afterward, we used a Fuzzy Interface System (FIS) to refine the prediction, incorporating defined membership functions and rulebased decision correlation. This assists in reducing uncertainty in borderline cases. Additionally, we then utilized a metaheuristic optimizer to tune CNN hyperparameters and fuzzy membership parameters to stabilize the model. Our experiment on the EyePACS dataset promises better classification in the early stage. Regardless of having less computational power, the proposed model achieved an overall accuracy of 96.2%, a weighted F1-score of 95.9%, a weighted precision of 95.8%, and a weighted recall of 96.2%. It also shows higher precision and fewer false positives. Our proposed study provides more consistent and explainable DR prediction. It promises to make clinical decision-making easier and supports real-world screening.

534 Multimodal Skin Disease Classification on Underrepresented Tropical diseases and Skin Types

Ruchika Pharswan, Dinesh Kumar Vishwakarma
Delhi Technological University
ruchikapharswan2025@gmail.com

With the Rise in AI healthcare sector has been transformed a lot from a disease prediction to personalized medical care. Intensive Medical tasks like disease prediction, treatment recommendation now can be executed faster, more accurately than conventional methods, with the help of AI-driven medical systems. Though Dermatology has already come a long way yet data diversity and representation have been a constant challenge. There is a significant gap that existing datasets cannot be used for Indian disease detection dues to underrepresented Indian skin tone and type. This gap is addressed by our proposed work, we have compared the performance of two multimodal framework to classify 8 skin diseases on lately curated skin diseases data set that represents Indian skin type, tone and tropical region-specific diseases. Wherein, model 1: DenseNet-121 with multi-layer perceptron (MLP), and model 2: Vision Transformer (ViT) with multi-layer perceptron (MLP) where model 2 outperformed model 1 with 98% accuracy and also deal with inherited demographic data imbalance gracefully. Furthermore, explainability techniques were used to further integrate the multimodal model that performed the best.

9789359807348

535 A Sustainable Inventory Framework for Deteriorating Items Considering Inspection, Advanced Payment, and Carbon-Reducing Green Technology Investment

Rohit. Pijus Kanti De
National Institute of Technology Silchar
rohit23_rs@math.nits.ac.in

Inventory systems with deteriorating items often face the challenge that spoilage in one product can accelerate the deterioration of others stored nearby. Regular inspections and timely removal of such items can effectively re-duce this impact, leading to improved performance. In this study, a new inventory model is developed that incorporates inspection frequency as a key factor in determining the effective deterioration rate. In addition, supplier prepayment requirements are included to better reflect practical trade conditions. Unlike traditional approaches that minimize costs, the proposed model integrates investment in green technology and seeks to maximize the retailer's total profit. The mathematical structure of the model is analyzed, and the concavity of the objective function is established, ensuring the existence of a unique optimal solution. To demonstrate applicability, a numerical example is presented. The results show that combining inspection policies with eco-friendly investment strategies improves both sustainability and profitability compared with existing models

539 Comparative Analysis of Carbon Footprint Predictions for Electronic Product Categories Using Random Forest, Federated Learning, and Contrastive Learning Models

Anantha Ram G S, Tejeshwar C D R, Sabarish B A
Amrita Vishwa Vidyapeetham
cb.sc.u4cse23408@cb.students.amrita.edu

Growth of digital technologies increased the energy consumptions and associated greenhouse emissions, contributing to rising carbon footprints. Accurate assessment and associated prediction of carbon footprints are critical for formulating effective sustainability strategies. This paper analyzes using random forest, Federated learning and contrastive learning for modeling and prediction. Random forest is modeled for capturing nonlinear relationship between the features, which enable robust baseline predictions .Federated learning address privacy by collaborating model across different distributed dataset without centralizing. Contrastive learning enhances the representation by differencing variations inturn improving the generalization across heterogeneous data. The dataset contained life-cycle attributes, manufacturing attributes, and physical attributes of different devices such as laptops, desktops, monitors, and servers associated with Global Warming Potential (GWP). Each model trained and evaluated with K-Fold cross-validation, using various performance metrics, such as mean absolute error (MAE), Root Mean Squared Error (RMSE), coefficient of determination (R2), and prediction and accuracy. Noted estimations were done by using Random Forest model considered as the strong baseline. Federated Learning came with a competitive accuracy while guaranteeing privacy. The triplet loss for Contrastive Learning got the highest unconditional prediction accuracy plus the smallest error boundaries. The study illustrated how successfully representation learning can be used for true mapping

9789359807348

and drawing complex relations among features. This analysis enables data driven decision making process to minimize environmental impacts and promote sustainable technology adoption.

544 Real-Time Intraday Trading Using Renko-MACD Strategy: Design, Implementation and Empirical Evaluation

Preeti Narooka (Manipal University Jaipur)*
Sia Asrani (Manipal University Jaipur)
Preeti Narooka (Manipal University Jaipur)
Ankit Vishnoi (Graphic Era Deemed to be University, Dehradun, India)
Deepak Panwar (Manipal University Jaipur)

This paper presents an automated intraday trading system integrating Renko chart analysis with MACD signals for equity markets. The system addresses emotional bias, execution latency, and inconsistent risk management through modular architecture comprising realtime data processing, technical indicator computation, and automated order execution via KiteConnect API. The dual-indicator strategy combines Renko charts for noise filtration with MACD for momentum confirmation. Rigorous backtesting on 12 months of NSE equity data (15 stocks, 93,750+ data points per instrument) and 60-day live paper trading demonstrates a 58.3% win rate, 1.65 profit factor, and maximum drawdown below 5.2%. Statistical validation through walk-forward analysis and comparison with baseline strategies confirms robustness. The system maintains sub-50ms execution latency with comprehensive transaction
cost modeling.

544 Real-Time Intraday Trading Using Renko-MACD Strategy: Design, Implementation and Empirical Evaluation

Preeti Narooka; Sia Asrani; Preeti Narooka; Ankit Vishnoi; Deepak Panwar
Graphic Era Deemed to be University, Dehradun
vishnoi.ankit@gmail.com

Human limitations in discretionary trading has led to rise in Automated trading systems. This paper presents a different approach for an automated intraday trading system that integrates Renko chart analysis with MACD signals for equity markets. Our system mitigates emotional biases, execution latency and inconsistent risk management using a modular architecture. It consists of real-time data processing, technical indicator computation, and automated order execution via Kite- Connect API. This dual-indicator strategy combines Renko charts for noise filtration with MACD for momentum confirmation. Backtesting on 12 months of NSE equity data (15 stocks, 93,750+ data points per instrument) and 60-day live paper trading demonstrates a 58.3% win rate, 1.65 profit factor, and maximum drawdown below 5.2% allows us to stimulate real world conditions. Statistical validation is done through walk-forward analysis and comparison with baseline strategies which confirms robustness. The system maintains sub-50ms execution latency with comprehensive transaction cost modeling.

9789359807348

546 Beyond the Black Box: Counterfactual and Reward-Based Interpretations for Transparent Reinforcement Learning

Yashkumar Rakeshkumar Patel (New York University)*

This paper introduces a novel explainability framework that bridges local and global interpretability for reinforcement learning agents by visualizing alternative action outcomes and quantifying decision trade-offs. Building on the concept of counterfactual reasoning, the proposed approach combines trajectory-based visualizations with reward factor decomposition to help users understand not only what an agent decided, but also why and with what potential consequence. Empirical user studies demonstrate that integrating these complementary explanation modalities leads to a measurable improvement in people's ability to infer agent preferences and behavioral priorities. The analysis highlights how layered, multi-perspective explanations can support trust, user insight, and critical assessment in complex sequential decision-making environments. The study concludes by discussing practical implications for the design of transparent and trustworthy AI systems and points to future directions for scalable interactive explanation in reinforcement learning.

555 Real-Time Diabetic Retinopathy Detection using Convolutional Neural Networks Diabetic

Urmila Pilania; Dipali Bansal; Manoj Kumar
Manav Rachna University
urmilapilania@gmail.com

Retinopathy (DR) is one of the primary causes of preventable blindness worldwide, particularly in people who have had diabetes for an extended time. The treatment of DR is feasible, provided it is diagnosed in a timely manner. The traditional models of DR diagnosis are manual, time-consuming, and ideally involve human intervention. In this paper, the authors introduce a deep learning framework to enable automated classification of retinal fundus images into discrete severity classes of DR. To achieve automated classification, the authors have focused on Convolutional Neural Networks (CNNs). The research work is designed and validated using a freely available dataset, with each image processed to highlight diabetic-specific characteristics for classification. The authors focused on accuracy, precision, recall, F1-score, and loss in identifying the severity level of DR. To prevent overfitting and develop a predictive model with improved generalizability, the authors employed techniques such as dropout regularization, data augmentation, and transfer learning. Proposed work also demonstrates that deep learning can provide efficient, scalable training and detection solutions for early detection of DR in under-resourced environments in real-time.

9789359807348

560 Advanced Machine Learning Models for Prediction, and Performance Optimization in Renewable Energy

Mohammed Alghassab (Department of Electrical Engineering, College of Engineering, Shaqra University)*; Amjad Aldweesh (College of Computing and IT, Shaqra University) Alghassab, Mohammed*; Aldweesh, Amjad

The global energy crisis, fuelled by climate change and fossil fuel depletion, demands sustainable renewables like solar, wind, and hydroelectric systems. Yet, their intermittency and environmental dependencies challenge accurate prediction, classification, scalability, performance, and dependability, impeding grid integration and planning. The analysis integrates supervised ML models—Random Forest (RF), Support Vector Regressor (SVR), Gradient Boosting, and CatBoost—using 96 records for prediction/classification and 29 for scalability/performance analysis. The grid search and 5-fold cross-validation, Gradient Boosting excels at 94.2% accuracy and 1.86 MW RMSE, surpassing RF (82.1%, 2.07 MW) and SVR (71.8%, 12.27 MW) by 12% accuracy and 10% error reduction. CatBoost achieves high scalability accuracy, adept at categorical features like policy support. The robust ML framework uncovers patterns for proactive energy management, emphasizing hydro's dominance (~130 MW) and environmental correlations (6–7 m/s winds). This advances smart grids, cuts CO_2 emissions, and supports climate goals, guiding policy and infrastructure for equitable, low-carbon ecosystems.

562 A Comparative and Ensemble Learning Approach to Citrus Leaf Disease Classification

Padmashree G, Seepika Wallabhdas, Gourab Ghosh
Manipal Institute of Technology
padmashreeg@gmail.com

Numerous foliar diseases that can significantly impair fruit quality and yield are common in citrus crops. Accurate and timely disease detection on citrus leaves is essential for managing both crops and diseases. This study examined how well four machine learning algorithms—KNearest Neighbors, Support Vector Machine, Decision Tree, and Random Forest—classified five categories using a citrus leaf dataset: Black Spot, Melanose, Canker, Greening, and Healthy. By combining classifiers in pairs, groups of three, and as an ensemble of four models, the study investigated ensemble learning in addition to evaluating each classifier separately. With an accuracy of 90%, the results showed that Random Forest was the best-performing single classifier; the Support Vector Machine and K-Nearest Neighbors classifiers performed similarly, in the mid to high 80% range. All four classifiers combined produced the best result at 90% accuracy, and all ensemble methods outperformed a single classifier. The study's conclusions demonstrate how ensemble learning can increase accuracy and dependability, advancing multiclass classification for the detection of plant diseases. The proposed approach offers a dependable and scalable solution for automated citrus leaf disease diagnosis, which could be integrated into real-time agricultural decision support systems.

9789359807348

566 Detection of Atrial Fibrillation using Photoplethysmography(PPG) signals using Machine Learning

Mamta Arora, Jampala Dinesh Chowdary , Badipadaga Yashwanth Reddy Jami Ravi Kiran
Manav Rachna University
dineshchowdary343@gmail.com

Photoplethysmography (PPG) sensors are one of the widely used sensors today. From wearable bands to clinical machines, PPG is widely used to detect heart rate and rhythm. Although the origins of the components of the PPG signal are not fully understood, it is generally accepted that they can provide valuable information about the cardiovascular system. There has been a resurgence of interest in the technique in recent years, driven by the demand for low-cost, simple, and portable technology for primary care and community-based clinical settings, the wide availability of low-cost and small semiconductor components, and the advancement of computer-based pulse wave analysis techniques. PPG signal is potentially used in Atrial fibrillation (AF) detection due to the convenience and similarity in physiological origin to the electrocardiogram (ECG). Previous studies have shown the possibility of using the peak-to-peak interval of the PPG signal in AF detection. The objective of the study is to apply deep learning models that assist in Atrial fibrillation detection using PPG signals

573 A Layered Architecture for enhancing fairness in Reward Distribution in Permissioned Proof-Of-Work Blockchains through effort verification

Uma J , Sravya Duvvuri, Keerthika V, R Dhaksana, Madhumitha K
Amrita School of Computing, Coimbatore, Amrita Vishwa Vidyapeetham
cb.en.u4cse22020@cb.students.amrita.edu

Blockchain networks revolutionize digital trust by replacing central authorities with distributed participants who maintain and secure the system. The fairness of incentive distribution remains a concern as, in Proof-of-Work (PoW) systems, the winner-takes-all model disproportionately rewards miners with higher computational power, sidelining honest contributors who expend significant energy without return. This undermines decentralization, discourages participation, and contradicts blockchain's foundations. This paper proposes a modular reward enhancement mechanism that fairly recognizes miners' efforts in PoW systems. The approach uses a fixed-length dynamic contribution window to track hash attempts locally. Miners periodically share concise metadata—nonce ranges, timestamps, and effort logs—with peers via a decentralized P2P network. A lightweight verifier node, elected dynamically through a round-robin or stake-weighted hash lottery, validates these claims. Verified effort data is then used to distribute micro-rewards from a designated side pool proportional to each miner's contribution. This model preserves the competitive block race while introducing equitable effort-based incentives, reducing centralization and improving energy justification. It prevents selfish strategies, supports smaller nodes, and remains compatible with existing infrastructures, contributing to a more sustainable and inclusive blockchain ecosystem.

9789359807348

577 Deep Learning-Driven Smart Image Registration for Improving Polycystic Ovary Syndrome Diagnosis Us-ing Ultrasound Image

Lalit Kumar Behera, Satya Narayan Tripathy
Berhampur University
lkb.rs.cs@buodisha.edu.in

The Polycystic Ovary Syndrome (PCOS) is a prevalent hormonal disorder, mostly found in women of reproductive age, where accurate and early diagnosis is crucial for effective management. Ultrasound imaging remains a primary non-invasive diagnostic tool; however, challenges in image variability and interpretation often hinder dianostic precision. This study presents innovative deep learning fusion with image registration method, aimed at improving the alignment and consistency of ultrasound images to enhance PCOS diagnosis accuracy. By leveraging convolutional neural networks and advanced methods of feature extraction, the proposed framework achieves robust and precise registration of ovarian ultrasound scans, enabling better visualization and comparison of ovarian morphology. Experimental results demonstrate significant improvements in registration, leading to more reliable identification of PCOS characteristics such as follicle count and distribution. Our findings suggest that integrating deep learning-driven image registration into ultrasound analysis pipe-lines can substantially augment diagnostic confidence and support clinicians in making timely and accurate PCOS diagnoses

579 A Hybrid Differential Privacy-Enhanced Federated Learning Architecture for Sensitive Financial Data using DistilBERT

Krishna Priya G, Samyuktha B M, Devapriya Jathin3
Amrita Vishwa Vidyapeetham
cb.en.u4cse22109@cb.students.amrita.edu

Federated Machine learning (FML) has become a popular approach that performs decentralized analysis of sensitive data, such as financial sector data, to allow secure model training across distributed platforms without the need for sensitive data to be uploaded. Federated learning is used to train financial fraud detection models where it was explored how federated learning can be approached while minimizing the tradeoff between the utility of the model and privacy of the sensitive data used. An enhanced privacy-preserving framework is proposed where the Baseline Fedprox algorithm was enhanced with Attention-Aware Privacy and a Hybrid Security Model. This created a more advanced and secured financial business models. Experimental results involving baseline accuracy measures along with convergence stability measure shows that the proposed approach guarantees strong privacy while maintaining a high performance score, making it suitable for financial models where data privacy is utmost priority.

9789359807348

580 An IoT-Driven Smart Solution for Air Quality Monitor and Waste Management Optimization

Amit Hasan Khan (Brac University); Fairoz Nower Khan (Brac University); Abdullah Al Farabe (Brac University); Maliha Rahman (Brac University); Md. Rezyuan (Brac University); Nabuat Zaman Nahim (Brac University); Jia Uddin (Woosong university)* Khan, Amit Hasan ; Khan, Fairoz Nower ; Farabe, Abdullah Al; Rahman, Maliha; Rezyuan, Md. ; Nahim, Nabuat Zaman ; Uddin, Jia*

In the present situation, as the population is expanding slowly but surely, nature should be clean and hygienic. As the population continues to grow steadily, nature must remain pure and sanitary. Water-filled trash cans create an unhealthy environment in many metropolitan areas. Additionally, the discharge of hazardous pollutants such as CO2, smoke, alcohol, benzene, and NH3 into the air is caused by these waste compartments. Our proposed model, an Internet of Things (IoT)-based waste and smart air quality monitoring system, would be beneficial in keeping an eye on this scenario. Currently, frameworks and IoT energy are combined to create a more effective working arrangement and quickly finish tasks. This paper examined the facts surrounding monitoring garbage quantity and air quality in a display we had set up. A web server used the internet to send a message to the relevant authorities identifying the amount of garbage inside the dustbin, smoke detection and alarm, and dangerous gases in the atmosphere. The quality assessment later showed improvements in our workflow and the paper's quality, as evaluated using Kitchenham's review system.

583 Novel rapid economic growth by progressive engagement of rural labour in China – based algorithm: Human-inspired optimization

Lenin Kanagasabai
Prasad V. Potluri Siddhartha Institute of Technology
knlenin@gmail.com

Workers in China have played a foremost role in the economic uplifting of the country. A robust work ethic has factually driven the economies; through concentrated export-led industrial production fueled by its gigantic workforce. Chinese workers, predominantly migrant laborers from rural to urban regions, have been the dynamic force behind China's quick economic de-velopment and national growth for the past four decades. Their contributions converted the nation into a worldwide manufacturing hub and drove substantial societal change. Migrant workers were vital for the building of China's enormous infrastructure ventures, comprising railways, bridges, and high-rise building. Rapid economic growth by progressive engagement of rural labour in China – based optimization algorithm is integrated with optimal impact of digital commercial advertising on consumers - based algorithm. The optimal impact of a digital commercial advertisement on a consumer is an, worldwide outcome, nevertheless relatively a vibrant procedure prejudiced by abundant factors. The maximum active commercial advertisement engross customers by personalization, trustworthiness, and responsive association, leading to quantifiable consequences like augmented brand alertness, customer fulfilment, and greater purchase intent. Promotions that generate emotions like cheerfulness, recollection, and eagerness which construct sturdier associations among the brands and its audiences. Translucent communiqué, authentic reviews, and reliable brand storytelling construct the trust, which is an acute intermediary in the association amongst promotion and customer behavior.

9789359807348

584 Breast Cancer Diagnosis using Quantum Support Vector Machines: A Comparative Study with Classical SVM

Vibha Jain; Ishwari Singh Rajput; Aditya Gupta
Thapar Institute of Engineering & Technology, Patiala, India
vibha.jain@thapar.edu

Breast cancer is one of the leading causes of cancer-related deaths for women around the world, and early detection remains important to enhance survival and treatment outcomes. Classical machine learning models, especially Support Vector Machines (SVM), have been developed for breast cancer diagnosis and tested on various datasets and demonstrated good performance. Quantum Machine Learning (QML) has emerged as an application of quantum computational feature spaces to yield improvements in classification performance. In this work, we evaluate Quantum Support Vector Machines (QSVM) on the Breast Cancer Wisconsin dataset, and systematically compare the performance with the classical SVM. Our preliminary results show that QSVM achieves accuracy up to 97.4% with the ZZFeatureMap at six qubits and 98.2% at twelve qubits. The accuracy is competitive with the classical SVM with RBF kernel (98.2% accuracy). The runtime analysis further demonstrates the trade-off between the number of qubits and training time. Overall, this research supports that QSVM can produce comparable predictive accuracy to strong classical SVM baselines and provides a route towards quantum-enhanced diagnostics within health care.

591 Data-Centric Approach to PEM Fuel Cell Performance Prediction

bharti Panjwani; Daniel Rodrigues; vijay Mohan; Darshan R Rao; Harshith Raju; Ananya Naik
SMVITM, Bantakal
bharti.cs@sode-edu.in

PEMFCs referred to as Polymer Electrolyte/Proton Exchange Membrane Fuel Cells are considered as the source of environmentally sustainable transportation around the globe. With the current technologies, they haven't yet reached their full potential, and thus, effective supervision and regulation of a PEM fuel cell is necessary to ensure the reliability and optimal performance of such systems. Due to changes in input conditions and system parameters, the stack voltage is also susceptible to fluctuations, making it essential to understand the dynamics involved in this at the initial stages. At this point, Machine and Deep Learning approaches tend to offer an efficient and reliable way to evaluate the performance of the engineered system across numerous scenarios before it is employed in real-world applications. The purpose of this study is to introduce a stacked ensemble machine learning based model developed in order to predict stack voltage based on a number of operational parameters including current, pressure, gas flow, humidity and temperature. The approach used combines the characteristics of various machine learning models with Ridge Regression functioning as the meta-model to predict the voltage as the output. Simulated data is derived from a PEMFC stack, which is used to train the model. The model functions better in terms of accuracy and Root Mean Squared Error(RMSE) than any other individual machine learning model. The proposed model enables real-time monitoring, supports system automation, while also enhancing the efficiency of the PEM Fuel Cell stack system.

9789359807348

593 A comparative study of AI powered detection and classification of brain tumor using MRI Images

Rinal Mistry, Himanshukumar R Patel, Atindra Shukla, Pinkesh Patel, Rignesh Patel
Faculty of Technology, Dharmsinh Desai University
rinalmistry610@gmail.com

Brain tumor - an abnormal growth of brain cells, can be detected using Magnetic Resonance Imaging (MRI) technique. MRI greatly helps in clinical diagnosis and treatment planning for brain tumors. Automated deep learning approaches, particularly Convolutional Neural Networks (CNNs), have shown remarkable success in medical imaging tasks. Among the widely used CNN architectures, Visual Geometry Group architectures (VGG) are known for their simplicity, consistency, and high performance in image classification. This study presents a comparative analysis of VGG16 and VGG19 for brain tumor classification using MRI datasets and effect of using a common limited dataset to train both the models. Four classes of Brain tumor are considered - Glioma, Meningioma, Pituitary and no tumor. Both models were trained using the same data, pre-processing and hyperparameters for the classification task. Their performance was assessed in terms of accuracy, precision, recall and F1-score. Results demonstrate that while both VGG16 and VGG19 exhibit excellent computational efficiency and convergence speed, VGG19 becomes prone to overfitting as deeper architectures like VGG19 require even larger image datasets for training as compared to VGG16.

597 Comprehensive study on Bell-based Frobenius-Tangent-Euler polynomials of complex variable and their applications

Azhar Iqbal, Waseem Ahmad Khan
Prince Mohammad Bin Fahd University
aiqbal@pmu.edu.sa

The aim of the present study is to explore some applications of the Apostol-type Bell-based Frobenius-Tangent-Euler polynomials of complex variable. Initially, using generating function methods, the relationship between these numbers and Apostol-type Bell-based Frobenius-Tangent-Euler polynomials for the special value is obtained. Subsequently, employing the derivative operator to the generating functions for Apostol-type Bell-based Frobenius-Tangent-Euler polynomials, a formula involving these numbers is derived. Using this formula, we present some recurrence relations along with their applications. Finally, some observations regarding these numbers are presented.

9789359807348

598 A Brief Study of Degenerate Poly-Bernoulli Polynomials of the Second Kind

Waseem Ahmad Khan, Azhar Iqbal
Prince Mohammad Bin Fahd University
wkhan1@pmu.edu.sa

The present work investigates the utilization of the polyexponential method in exploring various classes of special polynomials and numbers. By employing the polyexponential operator, several new identities and representations are established for fundamental mathematical entities such as Bernoulli numbers and polynomials, Stirling numbers, and the Riemann zeta function. In addition, the study highlights the intrinsic connections between the polyexponential function and degenerate Stirling numbers, revealing deeper structural relationships among special numerical sequences and polynomial families. The obtained results not only extend existing mathematical frameworks but also introduce novel applications that enhance the analytical understanding of these special functions.

612 Hotspot Temperature Prediction For Cloud Data Centres using Machine Learning

Ashay Wakle, Himanshu Gupta
Manipal Institute of Technology
ashay.wakle@gmail.com

Efficient temperature control is one of the biggest challenges in modern data centers. When servers operate at excessively high temperatures, their performance degrades due to ageing effect. This enhances the burden on cooling systems, which increases the energy consumption and operational cost. To address this, the present study developed a machine learning (ML) framework for predicting server hotspot temperature (Thost). The dataset used in this study is derived from real server logs. These logs continuously record operating conditions, such as CPU load, memory usage, fan speeds, network traffic, and multiple temperature readings, which demonstrate the behavior of servers under varying workloads. The dataset underwent a robust preprocessing pipeline, which includes enforcing physical limits, logical rules, logarithmic transformations, etc., to ensure consistency and realism. Experimental findings show that Random Forest provides the most efficient prediction with 99.56% R2 and 0.8174 RMSE.

619 Enhancing Braille Recognition Through Image Processing and Conversion Efficiency

Amrita Vishwa
Vidyapeetham, Bangalore
bl.en.u4cse22119@bl.students.amrita.edu

Braille is a system of raised dots that can be read with the fingers of blind people or those who have low vision. Braille is a language that is understood by only the blind, so here comes a necessity to ensure that others can properly interpret the braille code to ensure efficient communication and linguistic accuracy. This can be done through the appropriate conversion of Braille to other easily interpreted languages. It

is also important to understand that the converted text implies the meaning of the base text, so it is important to spell-check the converted text. The converted text preserves the intended sense of the original content by utilizing sophisticated image processing techniques offered by the OpenCV library to detect Braille dots, segment characters, and convert them to binary arrays. These arrays are then translated into English using hash maps and hash sets. Arrays and array lists facilitate data handling and manipulation throughout the process. Additionally, the usage of dictionaries in spell-checking ensures linguistic accuracy in the converted text, preserving the original content's meaning. This method allows people with visual impairments to communicate accurately and meaningfully, which not only improves accessibility but also fosters diversity.

622 Benchmarking Voice-Based Parkinson's Severity Prediction and Limits of Contrastive Feature Masking

Divyansh Sirohi, Lavesh Goyal, Himanshu Gupta
Manipal Institute of Technology
sirohidivyansh@gmail.com

With the growing population of elderly individuals, the number of Parkinson's disease (PD) patients is increasing worldwide. Healthcare is rapidly evolving, toward intelligent and data-driven systems. These systems are capable of monitoring patients remotely with high precision. However, in resource-limited areas, it becomes difficult to track PD. Hence, voice biomarkers become crucial in tracking the disease. However, the effectiveness of the machine learning models under real-life data remains uncertain. Real-life data is noisy and irregular hence adding a new dimension to the evaluation of models. We study 17 predictive models, including classical algorithms, ensemble techniques, and MLPs, on the Oxford Parkinson's Disease Telemonitoring Dataset. We also study the effectiveness of Contrastive Feature Masking. Contrary to expectations, CFM consistently reduced performance. The 5-layer, 512-unit MLP was least affected and achieved the strongest results (R2=0.439, MSE=62.15, MAE=5.98). Simulated experiments revealed that even small data-quality degradations cause massive performance loss. SHAP-based interpretability identified DFA, PPE, and RPDE voice complexity metrics as the strongest contributors. Overall, our findings highlight that architecture selection and data quality play a massive role than post-hoc evaluations.

623 ANN Predicted Multi Optimization of FSW Considerations for Al 6082 Alloy using AHP, and TOPSIS Techniques

Vivek John , Saurabh Aggarwal, Vinny John
Uttaranchal University
vincentvivek09@gmail.com

Managing multiple objectives is a crucial subject in difficult industrial applications. Industries have tried a variety of methods to comprehend the input machining characteristics. This study focuses on using TOPSIS, AHP (Analytic Hierarchy Process) techniques which used for optimizing multiple objectives for identification of the optimum parameters, their combinations and preferential order by identifying resemblance to the AHP and ideal solution. This method of multiple-objective method has been utilized for surface roughness minimization simultanously. Further, ANN modeling is employed as it compares

9789359807348

training methods such as radial basis and back propagation to get more accurate results. ANN indicators, confirms the trends and Taguchi and ANOVA revealed that welding speed (Sw) influenced significantly on the welding strength of Al 6082 alloy. Trial run six with a welding speed of 900 rpm, rotational speed of 35 mm/min, and shoulder diameter of 12 mm was determined to have an optimal rate of joining. This sample outperformed due to its optimum welding speed, and high hardness to produced better-density joint.

624 Preserving Tradition with Technology: A Real-Time Model for Kangayam Bull Detection in Eru Thazhuvudhal

K.Iyshwarya Ratthi, Arul Kumaran.S, Shreya K
Thiagarajar College of Engineering
kirece@tce.edu

Accurate detection of indigenous Kangayam breed plays a crucial role in automated Jallikattu monitoring, a traditional bull-taming sports. However, breed-specific detection, especially for the Kangayam breed, has not received sufficient focus in computer vision literature. Moreover, high-performing object detection models often demand substantial computational resources, limiting their deployment on field-based or edge devices. To address these challenges, we propose an efficient detection framework for Kangayam bull based on the latest YOLOv11 architecture. In this study, we evaluate and compare five variants of YOLOv11 (YOLOv11n, s, m, l, and x) on a custom-built Kangayam Detection Dataset. Our improved approach integrates a lightweight backbone using ShuffleNetV2 in YOLOv11n and employs depth-wise separable convolutions in the Neck to reduce computation. Furthermore, multi-head self-attention (MHSA) is incorporated before the backbone's output stage to enhance breed- specific feature extraction. Experimental results show that our optimized YOLOv11n variant attains a mean Average Precision (mAP) of 92.8%, and model size of only 2.1 MB, offering an 86.5% reduction in weight compared to YOLOv11s. Additionally, the detection speed improves by 72.3%, making the model ideal for deployment on low-power edge devices. This study contributes a scalable and real-time solution for bull breed classification and promotes the adoption of lightweight AI in agricultural monitoring systems. The Kangayam- YOLOv11 dataset developed in this work will be released publicly to encourage further research.

627 Data Science: An Approach in Mechanical Engineering for Predictive Modeling to Reduce Failures in Stainless Steel using Artificial Neural Network

Vivek John, Saurabh Aggarwal, Vinny John, Amit Kumar Maurya
Uttaranchal University
ervincentvivek09@gmail.com

The application of intelligent systems to improve the functionality and optimization of manufactured parts in factories is now a necessity. Accurate predictions are crucial for decision-making in fields like business, medicine, engineering, and other fields. All scientists, engineers, and factory workers need to study and use one of the newest and most popular of these techniques, which are termed "Data Science. "This article provided a quick introduction to data science, evaluated its methodologies, with an

emphasis on how it is used in mechanical engineering, as well as the difficulties it faces and potential solutions. The process that a data scientist must follow in their work is detailed in the sections that follow. Additionally, certain projects in the field of mechanical engineering that employed data science techniques are evaluated. Practice has been done to highlight why using data science in mechanical engineering research and projects is essential in light of the topics that have been covered in the article. In order to create a reliable mathematical model for this investigation, Taguchi's optimization investigation was used to stabilize the relation between the response variables MRR and surface roughness. The ANN model effectively predicted the Material Removal Rate (MRR) (0.625 gm/min actual compared to 0.623 gm/min forecasted) and Surface Roughness (SR) (1.36 µm actual versus 1.78 µm forecasted.

628 Satellite-Based CNN Detection of Corporate Sustainability and Environmental Human Rights Infractions in India, China, and the USA

Sushmita Dhar, Mohd Imran
Chandigarh University
sushmita.r243@cumail.in

This study focuses on the integration of convolutional neural networks with satellite remote sensing in order to identify corporate environmental human rights violations in India, China and the United States. A systematic literature review using modified PRISMA methodology collated multidisciplinary evidence that included deep learning applications, environmental law and corporate sustainability frameworks. CNN architectures achieved detection accuracies of more than 90% on deforestation, water pollution, and unauthorized waste disposal with the temporal analysis of patterns of systematic evasion of compliance revealed. Cross-jurisdictional analysis revealed different typologies of violations: in India, there was a presence of waste-related violations, in China there was evidence of sophisticated methods of concealment while in the USA there were complex federal state regulatory problems. Extended Producer Responsibility compliance rates varied between 34-89 percent in jurisdictions, so there are significant implementation gaps. The combined CNN-GIS monitoring system provided close to real-time detection with processing latencies down to 27 minutes, which confirmed the technical feasibility for scalable regulatory enforcement improvement, however, it required jurisdictional adaptation of legal frameworks on admissibility of satellite-derived evidence.

629 Integration of a Machine Learning Model to Enhance Post-Manufacturing Processes

Şaban Demirci (Yildiz Technical University)*; Orhan Çakır (Yıldız Technical University)
Demirci, Şaban*; Çakır, Orhan

This study has the potential to revolutionize manufacturing workflows by enhancing efficiency, accuracy, and error handling. It introduces a Fusion360 add-in that automates CAM data extraction and utilizes Gemini, a cloud-based AI engine, to analyse machining operations, toolpaths, and workpiece geometry. The system exports data in JSON, CSV, and STEP formats, enabling comprehensive analysis and documentation. Gemini evaluates the extracted data to identify inefficiencies, optimise tool selection, and recommend improvements, presenting results through a scoring system for efficiency,

quality, and safety. The add-in features real-time progress tracking, intuitive user interfaces, and visualized results to enhance user experience. While currently suited for individual projects, future development aims to scale the system for industrial applications by incorporating advanced AI models and algorithms. This study demonstrates the feasibility of AI integration in manufacturing, paving the way for faster, more efficient, and error-free production processes.

633 Robust Chronic-Kidney-Disease Prediction Under Missing and Noisy Clinical Data: A Comparative Study of Model–Imputation Pairs

Lavesh Goyal, Divyansh Sirohi, Himanshu Gupta
Manipal Institute of Technology
lavesh.mitmpl2023@learner.manipal.edu

Clinical prediction models often look excellent on tidy datasets but struggle on ordinary hospital records that contain gaps and noisy measurements. This work examines chronic kidney disease (CKD) prediction under those conditions rather than ideal ones. The analysis uses 400 patient cases from Apollo Hospitals, Tamil Nadu, keeping the native 10.6% missing values. Three imputation routes, such as median substitution, K-Nearest Neighbours, and multiple imputation by chained equations (MICE), are employed to analyse the performance of Logistic Regression, Decision Trees, Random Forest, XGBoost, and Multi-Layer Perceptron (MLP). Further, the performance of these models is evaluated on a cleaned test dataset, with extra missingness at 10–40% (both MCAR and age-linked MAR), and with Gaussian noise at 5–20%. Result shows that the performance of models on raw dataset significantly improves up to 3.6% with MICE imputation strategy relative to simple approach. Additionally, missing values have a greater impact on performance than moderate measurement noise. Further, Random Forest and shallow neural networks show higher resilience. This suggest their suitability for deployment in data-limited clinical environments.

639 Real-Time Physiological Monitoring Using Wearable Sensors for Acute Mountain Sickness Prediction

Priya Patel, Md Mushfiqur Rahman Chowdhury,Pooja Sharma,Shubhajit Roy Chowdhury
Indian Institute of Technology, Mandi
patelpriyah7@gmail.com

This study introduces a wearable, portable device for early Acute Mountain Sickness (AMS) detection using integrated real-time physiological sensors. The device records SpO_2, heart rate, CO_2, and galvanic skin response (GSR), which was validated in a preliminary trial involving two healthy female subjects at different altitudes. The results demonstrated stable SpO_2 readings between 87% and 100%, with the sensor reliably reflecting physiological acclimatization at rest and postexertion. Heart rate measurements ranged from 78 bpm to 166 bpm, aligning with normal responses and showing transient spikes due to motion or sensor placement, whereas GSR values between 257 and 321 confirmed the module's stress sensitivity. CO_2 readings, measured at 575–723 ppm, indicate sensor limitations and require further calibration for accurate exhaled CO_2 detection. Data transfer via Bluetooth and visualization on an LCD confirmed the full hardware integration and field viability. Multi-sensor fusion shows promise for constructing an AMS index, with SpO_2 assigned high weight and HR, CO_2, and GSR assigned moderate-

9789359807348

to-low weights within algorithmic analysis. These results lay the groundwork for robust AMS monitoring, although further work is needed for sensor calibration, multisubject validation, and enhanced algorithm development for predictive accuracy at high altitudes.

652 Analysing the Efficiency of SRAM Cell Utilizing FinFET Technology based Reversible Logic: A Performance Evaluation

Subarna Mondal (Makaut, West bengal)*; Soumya Dutta (Makaut, West Bengal); SOUMYA SEN (Dr. B.R. Ambedkar National Inst. of Technology ,Jalandhar ,India); Ashish Raman (NIT, Jalandhar); Sahil Hamid (NIT, Jalandhar); Angshuman Khan (UEM Jaipur)

Mondal, Subarna*; Dutta, Soumya; SEN, SOUMYA; Raman, Ashish; Hamid, Sahil; Khan, Angshuman

For ultra-low power nano-computing and future technologies like quantum and optical computing, reversible logic promises an intriguing computing paradigm. Unlike conventional circuits, reversible circuits utilize reversible gates with a unique input-output mapping, making them ideal for constructing circuits with ultra-low power that surpass the KTln2 limit. This is particularly crucial for emerging nanotechnologies where minimizing effective heat dissipation management depends on energy dissipation brought on by information destruction. Power dissipation is a pressing concern in low-power Very Large-Scale Integration (VLSI) circuit design, especially as the demand for high-capacity electronics continues to grow with advancing technology. Static Random Access Memory (SRAM) is favoured for its rapid performance in data storage and processing. However, the additional memory cells being used have resulted in greater power being used. While various low-power techniques are utilized in SRAM cell design, adiabatic logic, exemplified by reversible gates, stands out for its ability to minimize heat dissipation entirely. In this research, we have employed reversible logic gates in the development of a 6T static random-access memory (SRAM). These gates are made with 22nm FinFET technology. By addressing the crucial problem of power degradation in low-power VLSI circuit design, the goal is to lower leakage power consumption in memory applications.

653 A State-of-the-Art Review on Feature Extraction and Classification Techniques for Motor Imagery EEG Signals for Brain-Computer Interface

KM Nidhi Sharma; Pawan Pawan; Pradeep Pant

Meerut Institute of Engineering & Technology (MIET)

nidhi.sharma.mtcs.2024@miet.ac.in

Brain-Computer Interface (BCI) systems that use motor imagery (MI) for human-machine interaction got so much consideration these days. Systems that are working on this concept, require robust techniques for extracting characteristics from electroencephalogram (EEG) signals and precise classification algorithms to function properly. These systems rely on reading brain activity from EEG signals. The Wavelet Transform (WT), Common Spatial Pattern (CSP), Empirical Mode Decomposition (EMD), and other sophisticated feature ex-traction algorithms are all thoroughly examined in this study. Additionally, the accuracy, flexibility, and computational efficiency of popular classification techniques, for example Support Vector Machines (SVMs), Linear Discriminant Analysis (LDA) are investigated. The review aims to highlight recent advancements, present challenges, and possible impending study directions to improve the efficacy of MI-based EEG signals for BCI systems.

9789359807348

672 Evo-RRT*: Evolutionary Programming for enhancing RRT* paths toward time efficient navigation

Priyanka Upadhyay, Ravinder Singh
Netaji Subhas University of Technolgy, New Delhi India
engg.ravindersingh@yahoo.com

Path optimization problems associated with various factors such as smooth trajectory, low space complexity with the shortest path, collision avoidance, etc. Conventional Informed Rapidly Exploring Random Tree (IRRT*) is keen solution to the path planning problem however reliability of IRRT* reduces as generated path contain a greater number of discontinuity nodes in complex environment that result in time lag reaching the destination. The proposed Evo-RRT* (hybridization of Evolutionary programming with Rapidly exploring Random Tree) addresses these challenges by incorporating the RRT* with EP along with the concept of compliant segments and. The initial path is generated using RRT* and Evolutionary Programming subsequently refines it through operations such as smoothing, deletion of redundant nodes, visibility enhancement, and waypoint updates. The proposed technique is tested in various environmental setups and 5.6% reduction in path length, 12.1% reduction in computational time and 34% reduction in sharp turn evaluated against the conventional IRRT*. The proposed research work provided an efficient solution in path optimization problems and applicable in autonomous navigation, search and rescue operation, trajectory optimization, etc.

676 Drone Detection Using Dual Modality with YOLOv8

Vaibhav Mahawar
Dr B R Ambedkar NIT Jalandhar
vaibhavkm.mi.24@nitj.ac.in

The growing use of small unmanned aerial vehicles (UAVs) in civilian and restricted areas calls for strong real-time detection systems that can work in a variety of weather conditions. Most studies look at visible and thermal infrared (IR) images separately, which leads to detectors that only work for one type of image and don't work well across domains. We propose a unified IR-Visible aerial-object detection framework based on YOLOv8, trained on a large dataset of 20,323 multi-modal frames with four operational classes: aeroplane, bird, drone, and helicopter. A full preprocessing pipeline from MATLAB to Python has been built to turn raw IR and visible video annotations into structured YOLO-format training samples. This will improve small-object sensitivity across all modalities. The suggested method provides a scalable, modality-neutral detection solution that can be used for airport surveillance, long-range monitoring, and real-time security.

677 Predicting the Thermal Conductivity of Epoxy–Filler Composites Using Deep Learning for Cryogenic Applications

Gottimukkala Syamuel Raj (Dr B R Ambedkar National Institute of Technology Jalandhar)*
Syamuel Raj, Gottimukkala

The use of epoxy-filler composites in satellite systems to attach sensors is increasing, as traditional materials are unstable in zero atmospheric conditions and differential thermal conditions in space. Epoxy composites give stronger bonds, but they have low thermal conductivity, which in turn limits heat

dissipation from sensitive instruments. The conductivity of the epoxy composites is increased by adding high-conductivity fillers into them while preventing thermal buildup and ensuring secure sensor attachment. Predicting the effective thermal conductivity (k_composite) of these materials is challenging because heat transfer depends on nonlinear interactions among constituent conductivities, filler loading, interfacial resistance, and temperature. These effects are enhanced under cryogenic conditions, where phonon scattering dominates. Classical analytical models such as Maxwell, Bruggeman, and percolation theory often fail to represent these complex behaviours accurately. This study develops a Deep Learning (DL) algorithm to predict the thermal conductivity of epoxy–filler composites using 364 samples defined by matrix thermal conductivity (k_base), filler thermal conductivity (k_filler), filler volume fraction (ϕ), and temperature (T). A Deep Neural Network (DNN) was optimised using Bayesian Optimisation, achieving a test R2 of 0.97, outperforming baseline models. The results demonstrate the effectiveness of deep learning in modelling cryogenic thermal behaviour and support the design of thermally efficient bonding materials for next-generation aerospace applications.

678 PCA-Enhanced Stacking Ensemble for Multisite Autism Spectrum Disorder Classification Using sMRI and rs-fMRI

Jyoti Sharma (DR B R Ambedkar National Institute of Technology)*
Sharma, Jyoti*

Early and timely ASD detection is becoming more important as cases continue to rise. In this study, we developed a framework that uses both sMRI and rs-fMRI and extracted radiomic features capturing intensity, gradients, shape, and texture. These features were combined and adjusted to reduce differences between sites and a PCA-based stacking model—using Random Forest, Gradient Boosting, Logistic Regression and XGBoost was trained on them. This integration helped stabilize the feature space and reduce noise introduced by scanner variability. The system reached 0.769 accuracy, 0.719 AUC, 0.875 sensitivity, and 0.60 specificity. The PCA component analysis revealed key features, mainly intensity and GLCM texture measures, contributing to predictions. These observations indicate that engineered radiomic patterns carry meaningful information relevant to ASD related neurodevelopment. Such additions helped the model handle differences across subjects more reliably. This provided a more stable baseline. Taken together, the data point to multimodal MRI and transparent modeling as a better way to detect ASD.

679 Deformable-Token Transformers with Diffusion Suppression for Sub-Centimeter Pulmonary Nodule Detection

Pulmonary nodules are severe conditions, which require correct and valid identification of pulmonary nodules in the diagnosis of lung cancer at an initial stage. We propose DETECT-S3, a unified system that incorporates candidate generation, deformable 3D tokenization, cross-view consistency transformers, and multi-headed prediction and calibrated scoring. The system also introduces a few novel training strategies including Multi-Instance Curriculum (MIC) to conduct gradual supervision, Uncertainty-

9789359807348

Aware Candidate Mining (UCM) to refine hard examples, and Diffusion-based False Positive Suppression, which enhances accuracy and robustness. Radiomics-augmented tokens also introduce handcrafted features into the transformer space by use of representation augmentation. To obtain clinical reliability, DETECT-S3 instituted more advanced calibration mechanisms such as test-time adaptation and conformal prediction which provide well-calibrated confidences estimates. Detected from benchmark CT data, the sensitivity of DETECT-S3 is higher and the false positive rate is lower than existing methods such as 3D Faster R-CNN, Swin-UNETR, and nnDetection. The work offers a clinically viable, interpretable, and uncertainty aware resolution to the computer-aided lung nodule detection, which improves credible AI in medical imaging.

680 A Robust ORB Pipeline with Depth Filtering for Improved Pose Accuracy

Yashika Arya (Dr. BR Ambedkar National Institute of Technology)*
Arya, Yashika*

Visual SLAM(Simultaneous Localization and Mapping) systems that rely on RGB-D sensors often struggle with depth noise, especially along object boundaries and in low-texture regions. In this work, we explore a simple depth-aware extension to the ORB(Oriented FAST and Rotated BRIEF) feature pipeline that aims to make pose estimation more stable without altering the overall structure of a feature-based SLAM system. The approach introduces two additions: a bilateral filtering step applied to the raw depth map, and a depth-based confidence weighting that influences the PnP(Perspective and Point) andRANSAC(Random Sampling Consensus) stages during camera motion estimation. We evaluate the method on two indoor sequences from the TUM RGB-D dataset (fr3 long office household and fr1 room). The depth filtering and weighting consistently help the system avoid pose jumps and reduce the influence of unreliable depth measurements, resulting in cleaner trajectories compared to the standard ORB baseline. The method remains lightweight and can be integrated into existing RGB-D SLAM pipelines with minimal overhead.

681 Drone Detection Using Noise-Suppressed Acoustic Features in Low-SNR Environments

Nausheen Zaidi (Dr. B R Ambedkar National Institute of Technology, Jalandhar)*; Sourabh Verma (Dr. B R Ambedkar National Institute of Technology, Jalandhar); Deblina Biswas (Dr. B R Ambedkar National Institute of Technology, Jalandhar); Om Prakash Verma (Dr. B R Ambedkar National Institute of Technology, Jalandhar) Zaidi, Nausheen*; Verma, Sourabh; Biswas, Deblina; Verma, Om Prakash

The rapid expansion in the usage of unmanned aerial vehicles (UAVs) necessitates the development of sophisticated detection systems to ensure airspace security. Acoustic-based approaches give a good alternative to radar or vision, particularly in harsh conditions. This paper presents a noise-suppressed acoustic drone detection system based on a Bidirectional Long Short-Term Memory (BiLSTM) network. We offer a complete pre-processing pipeline that incorporates spectral filtering and noise reduction to increase feature quality. We gathered a varied audio dataset from online recordings, publicly accessible research datasets, and a synthetic dataset to improve model generalization in low-SNR settings. In 5-fold cross-validation, the classifier trained on Mel-Frequency Cepstral Coefficients (MFCCs) and associated delta features attained a mean test accuracy of 98.05%, with the best fold reaching 98.20%. These results show that our combined approach effectively detects UAVs in realistic acoustic settings, making it suitable for real-time monitoring applications.

STEM RESEARCH SOCIETY

Science Technology Engineering Management

Trust for the People by the People

DARPAN ID: UP/2025/0615045

https://stemrs.in/

Feel Proud to be a Part of STEM-Research Society

The objective of the foundation is Scientific, Technical, Research and Educational in nature. The foundation strives to advance the theory, practice, and application of Science, Technology, Engineering and Management and maintains a high professional standing among its members. The basic purpose of the STEM-RS is to bring together Researchers, Academicians, Industrialists and Experts from different parts of the country and abroad to exchange the knowledge and ideas at a common platform by organizing National and International events such as Conferences, Seminars and Workshops that unite the Science, Technology, Engineering and Management and topics which are not mentioned here for the empowerment of research and development. The STEM-RS foundation will build a dynamic, interactive, global community of researchers, academicians and industrialists to advance excellence in Science, Technology, Engineering and Management.

You can pay your annual membership fee by one of the following ways:

1. By Direct Deposit of Cash/Demand Draft/cheque in the below account
2. By Net Banking *(Internet Banking using NEFT/ RTGS facility. RTGS Payment Charges are levied to the payers and differ from bank to bank.)*

Terms and Conditions

Ignorance of terms and conditions is not an acceptable excuse for violation. STEM-RS Members are expected to know and abide by these terms and conditions as well.

1. Every member shall work in the positive direction and upliftment of the Society/Foundation
2. Payment made through any other mode will not be accepted.
3. The Memberships will be activated on verification of receipt of Membership Fee from Bank Statement.
4. Membership Registrations are to be done individually. i.e. there is no Group / Multiple Registration
5. The fee once paid will not be refunded on any account nor would this fee be held in reserve for future.
6. In case of any participant found to have paid more fee than prescribed, due to technical reason and on receiving the communication from the said applicant, the said extra payment, if found, shall be refunded to the same origin from which the payment is received.
7. The Executive Committee (EC) holds the rights to accept or reject the membership application of any individual. Also the decision of the EC shall be final and cannot be objected/questioned.

Eligibility and Benefits to Join STEMRS

Eligibility

1. A person should attain minimum age of 18 Years (on the date of Joining).
2. Membership is linked to the possession of at least a graduate degree (in any domain).

Benefits

1. Members receive substantial discounts to affiliated association events such as Seminars, Conferences, Workshops and a like.
2. Provides the latest news, a wide range of publications and resources to keep you informed.
3. To provide the updates on Special Issues in Indexed Journals/ Books.
4. To provide face to face networking opportunities for members.
5. To assist in organizing events such as FDP's, Seminars, Workshops and Conferences.
6. Student Author Travel Grant

Levels of Membership and Application Forms

The Society offers a range of individual membership levels to best fit the stage of your career. The information below contains details fee along with duration (in years).

S.No	Category	Membership Fee (Non-refundable)
1	Life Member	₹5000 (For Indian) / $100 (For Others)
2	Member	₹1000 (For Indian) / $25 (For Others) for One Year
3	Student Member	₹500 (For Indian) / $15 (For Others) for One Year
4	Platinum Member	₹12000 (For Indian) / $200 (For Others) for Ever

STEM AWARDS

Every year ***STEM Research Society Awards*** are generally given in the following categories:

- Frontiers of Knowledge
- Best Researcher (Female & Male)
- Young Researcher (Female & Male)
- Life Time achievement
- Best Academician/Teacher/Mentor
- Best Leadership

Nominations are open for the Best and Young Researcher Award. The award in this category is based on the following parameters:

- ✓ Scopus Citations
- ✓ Google Citations
- ✓ H and i10 Index
- ✓ Number of Research papers published/accepted in the year (2025 - 2026)
- ✓ Funded projects/Patents (filed/published/granted)/ Consultancy

The list of previous awardees is available at https://stemrs.in/awardee.php
For more details, please visit: https://stemrs.in/awards.php

The 5th Science, Technology, Engineering, and Management (STEM) Award Ceremony will be held at Nit Jalandhar, in December 27, 2025. This prestigious event celebrates the remarkable achievements of professionals in various fields, acknowledging their contributions to research, academia, and leadership. Awards are distributed across multiple categories for both male and female recipients. The Young Researcher Award recognized emerging talents making significant strides in their fields. The Best Academician Award honored outstanding educators for their dedication and impact on students and the academic community. The Best Leadership Award celebrated exceptional leaders driving progress and innovation. The Excellence in Research Award was given to individuals who have demonstrated groundbreaking research and significant contributions to their disciplines. Lastly, the Best Researcher Award acknowledged those with a consistent track record of high-quality, impactful research. The ceremony highlighted the STEM - Research Society's commitment to fostering excellence and innovation across science, technology, engineering, and management disciplines.

डॉ॰ बी. आर. अम्बेडकर राष्ट्रीय तकनीकी संस्थान, जालंधर, पंजाब
Dr B R Ambedkar National Institute of Technology Jalandhar, Panjab, INDIA
27 - 29 December 2025

SoCTA Series

मालवीय राष्ट्रीय प्रौद्योगिकी संस्थान जयपुर भारत
Malaviya National Institute of Technology (MNIT) Jaipur Rajasthan, India
27 - 29 December 2024

डॉ॰ बी. आर. अम्बेडकर राष्ट्रीय तकनीकी संस्थान, जालंधर, पंजाब
Dr B R Ambedkar National Institute of Technology Jalandhar, Panjab, INDIA
24 - 26 December 2023

विश्वविद्यालय प्रौद्योगिकी संस्थान, हिमाचल प्रदेश विश्वविद्यालय, समरहिल, शिमला
University Institute of Technology, Himachal Pradesh University Summerhill, Shimla
16 - 18 December 2022

भारतीय सूचना प्रौद्योगिकी संस्थान कोटा
Indian Institute of Information Technology Kota
17 - 19 December 2021

एसटीईएम अनुसंधान सोसायटी
In Association with STEM Research Society
25 - 27 December 2020

राष्ट्रीय तकनीकी संस्थान, पटना, बिहार
National Institute of Technology, Patna, Bihar
27 - 29 December 2019

डॉ॰ बी. आर. अम्बेडकर राष्ट्रीय तकनीकी संस्थान, जालंधर, पंजाब
Dr B R Ambedkar National Institute of Technology Jalandhar, Panjab, INDIA
21 - 23 December 2018

बुन्देलखण्ड विश्वविद्यालय, उत्तर प्रदेश, झांसी
Bundelkhand University Jhansi
22 - 24 December 2017

एमिटी विश्वविद्यालय, जयपुर, राजस्थान
Amity University Jaipur, Rajasthan
28 - 30 December 2016

https://socta.in/ || https://stemrs.in/