

9<sup>th</sup> International Conference  
on



Soft Computing : Theories and Applications  
December 27-29, 2024

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## SOUVENIR CUM BOOK OF ABSTRACTS



Organized by

Malaviya National Institute of Technology Jaipur,  
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मालवीय राष्ट्रीय तकनीकी संस्थान, जयपुर, राजस्थान, भारत

Editors

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Prof. Rajesh Kumar

Dr. Tarun K. Sharma

Dr. Om Prakash Verma

Dr. Jitendra Rajpurohit

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# Soft Computing: Theories and Applications (SoCTA2024)

December 27 – 29, 2024

Malaviya National Institute of Technology (MNIT) Jaipur Rajasthan, India

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**Dear Participants and Researchers,**

Welcome to the book of abstracts for SoCTA2024! 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 9th International Conference on Soft Computing: Theories and Applications (SoCTA 2024), being hosted by Malaviya National Institute of Technology (MNIT), Jaipur, from December 27–29, 2024. 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. SoCTA 2024 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, SoCTA 2024 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 SoCTA 2024 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 SoCTA 2024 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 SoCTA 2024 in the vibrant city of Jaipur.

**Warm regards,**

Organizing Committee – SoCTA 2024

**SoCTA (Soft Computing: Theories and Applications)** is now **Eight 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:**

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

9<sup>th</sup> in the series, SoCTA2024 held at Malaviya National Institute of Technology Jaipur (MNIT), Jaipur Rajasthan, INDIA in hybrid mode during December 27 – 29, 2024.

SoCTA2024 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 5 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 SoCTA2024 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. SoCTA 2024 is scheduled at MNIT Jaipur Rajasthan, India.

Looking forward to have your significant contribution in SoCTA Series...



## *Message from the Conveners*

It is our great pleasure to welcome you to the **9<sup>th</sup> International Conference on Soft Computing: Theories and Applications (SoCTA2024)** at MNIT Jaipur, Rajasthan, 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 SoCTA2024 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 SoCTA2024 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 SoCTA2024 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 SoCTA2024.

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

## Message

It is a matter of immense pride and pleasure for **Malaviya National Institute of Technology (MNIT), Jaipur** to host the **9th International Conference on Soft Computing: Theories and Applications (SoCTA 2024)** in collaboration with **Dr. B. R. Ambedkar National Institute of Technology, Jalandhar**, and the **STEM Research Society** from **December 27–29, 2024**.

The SoCTA series, which began its journey in 2016, has grown into a globally recognized platform for researchers, academicians, and practitioners to engage in vibrant discussions and explore advancements in soft computing. It is particularly significant that the **7th edition, SoCTA 2021**, was hosted at **IIIT Kota**, with its campus based here at **MNIT Jaipur**. Today, as we celebrate the 9th year of this impactful series, it is heartening to see its steady growth and enduring relevance.

Soft computing has transformed the way we approach complex, real-world problems, offering robust solutions through techniques such as fuzzy logic, neural networks, and evolutionary algorithms. SoCTA 2024 continues this tradition by providing a dynamic platform to present pioneering research, discuss emerging trends, and foster collaborations across disciplines.

At MNIT Jaipur, we are committed to promoting cutting-edge research and fostering academic excellence. Hosting SoCTA 2024 is a reflection of our dedication to advancing knowledge in this critical field. We are delighted to collaborate with **Dr. B. R. Ambedkar NIT Jalandhar** and the **STEM Research Society**, whose support has been instrumental in shaping this conference.

I extend my heartfelt congratulations to the organizing team, contributors, and participants for their efforts in making SoCTA 2024 a success. I look forward to the rich intellectual exchange and innovative ideas that this conference will undoubtedly inspire.

***As received in its original form from the Director's office – MNIT Jaipur.***

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**Professor Sankar K. Pal, FNA, FASc, FTWAS, FIEEE**  
**PRESIDENT**  
**(Distinguished Scientist and Former Director)**

**Founding Principal Investigator**  
**Center for Soft Computing Research**

December 06, 2024

## Message

It is an honor to write a few lines sharing my thoughts on the 9<sup>th</sup> International Conference on Soft Computing: Theories and Applications (SoCTA 2024), hosted by Malaviya National Institute of Technology (MNIT), Jaipur, in collaboration with Dr. B. R. Ambedkar National Institute of Technology, Jalandhar, and the STEM Research Society, during December 27–29, 2024.

Having had the privilege of serving as a keynote speaker at two previous editions of SoCTA, I have closely witnessed with pleasure the evolution of this conference in India. As I see, SoCTA will establish soon itself as a global platform for discussing and disseminating cutting-edge advancements in soft computing technology and applications and fostering collaborations across disciplines and geographies.

I believe SoCTA-2024 will continue this proud legacy and will offer an interactive platform to explore theoretical developments and state-of-the-art applications of soft computing paradigm, with emphasis towards AI and data science. The association with MNIT Jaipur, Dr. B. R. Ambedkar NIT Jalandhar, and the STEM Research Society will further enrich the quality and scope of this event.

I congratulate the organizers for their tireless efforts and extend my best wishes for a successful and academically impactful conference. I am sure the participants would benefit immensely from the deliberations.

I wish the event a grand success.

Sankar K. Pal  
(Padma Shri Awardee)  
National Science Chair, Govt. of India



प्रो० के० के० पंत  
निदेशक

Prof. K.K. Pant  
Director

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### Message

It is my privilege to share my thoughts for the **International Conference on Soft Computing Theories and Applications (SoCTA-2024)**. This conference serves as a significant platform to foster collaborations, share groundbreaking research, and advances the field of soft computing.

In an era of rapid technological advancement, soft computing techniques are playing a pivotal role in solving complex real-world problems across various domains such as artificial intelligence, machine learning, optimization, data mining, and more. This conference offers a unique opportunity to explore new theories, innovative applications, and interdisciplinary approaches that are shaping the future of soft computing.

I am definite that this conference will witness thought-provoking discussions, inspiring keynote speeches, and insightful presentations from experts and researchers from around the world. I hope this event will not only provide valuable knowledge but also encourage collaboration and networking among researchers, professionals, and academics.

The Honourable Prime Minister Modi ji's **Mission Karmayogi** underscores the need for continuous learning and adaptability among civil servants to navigate the demands of a digital and interconnected world. On a similar note, SoCTA-2024 is instrumental in bringing together Scientists, researchers, practitioners, and emerging scholars to explore innovative solutions and tackle societal challenges. The discussions at SoCTA-2024 serve as a testament to India's collective effort to advance Soft Computing, from **pattern recognition** to **Machine Learning**, **Computer Vision**, and **Generative AI**, all of which contribute to the development of technologies that meet human needs and aspirations.

As India advances toward its goal of **Viksit Bharat**, Soft Computing and AI will play a pivotal role in driving technological, economic, and social progress. I commend the organizers of SoCTA-2024 for their foresight in curating this impactful event, and I extend my best wishes for its success. May this conference inspire groundbreaking research, foster meaningful collaborations, and illuminate the path to a sustainable, inclusive, and innovative future.

With kind regards,

(K K Pant)





प्रो. राजीव आहुजा  
PROF. RAJEEV AHUJA  
निदेशक  
DIRECTOR

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ई - मेल / E-mail : [director@iitrpr.ac.in](mailto:director@iitrpr.ac.in)

## MESSAGE

It is an honor to contribute to the International Conference on Soft Computing Theories and Applications (SoCTA-2024). This event reflects the evolution of Soft Computing, from foundational techniques to cutting-edge Generative AI, aligning with the vision of a Vikasit Bharat, as envisioned by Hon'ble Prime Minister Shri Narendra Modi Ji.

Soft Computing, with techniques like Fuzzy Systems, Neural Networks, Evolutionary Computing, and Probabilistic Reasoning, offers innovative solutions to address imprecision and uncertainty. These methods have revolutionized industries, enabling advancements in speech/image processing, Machine Learning (ML), and Computer Vision, driving automation and decision-making.

The emergence of Generative AI exemplifies technology's shift from analysis to creation, with models such as GANs and Transformers. This technology is transforming sectors like healthcare, robotics, education, and the arts, showcasing India's potential for global leadership in innovation.

Soft Computing's role in nation-building is profound. It drives solutions for agriculture, smart infrastructure, healthcare, and education, supporting initiatives like Digital India, Make in India, and Skill India. By empowering India's self-reliance (Aatmanirbhar Bharat), Soft Computing accelerates the realization of a Vikasit Bharat, where technology addresses societal challenges and improves lives.

SoCTA-2024 serves as a dynamic platform for researchers, academicians, and young scholars to exchange ideas and develop solutions that align with national goals. This conference highlights India's commitment to leveraging technology for sustainable growth and global leadership.

I congratulate the organizers for hosting this impactful event and extend my best wishes for its success. May SoCTA-2024 inspire groundbreaking advancements, bringing India closer to Vikasit Bharat and reshaping the global technological landscape.

Jai Hind! Jai Bharat !

(RAJEEV AHUJA)



### MESSAGE

It's a great pleasure for me to learn that MNIT Jaipur in collaboration with Dr.B.R.Ambedkar NIT Jalandhar is organizing the '9<sup>th</sup> International Conference on Soft Computing Theories and Applications, Dec27-29, 2024 (**SOCTA 2024**). I am sure that the conference would provide a forum to all the academicians, industry professionals and researchers to exchange innovative ideas and information to explore the advances in the field of soft computing, both theory and applications in various domains for a smart and a better future. I am delighted to welcome all the delegates, invited speakers and other guests to **SOCTA 2024** and wishing the conference a great success. I would also like to thank all the organizers from both the institutions specially Dr.Om Prakash Verma and Prof.Tarun K. Sharma for their untiring efforts .



(Ajit Kumar Verma),  
Mentor, SOCTA 2024



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Ref. No.....*22*.....

Date : *07/12/2024*

## Message

It gives me great pleasure to extend my warm regards to the participants and organizers of the **9th International Conference on Soft Computing: Theories and Applications (SoCTA 2024)**, being hosted by **Malaviya National Institute of Technology (MNIT), Jaipur**, in collaboration with **Dr. B. R. Ambedkar National Institute of Technology, Jalandhar**, and the **STEM Research Society**, from **December 27–29, 2024**.

Having had the privilege of witnessing **SoCTA 2018** as the Director of **NIT Jalandhar**, I have observed firsthand the depth of intellectual engagement and the transformative role this series plays in advancing research in soft computing. It is truly commendable how SoCTA has consistently grown over the years to become a distinguished global platform for fostering innovation and collaboration.

Soft computing has emerged as a powerful paradigm, addressing complex, real-world challenges across diverse domains. The continued success of the SoCTA series is a testament to the dedication of its organizers and the enthusiastic participation of the academic and research community.

This year's conference at MNIT Jaipur, a premier institution known for its excellence, further strengthens the impact of this series. The association with NIT Jalandhar and the STEM Research Society reflects the spirit of collaboration that defines SoCTA's legacy.

I extend my heartfelt congratulations to the organizing team and all contributors for their efforts. I am confident that SoCTA 2024 will inspire groundbreaking ideas and foster meaningful collaborations.

**Best wishes for a successful conference!**

(Prof. Lalit Kumar Awasthi)



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प्रोफेसर यस सुन्दर  
Prof. S Sundar  
निदेशक  
Director

### Message

It gives me immense pleasure to extend my warm greetings to all the participants, organizers, and esteemed guests of the 9th International Conference on Soft Computing Theories and Applications (SoCTA-2024), being organized by MNIT Jaipur in collaboration with Dr. B.R. Ambedkar National Institute of Technology Jalandhar. Over the years, SoCTA has emerged as a premier platform for researchers, academicians, and industry practitioners to explore and exchange ideas in cutting-edge domains such as Soft Computing, Machine Learning, Quantum AI, Computer Vision, Autonomous Systems, and Robotics. This conference not only celebrates the journey of Soft Computing but also charts its transformative evolution toward Generative AI, addressing challenges of imprecision, uncertainty, and dynamic real-world complexities. The theme of SoCTA-2024 resonates with Hon'ble Prime Minister Shri Narendra Modi Ji's vision of Viksit Bharat by 2047. Through innovative solutions in areas like healthcare, agriculture, infrastructure, and education, Soft Computing and AI are instrumental in driving India's mission of Digital India, Make in India, and Aatmanirbhar Bharat. Conferences like SoCTA play a crucial role in fostering research and innovation, empowering aspiration India to achieve global leadership in technology.

I commend the organizers for bringing together over 350 participants from around the globe and curating a program enriched with keynote addresses, invited talks, and technical presentations. The publication of the conference proceedings in Springer's Lecture Notes in Networks & Systems (LNNS) series further underscores its academic significance. On this occasion, I urge all participants to leverage this platform to learn, collaborate, and innovate, contributing to a future-ready India and beyond. Wishing SoCTA-2024 grand success and looking forward to groundbreaking discussions that redefine the technological landscape.

  
Prof. S. Sundar  
Director, NIT Mizoram  
&  
Chair Professor, IIT Madras

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It is a privilege to share my thoughts on the occasion of the 9th International Conference on Soft Computing: Theories and Applications (SoCTA 2024), which will be hosted by Malaviya National Institute of Technology (MNIT), Jaipur, in collaboration with Dr. B. R. Ambedkar National Institute of Technology, Jalandhar, and the STEM Research Society, from December 27–29, 2024.

Having had the honor of serving as a keynote speaker at two previous SoCTA conferences, I have had the opportunity to witness firsthand the remarkable growth and evolution of this esteemed event. SoCTA has firmly established itself as a premier global platform for sharing groundbreaking developments in soft computing, encouraging cross-disciplinary collaboration and fostering connections across borders.

This year's conference continues to uphold this distinguished tradition, providing an excellent platform for exploring both the theoretical advances and real-world applications of soft computing. The partnership with MNIT Jaipur, Dr. B. R. Ambedkar NIT Jalandhar, and the STEM Research Society enhances the depth and breadth of the event, ensuring its success.

I commend the organizers for their unwavering dedication and extend my heartfelt best wishes for a successful and impactful conference. May SoCTA 2024 serve as a source of inspiration for innovative ideas and meaningful collaborations that will propel the field of soft computing to new heights.

Warm regards,

Prof. (Dr.) Swagatam Das,

Professor-in-Charge (2024 - 2026), Computer and Communication Sciences Division (CCSD),  
Professor, Electronics and Communication Sciences Unit,  
Indian Statistical Institute, Kolkata, India.

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### Message

It is a matter of great pride and joy to witness the 9<sup>th</sup> International Conference on Soft Computing: Theories and Applications (SoCTA 2024), being hosted by Malaviya National Institute of Technology (MNIT), Jaipur, from December 27-29, 2024. SoCTA, which began its illustrious journey in Jaipur in 2016, has become a hallmark event in the global soft computing community, bringing together researchers, academicians, and practitioners to exchange ideas and explore innovations.

The SoCTA series has truly carved its niche, growing steadily and now celebrating its ninth year. The 7<sup>th</sup> edition, SoCTA 2022, held at University Institute of Technology - Himachal Pradesh University Shimla, was a testament to the conference's commitment to excellence.

As someone who has closely followed the series, I am delighted to see the remarkable progress made by the team in maintaining the high standards and reputation of this conference. Their dedication and vision have been instrumental in making SoCTA an integral event for researchers worldwide.

I congratulate the organizing committee, contributors, and participants for their invaluable contributions. May SoCTA 2024 inspire meaningful discussions, groundbreaking research, and impactful collaborations. I look forward to the enriching interactions and innovative ideas that will emerge during this significant gathering.

Best Wishes

A handwritten signature in green ink that reads "A. J. Singh". The signature is fluid and stylized, with a long horizontal stroke at the end.

(Prof. A.J. Singh)

Director, University Institute of Technology  
Himachal Pradesh University Summerhill Shimla-177005  
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### Message

It is with great pride and immense satisfaction that I extend my warmest greetings to the participants and organizers of the **9<sup>th</sup> International Conference on Soft Computing: Theories and Applications (SoCTA 2024)**. This esteemed event, organized by **Malaviya National Institute of Technology (MNIT), Jaipur**, in collaboration with **Dr. B. R. Ambedkar National Institute of Technology, Jalandhar**, and the **STEM Research Society**, will take place from **December 27-29, 2024**.

Having had the privilege to serve as the General Chair for the SoCTA conferences from 2016 to 2020, I have witnessed the remarkable growth of this series since its inception. What began as a vision to create a vibrant platform for discussing and advancing research in soft computing has now evolved into an internationally recognized and sought-after conference series. Each year, SoCTA has grown in scope and impact, attracting researchers, academicians, and professionals from diverse fields and geographies.

The field of soft computing has become increasingly significant in addressing the complex challenges of our times. Techniques like fuzzy logic, neural networks, genetic algorithms, and hybrid methods continue to revolutionize areas such as artificial intelligence, optimization, and decision-making. SoCTA's mission to bring these innovations to the forefront has been both timely and transformative.

SoCTA 2024 marks another milestone in this journey. The collaboration with MNIT Jaipur, Dr. B. R. Ambedkar NIT Jalandhar, and the STEM Research Society adds immense value to this year's conference, ensuring its relevance and impact.

I congratulate the organizing team for their dedication and vision in upholding the legacy of SoCTA. I am confident that this conference will foster innovative ideas, inspire collaborations, and contribute meaningfully to the field of soft computing.



Ajith Abraham



Message



It is a privilege to share my thoughts on the occasion of the **9<sup>th</sup> International Conference on Soft Computing: Theories and Applications (SoCTA 2024)**, organized by **Malaviya National Institute of Technology (MNIT), Jaipur**, in collaboration with **Dr. B. R. Ambedkar National Institute of Technology, Jalandhar**, and the **STEM Research Society**, from **December 27–29, 2024**.

Reflecting on my experience as a keynote speaker at **SoCTA 2020**, held during the challenging period of the COVID-19 pandemic, I am reminded of the resilience and adaptability demonstrated by the organizers and participants. Despite the constraints of that unprecedented time, SoCTA 2020 upheld its commitment to advancing research in soft computing by seamlessly transitioning to virtual platforms, ensuring the exchange of ideas and fostering collaboration.

The success of SoCTA 2020 is a testament to the unwavering dedication of its organizers and the global research community. Now, as we gather for SoCTA 2024, it is inspiring to see the series continue its legacy of excellence, providing a robust platform for exploring cutting-edge theories and applications in soft computing.

This year's conference promises to build on its strong foundation, bringing together experts and young researchers to address contemporary challenges and share innovative solutions. I commend the organizing team for their efforts in elevating the conference's stature and fostering a culture of learning and collaboration.

I extend my best wishes to all participants and look forward to the inspiring outcomes of SoCTA 2024.

**P. N. Suganthan**

**KINDI Computing Research, Qatar University**  
**College of Engineering H07, Room B211, Office Number 6**

**Seyedali Mirjalili**

Professor, Director

Centre for Artificial Intelligence Research and Optimisation  
Torrens University Australia



### **Message**

Optimization plays an important role in solving complex real-world problems in both science and industry. It also serves as the driving force of Artificial Intelligence (AI). Many AI models depend on optimization to learn and improve their performance. Advances in optimization technique continue to push the boundaries of AI. As someone who had the pleasure to participate in SoCTA 2021 as a keynote speaker, I found this event quite engaging and inspiring. I am confident that SoCTA 2024 will further contribute to the growth of this exciting field.

**Seyedali Mirjalili**



**Message for the 9th International Conference on Soft Computing Theories and Applications (SoCTA-2024)**

It is a privilege to contribute a message for the International Conference on Soft Computing Theories and Applications (SoCTA-2024). This conference reflects the remarkable journey of Soft Computing, progressing from foundational tools to the cutting-edge domain of Generative AI. Soft Computing, with its techniques like Fuzzy Systems, Neural Networks, Evolutionary Computing, and Probabilistic Reasoning, provides innovative solutions to tackle imprecision, uncertainty, and approximation. From enabling pattern recognition in speech and image processing to advancing Machine Learning (ML) and Computer Vision, these methodologies have revolutionized industries by automating decision-making and interpreting complex data.

SoCTA-2024 serves as a dynamic platform to bring together global researchers, academicians, and young scholars to exchange ideas and innovate solutions aligned with these national aspirations. The conference underscores India's commitment to leveraging cutting-edge technologies for sustainable growth and global leadership.

I congratulate the organizers for hosting this impactful event and extend my best wishes for its success.



Jocelyn Faubert, PhD, FAAO

Professor

Université de Montréal



**L-Università  
ta' Malta**

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## **Foreword**

Dear Readers,

I am privileged and honoured to have been a keynote speaker at the inaugural International Conference on Soft Computing: Theories and Applications (SoCTA) in 2016, held in Jaipur. Since then, it has become one of



the most sought-after soft computing events and evolved into a world-renowned, high-impact conference attracting both established and emerging researchers from across the globe, showcasing their research, sharing their innovative ideas, and collecting feedback to improve their research work primarily in soft-computing but also in other related domains. The success of previous editions of the International Conference on Soft Computing: Theories and Applications (SoCTA) is a testament to the collective efforts of dedicated organising committees, esteemed speakers, and enthusiastic participants. It provides delegates with unique prospects to collaborate with other researchers to excel in their academic careers and amplify the impact of their contribution. I had the honour of delivering a keynote address at SoCTA2019. Again, this was a fantastic experience meeting

with so many distinguished experts shaping the landscape of soft computing. I am confident in the success of SoCTA2024, which is being organised once again in the 'Pink City' of Jaipur.

I look forward to participating in person and seizing this excellent networking opportunity. I am confident about SoCTA2024's success in achieving new milestones of excellence by attracting high-quality papers and fostering stimulating discussions advancing soft computing. I wish the organisers and all virtual and physical attendees all the best and rewarding success.

Best regards,

Prof Lalit Garg,

Associate Professor,

[Department of Computer Information Systems](#)  
[Faculty of Information & Communication Technology,](#)  
[The University of Malta, Msida, Malta](#)

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December 6, 2024

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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 ninth edition of the conference “**International Conferences on Soft Computing: Theories and Applications (SoCTA 2024)**” to be held in hybrid mode during 27 – 29 December 2024 and it is a delight to see the event growing every year.

It is a challenging time for everyone and an exceptional situation for conference organizers due to post-pandemic situation around the world. This unique situation has opened lots of new avenues for organizers, like organization of the conference in hybrid mode, and inclusion of more participants and speakers from across the globe by breaking the barriers of time zone.

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  
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Department of Applied Mathematics and Computer Science

Technical University of Denmark

Richard Petersens Plads, Build. 321, 134

DK-2800, Kgs. Lyngby, Denmark

Dear Organizing Committee,

I am writing to express my strong support for the Soft Computing Techniques and Applications (SoCTA'2024) conference, which will be held during the last week of this year at the Malaviya National Institute of Technology (MNIT) in Jaipur, India.

SoCTA has long served as an efficient platform for exchanging knowledge and recent advancements in the field of Soft Computing. It also significantly enhances networking and cooperation among professionals and scientists in this field.

The domain of Soft Computing is gaining significant prominence and relevance with the recent advancements in AI applications. It provides robust and innovative solutions for solving parametric systems in a wide array of fields, including Neural Architecture Search, Robotics, Intelligent Systems, and Data Science. Furthermore, it has the potential to include versatile tools, which are applicable across various type of problems and disciplines.

I am confident that SoCTA 2024, as it has successfully done for the past eight years, will provide valuable insights and foster collaboration among professionals, academicians, and scientists.

I congratulate the organizers for their dedication and efforts in arranging such an impactful conference. I am certain that the participants will greatly benefit from the meeting and enjoy the event.



Sebastian Basterrech

Postdoctoral researcher

DTU-Compute, Technical University of Denmark

## *Invited Talks*



### **Prof. KC Santosh**

Professor (AI) and Chair, Department of Computer Science  
UNIVERSITY OF SOUTH DAKOTA  
Founder & Director, 2AI: Applied Artificial Intelligence Research Lab  
Vermillion, South Dakota  
United States

**Prof. KC Santosh**, a highly accomplished AI expert—is the chair of the Department of Computer Science and the founding director of the Applied AI Research Lab at the University of South Dakota (USD). He also served the National Institutes of Health as a research fellow and LORIA Research Center as a postdoctoral research scientist, in collaboration with industrial partner, ITESOFT, France. He earned his Ph.D. in Computer Science—Artificial Intelligence from INRIA Nancy Grand East Research Center (France). With funding exceeding \$2 million from sources like DOD, NSF, ED, and SDBOR, he has authored 10 books and more than 250 peer-reviewed research articles, including IEEE TPAMI. He serves as an associate editor for esteemed journals such as IEEE Transactions on AI, Int. J of Machine Learning & Cybernetics, and Int. J of Pattern Recognition & Artificial Intelligence. He, founder of AI programs at USD, has significantly increased graduate enrollment by more than 3,000% in just three years, establishing USD as a leader in AI within South Dakota.

To name a few, Prof. Santosh is the proud recipient of the Visionary Leadership Award (University of Derby - UK, 2023) Cutler Award for Teaching and Research Excellence (USD, 2021), the President's Research Excellence Award (USD, 2019), and the Ignite Award from the U.S. Department of Health & Human Services (HHS, 2014).

Effective from Spring 2024, he has joined the NIST's AI Safety Institute Consortium, with USD being the only institution representing the state of South Dakota in this consortium.



### **Prof. Vijayan K. Asari**

Professor in Electrical and Computer Engineering  
Ohio Research Scholars Endowed Chair in Wide Area Surveillance  
Director, University of Dayton Vision Lab (Center of Excellence)  
University of Dayton, United States

**Prof. Vijayan K. Asari** is a Professor in Electrical and Computer Engineering and Ohio Research Scholars Endowed Chair in Wide Area Surveillance at University of Dayton, Dayton, Ohio. He is the director of the University of Dayton Vision Lab (Center of Excellence for Computational Intelligence and Machine Vision). Dr. Asari had been a Professor in Electrical and Computer Engineering at Old Dominion University, Norfolk,

Virginia till January 2010. He was the founding director of the Computational Intelligence and Machine Vision Laboratory (ODU Vision Lab) at ODU.

Dr. Asari received the Bachelor's degree in electronics and communication engineering from the University of Kerala (College of Engineering, Trivandrum), India, in 1978, the M. Tech and Ph. D degrees in electrical engineering from the Indian Institute of Technology, Madras, in 1984 and 1994 respectively. His doctoral dissertation was "Multiple Valued Logic Neural Network Architectures and Algorithms for Prediction, Classification and Recognition of Multi-valued Patterns" under the guidance of Dr. C. Eswaran at IIT Madras.



**Dr. Bijaya Ketan Panigrahi**  
Professor, Department of Electrical Engineering,  
Founder Head, Centre for Automotive Research and Tribology (CART),  
Indian Institute of Technology (IIT), New Delhi

**Dr. Bijaya Ketan Panigrahi** has been working as a Professor in the Department of Electrical Engineering since 2005 and was the founder head of Centre for Automotive Research and Tribology (CART) at the Indian Institute of Technology (IIT), New Delhi, India. He is the Indu Shrivastava & Serla Singh Chair Professor in Artificial Intelligence at IIT Delhi. Prior to joining IIT Delhi, he served as a faculty in Electrical Engineering Department, University College of Engineering, Burla, Sambalpur, Odisha, India from 1992 to 2005. His research focus is the design and develop artificial intelligence-based tools for the detection and classification of power quality events, fault diagnostics of induction motor drives, diagnostics of electric vehicle motors. He has investigated intelligent techniques for the design of maximum power point tracking controllers for the solar photovoltaic system. Professor Panigrahi is also actively involved in the research area of energy management in smart grid, EV charging infrastructures, impact of fast charging on the grid, EV battery technology, Battery Management System etc. He is mentor of many startups working in the area of EV charger design, Battery pack design and IoT devices for EVs. Dr Panigrahi has published more than 750 research articles in various international journals and conference proceedings. He is serving as the editorial board member / associate editor/ special issue guest editor of different international journals published by IEEE, IET, Elsevier, Springer etc. He is also associated with various international conferences in various capacities. He is a fellow of IEEE, Indian National Academy of Engineering (INAE), National Academy of Sciences (NASI), India, and Asia-Pacific Artificial Intelligence Association(AAIA).



**Mr. Aninda Bose**

Executive Editor

Research Publishing – Books || Interdisciplinary Applied Sciences

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**Mr. Aninda Bose** is presently working as Executive Editor with Springer Nature. Mr. Bose is part of the Global Acquisition Team at Springer Nature and responsible for acquisition of scientific content across the globe. He is responsible for acquisition of content in Interdisciplinary Applied Sciences. He has more than 27 years of industrial experience in marketing and different fields of publishing. Mr. Bose has completed Masters in Organic Chemistry from Delhi University and Masters in Marketing Research from Symbiosis Institute of Management Studies, Pune. Mr. Bose has delivered more than 160 invited talks on Scientific Writing and Publishing Ethics in reputed Universities, International Conferences and Author Workshops. He has published books for secondary level in Chemistry and is a member of American Chemical Society, USA.



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/>

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# Abstracts

## 31      **Review of Digital and Medical Image-based Compression Techniques**

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Compression is indispensable in various technologies to reduce data size for storage and transmission. It can be classified into lossless and lossy methods. This article surveys fundamental compression algorithms, including lossless, lossy, and near-lossy techniques, focusing on their application to images and medical endoscopic capsule images. Numerous studies have examined how these methods have evolved to meet current data quality, coding, and application requirements. The survey highlights the most effective approaches for future image and medical imaging compression.

## 37      **Enhanced Scalable Multicriteria Based Recommendation System Using Fuzzy Clustering**

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The large pool of data provided to select an item makes the decision for users very difficult so recommender systems are the technology that gets people out of the situation by providing them with small set of relevant items to select from. But not always the recommended set of items are accepted by the users, at some point any certain item might not align with their certain criteria for selecting items. so considering multiple criteria for any particular item can help in providing most relevant and accurate recommendations. This paper proposes an innovative approach to enhance the scalability and effectiveness of recommendation systems through the integration of fuzzy clustering techniques. Traditional recommendation systems often face challenges in efficiently handling large-scale datasets and providing personalized recommendations. By incorporating fuzzy clustering methods, this study aims to address these limitations by effectively segmenting users into clusters based on their preferences and behaviors. The proposed methodology involves the application of fuzzy clustering algorithms to efficiently categorize users and items, thereby improving the scalability and accuracy of recommendation systems. Experimental evaluations demonstrate the effectiveness of the proposed approach in enhancing recommendation quality and scalability, thereby providing valuable insights for the development of scalable recommendation systems in various domains.

## 41 Optimal Soft Computing Surrogate Models: Prediction of Self-Compacting Concrete Strength

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This paper presents the development of optimal machine learning-based models for the prediction of the compressive strength(CS)of self-compacting concrete (SCC). The models included regression models that are multi-parametric and optimal artificial neural networks (ANN). Gradient descent search was adapted in determining optimal regression models while Akaike's information criteria (AIC) blended with the best training strategy were used in the explorative search for optimal ANN topology. Around 900 data in-stances of SCC mix were used to find the models. The inputs used for this are quantities of mix ingredients such as quantities of cement, water-powder ratio, fine aggregate, fly ash, and coarse aggregate. Twenty-eight day's compressive strength formed the output. Results of the evaluation of the models indicated that, for the data considered, optimal ANN model of topology 5-13-1 is found to be the best with a high R2 value at 0.9 while the optimal regression models showed moderate prediction accuracy with R2 in the range of 0.7 -0.75.

## 42 Enhanced Recognition of Human Emotion via Multimodal Inputs using Fusion LSTM++ model

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Emotion recognition research in human-computer interactions has necessitated the development of automatic emotion identification systems. People's ability to identify their emotions may help them better manage their emotions and engage with different situations in their lives. Numerous studies have explored into emotion categorization methods, although the majority of them simply consider one, a small number, or independent physiological signs. Recognizing the importance of distinct signals and their integration operates will enable the development of further informative, economical, and objective techniques for detecting emotions, processing, and interpretations. In this paper, a novel FusionLSTM++ is proposed that integrates multimodal inputs such as audio, text, and motion data, including facial expressions and hand movements by employing a hybrid neural network approach. It involves designing separate classification structures for each modality and fusing the outputs at the final layer, resulting in more reliable and accurate emotion detection. Experimental evaluation on the IEMOCAP dataset demonstrates the effectiveness of our neural network-based framework in capturing nuanced emotional expressions, contributing to the advancement of multimodal emotion recognition in human-computer interactions.

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Evaluating credit risk in peer-to-peer (P2P) lending platforms is crucial due to the absence of information typically accessible through conventional banking channels. The financial systems integrity may be compromised if default risk is not accurately assessed. This research proposes an Outlier Detection with Borrower Network Similarity (ODBN) framework for enhancing the accuracy of credit risk assessment on P2P platforms. To achieve this goal, we suggest incorporating alternative data into conventional credit assessment methodologies. Initially, an unsupervised learning approach is used to differentiate between borrowers who exhibit unconventional behavior and those that follow regular borrowing patterns. The borrower network centrality measures are computed for these two categories of borrowers to provide alternative data. The predictive power of the similarities found in the regular borrower cluster samples is observed to be higher than that of the eccentric borrower cluster. To gain deeper insights into the results, the Shapley values are visualized as a network. The empirical findings on the Lending Club dataset suggest that the ODBN improves the models ability to explain and forecast with more precision.

## 56      **Choice of Baseline Model: Impact on Transfer Learning- Based Detection of Diabetes Retinopathy**

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One of the main causes of blindness is the eye disease known as Diabetic Retinopathy (DR). Diabetic Retinopathy is caused due to prolonged diabetes, so it is a chronic disease. The disease early detection can help to save the vision of the persons suffering with diabetes. The growth of exudates, hemorrhages, and microaneurysms shown in an eye image are clear indication of an unhealthy eye. Detection of DR can be categorized in multiple stages according to the disease progression showing features exhibited by the eye fundus images i.e. from early stage to advanced stage. In this paper, we have used two standard base deep learning models named as ResNet50V2, and VGG16 with combinations of Dense layers, Random Forest, Naive Bayes and Logistic Regression classifiers for detection of DR in five multiple categories. In our work, we have trained and validated these models over APTOS19 dataset provided by Kaggle dataset repository. Complete tables of the comparisons of the accuracies of various combinations of the deep learning models with other classifiers are given in the result section. In our proposed architecture, the ResNet50V2 with Logistic Regression classifier has shown the 99 % accuracy in training & 76% accuracy in the validation performance. It shows that, ResNet50V2 model has performed better than VGG16 model.

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The discipline of disease prognosis has recently garnered significant interest. In order to convert the input prediction signals into the estimated diseases for each patient, it is necessary to train a suitable classifier. However, to achieve accurate prediction outcomes, existing machine learning methods primarily depend on a substantial quantity of EMR training data that has been manually labelled. On the other hand process of converting data from different fields into graph topologies has become increasingly popular in recent years. Graph Neural Networks (GNNs) have become the widely accepted and commonly used tool for machine learning problems involving graphs. Additionally, neural network models such as the Multi-Layer Perceptron (MLP) can be represented as graphs. Here Graph Convolution Network (GCN) model along with its applications like link prediction and node classification is experimented on medical record consists of symptoms and disease information. Results are assessed on accuracy, precision and recall on all verticals like train, validate and test.

### **63 A survey on Machine Learning Based Reliability Solutions for Engineering**

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In many academic and industrial domains, machine learning (ML) is expanding quickly. Reliability engineering will very certainly follow suit. It has had a substantial influence on several engineering disciplines, including image analysis, voice recognition, and communication. It can be challenging to navigate and incorporate the existing, sprawling literature on machine learning for reliability engineering into a cohesive whole. By summarizing and guiding this developing analytical environment, as well as by stressing its key landmarks and roads in this article. This study will revisit and go through the research on the use of ML to reliability engineering and RUL forecasts. This study will review several academic works in each area and provide a synopsis of Deep Learning (DL) algorithms' use in diverse engineering systems to highlight their rising popularity and unique features. Finally, this study will summaries a number of exciting new approaches for using ML and DL algorithms to reliability engineering and RUL Predictions in the future. In general, study focus on employing ML and DL algorithms to address significant reliability engineering difficulties and for RUL forecasts.



## 64      Some Results in Modified Intuitionistic b-Fuzzy Soft Environment

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These days, a wide range of study fields successfully employ soft computing approaches, which are based on fuzzy logic, evolutionary algorithms, expert systems etc. This work establishes a new class of Modified Intuitionistic b-Fuzzy Soft Metric Spaces ( $\overrightarrow{MibFSMS}$ ). Basic properties and topological configurations are defined in the framework of this new idea. Furthermore, certain novel findings are examined, and examples are provided to support the findings' effectiveness. Additionally, an application is provided to demonstrate how the primary result can be applied.

## 73      A Optimal Solution for Video Forgery Detection using Optical Flow Method

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Initially communication was restricted only till texture documents. Currently due to advancement in network technologies and development of multimedia systems, it was possible to have communication using various multimedia elements like images, audio files, video files etc. Started from static images, where information captured was limited only in one frame and moving a way ahead on these lines we have reached to dynamic images where information is conveyed in number of frames which are synchronized for motion and sound. As information transfer increased thus video file communication on the internet along with added security and threats to it also increased. One such threat is hacking of video files. Within the domain of hacking, the focus of this paper is on video forgery. This paper, examines various aspects of video forgery and from its types and methods for video forgery detection, then the best suited method is selected and within it an optimal algorithm is suggested. The video forgery detection is proposed as a system design approach which exploits various cases of forged video types in terms of its detection going upto the level of identifying the forged object in it.

## 74      Impact of color channels on performance of U-Net for blood vessel segmentation

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Fundus photography is employed by medical practitioners to track advancement of specific eye conditions. Retinal blood vessels (BV) serve as a pivotal indicator for identifying and addressing retinal ailments hence accurately segmenting them is imperative for a thorough retinal examination. This paper focuses on the study of performance of different color channels on BV segmentation using U-Net Architecture. Statistical analysis was carried out on DRIVE dataset and it reveals significant variations in segmentation performance across channels. Green channel was most effective and showed best performance for BV segmentation. This can be ascribed to the enhanced contrast properties which

effectively delineate BVs from the retinal background. The red and blue channels, exhibit relatively poorer performance due to over-saturation and under-saturation issues respectively. Evaluation metrics like accuracy, sensitivity, specificity, precision and intersection over union (IoU) define the efficacy of results. Green cha.

## 76 Design of Targeted Rescue Operations Framework in Collapsed Infrastructure

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Traditional approaches to disaster management in collapsed infrastructure rely on manual search and rescue operations, which are time-consuming, inefficient, and risky for the safety of first responders. The absence of real-time data and situational awareness further complicates accurate decision-making and resource distribution. IoT technology provides an opportunity to revolutionize disaster management by employing smart building management systems for monitoring and early warnings. This paper studies the existing targeted Search and Rescue (SAR) operation frameworks and proposes a framework for SAR called Targeted Rescue Operations (TROPS), consisting of Infrastructure Management Systems (IMS) and Mobile Rescue Assistant Platforms (MoRAP) for rescuing victims based on the infrastructure criticality score (ICS). The ICS considers occupant count, habitability, and structural integrity. We implement an IoT-based architecture to collect the sensor data. To estimate the number of occupants, machine learning algorithms are applied to sensor data for passive detection. This approach aims to optimize search and rescue operations and thereby reduce rescue time.

## 83 Smart Farming: Integrating Remote Sensing Data and Machine Learning for Real-Time Crop Monitoring and Decision Support

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This research examines the integration of inaccessible detecting information and machine learning calculations for real-time trim checking and decision support in agribusiness, sup-orting the worldview of shrewd cultivating. Leveraging progressed advances such as IoT sensors, satellite symbolism, and information analytics, the study creates a comprehensive system to upgrade agrarian efficiency and maintainability. The exploratory comes about illustrate the adequacy of machine learning models, especially Random Forest, in foreseeing edit yields with an precision of 85%. Furthermore, the comparative investigation with relat-ed work exhibits the headways accomplished by the proposed approach in giving compre-hensive arrangements for accuracy agribusiness. The discoveries emphasize the transforma-tive potential of advanced advances in revolutionizing rural hones and advancing maintain-able nourishment generation. Moving forward, assist investigate is justified to investigate the adaptability and generalizability of the proposed approach over distinctive rural settings and trim sorts.

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This exploration researches judicious examination of student scholarly execution in the COVID-19 period through an information mining approach. Using algorithms, for example, decision trees, support vector machines, k-nearest neighbors, and random forests, the audit plans to perceive examples and patterns in student information to sort out scholarly outcomes. By gathering and preprocessing assorted datasets encompassing student economics, learning ways of behaving, and scholastic records, the examination plunges into the complicated transaction of variables impacting student accomplishment amid the pandemic. Through broad trial and mistake and evaluation, the survey accomplishes promising results, with algorithms reliably yielding high exactness, accuracy, audit, F1-score, and AUC-ROC values. The correlation with related work features the meaning of the disclosures in advancing perceptive examination in tutoring and watching out for the hardships introduced by remote learning conditions.

86      **A Deep Learning-based Hybrid Framework for Multimedia Data Processing in IoT Healthcare**

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In the realm of Internet of Things (IoT) healthcare, the efficient processing of multimedia data poses significant challenges due to the diversity and volume of information generated. This paper presents a novel Deep Learning-based Hybrid Framework (DLHF) designed to address these challenges by integrating advanced deep learning techniques with IoT infrastructure. The framework leverages convolutional neural networks (CNNs) for image and video analysis, recurrent neural networks (RNNs) for time-series data processing, and attention mechanisms for enhancing model interpretability and performance. Furthermore, DLHF incorporates edge computing capabilities to optimize resource utilization and reduce latency, crucial for real-time healthcare applications. The effectiveness of DLHF is demonstrated through experimental evaluations using a dataset of multimedia healthcare data, highlighting its superior performance compared to traditional methods. This framework not only enhances the accuracy and efficiency of multimedia data analysis in IoT healthcare but also establishes a foundation for future developments in personalized and responsive healthcare systems.

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The Air Quality Index (AQI) is a measure of the pollution levels in the air, usually developed by government agencies to convey the threat posed to the public by the pollution levels. In recent times, it has been observed that air pollution poses a major threat to public health during certain periods of the year. Since there is no universally accepted way of calculating AQI, this paper aims to predict daily AQI using a multi-pollutant index. Most of the research done on Indian data does not treat AQI as a time series but instead as a fully independent variable. To fill the gap in this area, an autoregressive approach to four classical machine learning algorithms, i.e., KNN Regressor, Random Forest, Decision Tree, and XGBoost was utilized. These models were trained on air quality data from metropolitan cities in India. The results have been evaluated in terms of the R<sup>2</sup> Score and Absolute Error and have been compared with state-of-the-art algorithms. An evolutionary approach to optimization was used to tune the hyperparameters of these models, utilizing a mixed continuous-discrete genetic algorithm, which drastically improved their performance. It was observed that AQI levels could be predicted at up to 97 percent accuracy using the genetically tuned XGBoost Regressor.

## 90      **Prediction of Chronic Kidney Disease Using Machine Learning Algorithms**

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Chronic kidney disease (CKD) is a persistent medical illness which may arise due to kidney cancer or impaired renal function. Despite the fact that it is possible to halt or slow the progression of this chronic illness entirely, it is also possible to stop or decrease the course of this condition to an end-stage when hemodialysis or surgical therapy is the only way to sustain the life of a patient. Timely identification and suitable treatment might enhance the probability of this occurrence. This study has explored the possibilities of several machine learning (ML) algorithms to diagnose CKD at an early stage. Initially, the research first considers 25 attributes, excluding the class attribute. However, it ultimately selects just 11 of these features as the subset for identifying CKD. Seven different ML classifiers were tested in a supervised learning environment. The experimental results revealed that the XGBoost classifier performed very well, with precision, accuracy, recall, and F1-score equivalent to 0.98. The study's methodology suggests that current advances in machine learning provide an intriguing opportunity to discover novel ways for evaluating prediction accuracy in the context of renal disease and other similar fields.

## 102     Agricultural Pest Classification using Dense Network with Statistical Approach to Dataset Balancing

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Agricultural pests cause significant damage to food crops globally, leading to food scarcity for the human population. Timely identification of pests is crucial for selecting appropriate pest control methods, which is not possible manually. Deep Learning methods have proved very efficient in this regard, and many pre-trained Convolutional Neural Network models, like ResNet, DenseNet, VGGNet, and Inception-based models, are available for image processing tasks. This paper proposes a statistical approach and oversampling using geometric transformations to reduce data imbalance in the IP102 dataset and implement multiple pre-trained CNN models to classify pest species to improve prediction accuracy.

## 103     MEMORY LANE - An Intelligent Assistant for Alzheimer's Patients and their Carers

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Alzheimer disease is a brain disorder that gradually weakens thinking and memory abilities, making it difficult for patients to recognize friends, family, and relatives. As the disease progresses, patients may struggle to use existing applications designed to help them identify their loved ones. To address this issue, this paper proposes an intelligent assistant for Alzheimer patients and their carers, named Memory Lane. Memory Lane works in four phases:

- An offline speech recognition system.
- A transformer-based intent classification model.
- A CNN architecture that generates face embeddings to compare L2 distances with existing stored embeddings for face recognition.
- A module that retrieves information from MongoDB and uses TTS for communication.

Overall, the proposed assistant, Memory Lane, has the potential to be a valuable tool in assisting Alzheimer patients and their carers, thereby improving their quality of life.

## 104     Optimizing Traffic Signal Control Using Reinforcement Learning

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Inefficient traffic light control systems contribute significantly to road congestion, leading to various issues. In this manuscript, we propose a reinforcement learning approach for optimizing traffic light control across diverse scenarios. We developed a customizable crossroads environment, allowing us to simulate multiple settings by altering specific variables. Our method employs the Q-learning algorithm to train the reinforcement learning agent. Finally, in order to validate our approach, we tested it in crossroad environments with moderate and low traffic congestion and obtained satisfactory results.

## 113 Genetic Algorithm-Driven Feature Selection Optimization for Skin Cancer Classification

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Convolutional Neural Networks (CNNs) have shown promising performance in automating the feature selection process for classification of images, yet achieving optimal performance remains a complex task. This paper proposes an evolutionary approach to optimize the feature selection classification of Skin Cancer (Benign vs Malignant). By using the pre-trained VGG-16 model to extract image features and then employing Principal Component Analysis (PCA) + Genetic Algorithm (GA) for feature selection, followed by a classifier to monitor accuracy, this methodology aims to yield a greater classification accuracy on minimum number of features. Artificial Neural Network and Random Forest Classifier were employed for classification. Accuracy of the classifiers was observed on both i.e. features optimized with only PCA and features optimized with GA driven PCA. Results of the Artificial Neural Network Classifier are compared with that of the ensemble classifier (Random Forest).

## 115 Explainable Transfer Learning for Maternal-Fetal Plane Classification

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Ultrasound imaging is the initial prenatal screening test to analyse fetal development and to evaluate any abnormalities. In recent times, deep learning techniques have shown promising results in automating the classification of maternal-fetal planes from ultrasound images. However, the application of deep learning faces several challenges including the issue of class-imbalanced data. Our model uses a pre-trained Xception module fine-tuned for maternal-fetal plane classification. To address overfitting and data scarcity, we incorporate a data augmentation module. Recognizing the importance of interpretability in clinical settings, our work integrates explainable artificial intelligence techniques into the classification framework. By employing class activation maps, we provide clear visual explanations for the models decision-making process, enhancing trust and understanding among medical experts. With an accuracy of 99.81%, this model demonstrates exceptional performance while addressing key challenges in the field, potentially improving prenatal care through more reliable and interpretable ultrasound analysis.

## 118 Concentration-dependent viscosity model of hybrid non-Newtonian nanofluid with thermal radiation, Ohmic heating and Cattaneo-Christov heat flux

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A numerical study on the thermal and mass transfer of magnetohydrodynamic (MHD) flow of a viscous non-Newtonian fluid over a stretching surface has been taken into account. A concentration-dependent viscosity fluid model has been employed to study the non-Newtonian behavior. Cattaneo-Christov heat flux model (CCHF) has been incorporated to study thermal and mass transport. Hybrid nanofluid has been used to increase the thermal performance. Consequences of thermal radiation, Ohmic heating, and slip boundary conditions have been scrutinized. Governing equations have been transposed into a



dimensionless system of ordinary differential equations (ODEs) by employing appropriate similarity transposition. Numerical scheme bvp4c in MATLAB has been incorporated to find the numerical solutions. Consequences of various controlling parameters on fluidic flow, thermal, and concentration profiles have been reported with graphs and tables. Analogy of the presented results with previously published data has been established.

## 127 Deep Learning-Enhanced Classification of Road Surface Conditions

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A major difficulty in infrastructure management is the identification of defects in road surfaces, therefore compromising the structural integrity of roadways and traveler safety. Conventionally, this problem has been solved with lengthy, costly, ineffectual manual inspection. Automated crack detection systems are absolutely necessary if we are to increase efficiency, save costs, and offer quick road repair actions. This effort attempts to use an automated crack-detecting method to overcome the limits of hand examinations. The proposed approach integrates a two-stage Convolutional Neural Network (CNN) for feature extraction with the Extreme Learning Machine (ELM) algorithm for effective classification, therefore utilizing developments in deep learning. The system is evaluated extensively using a custom dataset as well as the SDNET2018 data to determine its performance. The results show that the proposed model achieves higher accuracy in spotting road fractures than present techniques, so highlighting its ability to improve maintenance practices and hence support road safety via quick intervention. This approach offers a reasonable and cheap solution for a major infrastructure problem.

## 129 A comparative analysis of image steganography using discrete wavelet transform sub-bands

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Steganography is the method of conveying camouflage data over a suitable multimedia carrier, such as text, image, audio, or video files. The idea behind this is that if a feature is visible, the attack point is also apparent, hence the objective is always to hide the embedded data's existence. One of among the most popular techniques for concealing sensitive information is image steganography. Despite advances in steganography, little investigation has been done on the use of different DWT sub-bands for image steganography. With regard to image steganography, the purpose of this study is to assess and contrast the effectiveness of various DWT sub-bands. Using all the sub-bands for comparison analysis based on quantitative metrics including Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE), and Structural Similarity Index Matrix (SSIM), this paper adopted a secret image of the same size as the cover image. In comparison to the other two sub-bands, the experimental findings show that embedding in the middle frequency sub-bands yields more efficient results by achieving average PSNR of 44.5 dB.

### 131 Fractional Frangi: Retinal Vessel Enhancement Filtering

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Diagnosing diseases through retinal vasculature has long been a focus of medical research. However, segmenting vessels from retinal images remains challenging due to variations in image intensity and retinal vessel thickness. Existing enhancement filters often provide non-uniform responses across vessels of different radii and are less effective at vessel edges, bifurcations, and areas with vascular pathologies. Non-vascular structures often degrade performance, and some low-contrast small vessels are hard to detect after several down-sampling operations. To solve these problems, this study explores the use of multiscale second-order local structures to develop a vessel enhancement filter based on the eigenvalues of the non-local and non-singular fractional Hessian matrix. The suggested method's effectiveness is assessed using the publicly accessible dataset HRF and some authentic images from SMS Medical Hospital, Jaipur, India. Our findings indicate that the suggested method outperforms most listed techniques and achieves this with improved computational efficiency.

### 134 Optimization of Speech Emotion Recognition Based on Deep Learning Techniques

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Speech Emotion Recognition (SER) is essential for applications such as emergency situations, virtual reality encounters, interaction between humans and robots, and behavior analysis. Conventional methods extract significant characteristics from voice spectrograms using hand-crafted features and CNN, which frequently leads to high computing complexity. Using a key sequence segment selection technique and radial basis function network similarity measurement in the produced clusters, we present a novel SER framework. The discovered critical segments are transformed into spectrograms using the Short-Time Fourier Transform (STFT), which are further processed by a CNN (hyper parameter tuned) to extract discriminative features. After being normalized to ensure proper detection, these features are put into a deep bidirectional long short-term memory network to gain temporal information required for ultimate emotion recognition. Our strategy improves recognition accuracy and decreases computational complexity by processing critical portions rather than the complete phrase. Experiments on the RAVDESS datasets demonstrate the suggested model's efficiency and reliability, which surpasses the most sophisticated techniques with an accuracy of 84.15%.

### 137 Fractional Derivative Approach for Training of Neural Networks

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In the burgeoning field of fractional calculus, Neural Networks stand out as a particularly promising area. Fractional-based optimization algorithms have demonstrated remarkable effectiveness in the realm

of Neural Networks. Nonetheless, the intricacies introduced by fractional derivatives are significant and pose

Challenges when applied to deep neural networks, additionally failing to guarantee convergence. This study introduces a simplified version of fractional gradient descent that ensures convergence. The mathematical convergence for the proposed method has been verified. Additionally, the effectiveness of the modified fractional gradient descent approach was assessed on a number of datasets and contrasted with other well-known methods. Comparing the suggested method to the other methods, the analysis showed that it obtained a faster rate of convergence and provide better results.

## **142      Analysis of Supervised Machine Learning Algorithms on Polycystic Ovary Syndrome based on Age Segmentation in India**

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Ovaries are influenced by the common hormonal ailment known as Polycystic Ovary Syndrome (PCOS). There are sometimes irregularity in menstrual cycles, elevated levels of androgens (the hormone responsible for reproduction in males), and several small cysts on the ovaries. These factors can lead to symptoms like acne, greasy skin, weight gain, excessive hair growth, along with difficulties getting pregnant. If this sickness is not identified in a timely way, it may result in serious health issues. To solve the problem, this work employs a comparative analysis of categorization and prediction strategies. It also proposes the utilization of machine learning techniques to build an application for early PCOS prediction in based on certain age segment. Support Vector Machines (SVM), Random Forest (RF), and Logistic Regression (LR) are some of the machine learning techniques used to predict PCOS. Kaggle provides the necessary dataset. LR is able to determine with the highest accuracy in contrast to other state-of-the-art algorithms.

## **143      Deep Learning-Based Early Prediction Models for Ovarian Cancer**

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Accurate and early detection of ovarian cancer is crucial for effective treatment and improved patient outcomes. This paper investigates the use of deep learning models for classifying histopathological images of ovarian cancer. We employed five advanced convolutional neural networks DenseNet121, InceptionV3, VGG19, AlexNet, and ResNet50 to perform the classification task. The dataset comprised 10,000 augmented histopathological images, balanced between cancerous and non-cancerous classes. DenseNet121 and InceptionV3 demonstrated superior performance, with DenseNet121 achieving a validation accuracy of 97.47% and InceptionV3 reaching 98.20%. Both models exhibited high precision, recall, and F1 scores, making them reliable for diagnostic purposes. While VGG19, AlexNet, and ResNet50 showed comparatively lower accuracy, they provided valuable insights into the variability and complexity of the data, particularly in handling challenging cases. The study highlights the potential of deep learning models in enhancing the accuracy and efficiency of ovarian cancer diagnosis. Future work will focus on integrating additional image modalities and employing ensemble learning techniques to

further improve model performance. These advancements promise to support pathologists with more precise diagnostic tools, ultimately contributing to better clinical outcomes for patients.

#### 144     **An Advanced Methodology for Pavement Condition Assessment Using a Stacking Regressor Model**

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This article, which results from a sophisticated pavement condition assessment process, conducts a comparative analysis of machine learning models, focusing on stack regressor model which combines CatBoost and XGBoost as base estimators and Linear Regression as the final estimator. This method allows for exceptionally challenging data manipulation and feature interactions due to the unique properties of CatBoost and XGBoost utilizing key in-puts such as cracking percentage, plasticity index, maximum dry density, California bearing ratio (CBR), soil type, and layer thickness. A dataset of 2001 samples taken from the Indian road network is trained and validated. The result clearly shows that the stacking regressor model outshines the classical methods and other machine learning algorithms such as Random Forest, CatBoost, XGBoost, and LightGBM, out with the highest  $R^2$  scores (0.8055 for SCI and 0.7753 for BCI) and comfort with the lowest MSE (0.0208). The K-Fold Validation MSE for Stacking Regressor Model was found to be 0.0208 shows that the Stacking Regressor Model generalizes best for unseen data than standalone models, with CatBoost and XGBoost achieving slightly lower performance. SHAP analysis was performed which showed Cracking (%) being the most impactful feature among others and its high values push model output positively. This work presents the possibilities of combining advanced methods of machine learning in road management, which guarantee higher precision and speed, as well as cost-saving compared to traditional methods, i.e. the Flexible Weight Deflectometer (FWD) testing.

#### 146     **Diabetes Prediction in Females using Machine Learning Algorithms**

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A few of the ongoing diseases that are becoming more prevalent every year is diseases mellitus (i.e. Diabetes). Diabetes that is not under control may increase the chance of additional ailments like tumors, kidney failure, and eyesight. This paper conducting a comparative analysis to address the aforementioned problems, relying on classification and prediction techniques. In this research, classification techniques are used and data is sourced from the Pima Indian Diabetic Database at the UCI Machine Learning Laboratory. The dataset contains the female patient data. With the quick growth of machine learning, several facets of medical health have benefited. In this study, a comparative analysis has been conducted to pre-dict the diabetes in females using machine learning classification on a dataset that includes Support Vector Machine (SVM), Random Forest (RF) and Decision Tree (DT). After analyzing the statistical results, it has been observed that the RF outperforms with a maximum accuracy of 76%.

## 151 Stability analysis of a single species population model incorporating fuzzy quota harvesting

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In this work, an attempt to analyze a single-species logistic growth model with quota harvesting using fuzzy differential equations has been done. The model's parameters, such as the carrying capacity, intrinsic growth rate, population density, and harvesting coefficient, have been taken as triangular fuzzy numbers. Using the generalized Hukuhara derivative method, the solution process is carried out. The parametric restrictions have been obtained for the existence of equilibrium points and their feasibility. Further, the stability of the system has been analyzed analytically as well as numerically in different conditions. The phase portrait diagrams have been plotted for the sake of clarity in the analytical findings.

## 154 Bot-IoT Attack Detection Based on Hybrid Improved Grey Wolf Optimizer with Deep Model

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Cyberattacks are becoming increasingly complex and frequent, necessitating the importance using intrusion detection systems (IDS) to safeguard network perimeter. The advancement of Artificial Intelligence (AI) techniques resulted potential improvement in the effectiveness of IDS for detecting attacks. IoT is a significant contributor to increased data traffic and attack sources. It is necessary to extract significant features from the network traffic to construct the robust IDS model. So, this work aims to detect the IoT related attacks effectively on large volumes of network traffic using Improved Grey Wolf optimizer (IGWO) with a Vector Convolutional Network (VCN). The IGWO is proposed to select the important features from the large number of features to build the robust IDS using VCN. The proposed approach is experimented on two datasets: Bot-IoT and NSL-KDD. Bot-IoT which contains network traffic data generated by IoT devices, while NSL-KDD is a standard benchmark dataset for building the IDS. The proposed method effectively handles large volumes of network traffic data and shows better performance on both datasets.

## 155 Constructs Affecting Continued Intention to Use Digital Learning Technologies in Educational Institutions

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Despite the benefits of Digital Learning Technology (DLT) and its potential to produce deep insights and predictions, its adoption in educational institutions is still limited. Over the years use of digital learning technology has been increasing in India. To ensure inclusive and quality education, although there is an unprecedented opportunity for DLTs to be leveraged together with teaching learning methods but

because of limited resources, reliance on conventional methods, lack of training, management policies etc., still the educational institutions could not achieve the complete potential of these technologies. In literature, several theories such as TAM, ECM and UTAT have been used to model the continuance intention of the use of DLTs in educational institutions. This research-in-progress paper gives a background of existing continuance intention literature and theories and based on this it identifies the effective constructs for the continued usage intention of DLTs in educational institutions. Research findings indicate that Perceived Ease of Use (PEoU), Enjoyment (E), Perceived Usefulness (PU), User Perception (UP) and Computer Self Efficacy (CSE) are positively linked to Continued Intention.

## 156 Exploring Deep Learning Techniques for Topic Modeling of Natural Disaster Tweets

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The sheer quantity and depth of social media data has opened a gateway to understand more about human behavior during certain conditions. The advent of topic modeling models has significantly helped uncover underlying hidden patterns and offered new perspectives on interpreting social phenomena. However, social media content is often brief, text-based, and unstructured in nature, presenting difficulties for data collection and analysis. In this paper, we assess four topic modeling techniques: Latent Semantic Analysis (LSA), Latent Dirichlet Allocation (LDA), BERT Transformer, and Llama3 with BERTopic. We used tweets created during hurricanes, wildfires, blizzards, and floods and implemented an all-encompassing preprocessing pipeline that included stop-word removal, word vectorization, data cleaning, and the manual elimination of unimportant phrases. The findings reveal that while LSA provides broad thematic summaries, LDA is more adept at identifying distinct topics. BERT with Hierarchical Clustering performs well in capturing the general thematic context, whereas Llama3 coupled with BERTopic excels in distinguishing theme clusters and highlights nuanced relationships between subjects. The comparison of these techniques provides insights into the strengths and weaknesses of different topic modeling approaches and their suitability for analyzing social media content during natural disasters. Furthermore, it sheds light on the efficacy of using traditional topic modeling models and generative models in conjunction with topic modeling to analyze Twitter data.

## 158 Optimal policy for deteriorating items with green technology cost under price, advertisement and greening level dependent demand

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Greener products are growing more in demand as people are becoming more concerned about the environment. Advertisement and selling price of products are also important factors which play an important role in attracting attention of customers and influencing the demand of the products in business environment. Considering all these factors, an inventory model is developed in this article for non-instantaneously degrading items. The product's demand rate is influenced by advertisement, selling price and greening level of items. The holding cost per item per unit time is assumed to be linearly dependent on time. The purpose of this re-search is to find the optimal price, total cycle length and lot size which maximizes the overall profit. We use Mathematica to determine the optimal solutions. The



result reveals that the net profit is highly sensitive to the market potential. A numerical example is solved to validate the proposed model. Sensitivity analysis is performed to study the effect of important parameters on the overall profit.

## **162     Leveraging Artificial Intelligence (AI) in India's Healthcare Sector: Applications, Challenges, and Pathways to Achieving SDG-3**

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Despite facing numerous obstacles along the way, the health sector in India has emerged as the fastest-expanding industry. Notably, it is aided by the much advancement in technology, more so by AI. This chapter reviewed the current context and scenario of AI in the Indian healthcare initiative, providing potential applications, the challenges confronting it, and recommendations for reducing these obstacles. Artificial Intelligence (AI) is the use of technologies that first enable machines to understand, interpret, and then perform healthcare duties. It finds applications in various situations, including diagnostics, hospitals, medical supplies and insurance, drugs, and telemedicine etc. To effectively harness the power of AI on the path to achieving SDG-3 “ensuring healthy lives and well-being for all” actions will also be taken in terms of access to valid and reliable data, efficacious technology for human-machine interaction, handling of ethical, legal, and social consequences of AI, building the workforce capacity for the use of AI, fulfilling the R&D demands of AI technology, and carefully testing AI technologies. It is within these challenges that AI can make immense contributions toward the achievement of SDG 3 in India.

## **169     Soft Computing Applications for Time-series Prediction of PM2.5 concentration using Python**

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This study presents an autoregression model developed in python platform for time-series prediction of PM2.5 at Anand Vihar location in New Delhi, India. The study analysed both fixed and rolling autoregression models for predictions. The hourly PM2.5 concentration data of the region has been collected and used for training of proposed model. The performance of the proposed model has been analysed in terms of mean absolute error (MAE), root mean squared error (RMSE) and mean absolute percentage error (MAPE). The outcomes specify superior performance of rolling autoregression model developed in python thereby giving lower error responses compared to fixed autoregression model. The MAE, RMSE and MAPE obtained for rolling autoregression model for a maximum multistep ahead prediction of 7 hours<sup>TM</sup> duration was 7.09  $\mu\text{g}/\text{m}^3$ , 8.10  $\mu\text{g}/\text{m}^3$  and 1.88% respectively.

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This article presents nonlinear autoregressive neural network for time-series prediction of seasonal monsoon rainfall in India during the month of July. Real-time data of past 119 years has been considered for the training of proposed model using three different machine learning algorithms namely Levenberg-Marquardt (LM), Scaled-Conjugate Gradient (SCG) and Resilient Backpropagation (RP). The performance of these algorithms has been compared in terms of mean absolute error (MAE), root mean squared error (RMSE) and mean absolute percentage error (MAPE). The findings highlight superior performance of LM-algorithm compared to other two machine learning algorithms.

### 171 Unified Scoring and Topic Modeling: A Combined Approach for Superior Multi-document Summarization

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With the growing volume of text documents, finding relevant information online has become increasingly difficult. Automatic Text Summarization (ATS) offers a solution that allows for the processing of extensive collections of documents and the efficient extraction of the most relevant content. Despite significant progress, ATS still faces challenges such as managing long and repetitive sentences, preserving textual coherence, and maintaining semantic alignment. This work introduces an extractive text summarization approach based on topic modeling to address these limitations. The proposed method focuses on producing summaries with highly representative sentences, reduced redundancy, concise content, and strong semantic consistency. Its effectiveness is demonstrated through experimental evaluations on DUC datasets, where it performs better than state-of-the-art techniques.

### 184 Dementia and its Subtypes: A Statistical Review

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According to the Alzheimer Report 2022, dementia is a serious global health issue that now affects over 55 million people globally and accounts for around 10 million new cases each year. Dementia is the sixth most common cause of death among chronic illnesses, which highlights the urgent need for sophisticated diagnostic equipment. With 60%–70% of cases, Alzheimer's disease (AD) is the most common kind. It is followed by Parkinson's-related dementia, vascular dementia, lewy body dementia, and frontotemporal dementia. Forgetfulness (affecting 80%–90% of patients) and item misplacement (60%–80%) are common symptoms. The diagnosis of dementia may benefit greatly from recent developments in artificial intelligence. Dementia phases have been successfully detected using machine learning techniques such as ensemble learning, gradient boosting, and support vector machines (SVM). Similarly, deep learning models like CNNs, CNN VGGNet, RNNs, and LSTM networks have found considerable

success. With impressive accuracies of 96.64% and 98.39% on MRI-based pictures from the OASIS dataset, a novel method called ADCPBOBM demonstrated its resilience over a range of dataset sizes.

#### **188      Applicability of Chaos Theory to Artificial Protozoa Optimizer**

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Swarm algorithms are an efficient means of optimization. They work by leveraging a population of solutions that move towards one of the best solutions using different equations based on the different natural mechanisms adopted in the algorithms. Chaos theory has been studied by numerous re-searchers to enhance the optimization prowess of different swarm algorithms. This work explores the optimization of the Artificial Protozoa Optimizer, a recently discovered swarm technique, using 10 different chaotic functions. The efficiency of the suggested approach is assessed in several dimensions and different optimization functions. The outcomes validate the effectiveness of the chaotic maps to improve the potential of Artificial Protozoa Optimizer as a reliable optimization method.

#### **190      An Ensemble Approach for Student Academic Performance Prediction**

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The academic success of students is the top-priority objective of all institutions across the globe because it is a widely accepted indication of their overall reputation and ranking in the educational field. Institutions can benefit significantly from academic performance prediction models, which can assist them in providing excellent resources and learning experiences to students, thereby ensuring their retention in the academic arena. As such, predicting student academic performance using educational datasets has become one of the most essential components of the technology-assisted educational environments of the present times. This study proposes a robust prediction model using the Extreme Learning Machine (ELM) and Random Forest (RF) complementary strengths. Using ELM facilitates quick learning speed and underlines the ability to efficiently handle large-scale data to map input data features. The RF classification technique, noted for its accuracy and capacity to handle complicated feature interactions, classifies the mapped features. The E-RF hybrid model involving ELM's feature extraction and RF's classification capabilities yields improved prediction accuracy and computational efficiency, as is evident from the experimental results.

#### **192      An Empirical study on Tea Leaf Disease Detection on utilizing Diverse Leaf Image Features**

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In this study, a machine learning (ML) based method is proposed for the early detection of plant leaf diseases. Tea leaf disease detection plays a crucial role in enhancing agricultural productivity and ensuring the health of tea plantations. In this study, a comprehensive methodology for tea leaf disease detection utilizing image processing (IP) and machine learning (ML) techniques is presented. Our

approach involves the extraction of diverse features from tea leaf images, encompassing color, texture, shape, and size attributes to capture a wide range of characteristics indicative of disease presence. These features are then utilized to train and evaluate a classification model capable of accurately distinguishing between healthy and diseased leaves. Experimental findings underscore the efficacy of our proposed approach in accurately identifying tea leaf diseases, thus facilitating the advancement of plant disease management strategies within the tea cultivation domain enhancing agricultural productivity and ensuring the health of tea plantations.

## **206 YouTube Creator inspired Optimization and Hybrid Invasive ductal carcinoma - Ficus religiosa Root Search Algorithm**

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Advanced YouTube creator's inspired optimization (AYC) algorithm and Invasive ductal carcinoma optimization Algorithm (IDC) are applied for solving the factual power loss diminution problem. YouTube creator inspired algorithm is grounded on strategy, creating content with reference to objective of the channel. Exploitation segment is based on the continuously keeping the subscribed and non-subscribed audiences by the YouTube creators. YouTube creator inspired optimization algorithm is combined with Cape dune mole-rat optimization algorithm to boost the exploration competence of the process. Invasive ductal carcinoma algorithm is based on evolution and rise patterns of Invasive ductal carcinoma. Algorithm is modeled by encompassing the infiltrating ductal carcinoma adjusting propensities, optimal development situations will prevail within the breast. After the determination the size of the infiltrating ductal carcinoma, progression of the infiltrating ductal carcinoma in the breast has to be analyzed and infiltrating ductal carcinoma cell may grow in another region of the breast in exponential mode. Infiltrating ductal carcinoma cells will spread from the breast to other body parts and mutation factor has been integrated to emulate the spreading factor.

## **212 Performance Evaluation of Machine Learning Models on Loan Default Prediction Using Artificial Bee Colony for Feature Selection**

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This study addresses the challenges of loan default prediction and credit card fraud detection, crucial for financial stability and consumer trust. It evaluates the performance of Support Vector Machine (SVM) and Naive Bayes models, focusing on feature selection using the Artificial Bee Colony (ABC) algorithm. The ABC approach is applied to the Kaggle European cardholder dataset for feature reduction, followed by categorization of fraudulent transactions using Naive Bayes and SVM. The SMOTE method is used to handle the highly unbalanced dataset. Performance is measured using precision, recall, f-measure, and accuracy. The results show that the ABC-SVM algorithm achieved 95.4% accuracy, while ABC-NB reached 89.3%, outperforming traditional and population-based feature selection methods.

## 213 YOLO for Urban Traffic: Insights from Helsinki Port Surveillance

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Computer vision and real-time object detection and classification play a crucial role in modern surveillance systems that enhance public security and traffic management. YOLO-based object detection techniques for urban environments are thoroughly examined in this paper, focusing on the areas around the Helsinki port. By utilizing live stream data, the research examines and depicts the challenges of object detection and classification in real life scenarios. Unbalanced data distributions, variable camera angles and different weather and lighting conditions posed several challenges, prompting innovative solutions. This research work not only discussed these challenges, but also provides detailed insights into the data collection and model training methodology. To guarantee the dataset accuracy and diversity, several sophisticated methods were analyzed, such as binary filter masks and Computer Vision Annotation Tool (CVAT) annotations. The datasets were used for training various YOLO (You Only Look Once) models, to compare efficiency, accuracy and speed.

## 215 A Comprehensive Review of Steganography Techniques using Object Detection

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Steganography is the art of hiding a message within another message, and it has been used for centuries to protect sensitive information. Steganography is a critical tool for ensuring the confidentiality and integrity of information in various fields, including military, business, and social media. Several steganography techniques have been proposed in the literature, including traditional, machine learning, and deep learning-based approaches. The utilization of machine and deep learning techniques enhances the capabilities of steganography concealment methods, including the application of object detection. Despite the progress made in steganography research, there is still a lack of comprehensive studies that compare the performance of different object detection techniques for steganography. This study aims to fill this knowledge gap by providing a comprehensive review of steganography techniques based on object detection. The aim of this study is to provide a comprehensive review of steganography techniques based on object detection and to identify the most effective techniques.

## 221    **A Critical Analysis of Recent Advancements in CNN-Based Image Segmentation for Brain Tumor Detection**

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A human body is a system of many organs and structures and the most important and sensitive is the brain. Now, one of the well-known causes of brain dysfunction is a tumor that is classified as the uncontrolled growth of excessive cells. These cells consume nutrients that would otherwise go to healthy cells resulting in brain failure. In the past, doctors must literally look at Medical Resonance images to identify the exact locations of tumors in the brain as well as their size which is time consuming and is also very subjective in terms of the data acquired. Central nervous system cancer, or more specifically brain cancer is an occupying disease that has led to the loss of numerous lives and due to this, its diagnosis at the early stage of development is crucial. This review is centered on the Convolutional Neural Network (CNN) based image segmentation for the detection of brain tumors. They use different techniques of image processing such as image segmentation, image enhancement, and feature extraction to enhance the tumor detection in MRI images better and faster. The detection process involves four key stages: It mainly includes image pre-processing, image segmentation, feature extraction, and classification. It was noted that demonstrating the effectiveness of image processing and neural networks in identifying and classifying brain tumors in MRI scans.

## 225    **Deep learning-based hate speech detection: Comparative methodologies and Performance assessment**

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The identification of hate speech has emerged as a crucial responsibility for upholding civil debate and guaranteeing user security on internet platforms. This paper presents a technique that uses a dataset that has been adversely evaluated by people to identify hate speech in Wikipedia comments. Convolutional neural networks and bidirectional long short-term memory (BiLSTM) networks are the primary models utilized in this study for the categorization of hate speech.. In this paper strategies are being used to address imbalanced classes and preprocess the data to obtain pertinent features. It is shown through considerable experimentation that our suggested approach is effective in accurately detecting instances of hate speech. To demonstrate the superiority of our model in terms of performance measures like precision and recall this paper also does a comparative analysis with existing approaches. Results support the continuous efforts to create a more welcoming and courteous online environment by highlighting the significance of utilizing cutting-edge DL algorithms for identification of hate speech in online forums.



## 230 Analyzing the enablers of women entrepreneurial orientation-The impact of personality using interpretive structure modelling and MICMAC

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Women are globally acclaimed as worthy entrepreneurs but in context to several developing nations like India, they are less engrossed in entrepreneurial ventures. In India less number of women possesses entrepreneurial orientation and as a result, this distends the challenge of development through sustainability. Personality factors significantly impact women orientation towards entrepreneurship. The measurement of such factors can be done using different personality dimensions like openness, conscientiousness, extraversion, agreeableness and neuroticism. The objective of present article is to identification of big five traits of personality as well as their impact in promoting entrepreneurial orientation among Indian women. Therefore, after an (SLR) i.e. systematic literature review, 13 crucial personality dimensions are identified and extracted. Further, a field enquiry and investigation including brainstorming sessions as well interview sessions with different experts in industry resulted in 5 dimensions of personality, finally. Total 22 experts participated in interview as well as brainstorming session. In order to find out the hierarchical interaction between dimensions, an ISM (interpretive structure modelling) has been used in the present re-search. To identify driving personality dimensions of women entrepreneurs in India, Fuzzy MICMAC approach has also been employed in this research. The findings suggest that 5 dimensions, (OCEAN) play a very important role in creating entrepreneurial orientation among women. The outcomes of the study can help the government, policy makers and academic institutions effective policy management and development of an entrepreneurial arena which can facilitate in creation of more women entrepreneurs in an economy.

## 237 Early Detection of Alzheimer's Using Customised Lightweight 3D CNN Architecture

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Alzheimer's Disease (AD) is a neurodegenerative disorder which progresses gradually and worsens over a period resulting in cognitive decline and affecting the motor skills of the person. As there is no cure for dementia, it is imperative to seek the assistance of medical professionals to curtail its progression. Further, accurate diagnosis at an early stage is very much essential to increasing the lifespan of the patients. Various Deep Learning techniques have recently been employed as promising tools for faster and more accurate detection and classification. This paper proposes a novel custom 3D CNN architecture based on a 3D extension of LeNet. This method ensures a more lightweight and quicker binary classification of Alzheimer's disease even on a small dataset. 3D MRI images from the ADNI dataset were used for training and testing. The proposed custom 3D CNN is compared with the existing 3D LeNet and 3D UNet models in terms of accuracy, loss, time per epoch, sensitivity and ROC AUC. It is found to outperform the existing architectures.

## 239 Optimizing Fraud Detection by Integrating Ensemble Methods and Neural Networks

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Over time, fraudulent online transactions have resulted in significant losses and harm for both individuals and businesses. The proliferation of advanced technology and global connectivity has contributed to an increase in the number of cases of online fraud. Strong fraud detection systems must be created in order to counteract these losses. The correct identification of fraudulent transactions depends heavily on machine learning methods. Nevertheless, there are obstacles to overcome when putting fraud detection algorithms into practice, including uneven class distributions, sensitive data, and restricted data availability. The secrecy of records makes it more difficult to make deductions and create better models in this field. By utilizing the Credit Card Fraud dataset, this study investigates various algorithms such as Logistic Regression, Random Forest, XGBoost that are appropriate for categorizing transactions as either authentic or fraudulent. By comparing all three algorithms XGBoost gives better accuracy of 98%.

## 240 Bus Arrival Time Prediction with LSTM Networks and CTGAN-Augmented Data

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Bus transport if provided effectively can reduce private car usage and fuel consumption, and alleviate traffic congestion and save energy consumption. However, travelers care about waiting times, which depend on accurate information about bus arrival times. This information is influenced by various factors such as time, day, and distance. In this paper, we explore the design and implementation of a predictive model to estimate public transport demand in Nairobi, focusing on factors such as day of the week, time, and distance. We outline a comprehensive workflow that encompasses data preparation, feature engineering, data scaling, and model development. Due to the small size of the available data, we employed a Conditional Tabular Generative Adversarial Networks (CTGANs) to enhance the quality of the dataset for better predictions. We compare the distribution of ground truth and synthetic data and used Long Short-Term Memory (LSTM) networks to predict bus arrival times. Our results show that the models performance improves when using a combination of ground truth and synthetic data. We also compare the performance of LSTM with Artificial Neural Networks (ANN) and other machine learning models, demonstrating the superior accuracy of LSTM in this context.

## 242 A Hybrid Improved Particle swarm optimization and Genetic algorithm for energy efficient task offloading in Industrial IoT

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Mobile Edge Computing (MEC) is a growing concept that expands on cloud computing technology. It leverages edge infrastructure to efficiently manage computationally intensive and time-sensitive tasks. By tapping into the capabilities of 6G network infrastructure, MEC can effectively reduce latency by transferring computing tasks from edge devices to edge servers. As part of Industrial 4.0 revolution, the use of large number of IOT sensors, edge de-vices, and edge servers are increasing at rapid phase. To effectively process these sensor and device data with less power and low latency is a key challenge. Here comes the need for an effective task offloading strategy to edge servers. This strategy must meet the industrial automation requirements of reduced energy usage and faster processing. A solution based on an Improved Particle Swarm Optimization with Genetic Algorithm (IPSOGA) is de-signed. It harnesses the power of effective exploration using Particle Swarm Optimization (PSO) and maintain genetic diversity within the population using Genetic Algorithm (GA). This hybrid approach is powerful in solving complex optimization problems with the aims to effective resource allocation, faster task offloading decisions, and consequently reduce processing delays. The proposed IPSOGA is compared with popular metaheuristic algorithms like Genetic Algorithm (GA) and Simulated Annealing (SA), and it has been proven to be superior in task offloading strategy by effectively reducing processing delays, energy consumption, and optimizing resource allocation efficiently.

## 243 Sign spotting for Indian sign language

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Humans communicate to share information and build relationships with each other. This method uses modalities such as speech, hand gestures and facial expressions to communicate with others. Despite the prevalence of spoken communication, individuals with speech and hearing impairments heavily rely on nonverbal modes of communication such as hand gestures, facial expressions etc. Hearing-impaired individuals communicate through visual language which uses hand gestures, facial expression and body movements to convey the information. Indian Sign Language (ISL) is other sign language rich in syntax, context and grammar. Education systems, other public sectors should have flexibility to communicate with hearing impaired individuals as well. Hence this work aims to build Sign Spotting method which helps in the accessibility of signs in the sign language data. This work presents the method for spotting Indian sign language at word levels in a continuous sign language video. For this task, publicly available ISL data was used, but customized it as per requirement by annotating gloss signs in multiple Indian sign language videos which have starting and ending timestamp. Our work helps to predict the gloss signs and their respective start and end timestamps in a continuous ISL video. This work uses Inflated-3D model and Spacial-Temporal models for extracting important features from the videos. Then use a temporal module for concatenating and spotting the signs. The precision, recall, and F1-score of our work are 0.545, 0.514, and 0.529 respectively. This is calculated using intersection over union (IoU) technique

to get a better insight about the results. This methodology aims to enhance the accuracy and adaptability of sign language recognition systems, contributing to a more effective and inclusive approach in interpreting Indian Sign Language.

## **248     A Visual Fingerprint Update Algorithm Based on Crowdsourced Localization and Deep Learning for Smart Internet of Vehicles (IoV)**

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With rapid advancements of the Internet of Vehicles (IoV), securing vehicular communications becomes highly important. In this paper, a visual fingerprint up-date algorithm is proposed for smart IoV systems by relying on crowdsourced localization and deep learning. The vehicles utilize their sensors to acquire some location data to be transmitted to the cloud, and a framework is developed. This, therefore, justifies creating a real-time localization database that accurately produces the localization database. In such a design, using visual data from vehicles, the model is deep learned in a way that learns characteristics about locations and generates visual fingerprints for security purposes. In this case, the generated visual fingerprints update regularly to ensure reliability. The algorithm has been rigorously tested on real-world data; its performance in vehicle localization and visual fingerprint updating is accurate, and it also robustly defends against environmental challenges such as lighting and weather changes. The crowdsourcing and deep learning-based updating algorithm of visual fingerprint enhances the security system of smart IoV. The real-time update flexibility is provided by the algorithm. Algorithmic model updates enable it to adjust and adapt more dynamically to changing road conditions, thus making false positives or negatives in authenticating the identity minimal and enhancing vehicular communication security.

## **249     Dropout and its role in Neural Network**

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When talking about complicated machine learning systems, it is usual to assume that deep neural networks with plenty of parameters are the way to go. On the other hand, over fitting is a common problem with big network systems, which can cause poor performance. Consequently, effectively managing problems like over fitting becomes challenging. Dropout is the most effective strategy for addressing such difficulties. Over the course of the training process, the notion entails removing units and their connections from the neural network in a random fashion. This makes it difficult for units to co-adapt to an extreme degree. Throughout the training process, dropout will select samples at random from a collection of thinning networks. By utilizing a single network with reduced weights. This technique mitigates over fitting and yields significant enhancements compared to alternative regularization approaches. This study focuses on increasing the efficiency of systems in supervised learning applications such as vision, recognition of speech, text classification, and biological computation. This is to achieve state-of-the-art results on various benchmarked datasets.

## 250     **An adaptive Statistical Sugeno-Takagi Fuzzy Logic System for Damage Identification in Structural Elements**

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The challenge of identifying the location and degree of structural damage from measured modular test data is discussed in this work. Reverse engineering is used in this procedure to find structural element faults. Direct techniques, such as the dynamics method, are used to obtain vibration test data. However, traditional approaches are expensive and time-consuming. Sugeno-Takagi FIS has thus been employed in this instance to train the data and discover a global solution for crack location prediction. However, it has been noted that the Sugeno-Takagi FIS is insufficient for training the dataset. Most of the time, mistakes and uncertainty are present in the data that was gathered to create the data set. Even while applying machine learning and artificial intelligence techniques has many benefits, they are nonetheless limited by the lack of a data set. Errors are added to the data set as the data is being collected. Therefore, a cleaning procedure that reduces mistake must exist. In this study, the Sugeno-Takagi FIS was subjected to the boot strapping method, and the outcomes are contrasted.

## 263     **E-Commerce Fake Review Detection using Natural Language Processing**

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In this era of booming e-commerce, online reviews carry an enormous amount of influence on the choices of consumers. This research works on distinguishing between original and spurious product review publications gathered from Amazon. The overall approach uses multiple natural language preprocessing techniques-terms, tokenization, stemming and efficient machine learning classification algorithms like Random Forest, Neural Networks, and others. The objective is to create a correct, highly accurate model to enhance the fake review classification system. There were extreme evaluation measures, including accuracy and precision. The best performer was Extreme Gradient Boosting, reporting an accuracy of 0.9018. It has the additional interesting implication on how one can take steps further in the improvement of performance of such a model by employing strategies such as cross-validation and adjustment of hyper parameters for robustness against overfitting. With a clear methodology and results that are very attractive, the research effort contributes to a very significant task in identifying authenticity in online product reviews.

## 267     **A Novel Deep Learning Framework with Global Attention Mechanism for Enhanced Heart Disease Detection and Prediction**

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Heart disease, more commonly known as cardiovascular disease (CVD), is a leading cause of mortality besides disability internationally, heart disease claims the lives of 18 million people annually. They can

save lives by finding those at risk of heart disease and giving them the treatment they need before it's too late. There is an urgent need to develop more precise and efficient detection tools for cardiovascular illnesses since they pose a major threat to public health around the world. Nowadays, medical professionals rely heavily on machine learning algorithms, particularly for disease diagnosis using medical databases. Such powerful algorithms and data processing methods have great promise for the accurate prognosis of cardiovascular disease, among other disorders. Thus, this research builds a deep learning model for heart disease estimate using feature selection as an input. For the feature selection procedure from the pre-processed datasets, a modified version of the freshly introduced crayfish optimisation algorithm (COA) is suggested. As a last step, this research introduces a new framework for auto encoder-based heart disease detection, the deep attention-based auto encoder (DA-AE). In order to improve feature learning during decoding, the decoder side of DA-AE employs the global attention method. The results demonstrate that our suggested method outdoes the state-of-the-art in terms of accuracy, precision, recall, besides F1-score, and that the projected basis offers substantial benefits in the estimate of heart disease. The experiments are conducted on two publicly available datasets.

## 270     **Multivariate data analysis to classify Blood Donors utilizing supervised learning models**

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A safe and adequate supply of blood and blood components can be achieved by recruiting, retaining, and encouraging donor populations, thereby ensuring the availability of blood needed for transfusions around the clock and throughout the year. Blood donation services can be improved by technology improvements that aid in the analysis of potential donors, as well as the development of applications to assess donor health questionnaires. The work conducted in the paper classifies blood donors with the status Eligible or Deferred using synthetic donor data comprising data fields created based on eligibility criteria for blood donation. The health vitals of the donors from among the data fields emerge as decision-makers in classifying the donor as Eligible or Deferred. Multivariate data analysis and modeling using supervised machine learning models help relate synthetic data to real-time data and draw useful patterns and conclusions. Building trust in the classified results obtained using Machine Learning models is facilitated by the use of Explainable Artificial Intelligence (XAI) tools. Further work can be done on analyzing and modeling data of different available blood groups, age groups and gender which can be deciding factors in recruiting and targeting potential donors to build efficient blood donation services.



## 273 Type 2 Diabetes Detection Using a Bio-Inspired Machine Learning Approach

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The increasing incidence of Type 2 diabetes necessitates developing good diagnosis methods for the improvement of early detection and intervention strategies. This research aimed at the challenge of classifying Type 2 diabetes accurately using clinical blood test data based on a bio-inspired machine learning approach. For this research, a dataset of 2,300 clinical blood test records was obtained with appropriate ethical clearance, and the presence of diabetes was predicted using different machine learning models, including Artificial Neural Network (ANN), Support Vector Machine (SVM), Decision Tree (DT), and Random Forest (RF). Features were optimized using Genetic algorithm (GA) to improve the performance of the model by selecting the most relevant variables. In the results, it was shown that the highest accuracy was obtained by the GA + ANN model at 98.67%; the precision, recall, and F1 scores were superior to the rest. The second-highest accuracy was acquired by the model GA + SVM at 94.50%. The accuracies obtained by the GA + DT and GA + RF models were 92.30% and 91.11%, respectively. In conclusion, this implies that the models learned using bio-inspired algorithms for feature selection are substantially more robust and interpretable. The implication of the applications of this study has significant impacts on clinical practice since the optimized machine learning models can be used to provide support in the timely intervention and tailor-made treatment plans in the early detection of Type 2 diabetes.

## 274 Deep Learning Neural Network-Based Evaluation of Neuroimages for Alzheimer's Disease Diagnosis

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The increased incidence of Alzheimer's disease creates a challenge that demands effective means to produce and apply the most accurate diagnostic methods to detect early and manage effectively. This research work has applied deep learning methodologies from convolutional neural networks, VGG16, VGG19, and ResNet50, to classify the stages of Alzheimer's disease on a dataset of 2,300 MRI scans. ResNet50 scored the highest by attaining 96.3% accuracy, which is significantly higher than VGG19, with 91.23%, and VGG16, with 86.56%. Precisely, the performance metrics such as precision, recall, and F1

scores indicated that ResNet50 obtained better accuracy in comparison to other models and minimized false positives and negatives, which signifies that it can easily identify subtle changes in the structure of the brain well representative of different stages of the disease. This has proven that deep learning techniques can improve the accuracy of diagnosis in neurology, and the entire stage classification of Alzheimer's disease will become reliable. In this regard, based on this study, clinicians can apply this knowledge in practice and would be able to successfully insert these models into their routine screening and monitoring of patients with Alzheimer's. Deep learning can lead to timely and accurate diagnosis, thus enabling patient-specific treatment plans, which may help improve outcomes and possibly arrest the disease's progression.

## **275     Machine Learning-Based Analysis and Detection of Autism Spectrum Disorder**

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The rise in the prevalence of Autism Spectrum Disorder (ASD) necessitates the employment of early detection and diagnosis to increase the potential for improving interventions. Traditional diagnosis involves the use of subjective behavioural assessments that have a significant variation when it comes to time consumption. The primary contribution of machine learning models is their potential to help automate the detection of ASD. This research explores such potential through the use of the Autism Brain Imaging Data Ex-change dataset. The four various types of machine learning algorithms, support vector machine (SVM), recurrent neural network (RNN), random forest (RF), and artificial neural network (ANN), have been used to classify ASD cases. Data preparation involves the imputation of missing values, feature scaling, and removal of outliers and redundant features to ensure the quality and relevance of the dataset in use. The data is split into training, validation, and test sets, and the models will be trained to calculate accuracy, precision, recall, and F1-score. The test results show that the SVM is better compared to other models, with an accuracy of 96.5, followed by RNN at 94.8%, RF at 93.5%, and ANN at 90.0% accuracy. The SVM model presented the lowest data loss; therefore, it should have better generalization capabilities toward unseen data.

## **276     Smart Traffic Control System Leveraging YOLOv8 and OCR for Improved Urban Mobility**

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This paper presents an enhanced and improved Intelligent Traffic Management System (ITMS) that combines the You Only Look Once (YOLOv8) object detection algorithm with Optical Character Recognition (OCR) to improve traffic flow and safety in urban areas. This system ensures real-time

classification and detection of vehicles using the YOLOv8 algorithmic approach and the OCR technology integrated with the system reads the license plates traffic signs. This adaptive and responsive traffic management solution can adjust to the traffic conditions, thus improving the flow of traffic and road safety. This study assesses the effectiveness of the implemented system through urban simulations and methodology comparisons, demonstrating and vindicating its potential for deployment in a real urban environment. The research highlights the importance of employing modern Artificial Intelligence and Machine Learning to enhance the quality of life in urban areas and address the challenges of traffic management in modern cities.

## **277     Evaluating AI-driven recommendation systems efficacy in delivering personalized content on Internet streaming platforms**

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The recent surge in online streaming platforms has complicated finding movies that match user preferences. This work shall propose an intelligent Movie Recommendation System (MRS), which will use artificial intelligence through cosine similarity to enhance the user experience. This system uses machine learning techniques to predict user behavior, past preferences, and content attributes. It computes the similarity between movies and users by the cosine similarity measure of the angle between vectors. It does so by leveraging collaborative and content-based filtering techniques that make dynamic recommendations in real-time, evolving with changing user preferences. Extensive testing on diversified datasets validates the effectiveness of the system in increasing user satisfaction and the time spent with it through an elevator effect. The proposed system will, therefore, be able to show the power of AI for state-of-the-art and contextually relevant movie suggestions highly relevant to user preferences that enhance entertainment in streaming platforms. AI-driven MRS addresses the problem of content overload, presents a scalable personalized enjoyable streaming experience, and ensures 99% guaranteed content exposure.

## **278     Optimized Gravitational Search Algorithm based Legal Text Summarization**

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Automatic legal case summarization crucially condenses a lengthy document into a short structure, while conserving its information content and overall meaning. Manual summarization necessitates a substantial amount of human labor and time. For this reason, automatic text summarization is introduced which saves the legal expert time. One of the key difficulties in legal text summarizations is the study of high-dimensional input results. This issue can be solved by using feature selection. Various heuristic algorithms like particle swarm optimization, genetic algorithm, and ant colony search algorithm provide better accuracy in particular problems, but they cannot be used as universal. Gravitational Search Algorithm is one of the modern optimizations based on heuristics algorithms according to Newton's law. But, the Gravitational Search Algorithm is incapable of recalling information that implies a reduction in memory. To overcome this issue, we have proposed a global optimum and local optimum solution from Particle Swarm Optimization that can be added with the gravitational search algorithm.

## 279 Machine Learning Applications for Predicting the Inflation Rate in India

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Inflation plays a very pivotal role in overall decision-making within an economy, as it carries significant implications for different macro- and microeconomic indicators within an economy. To use the inflation effectively as a decision-making tool, it becomes important for policymakers to predict the inflation efficiently and timely. The existing literature has largely relied on standard statistical measures for estimation of inflation. The present study tries to apply different machine learning models to predict the inflation in the Indian economy. The study considers monthly time series data of inflation, exchange rate, stock market returns, repo rate, index of industrial production, bond yield rate, and money supply for a sample period of October 2017 to October 2023. The result of the study confirms that in the Indian economy, the XGBoost model outperforms all other machine learning and linear regression models. The second-best performer is Random Forest, followed by linear regression. These models can help policymakers and researchers reach the most reliable forecasts of inflation in the Indian economy.

## 285 Harnessing Deep Learning Techniques for Rainfall Prediction Using Meteorological Data

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Weather Prediction plays a challenging role in the climate systems. This study concerned with the data acquisition from the high resolution of earth observation by satellite system on Sentinel-2. For classifying the prediction events, the Support Vector Machine (SVM) model has yielded 89.67% accuracy. Long Short Term Memory Model (LSTM) and Linear Regression (LR) Analysis help to quantify the weather prediction to improve the accuracy level of 95.5%. General Circulation Models of Earth's Climate System for Weather Forecasting has used to forecast the temperature and humidity over a one-week period. By utilizing historical weather data, including temperature and humidity to analyses the temporal dependencies effectively. The model's performance is evaluated using metrics such as Mean Absolute Error (MAE) of 0.236 and Root Mean Squared Error (RMSE) of 0.189. Results indicate that the LSTM model significantly improves prediction accuracy and compared with traditional methods. This approach not only enhances our understanding of atmospheric patterns but also provides a robust framework for future research in meteorological predictions.

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Financial markets are characterized by high levels of randomness and complexity, which makes it very difficult to predict stock prices. In the stock market, the anticipations concerning the possible fluctuations in stocks prices hold significant importance in the financial field, as these expectations have a direct impact on the decisions that are taken in the spheres of investment, risk minimization and market effectiveness. Accurate forecasting enables institutional investors, hedge funds and retail traders to implement data-driven strategies in relation to portfolio allocation and risks return levels. In this work, therefore, we suggest an improved approach to stock price prediction based on deep learning techniques. We select the NIFTY MIDCAP 50 index values of National Stock Exchange (NSE) of India, over a period of eleven years: 2013- 2023. The historical data for the High value of NIFTY MIDCAP 50 for the years 2013-2023. By using a deep learning technique known as the Long Short-Term Memory (LSTM) model, we predict the High value of NIFTY MIDCAP 50 for year 2024 with forecast horizon of one day. This model aims to produce low error in the predictions of the high prices of the NIFTY MIDCAP 50 index.

### **293    Enhanced Lung Cancer Detection via Modified U-Net and Deep Learning Classifiers: A Hybrid Approach Utilizing NSCLC Radiomics Data**

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Due to differences in the intensity of the Computed Tomography (CT) scan image, none of the several lung cancer detection methods are enough to detect accurate malignancy. The NSCLC Radiomics database is used to compile the dataset, which includes 300 individuals. U-Net, a deep learning model, is used for segmentation in the validation process. To achieve better results when segmenting CT scans, pre-processing procedures are used to boost the original image's poor contrast. Furthermore, the skip connections are enhanced with a selected kernel unit to acquire multiscale features with variable receptive field sizes attained by means of soft attention. Using the Modified War Search Optimizer (MWSO) to fine-tune the parameters of the proposed modified U-Net, the classification accuracy is improved. Lastly, a Convolutional Neural Network (CNN) ensemble pre-trained classifier is used to detect the classes of liver tumors. Classification of liver tumors is accomplished using the suggested DL models, which comprise Mobile Net, VGG16, Xception, EfficientNetB7, and ResNet50. Dice similarity and sensitivity are two measures that measure the intersection of ground facts and forecasts; they are used to evaluate the segmentation method's performance. Obtaining an accuracy of 97% is a testament to the efficacy of the proposed method in correctly identifying and segmenting lung tumors.

## 294 A Novel Approach for HER2-Stained Image Classification in Breast Cancer Using Swin Transformer and YOLOv4

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Metastasis is the primary cause of death from breast cancer (BC), which is still a major public health problem. Visual indicators and morphological features of stained membrane areas are used to score immunohistochemistry (IHC) slides for breast cancer. Recent years have seen a rise in the use of histology whole slide images (WSIs) in digital pathology algorithms used for computer-assisted evaluations. Manual evaluation of microscopy pictures stained with human epidermal growth factor receptor 2 (HER2) is difficult, time-consuming, and prone to errors. The large, nonhomogeneous slides, overlapping sections, and varying staining methods are to blame for this. The challenging aspects of the photos, such as the atypical cell structure and tissue coloration, can only be captured by classifying HER2 images based on the selection of basic criteria. The first step of this study is to use Swin Transformer's (ST) robust feature learning capabilities to extract features from input data. Golden Jackal Optimization Algorithm (GJOA) is used to fine-tune the ST parameters, which enhances the classification accuracy. Incorporating a backbone network with modules to produce feature maps for different target sizes, the study used the YOLOv4 algorithm for breast cancer diagnosis. The proposed model outperforms the current state-of-the-art approaches, according to results from the HER2GAN and HER2SC datasets. On the HER2SC dataset, for example, it improved accuracy, precision, and recall, besides F1-score by approximately 8 - 10%.

## 295 Strategic Selection of Communication Technologies to meet SLAs of Prepaid Smart Metering in India: A Data-Driven Approach

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Deployment of 250 million smart meters is in progress in India. It focuses on objectives to enhance grid management, boost energy efficiency, and empower consumers with improved data access. The implementation is driven by Distribution Companies (DISCOMs) under the Smart Meter National Programme (SMNP). This research primarily develops the data requirements for smart meters in India, including data types, size, frequency, and Service Level Agreements (SLAs). It then analyzes the suitability of cellular communication technologies, highlighting the capabilities of LTE Category 1 (CAT1) and LTE Category M1 (eMTC/CAT-M1) in meeting SLAs while addressing challenges posed by Narrowband IoT (NB-IoT). Furthermore, the paper examines the operational burdens that advanced technologies like 5G NR, REDCAP, and LTE CAT4 impose on smart meter applications. The findings underscore the importance of a balanced approach in selecting communication technologies to optimize the deployment of smart metering systems in India.



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Technological advancements have facilitated the growth of interconnected devices across various applications, which, in turn, impact the overall quality of experience. Latency-sensitive applications, in particular, require services to be delivered within stringent deadlines. Selecting the optimal server in multi-core edge computing environments, while adhering to these deadline constraints, remains a challenging issue. Traditional server selection approaches typically rely on proximity, where servers located near users are prioritized. However, these methods become inefficient when a server, although close to many users, becomes overloaded, resulting in its frequent selection over other, less burdened servers. To address this inefficiency, a fuzzy logic-based framework is proposed for server selection, aimed at offloading tasks to the most suitable servers while considering factors such as deadlines, server core capacity, and transmission delay. The proposed approach is evaluated under realistic conditions, emphasizing deadlines for task offloading. Through comprehensive simulations, the fuzzy server selection algorithm demonstrates its superiority over traditional schemes, significantly enhancing the quality of service.

### **300     Residual Neural Network model for Automatic Classification of multiple classes of Brain Tumors trained on MRI Images**

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Brain tumors pose significant health risks and can vary in severity depending on their type. Accurate classification of brain tumors, such as glioma, pituitary, and meningioma, is crucial for determining appropriate treatment plans. This paper presents a classification approach for brain tumors in MRI scans. The CNN model employs convolutional layers for feature extraction, batch normalization to improve training stability, and dropout regularization to reduce overfitting. These architectural choices enable the model to perform efficiently on test data to provide reliable predictions. Trained on a diverse dataset comprising 5,848 brain MRI samples across three sources, the model effectively classifies the four categories. Among several tested architectures, ResNet18 demonstrated superior performance, achieving the highest testing accuracy of 99.69% and an average accuracy of 98.44%. Data augmentation and transfer learning further enhanced the models performance. Evaluation metrics highlight its robustness and potential for clinical use. This automated classification approach aids radiologists in the diagnosis process with improved outcomes.

### 313     **An Evolutionary Approach for Hyperparameter Tuning of CNNs: A Case of Breast Cancer Detection**

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One of the most common types of cancer found among women is breast cancer and it is associated with a high mortality rate. Medical imaging remains a dependable method for detecting breast cancer, but manual image interpretation is time-consuming. This research work introduces a novel deep learning approach utilizing Convolution Neural Networks (CNN). CNNs are commonly employed for image classification, although identifying precise hyper parameters and architectures presents a significant challenge. The work included developing a highly accurate CNN model specifically designed for the detection of breast cancer using mammography. The method proposed relies on the evolutionary algorithms to search for appropriate hyper parameters and CNN model for classification. The experimental outcomes demonstrated that the suggested CNN model delivered superior accuracy compared to another research conducted in the field on tuning the hyperparameters by evolutionary algorithms specifically Particle Swarm optimization, Whale Optimization, Grey Wolf Optimization. The proposed approach can be regarded as a potent method for predicting breast cancer.

### 315     **Comparative Insights into Speech Emotion Recognition using Machine Learning and Deep Learning**

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Emotion identification from speech has become an important field of study in human-computer interaction, sentiment analysis and mental health monitoring. This research compares machine learning (ML) with deep learning (DL) strategies for recognizing emotions through speech. Support vector machines (SVM), a traditional machine learning technique is contrasted with advanced deep learning models like long short-term memory (LSTM) networks and convolutional neural networks (CNN). To accomplish Speech Emotion Recognition (SER), raw audio signals must be cleaned and normalized. Feature extraction finds essential speech parameters such as Mel-frequency cepstral coefficients (MFCCs), energy and pitch whereas classification categorizes retrieved features using algorithms such as SVM, CNN and LSTM based on underlying emotions. This research compares various models based on accuracy, training duration, and computational complexity. SVM with cross validation performs better when it's necessary to extract features from complicated datasets. This comparative perspective helps to identify optimal models based on application-specific needs.

### 318     **Optimization of Vibration of circular plates with different combination of plate parameters**

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Theoretical analysis of the vibration of clamped and simply supported circular plates is carried out under one dimensional linear temperature field for two different sets of plate parameters: (i) circular variation in thickness and linear variation in density (ii) linear variation in thickness and circular variation in density. The first four modes of vibration are calculated for the above mentioned sets using Rayleigh Ritz method. The first objective of the study is, to show how variation in plate parameters effectively affects the behavior of frequency modes/time period. The second objective is how we can control the frequencies by taking appropriate variations in plate parameters. The numerical illustration and comparison of time period of present study with available published results will present the objectives of the study.

### 323 A Fuzzy-based Subjective Answer Assessment Grading System Using Sentence Transformer

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Evaluating student knowledge presents a challenge, and one simple and efficient evaluation method is Question-Answer. There are various types of question-answer approaches available to evaluate a students

Skills. A subjective question is the most relevant method to check all the levels of skills. Evaluating subjective answers is another challenge, and manually doing this requires an expert who must be good at

Score grading, and it requires a lot of our time. We propose a subjective answer assessment grading system using a sentence transformer model to solve these difficulties. The proposed method works with two predefined models: the Jaccard approach for checking lexical similarity and the Cosine similarity for semantic similarity. And finally, our sentence transformer model is used to compare the contextual similarity. Combining these value-based hybrid techniques yields a promising score, based on the score fuzzy logic used to give subjective answer assessment grading, and it outperforms certain baseline approaches.

### 325 Genetic Algorithm for Quasi-total Roman domination

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If a graph  $G(V, E)$  satisfies the following conditions: if  $x$  is an isolated vertex in the subgraph induced by the set of vertices labelled with 1 and 2, then  $f(x) = 1$ ; otherwise, every vertex  $u$  for which  $f(u) = 0$  is adjacent to at least one vertex  $v$  for which  $f(v) = 2$ . The value of  $\sum_{u \in V} f(u)$  represents the weight of quasi-total Roman domination. The minimum weight of Quasi-total Roman dominating function on graph  $G$  is called the Quasi-total Roman domination Number of  $G$  indicated by  $\hat{\Gamma}_{qtR}(G)$ . There is a polynomial time algorithm for the same problem because QTRD is NP-hard. Proposing an effective polynomial-time solution can aid in overcoming the constraints encountered in applications, since the QTRD problem has applications in supply chain management, network security and defence, social network analysis, and telecommunications. To the best of our knowledge, QTRD problem lacks established meta heuristic techniques, in contrast to domination problem. To combat this, we present in this work solutions to the QTRD problem based on the genetic algorithm. The suggested algorithm employ heuristics to create population and run them through several stages of algorithm to produce more workable answers. The

QTRD problem performance of algorithm is evaluated and contrasted on a variety of random graphs created with the model and the well-known graph dataset Harwell-Boeing (HB).

### 326 Spiking Neural Network based Object Pose Alignment

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Object pose alignment, a prerequisite for many computer vision tasks, e.g., face recognition, 3D face reconstruction, robotics, augmented reality etc. There are lot of research to address this issue, still there lies a numerous issue regarding the problem. Among which one of them is the computational efficiency. To address this issue, this article proposes a novel method for object pose alignment of 6 DoF with Spiking Neural Network (SNN). SNNs are biologically inspired neural networks which replaces the traditional networks through their energy efficiency and event driven processing mechanism. The method uses SNN to predict the translation and rotation coordinates for the base position to align with the ground truth pose. The proposed method shows potential by reducing the computational cost by almost 10% and the final results of the problem are represented in result section, representing the initial pose and the aligned pose after training with SNN.

### 327 An Optimized Solar PV Model Parameter Extraction Technique Using Lungs Performance Based Optimization

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Accurate determination of photovoltaic (PV) model parameters is essential for studying the variables that affect PV power generation efficiency. The extraction of parameters from the PV model presents a challenging problem due to its multi-model as well as nonlinear characteristics. This paper presents a solution to this challenge through the utilization of the Lungs Performance Based Optimization (LPO) algorithm. The parameter identification technique has been described as an optimization problem focused on minimizing the current-based root mean squared error (RMSE). Additionally, the LPO algorithm is adopted in triple diode model (TDM) parameter extraction for RTC France, and Photowatt-PWP201 solar PV modules. The outcomes indicate that the LPO algorithm combined with the Newton-Raphson method demonstrates superior robustness and convergence accuracy contrasted to the other meta-heuristics (MH) algorithm with obtained minimum RMSE value of 7.3478E-04 and 2.0528E-03 for RTC France, and Photowatt-PWP201 solar PV modules respectively. Furthermore, an extensive performance evaluation of the MH algorithms has been performed, utilizing convergence curves,

boxplots, as well as characteristic curves for current (I) versus voltage (V) and power (P) versus voltage (V), derived from the experimental outcomes.

### 328 A Modified Honey Badger Algorithm for Parameter Estimation of Solid Oxide Fuel Cell

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The precise as well as effective technique is essential for determining the unknown characteristics of a solid oxide fuel cell (SOFC) to facilitate the robust design of energy systems utilizing SOFC technology. However, SOFC's mathematical model presents a complex, non-linear, multivariate structure as well as includes seven unknown parameters, which causes their parameter identification to be a significant challenge. To address this challenge, this paper presents an enhanced version of the Honey Badger Algorithm (HBA), also known as the Modified Honey Badger Algorithm (MHBA), for evaluating the optimal values of the SOFC unknown model parameters. The parameter identification technique is defined as an optimization challenge aimed at minimizing the voltage-based sum of squared errors (SSE). The performance of MHBA is tested using data from a Siemens based cylindrical SOFC cell with three different datasets corresponding to different temperatures. The outcomes obtained by MHBA are contrasted with HBA and various other Meta Heuristics (MH) optimization techniques. The findings reveal that MHBA achieves the lowest SSE values of  $3.34\text{E-}05$ ,  $5.25\text{E-}05$ , and  $7.95\text{E-}05$  at temperatures of 800 C, 900 C, and 940 C respectively, demonstrating that MHBA is the most suitable algorithm for SOFC parameter identification. Furthermore, a close match between estimated and experimental I-V curves underscores the effectiveness of MHBA in accurately evaluating unknown parameters across different scenarios. Further, statistical metrics evaluated for statistical analysis confirm that MHBA outperforms among other algorithms. The robustness and reliability of MHBA are also validated through convergence curves analysis, showcasing its superiority in identifying unknown SOFC parameters.

### 329 A Comprehensive Study Exploring Probabilistic Fully Degenerate Bell Polynomials Linked to Random Variables

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The aim of this study is to investigate probabilistic versions of the fully degenerate Bell polynomials related to the r.v T. Here T Here, T is a random variable for which the moment generating function exists and is well-defined within an interval. The purpose of this study is to establish various properties, provide explicit Expressions, and derive identities and recurrence relations for these numbers and polynomials.

### 330     **Some identities of new type degenerate Bell polynomials of the second kind with their applications**

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This work presents several expressions and identities relating to a new class of degenerate Bell polynomials and numbers of the second kind. In particular, we construct an equation using Dobinski-type formulas, generalized falling factorial sequences, and Stirling numbers of the second sort. We also create relations with the first and second kind Stirling numbers as well as formulas employing the second kind Stirling polynomials.

### 335     **Clustering and Multipath-Based Fault-Tolerant Routing for Optimizing QoS in MANET**

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Mobile Ad-hoc Network (MANET) consists of mobile nodes that interact wirelessly. However, data transmission between nodes can be affected by issues such as poor stability, high energy usage, and frequent network topology changes. To tackle these challenges, cluster-based routing algorithms have been developed. In these algorithms, Cluster Head (CH) nodes play a crucial role in routing data packets to the Base Station (BS) via the shortest path. Conversely, route failure can occur due to high node mobility, disrupting data transfer and requiring CHs to retransfer data packets. This leads to increased energy usage, delay, packet loss, and reduced network lifetime. Additionally, finding a new shortest route after failures was time-consuming due to frequent changes in network topology. Hence, this manuscript proposes a Clustering and Multipath-based Fault-Tolerant Ad-hoc On Demand Distance Vector (CMFT-AODV) routing algorithm for data transfer in MANETs. The main aim is to improve data throughput, reduce packet loss, minimize delay, and extend the network's lifetime. This new algorithm enhances the route discovery phase by integrating the multipath fault tolerance scheme, which addresses failures in the shortest route between nodes. At first, path-related parameters like reliability, energy usage, and transmission delay are determined to calculate the cost of each route between source and destination nodes. Based on the cost values, each route is sorted to recognize the near-optimal route. Furthermore, a round-robin path selection technique is proposed for multipath routing in each timeslot during transmission. Finally, simulation findings demonstrate that the CMFT-AODV reaches a higher network performance compared to the conventional routing algorithms in MANETs.



### 336     **Impact of Nature Inspired Hybrid Quantization Techniques on Deep Learning CNN Models in Diagnostic Scope**

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This research investigates nature-inspired quantization for better performance and efficiency in deep learning models particularly with application of them in medical diagnostics and thereby also proposes a hybrid methodology of using the these Algorithms. The study blends the use of Quantum-Inspired Learning Vector Quantization, Firefly Algorithm, Cuckoo Search, Artificial Bee Colony and Bat Algorithm to streamline the computational requirements without compromising on the accuracy of these models. The proposed parameter optimization models use a series of nature-inspired algorithms to be able to manipulate these memory and processing power requirements, leading them capable of working in edge devices and mobile platforms. The research targeted some of crucial medical diagnostic model to prove the algorithmic generalization over the medical diagnostic scope such as Brain Tumor detection, Pneumonia diagnosis, Alzheimer disease classification, and Ocular Detection with global state of the art results in terms of speed, model compression and energy metrics by compromising only marginal accuracy loss. By utilising the most effective portions of each algorithm, a hybrid Algorithm can be developed that combines the best performing 2 Algorithms to get the final quantized model and thus allows real-time diagnostic support on low-resource devices at scale leading to a high-performance solution. The provided evidence shows that this method is effective in creating quantized models that are reliable, precise, fast, and efficient, making them suitable for use in diagnostic scope.

### 337     **Ensemble Deep Learning for the Automated Detection of Ocular Diseases from Retinal Fundus Images using DensNet201 and Attention U-Net**

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The present work proposes an improved ensemble deep learning architecture, which aims to classify retinal fundus images into four major ocular diseases such as glaucoma, cataract, diabetic retinopathy, and normal. The architecture is formed by combining the two networks, DenseNet201 and Attention U-net. While the dataset used had inherent class imbalances, the trained model achieved an impressive overall accuracy of 98.3. In order to enhance generalization and avoid overfitting, the model embraced the use of techniques such as brightness changes, random rotation, and zooming out of the images. In order to optimize learning, various regularization approaches were applied including but not limited to dropout, L2 norm regularization, class weight adjusting, and learning rate scheduling and stopping strategies such as ReduceLROnPlateau and EarlyStopping. The model was successful in diagnosing diabetic retinopathy and glaucoma and identified cataracts with high accuracy while also detecting healthy eyes reliably. In the face of all these challenges, the model managed to surpass several other models, as it was able to find the right balance between generalization and accuracy, concurrently preventing the issue of overfitting which is associated with better results that have been published in the literature. This research delineates the steps that can be taken for further improvement and illustrates how attention mechanisms and feature extraction can be useful in the detection of ocular ailments.

### 338 Artificial Neural Network based Prediction of the Atmospheric attenuation and Scattering Coefficient at 1550 nm for Optical Wireless System in Foggy Atmosphere

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This paper proposes an ANN model for predicting the atmospheric attenuation and the scattering coefficient in the optical wireless communication system at 1550 nm. This paper extends from my prior work, which established that better transmission is attainable at 1550 nm relative to other wavelengths under the foggy atmosphere. The two critical parameters, scattering coefficient and atmospheric attenuation in relation to visibility are investigated. Further analysis reveals that as the visibility increases, both the scattering coefficient and attenuation exhibit a nonlinear decreasing trend as visibility increases from 0 to 5 kilometers. This model has trained with visibility data, and the performance measures demonstrated good accuracy where the mean square error (MSE) of the ANN model is of the order of  $1.2915 \times 10^{-6}$ , which implies very accurate prediction and the value of regression coefficient (R) stands for 1 indicating the high predictive accuracy of the chosen ANN. Thus, the application of the ANN model for estimating atmospheric attenuation and scattering coefficient improves FSO system utilization by varying the power levels, modulation techniques or beam steering, therefore improving signal transmission in spite of changes in conditions within the atmosphere.

### 339 Ecological Optimization of Quantum Einstein Refrigerator using Bose-Einstein distribution

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We study a quantum Einstein refrigerator in which a two-level quantum system is considered as a working material and a blackbody as a reservoir. We assume that the heat transfer occurs between the system and the reservoir through absorption and emission of photons, and the particles in the two-level system follow the Bose-Einstein distribution. With all these considerations, we examine the optimal performance of the refrigerator in a high-temperature regime under the ecological function, which balances useful cooling power and the lost cooling power of the refrigerator. In our study, we discuss two cases, large contact time and short contact time limits, and find the coefficient of performance at maximum ecological function. We further derive lower and upper bounds formulation of the corresponding coefficient of performance for the two mentioned cases. We analyze that for large and short contact time limits, the optimal value of the coefficient of performance is different only when the frequencies associated with the heating and cooling stages are equal.

## 342     A Comparative Study on Class Balancing Techniques for Imbalanced Binary and Multiclass Classification Problems in Healthcare Scenarios

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The class imbalance creates a significant challenge in the development of accurate binary and multi-class clinical prediction models in healthcare. This study compares three different approaches Random Over Sampling (ROS), Random Under Sampling (RUS), and Synthetic Minority Oversampling Technique (SMOTE)- to handle imbalanced data in clinical prediction problems. The primary objective of class balancing in healthcare prediction problems is to improve the predictive performance of the minority class, which often represents critical cases. The fine-tuned prediction models are developed using a Support Vector Machine and Random Forest technique from the balanced training data that was created. Fine-tuning is done through grid search to optimise each classification model. The performance of these methods is evaluated on one binary and one multi-class classification clinical prediction problem. This research highlights the importance of balancing techniques and effective classifier selection to enhance the predictive power of the clinical prediction model.

## 346     Escape the Maze – An AI Enabled Game to Create Smart Maze

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Game development as a project idea not only provides a platform to show-case programming skills but also encourages collaboration, design thinking, and the exploration of various aspects of game creation. The project, titled Escape the Maze Game involves a maze structure where the objective of the player would be to navigate the maze and reach the end. The game would be in first person, single player mode. While navigating the player would have to evade enemies and overcome other obstacles. The enemies would be created using Behavior Trees, adding layers of complexity and challenge to the overall gaming experience. To aid players during navigation, they would be provided with a Hint system which would highlight the optimal route to end. The technical backbone of the hint system lies in the application of Unity built in NavMesh system, leveraging A\* algorithm to intelligently chart and display the recommended pathway. The game is placed in a procedurally generated maze. The goal of the player is to avoid the enemies present inside the maze, and reach the end. Combining Game Development with AI enhances virtual world with lifelike behaviours creating immersive environments. The players would be provided with a hint button, which highlights the route to aid players reach the end.

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In recent years, the gain in popularity of aerial vehicles (AV) has attracted many researchers for elegant algorithms to ensure no human intervention navigation missions. Autonomous navigation has posed several challenges on mimicking environmental perception, deeper comprehension, situation assessment, decisions to reach the destination, and evading obstacles at equitable trajectories like humans that increased the system complexity. The appropriate sensors, efficient navigation schemes, and elegant algorithms have the potential to achieve full autonomy. In this paper, various sensors and navigation schemes have been presented and various modes of navigation, machine learning (ML), optimization algorithms, and deep learning (DL)-based methods are discussed. The survey encompasses unmanned aerial vehicle navigation methodology, advantages, challenges, and performance evaluation of the techniques. This survey also analyzes the different methods and provides the research challenges and gaps for possible system improvement.

### 351     **Advanced Deep Learning for Ransomware Detection: A Hybrid LSTM-GRU Approach**

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In the era where companies need to work remotely, the relevant usage of advancing technology comes with a side threat: the threat of Ransomware attacks. To formulate effective responses to ransomware attacks, we will explore whether advanced deep-learning algorithms can be an option. The paper examines how a hybrid Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) architecture can tackle the malicious usage of modern cyber technology, specifically in identifying and tackling ransomware bonuses. For the hybrid LSTM-GRU model, accuracy measures of 97% with performance measures given as precision, recall, and F1-score standing at 0.99, 0.97, and 0.98, respectively. For cases of ransomware, the respective scores were precision, recall, and F1. 0.96, 0.98, and 0.97. The explanation, using confusion matrices and ROC curves, depicts the model's strength in minimizing false positives and negatives, allowing it to be suitable for its intended use. These results endorse the competencies of hybrid recurrent networks in understanding the nuances of different time frames, which can significantly assist in fighting against the changing scenario of Ransomware. This research contributes to forming new types and approaches to cyber security measures, increasing protection efficiency against hacker attacks.

### 352 Fuzzy Reliability Assessment of Smart Grid System with Intuitionistic Fuzzy Sets

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Traditional reliability assessments often fail to incorporate complex aspects of the system, resulting in errors in data collection. This makes it difficult to accurately evaluate and record information in real-life situations. This paper presents an intuitionistic fuzzy reliability assessment of the smart grid system. The results are displayed in graphical form for more clarity and understanding.

### 354 A Novel Serverless Architecture for Efficient and Scalable Healthcare Solutions

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The exponential growth of healthcare data and the increasing complexity of medical diagnostics demand innovative computational approaches that can address the limitations of traditional techniques. This paper presents a novel quantum computing framework optimized for smart healthcare applications. The proposed framework leverages quantum principles, such as superposition and entanglement, to enhance computational efficiency, scalability, and accuracy in healthcare-related tasks, including disease diagnosis, real-time patient monitoring, and personalized medicine. A comparative analysis was conducted between the proposed framework and traditional methods, including Classical Machine Learning, Deep Learning, and Optimization Algorithms, across five key performance metrics: accuracy, processing speed, scalability, reliability, and resource efficiency. Experimental results demonstrate that the quantum framework consistently outperforms existing techniques, achieving up to 15% higher accuracy and 70% faster processing times in high-dimensional and real-time scenarios. This research highlights the potential of quantum computing to revolutionize healthcare by addressing critical challenges, such as handling large-scale data, achieving real-time responsiveness, and optimizing complex medical decision-making processes. The findings underscore the transformative potential of quantum technologies to redefine data-driven healthcare, paving the way for more efficient and effective patient care.

### 355 Enhancing Network Security: Utilising Artificial Neural Networks and Random Forest Approaches for Proactive Detection of DDoS Attacks

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Distributed Denial of Service (DDoS) attacks are a formidable network security vulnerability. They disrupt service availability and cause significant damage to organizations. They should be tackled at all costs. This article proposes a proactive approach to detect and distinguish DDoS attacks from typical network traffic instances using machine learning techniques. These techniques include Artificial Neural Network (ANN) and Random Forest. This paper used comprehensive preprocessing techniques, feature engineering strategies, and model architecture to optimise the detection process. The results of this study demonstrated that both Random Forest and ANN models exhibit excellent performance, with an

accuracy of 98% and 99%, respectively, in detecting DDoS attacks. The Random Forest model surpasses the ANN model in terms of accuracy, but both models show excellent recall, precision, and F1 scores for classifying typical and DDoS traffic instances.

### **356     Software-Defined Network-Based Intrusion Detection Blockchain-Driven Context for Industrial Internet of Things (IIoT)**

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As the Industrial Internet of Things (IIoT) becomes more and more integrated into vital infrastructure, strong security mechanisms are required to protect against any cyber attacks. In this study, a Blockchain-Driven Software-Defined Network (SDN)-Based Intrusion Detection Framework for the IIoT (SCM) is presented. The SDN principles provide the foundation of the SCM framework, which makes effective control and administration of network resources possible. Through dynamic adaptation to changing network circumstances, SCM improves IIoT system resilience against developing cyber threats. By integrating blockchain technology, security-related data is made transparent and unchangeable, offering an impenetrable trail of occurrences. The SCM architecture is thoroughly described in this article, with an emphasis on the main elements and how they work together. SCM framework offers a strong and efficient way to secure IIoT systems. It solves the dynamic nature of IIoT networks while guaranteeing the integrity and transparency of security-related data by fusing SDN and blockchain technology. SCM's effectiveness in identifying and reducing intrusions is confirmed by its practical implementation and assessment, which highlights the technology's potential to improve industrial settings' security conditions. The SCM framework offers a basis for future study and development in protecting vital infrastructure from new cyberthreats as IIoT continues to emerge.

### **357     Phishing Detection Using URL-Based Features: A Machine Learning Approach**

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Although the web has become part and parcel of our daily lives, it also provides anonymity for people who undertake malicious acts such as phishing. To deceive its victims, a phisher can use various methods like social engineering and creating counterfeit websites to steal personal and corporate account IDs, usernames, and passwords among others. To detect phishing websites several techniques have been proposed but phishers have come up with their ways of detecting them. Machine learning is one of the best approaches used in identifying these malicious activities because most phishing attacks have common characteristics that machine learning can recognize. In this paper, there is a comparison between distinct machine learning models for predicting phishing websites.



### 358     Addressing Security, Privacy, and Efficiency in Cyber-Physical and Medical Systems with Advanced Machine Learning Techniques

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Machine learning (ML) is driving advances in industries ranging from healthcare and finance to transportation and infrastructure, and therefore security and resiliency are a must. ML-based Cyber-Physical systems (CPS) such as autonomous vehicles, medical diagnostics and smart energy grids are highly susceptible to sophisticated cyberattacks. Adversarial attacks capable of modifying data to disrupt the system are illusive, making traditional security methods, like encryption and intrusion detection, insufficient to protect against them. Moreover, protecting sensitive personal data in ML applications presents unique privacy challenges, especially with healthcare. Measuring impacts to encrypted models while at the same time, existing propositions such as SecureML refine the privacy of such models by encrypting the underlying data, this leads to unwanted delays in processing time due to the compromise in both performance and security. To alleviate these issues, in this paper we propose ParSecureML, a novel GPU-based framework that builds upon secure multi-party computation (MPC) to ensure a better balance between data security, operational efficiency, and privacy in ML applications. By the power of ParSecureML, we are one step closer to developing resilient systems that can continue to operate even when challenged, enabling secure and efficient ML as we move onto increasing connectivity across the globe.

### 360     Advanced Forensic Analysis of Web-Based Social Messaging Platforms

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In allowing real-time chats across many platforms with shockingly ease, the emergence of web-based messaging apps like WhatsApp and Telegram has transformed communication. Even if they provide unrivalled simplicity, these technologies present different opportunities and difficulties for forensic investigations. Emphasizing their fundamental technologies, data storage approaches, and forensic data extraction methodologies, this article provides a complete forensic study of the web versions of WhatsApp and Telegram. Emphasizing the need of the QR token mechanism utilized for authentication and chat synchronization, we first look at the technical underpinnings of Web WhatsApp and Web Telegram. By use of a safe token exchange using QR codes, this mechanism guarantees that only confirmed users may access their chat history on web clients, therefore preserving the integrity and confidentiality of user interactions. Investigated in this study is the architecture of online portals employing JavaScript, WebSocket protocol, and Indexed Database for dynamic content loading, real-time message delivery, and efficient data storage. The section on forensic analysis specifies a strict method for gaining access to stored information from many web sites. This entails locating cache and indexed database files comprising necessary forensic artifacts: metadata, session data, and chat history. One explains the preservation of chat messages, timestamps, sender/receiver IDs, and extra contextual data by means of an in-depth analysis of ldb files in Indexed Database, thereby enabling a chance to

extract and assess this data for forensic uses. Much of this work is on the analysis of RAM memory dumps, in which case volatile data from live Web WhatsApp and Web Telegram sessions is collected and examined. This study reveals chat messages, session tokens, and other transient data not permanently kept on disk, therefore offering a more whole picture of user activity over a session. The discovery of a consistent method for collecting phone numbers from the RAM dump indicates the feasibility of automated forensic extraction, hence improving the relevance of these investigations.

### **361     Unveiling the Truth: A Survey of Digital Image Forensic Software Tools**

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This paper provides a comprehensive overview of the leading modern digital image forensic software toolkits that play a vital role in manipulation detection, authentication, and content analysis of digital media. Ten tools, i.e., FotoForensics, JPEGsnoop, Forensically, Adobe Photoshop, Ghio, Amped Authenticate, Belkasoft Evidence Center, Camera Ballistic, Microsoft ICE, and PhotoDNA, are examined that are developed to meet the particular needs of forensic experts, law enforcement, and legal experts who handle the examination of digital evidence. This analysis provides the functionalities and applications of each tool.



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The 3<sup>rd</sup> Science, Technology, Engineering, and Management (STEM) Award Ceremony will be held at Himachal Pradesh University, Shimla, in November 23, 2024. 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.





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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



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21 - 23 December 2018



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Bundelkhand University Jhansi  
22 - 24 December 2017



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28 - 30 December 2016

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