



13th International Conference on
Soft Computing for Problem Solving
(SocProS 2025)
Artificial Intelligence for Viksit Bharat

February 24th -26th, 2025

Department of Applied Mathematics and Scientific Computing
Indian Institute of Technology Roorkee, India



Book of abstracts



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13th International Conference on Soft Computing for Problem Solving Artificial Intelligence for Viksit Bharat

(SocProS-2025)

February 24th – 26th, 2025

Book of Abstracts

Editors

**Prof. Millie Pant
Prof. Kusum Deep
Prof. Atulya Nagar**



Organized by

**Department of Applied Mathematics and scientific Computing
Indian Institute of Technology Roorkee
INDIA**



प्रो० के० के० पंत
निदेशक

Prof. K.K. Pant
Director

भारतीय प्रौद्योगिकी संस्थान रुड़की

रुड़की – 247667(उत्तराखण्ड), भारत

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Roorkee - 247 667 (Uttarakhand), India

T: +91 - 1332-272742, 285500 (O), 9837070794 (O)

F: +91 - 1332 -285815, 273560

E: director@iitr.ac.in, dir_office@iitr.ac.in



Message

I am delighted to learn that the 13th International Conference on Soft Computing for Problem Solving, SocProS 2025, having the Theme **Artificial Intelligence for Viksit Bharat**, is being organized by Department of Applied Mathematics and Scientific Computing at IIT Roorkee during February 24-26, 2025. On this occasion I extend my sincere wishes to the organizing committee for successfully holding this mega event. I trust that the conference would provide an enriching and rewarding experience to the national as well as international audience.

Thanking you,

(K. K. Pant)

प्रो. मिली पंत, विभागाध्यक्ष

Prof. Millie Pant, Head of the Department

Ref. No. SocProS 2025

Dated: 24th February, 2025

Message from the Head of the Department



Department of Applied Mathematics and Scientific Computing (D-AMSC), formed in 2022, is one of the youngest departments of IIT Roorkee and is located at the Saharanpur campus of IIT Roorkee. It offers PhD and MTech in Applied Mathematics and Scientific Computing.

D-AMSC proudly organizes the 13th International Conference on Soft Computing for Problem Solving (SocProS 2025) during February 24-26, 2025, which is 13th in the series of SocProS conferences and is the 2nd International Conference conducted by the Department.

SocProS conferences are cross disciplinary in nature, where the focus is on the application of soft computing techniques in diverse domains. Trending topics like Artificial Intelligence and Data Science forms an important component of SocProS series. It aims to bring together the young as well as seasoned researchers of diverse domains on a common platform where they can share their ideas and can gain knowledge from the experts.

I hope this SocProS 2025 would be a fruitful experience for all the participants of SocProS 2025. I heartily welcome all the keynote speakers, invited speakers and delegates from all across the globe to participate in this conference. I hope you will enjoy the conference and the campus.

Millie Pant
(Prof. Millie Pant)



Ambala College of Engineering and Applied Research

Devsthali, Ambala-Jagadhari Highway, P.O. SAMBHALKHA-133101(Ambala)

Approved by Haryana Government and (AICTE) Affiliated to Kurukshetra University, Kurukshetra

Ph: 0171-2821833, 2822001 - 003, Telefax: 2822002

Website: www.ambalacollege.com, Email: info@ambalacollege.com

FROM THE DESK OF THE HONORARY CHAIR

**Dr. Chander Mohan,
Prof. Emeritus,
CSE Dept.**

Dear Delegates,

It is my pleasure, privilege and honor to be associated as the Honorary Chair of the 13th International Conference on Soft Computing for Problem Solving (SocProS 2025) being held during February 24-26, 2025, which is being organized by the Department of Applied Mathematics and Scientific Computing, Indian Institute of Technology Roorkee. I take this opportunity to welcome you all to this Conference on behalf of the Organizing Committee and on my own personal behalf.

SocProS 2025 is the 13th conference in the Series of International Conferences organized by it, and is a well planned effort in collaboration with Prof. Atulya Nagar, UK who has teamed up with Prof. Kusum Deep and Prof. Millie Pant, IIT Roorkee to bring this Conference to reality. IIT Roorkee has very kindly agreed to host it.

A lot of care has been taken to maintain academic standards in the entire conduct of SocProS 2025. This includes double-blind peer review of the submitted papers with the help of an International team of experts using Morozoff's Conference Management Tool. The proceedings of the conference are being published by Springer.

The day of the Conference has now finally arrived. I am happy to observe that many international keynote speakers and invited speakers will be addressing the gathering. The participating delegates are from different parts of the world.

I wish you all a fruitful experience and hope that you will enjoy the Conference and benefit academically from its varied academic spectrum.

I wish the Conference to be a grand success.

**Chander Mohan
Honorary Chair SocProS 2025**

Message from Convenors of SocProS 2025

Welcome to the **13th International Conference on Soft Computing for Problem Solving (SocProS 2025)**, hosted at the Indian Institute of Technology (IIT) Roorkee, with proceedings to be published by Springer. This year’s conference, themed “**Artificial Intelligence for Viksit Bharat,**” will showcase more than 170 presentations from distinguished academics and practitioners across diverse domains. Complementing the technical programme, we have arranged a comprehensive social programme, including our traditional conference gala dinner.

We are particularly delighted to present four plenary talks at this year’s conference. Over the years, this event has established itself as a premier platform in Mathematics and Computer Science, with particular emphasis on Soft Computing. Our fundamental aim remains to unite researchers who employ soft computing and innovative paradigms to address complex, highly nonlinear problems that prove challenging for conventional computing methods.

Soft Computing continues to lead research innovation, drawing inspiration from natural and biological systems characterised by decentralised, adaptive, and environmentally aware approaches. These qualities enhance scalability, flexibility, and resilience. Researchers in this field effectively combine traditional serial computing with parallel and powerful computing techniques and high-performance computing tools to advance computational capabilities.

Having previously been hosted across various Indian cities and at Liverpool Hope University, UK, this thirteenth edition maintains its commitment to nurturing emerging researchers whilst facilitating knowledge exchange with established academics. Our focus extends beyond pure academic research to encompass practical applications in science, technology, medicine, and economics, ultimately contributing to societal advancement.

This conference has become a sought-after platform, attracting academics, researchers, industry professionals, and entrepreneurs. We are honoured to welcome esteemed experts from India, Asia, Europe, South Africa, Australia, and America, who will share insights into cutting-edge research and technological advancements. The three-day programme features keynote addresses, invited talks, research presentations, and networking opportunities. Discussions will address contemporary challenges in big data, medical informatics, bioinformatics, cloud computing, and artificial intelligence innovations. The conference will explore emerging trends affecting both professional practice and daily life, with insights from globally recognised experts.

This conference series is distinguished by two key features. Firstly, SocProS events are “**go-green**” conferences, prioritising environmental sustainability whilst maintaining academic excellence. Secondly, we proudly support significant participation from young researchers, particularly women scientists—advancing female representation in **STEM (Science, Technology, Engineering, and Mathematics)**.

The success of SocProS 2025 reflects the dedication of numerous individuals. We extend our

sincere gratitude to our Organising Committee colleagues for their year-round commitment. Special thanks go to our stream organisers for their diligent work in securing presenters, and to our reviewers for their thorough evaluation of submissions. We acknowledge our sponsors and exhibitors, whose steadfast support, despite challenging economic circumstances, has been instrumental in creating this outstanding programme. We also thank Springer Plc. for their professional excellence in producing the conference proceedings.

Finally, we express our appreciation to each of you for contributing to **SocProS 2025**. It has been our privilege to serve as Conference General Chairs and Convenors, and we trust this conference will provide an enriching and stimulating experience for all attendees.

Wishing you a productive conference and valuable networking opportunities.

Prof. Millie Pant, IIT Roorkee

Prof. Kusum Deep, IIT Roorkee

Prof. Atulya Nagar, Liverpool Hope University, UK

About IIT ROORKEE (Venue of SocProS 2025)

The Indian Institute of Technology Roorkee at Roorkee has culminated from the oldest technical institution of the Indian sub-continent, established as the “Roorkee College of Engineering” in 1847 and rechristened as the “Thomson College of Civil Engineering” in 1854. Due to its numerous contributions towards the development of the country for over 100 years, this temple of learning was elevated to the status of a University, i.e. the University of Roorkee, the first technical university of India in 1949. This University of Roorkee was converted to IIT Roorkee by the Government of India on September 21, 2001, thereby further elevating it to an Institute of national importance. Over the years, it has built up and maintained an excellent academic reputation. The outstanding achievements of its alumni are a testimony to this. The IIT Roorkee has academic departments in the areas of Engineering, Sciences, Architecture and Planning, Management studies, Humanities and Social Sciences besides many Centres of higher education and research. In addition, IITR has a Campus located at Saharanpur and an Extension Centre at Greater Noida.

About Saharanpur Campus of IIT Roorkee

Indian Institute of Technology Roorkee, Saharanpur Campus, formerly known as the School of Paper Technology was established by the Government of India in 1964, with an aid from the Royal Swedish Government. This school was managed by a Society created by UP Government until its merger with the University of Roorkee (now IIT Roorkee since 2001) in 1978. Presently, the campus has three departments:

- Department of Paper Technology
- Department of Polymer and Process Engineering
- Department Applied Mathematics and Scientific Computing

Saharanpur Campus is well planned Campus acquiring 25 acres of land with the distance of around 50 KM from the Roorkee campus. The three departments offer degree programs in MTech and PhD

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Prof. K. K. Pant
Director, Indian Institute of Technology Roorkee, India



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Prof. Millie Pant
Head, Department of Applied Mathematics and scientific Computing, Indian Institute of Technology Roorkee
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Department of Mathematics, Indian Institute of Technology Roorkee



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Dean of faculty of science, Professor of Mathematical Sciences,
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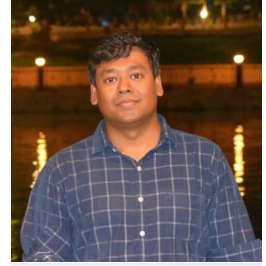


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Plenary Speakers

Plenary Speakers 1: Andries Engelbrecht

Andries Engelbrecht received his Master's and PhD degrees in Computer Science from the University of Stellenbosch, South Africa, in 1994 and 1999, respectively. He is currently appointed as the Voigt Chair in Data Science in the Department of Industrial Engineering at Stellenbosch University, where he also holds a joint appointment as a Professor in the Computer Science Division. Prior to his appointment at Stellenbosch University, he was with the Department of Computer Science at the University of Pretoria (1998–2018). During his tenure there, he was appointed as the South Africa Research Chair in Artificial Intelligence (2007–2018), served as the head of the Department of Computer Science (2008–2017), and acted as the Director of the Institute for Big Data and Data Science (2017–2018).

In addition to publishing numerous research articles, he has authored two books: Computational Intelligence: An Introduction and Fundamentals of Computational Swarm Intelligence.



Plenary Speakers 2: Christian Blum

Christian Blum is a Senior Research Scientist at the Artificial Intelligence Research Institute (IIIA-CSIC) in Spain. His expertise lies in swarm intelligence—a field inspired by the collective behavior of social insects, flocks of birds, and fish schools—and the hybridization of meta-heuristics with traditional AI and operations research techniques such as branch & bound and dynamic programming. His research focuses on solving complex combinatorial optimization problems and addressing challenges in distributed environments, including wireless sensor networks and ad hoc networks.



Blum holds a Ph.D. in Applied Sciences from the Université Libre de Bruxelles, where his dissertation centered on theoretical and practical aspects of ant colony optimization under the supervision of Professor Marco Dorigo. His academic journey also includes a DEA in Applied Sciences and a Diplom in Mathematics from German institutions. Over the years, he has contributed to a wide range of interdisciplinary projects in fields such as telecommunications, bioinformatics, neuroscience, and robotics. A notable example of his work is his collaboration with EPFL in Lausanne, Switzerland, on the automated reconstruction of dendritic and axonal trees.

He has an impressive publication record, with 60 JCR papers and more than 16,000 citations, achieving an h-index of 42. His research has received numerous accolades, including the 2021 SEIO-BBVA Award for the best methodological contribution in operations research and the Best Paper Award at the ANTS 2020 conference. Blum is actively involved in the academic community as an associate editor for several journals, including *Artificial Intelligence*, *Computers & Operations Research*, and **Engineering Applications of Artificial Intelligence*. His recent work has focused on optimization in distributed systems, hybrid algorithms for large-scale combinatorial problems, and bioinformatics-related challenges.

Plenary Speakers 3: Vaclav Snasel

Vaclav Snasel is currently a Professor with the Department of Computer Science, VSB—Technical University of Ostrava, Czech Republic. He works as a Researcher and a University Teacher. He is also the Dean of the Faculty of Electrical Engineering and the Computer Science Department. He is the Head of the Research Programme IT4 Knowledge Management, European Center of Excellence IT4 Innovations. His research and development experience includes over 30 years in the industry and academia. He works in a multi-disciplinary environment involving artificial intelligence, social networks, conceptual lattice, information retrieval, semantic web, knowledge management, data compression, machine intelligence, neural networks, web intelligence, nature and bio-inspired computing, data mining, and applied to various real-world problems.



Plenary Speakers 4: David L. Blunck

Dr. Blunck's research focuses on combustion, ignition, radiation, and energy. His group conducts research which seeks to understand the science associated with practical (e.g. gas turbine engine) and natural (e.g. forest fires) chemical energy conversion. He is the lead PI on more than three-million dollars of funded research at Oregon State and has many national and international collaborations.



Prior to joining MIME, he worked at the Air Force Research Laboratory, Turbine Engine Division, in Dayton, Ohio. Dr. Blunck was the lead investigator for fundamental combustion research efforts related to gas turbine combustors and pollutant formation. He helped to lead a team of engineers in designing and testing the world's smallest combustor for use in advanced gas turbine engines.

Dr. Blunck is the recipient of numerous honors and awards including the Welty Faculty Fellow, the AIAA Pacific Northwest Section Young Engineer of the Year (2014 – 2015), and the outstanding graduate student from the School of Mechanical Engineering at Purdue University (2010).

Plenary Speakers 5: Xin Yao

Xin Yao is the Vice President (Research and Innovation) and the Tong Tin Sun Chair Professor of Machine Learning at Lingnan University, Hong Kong. He is an IEEE Fellow and was a Distinguished Lecturer of the IEEE Computational Intelligence Society (CIS). He served as the President (2014-15) of IEEE CIS and the Editor-in-Chief (2003-08) of IEEE Transactions on Evolutionary Computation. His major research interests include evolutionary computation, neural networks, ensemble learning, and multi-objective learning. Recently, he has been working on trustworthy AI, especially on fair machine learning and explainable AI. His work won the 2001 IEEE Donald G. Fink Prize Paper Award; 2010, 2016 and 2017 IEEE Transactions on Evolutionary Computation Outstanding Paper Awards; 2011 IEEE Transactions on Neural Networks Outstanding Paper Award; 2010 BT Gordon Radley Award for Best Author of Innovation (Finalist); and other best paper awards at conferences. He received a 2012 Royal Society Wolfson Research Merit Award, the 2013 IEEE CIS Evolutionary Computation Pioneer Award and the 2020 IEEE Frank Rosenblatt Award.



Invited Speaker

Prof. Ajit Kumar Verma is a Professor(Technical Safety), Western Norway University of Applied Sciences, Haugesund, and has been in Norway since 2012. He was a Professor /Senior (HAG) scale Professor for around 15 years at IIT Bombay with the Reliability Engineering/Department of Electrical Engg. He was an adjunct at the University of Stavanger, Norway and has been a Guest Professor at the Luleå University of Technology for the past several years. He was awarded (2017) Honorary Professor at Amity University, India and also a Life Time Achievement awards at IIT Madras by SRESA and recently at Kurukshetra University. He has supervised/co-supervised 40 PhDs and over 100 Masters theses(IITB; HVL,Norway; Univ.of Gävle,Sweden; LJM Univ,UK; WMG, Warwick Univ, UK) in the area of Electronic Systems Reliability, Software Reliability, Reliable Computing, Power Systems Reliability, Reliability Centred Maintenance , Soft Computing in RAMS for Complex Engineering Systems and Probabilistic Safety/Risk Assessment in power plants and Computational Intelligence Applications in multiple domains. He has executed various research projects in India to promote industry interface and has been course co-ordinator for industry CEPs like Reliability engineering, Six Sigma, Software Inspections, Competency Tracking System and Software Reliability for IT industries. He has jointly edited a dozen books published by Springer and is also an author in 8 books. He has over 250 publications in various journals and conferences. Springer has published a book in 2020 to honour him. He has served as a Guest Editor of over a dozen Special Issues of various journals including IEEE Transactions besides being the patron/editor in chief in various journals and a series editor in six book series. He has been a Patron/General Chair/ Conference Chair of various International Conferences.



Prof. Ritu Gupta received the M.A. and Ph.D. degrees in statistics from the University of Delhi, Delhi, India, in 1989 and 1994, respectively. From 1989 to 1996, she was a Lecturer in statistics with the University of Delhi. From 1996 to 1998, she was a part-time Lecturer with the Curtin University of Technology, Australia, and from 1998 to 2000, she was Research Officer with the Statistical Consulting Group, University of Western Australia, Australia. Since 2000, she has been a Lecturer in the Department of Mathematics and Statistics, Curtin University of Technology, Bentley, Australia. Her main research interests are in the areas of combinatorics, queueing systems, and (statistical) design of experiments. Algebraic Number Theory, and Valuation Theory.



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1. A Comprehensive Review of Vision Language Models in the Realm of Full Self Driving Systems

Paper Id 5

Amirthavarshini V¹, Jayant Toleti¹, S. S. Chakravarthi¹

¹Department of Computer Science Engineering, Amrita School of Computing, Amrita Vishwa Vidyapeetham, Chennai, India
amirtha.venkadesh@gmail.com, jtoleti@gmail.com,
ss_chakravarthi@ch.amrita.edu

Abstract: This paper presents a comprehensive review of the advancements in the context of autonomous driving (AD) systems, exploring their potential and current applications of Large Language Models and Vision Language Models in enhancing Full Self-Driving (FSD) capabilities. As AD systems evolve, the integration of multimodal inputs, particularly visual and textual data, through advanced VLMs has become a critical factor in improving vehicle perception, decision making, and interaction with complex environments. This survey addresses six key research questions that assess the progress of VLMs in various aspects, including object detection, scene understanding, natural language instructions, and safety-critical decision processes in FSD systems. The review points out significant strides made in combining visual recognition with linguistic interpretation, while also identifying existing challenges, such as real-time performance constraints, sensor limitations, and the need for large-scale annotated datasets. By synthesizing recent developments and ongoing research, the objective of this paper is to provide a clear overview of the current state of VLM integration in autonomous driving and to outline future directions for advancing these technologies in real-world applications.

Keywords: Autonomous Driving Systems, Large Language Models, Vision Language Models.

2. Optimal Defense Strategies for Security Agencies: A Dual Hesitant Fuzzy Matrix Game Approach

Paper Id 16

Sandeep Kumar¹, Aashish¹

¹Department of Mathematics, Ch. Charan Singh University, Meerut (250004), Uttar Pradesh, India
drsandeepmath@gmail.com, aashish580004@gmail.com

Abstract: Up till now, Game theory has been modified with the concepts of various kinds of uncertainties. Dual Hesitant Fuzzy Set (DHFS) provides a noteworthy tool for expressing the uncertain quantitative aspects effectively in two player zero sum matrix game problems (TMGPs) with uncertain pay-offs. In the present work, we deal with TMGP with pay-offs given by DHFSs. For solving such problems, first, we transform a dual hesitant fuzzy element into a Dual Hesitant Fuzzy Element with Possibility (DHFEP) for equating the lengths of

two dual hesitant fuzzy element. Then, we define value and ambiguity functions for these elements with comparative laws. Further, four steps algorithm is developed to solve dual hesitant fuzzy matrix game problem based on the suggested value and ambiguity functions. To demonstrate the relevance of the proposed work, a real-world event-based problem-how to counter a terrorist attack is considered in order to calculate the optimal defense strategies for the security agencies.

Keywords: Dual Hesitant Fuzzy Set, Value function, Ambiguity function, Two-person zero-sum matrix game, Terrorism.

3. Fooling A Deep Learning-based Facial Expression Recognition System using its Class Activation Map and Differential Evolution

Paper Id 18

Pramod Kumar¹, Gayatri Gamini¹, Ayan Seal¹, Sraban Kumar Mohanty¹, Haibo Zhang², Kouichi Sakurai³

¹Department of Computer Science and Engineering, PDPM Indian Institute of Information Technology Design & Manufacturing Jabalpur, Jabalpur, Madhya Pradesh-482005, India

²Kyushu Institute of Technology, 680-4 Kawazu, Iizuka-shi, Fukuoka, Japan

³Department of Informatics, Graduate School of Information Science and Electrical Engineering, Kyushu University, Fukuoka 8190395, Japan

21MCSA05@iiitdmj.ac.in, 22MCSS01@iiitdmj.ac.in ,ayan@iiitdmj.ac.in, sraban@iiitdmj.ac.in, haiboz0105@gmail.com, sakuraicsce2009g@gmail.com

Abstract: The facial expression recognition (FER) system aims to recognize human emotional states based on a given face image. FER has recently gained prominence as a study subject due to its numerous applications, such as face video surveillance, healthcare, data-driven animation, etc. The study of adversarial disturbance targeted at FER systems is still in its early phases. One past study searched a face image to find a pixel using differential evolution (DE) to generate the perturbed image for fooling deep learning (DL) models. However, searching the entire image is a time-consuming task. Additionally, choosing a pixel from an irrelevant area of a face may result in a lower success rate for the black box attack. In this study, a region of interest is obtained by the class activation map of the adopted DL model to make a fool. Then we restrict ourselves to select and alter a pixel using DE to reduce search time and increase the success rate in two attack scenarios, such as untargeted and targeted. The results on three benchmark datasets, Japanese Female Facial Expression, Extended Cohn-Kanade, and FED-RO, show that the proposed strategy performs better than a recognized state-of-the-art method.

Keywords:

4. Cryptocurrency and Blockchain The Future of Finance?

Paper Id 19

Suthir Sriram¹, Sima Pandit¹, Nivethitha V¹, Thangavel M²

¹Department of Computer Science and Engineering, Amrita School of Computing, Amrita Vishwa Vidyapeetham, Chennai, India

²College of Information and Technology, United Arab Emirates University
s_suthir@ch.amrita.edu, sima92166@gmail.com, v_nivethitha@ch.amrita.edu,
thangavelm@uaeu.ac.ae

Abstract: With the introduction of automation and new technologies into everyday life, the financial services landscape has shifted from traditional, person-to-person contact-based models to modern digital and mobile platforms. However, this process is marked by centralization, which represents the most salient feature of international financial systems and often creates systemic vulnerabilities. Historically, financial crises have revealed these risks, leading to a loss of confidence in traditional banking institutions. In response to these challenges, Satoshi Nakamoto's Bitcoin marked the dawn of decentralized finance through blockchain technology, securing and tamper-proofing digital transactions. Blockchain's decentralized data structure organizes information into immutable "blocks," guaranteeing transparency and protection against alterations. Blockchain-based systems enhance security, reduce transaction costs, and build trust in distributed environments. While cryptocurrency investments carry significant risks due to market volatility, they also present opportunities to improve financial inclusion, especially in regions lacking access to mainstream banking. This paper explores the role of Fintech and cryptocurrencies in creating new market structures and providing alternatives for economies facing currency devaluation. It emphasizes the importance of developing robust cybersecurity measures and regulatory frameworks to mitigate risks. The article provides key insights for stakeholders seeking to harness blockchain and cryptocurrency's transformative capabilities while navigating associated challenges.

Keywords: blockchain, cybersecurity, decentralization, Fintech, volatility

5. Automatic HTML Code Generator Using ML Techniques

Paper Id 21

V Nivethitha¹, Suthir Sriram¹, M. S. S. Sandeep¹, Kristtamsetty Adi Narayana¹

¹Department of Computer Science and Engineering, Amrita School of Computing, Amrita Vishwa Vidyapeetham, Chennai, India

v_nivethitha@ch.amrita.edu, s_suthir@ch.amrita.edu,
mattasandeep26@gmail.com, aadinaidu812@gmail.com

Abstract: There are standard web design and development processes that were earlier used, which included transforms of the graphical patterns into HTML or combined with

errors. On this process, constant collaboration between designers and software engineers stands out as important. Therefore, with the web development requests going up, there is a real need to seek better solutions that generate websites in the shortest time possible while reducing the effects of modify. Now, we will introduce a new approach to fill the gap in converting hand-drawn mockups for UI designs into applications code using computer vision and deep learning techniques. The proposed approach begins with the use of hand-sketched mockups for determining the main areas of the web interface: buttons, text fields, and images. We develop a deep learning model that generates HTML code for seamlessly bridging design and development. Our system is trained on a dataset of mock-ups, generates most web components accurately. Our method accuracy in experiments reached 93%, with a total validation accuracy of 80%. These results emphasize the utility of our approach and suggest that much of the manual coding currently required for web development can, in principle be minimized. The automated system not only creates web pages more effectively once the system is implemented but also allows designers to investigate more design possibilities quickly without actually encoding. This would allow designers to focus more on their creativity rather than becoming great coders. With this, the developer's effort is also reduced because he has to do less and less manual coding. One more important point to be noted is that the principles here are not only concerning web development but also most of the other related areas in software development. Index Terms—Object detection, object recognition, convolutional neural network, deep learning, automatic code generation, HTML.

Keywords: Object detection, object recognition, convolutional neural network, deep learning, automatic code generation, HTML.

6. Crop Type Classification Using Satellite Images

Paper Id 22

Sumanth Kompelly¹, B. V. Mralath Kumar¹, Nivethitha V¹, Suthir Sriram¹

¹Dept. of Computer Science and Engineering, Amrita School of Computing, Amrita Vishwa Vidhyapeetham, Chennai, India

`ch.en.u4cse21170@ch.students.amrita.edu,`

`ch.en.u4cse21109@ch.students.amrita.edu, v_nivethitha@ch.amrita.edu,`

`s.suthir@ch.amrita.edu`

Abstract: Recent advances in hyperspectral imaging and machine learning are changing the way crop species are assessed, for which identification plays a critical role feeding the global population. This research uses images obtained from the Deutsches Zentrum für Luft- und Raumfahrt Earth Sensing Imaging Spectrometer (DEIS) to identify key arable crops in southeastern Hungary including hybrid corn, soybean, sunflower, and winter wheat. In this work, WA-CNN, Random Forest, and SVM machine learning algorithms are used to show how these models can improve the remote sensing of agricultural areas with precision, thereby optimizing agricultural output and land usage. A notable aspect of this methodology is the application of Cross-Validation (CV), which plays a dual role: It not only compares the performance of different models but also optimizes weights of ensemble, which are given to classification so as to enhance the reliability of the same. The results show that employing

DESIS data allows for accurate determinations of crop development and yield prediction – valuable information for farmers and authorities. Furthermore, since landscapes may be fragmented and fields differ in size, this study combines high spatial resolution imagery with high temporal frequency data. The study raises the argument that effective crop surveillance systems should be developed due to the beneficial effects they could have on agriculture as long as they increase the quality of decision-making in a subject of farming processes, which will be crucial in meeting the ever-growing needs of the constantly growing global population. **Keywords:** Crop Type Classification, Hyperspectral Imaging, Machine Learning, Remote Sensing, DESIS, WA-CNN, Random Forest, SVM, Agriculture

7. Fraud Detection using ML algorithms

Paper Id 31

Prerna Upadhyay¹, Shahin Saifi¹, Jyotsna Koul¹, Shailesh Kamble¹, Nisha¹

¹Department of Computer Science and Artificial Intelligence, Indira Gandhi Delhi
Technical University for Women, Delhi, India

prerna142btcsai21@igdtuw.ac.in, shaileshdkamble@igdtuw.ac.in,
shahin146btcsai21@igdtuw.ac.in, nisha001phd23@igdtuw.ac.in,
jyotsna155btcsai21@igdtuw.ac.in

Abstract: The increase in digital transactions has created an urgent need for reliable fraud detection. This study evaluates the performance of various machine learning models—Logistic Regression, K-Nearest Neighbors (KNN), Support Vector Classifier (SVC), Decision Trees, Random Forests, and Neural Networks—alongside a Graph Neural Network (GNN) to detect fraudulent transactions. Recognizing the inherent class imbalance in fraud detection datasets, we applied random under-sampling and the Synthetic Minority Over-sampling Technique (SMOTE) to create balanced training sets and optimize model performance. Our results revealed that Neural Networks achieved the highest accuracy, reaching 98.22% with under-sampling and 100.00% with SMOTE. Logistic Regression also demonstrated strong performance with a 98.67% accuracy on SMOTE-balanced data, followed by KNN (97.46%) and SVC (98.51%). Although the GNN model leverages advanced graph-based representation learning, it achieved an accuracy of 70.38%, suggesting limitations in graph neural networks for this specific task. We evaluated model performance using accuracy, precision, recall, and F1-score metrics, which provided comprehensive insights through confusion matrices. The findings emphasize the critical role of data handling techniques, as balancing the dataset significantly enhanced model sensitivity and accuracy. This study underscores the efficacy of machine learning in fraud detection and highlights areas for improvement, including exploring optimized architectures and real-time data analysis for GNNs. In conclusion, selecting appropriate models and data balancing techniques is essential in developing effective fraud detection solutions, with Neural Networks and SMOTE proving particularly successful in identifying fraudulent transactions.

Keywords: SMOTE, oversampling, classifiers, decision tree, neural network, PCA, GNN, SVM, fraud.

8. Assessing Students' Emotions in Learning Environment: Integrating Deep Learning with Statistical Learning

Paper Id 32

Tushar Tripathi¹, Tripti Mahara¹, Madhumita Guha Majumder¹

¹Prin. L.N. Welingkar Institute of Management Development and Research, Bangalore, India

tushar@welingkar.org, tripti@welingkar.org, madhumita@welingkar.org

Abstract: Understanding the facial expressions are one of the most widely utilized method to discover the hidden emotions of an individual. Ascertaining the emotions are helpful across most of the domains ranging from psychology, health care, marketing, education etc. and can benefit both the individual and the society. The research here focuses on identifying the seven basic emotions (angry, disgust, happy, sad, fear, neutral, surprise) of the students in a B-School across four time slots during a day for 6 days (Monday- Saturday) using Deep Learning Algorithm. To achieve this, performance of three Deep learning models namely AlexNet, VGG16 and VGG19 are compared and based on the performance AlexNet is selected to detect the emotions of the students. Statistical techniques including 2-way ANOVA and Multiple Linear Regression are also utilized to validate the results. Results of analysis reveal that majority of the students go through two emotions: Happy and Sad throughout the day with neutral following. Extreme emotions like anger, fear and disgust are observed amongst very few students. Results also reveal that time slot and day are not significant in determining the emotions. The outcome of this research can be utilized by teachers and top management who are the two predominant stake holders in the education system concerned with the well-being of the students.

Keywords: Deep Learning, Facial Emotions, Statistical Learning, Students.

9. Rayleigh Wave in Nonlocal Fractional Order Thermoelastic Solid Half Space under Hydrostatic Initial Stress

Paper Id 35

Sangeeta Kumari¹, Surbhi Sharma¹, Mrinmoy Das¹

¹Department of Mathematics, Chandigarh University, Gharuan, Punjab, India

sangwan.sangeeta.ss@gmail.com, surbhibhardwaj92@gmail.com,
mrinmoykvb@gmail.com

Abstract: The current paper investigates Rayleigh surface wave propagation in a non-local fractional order thermoelasticity with hydrostatic initial stress in the isotropic solid half-space. The governing equation for the Rayleigh-type surface wave are solved mathematically and satisfying the relevant boundary conditions i.e. thermally insulated and isothermal

boundries and calculated secular equation for both the cases which shows the dependency of non-dimensional wave speed on fractional order, nonlocality parameter. In absence of initial stresses, nonlocal fractional order thermoelasticity, the frequency equation gives the speed of Rayleigh wave. We consider the aluminium material for the numerical simulation and represents the effect of nonlocal, frequency and fractional order parameter on velocity of Rayleigh wave.

Keywords: Nonlocal thermoelasticity; fractional order thermoelasticity; Rayleigh wave; dispersion relations; wave speed.

10. MediAI: A Specialized Medical LLM for Accurate Diagnosis and Clinical Documentation

Paper Id 38

Chitra Jain¹, Aryan Kaushik¹, Abhishek Saini¹, Maitri Vashistha¹, Kamal Kumar Gola¹

¹Department of Computer Science and Engineering, COER University, 247667, India

chitra.cj1996@gmail.com, kaushikaryan999@gmail.com,
abhishek143saini@gmail.com, vashisthamaitri16@gmail.com,
kkgolaa1503@gmail.com

Abstract: Large language models (LLMs) like ChatGPT-4 have shown promise across multiple domains, yet healthcare presents distinct challenges that demand high accuracy and reliability. To address these requirements, we developed MediAI, a specialized medical LLM aimed at improving clinical documentation quality and supporting diagnostic processes. Unlike general-purpose LLMs, which often lack the depth needed for healthcare-specific contexts, MediAI employs an approach that moves beyond simple responses by actively interacting with patient data through structured, iterative questioning to extract key information. Utilizing advanced frameworks like Retrieval-Augmented Generation (RAG) and reflective questioning, MediAI generates medical notes that are both contextually accurate and sensitive to clinical relevance. To evaluate MediAI's performance, we used metrics such as ROUGE and Named Entity Recognition (NER), alongside tailored healthcare datasets, to validate its effectiveness in questioning and documentation accuracy. These assessments indicate that MediAI can meet the high standards necessary in clinical settings, improving the precision and efficiency of patient care. Our findings support the idea that healthcare-specific LLMs, purpose-built with a focus on contextual retrieval and structured questioning, can offer dependable assistance with 93.7% accuracy in medical guiding alignment and 92.9% uptime, enhancing clinical workflows and patient outcomes.

Keywords: Healthcare, GenAI, Medical Chatbot, LLM, NLP, RAG

11. AI-Powered Custom Emoji Generator: Enhancing Digital Expression and Engagement

Paper Id 40

Kushagra Sharma¹, Jatinder Kaur¹
¹Chandigarh University, Punjab, India
kushagras506@gmail.com, jatindere6967@cumail.in

Abstract: Communication in the digital world has changed a lot since emojis are used as means to convey emotions, thoughts or reactions. However, most of the emoji platforms do not have enough freedom and general features that are necessary to adapt to user’s needs and the context of an emoji. To this end, this paper presents a concept of the custom emoji creator that utilizes artificial intelligence to generate emojis on the basis of descriptive texts submitted by a user. The system developed here uses the Flask framework and, for the generation of the emojis, the OpenAI language models; additionally, the Naive Bayes recommendation system is used for improvement based on feedback. Therefore, this research assesses the effectiveness of the system by means of indices, log data or activity and feedback data. This paper adds to improving digital expression since it offers the client better, context-relevant emojis, increases interaction, and improves the quality of communication.

Keywords: AI-powered emoji generator, digital communication, personalized emojis, user feedback, Naive Bayes, Flask framework, OpenAI, emoji generation.

12. MSD-YOLOViT10: Optimized Underwater Marine Species Detector

Paper Id 43

Mouleek Kapoor¹, Aditi Shetkar², Shitala Prasad²
¹Computer Science & Engineering, DTU, India
²School of Mathematics & Computer Science, IIT Goa, India
mouleekkapoor1910@gmail.com, aditi24231101@iitgoa.ac.in,
shitala@iitgoa.ac.in

Abstract: Detecting, monitoring, and conserving marine species within ecosystems is essential for maintaining environmental balance. Traditional methods rely on manual detection of species on the ocean floor, a process that is both labor-intensive and time-consuming. These methods often require extensive sampling efforts, which can be intrusive and potentially harmful to marine environments. Additionally, these limitations impede large-scale, continuous monitoring, reducing the ability to promptly respond to changes in marine ecosystems. To overcome these challenges, we present an advanced model, MSD-YOLOViT10, which integrates a visual transformer with the YOLOv10 neck. This integration enhances the representation of marine species, leading to significant improvements in detection performance within marine ecosystems. Preliminary results on the IITGoa Marine Vision (IIT-GoaMV) dataset demonstrate that MSD-YOLOViT10 outperforms existing state-of-the-art methods in marine species detection and recognition. The resources will be available at <https://github.com/mkapoor1910/Marine-Species-Detection>.

Keywords: Feature Representation, Marine Species Recognition, Object Detection, YOLOv10, Visual Transformer.

13. Analysis of CNN models with Transfer learning in Mango Diseases Detection

Paper Id 44

Mukesh Kumar Singh¹, Natthan Singh², Vishnu Sharma³

¹Department of Computer Science & Engineering, Galgotia College of Engineering & Technology, Greater Noida, India

²Department of Computer Science & Engineering, I.E.T. Lucknow, India

³Department of Computer Science & Engineering, I.T.S. Engineering College Greater Noida, India

mukesh812singh@gmail.com, natthan.singh@ietlucknow.ac.in,
vishnusharma97@gmail.com

Abstract: Mangos are a valuable fruit and a source of antioxidants because they contain phytochemicals like carotenoids and polyphenols. But mangoes are susceptible for various diseases such as bacterial canker, anthracnose, and powdery mildew. In this study, the main approach for detecting diseases in mango crops—with a focus on diseases that have a major impact on production and quality—is Convolutional Neural Networks (CNNs). The study preprocesses mango images by encoding class labels and standardizing pixel values using a Kaggle dataset in order to maximize model performance. Through transfer learning, several CNN architectures—including VGG16, VGG19, ResNet50, DenseNet121, and AlexNet—are compared, and high accuracy rates are attained. The models ResNet50 and DenseNet121 have shown their efficacy in identifying mango leaf diseases by achieving the maximum accuracy, up to 100%. This study highlights how CNN models may be used to enhance early disease identification in mango crops, perhaps leading to increased agricultural output and better financial results.

Keywords: VGG16, VGG19, ResNet50, DenseNet121, AlexNet, Mango diseases.

14. Leveraging Machine Learning to Optimize Financial Markets

Paper Id 45

Chirag¹, Sonia¹

¹Department of Mathematics, Chandigarh University, Mohali, India
Chiragkumar354@gmail.com, Sonia.e8843@cumail.in

Abstract: This study aims to improve the accuracy of machine learning-financial market forecasting. Financial markets are notorious for being unpredictable and volatile, making predictions particularly difficult for traders or analysts. This study introduces an enhanced trend-following algorithm, that is combined with the Average True Range (ATR) indicator, and proposes new adaptive signal confirmation models. When combined, they produce more accurate buy and sell signals. This captures market trends with minimal false signals through the application of machine learning. This general framework improves prediction

accuracy and the risk-adjusted returns drastically over the naive models proposed to date, thus providing a practical way for traders and institutions dealing with increasing financial sophistication. The study paves the way for further improvements in AI optimized finance and incorporation of machine learning into state-of-the-art trading systems.

Keywords: Financial Market, Machine Learning, Average True Range, Trend Following, Volatility, Algorithmic Trading, Optimization.

15. Evaluating Machine Learning Techniques for Student Performance Prediction in Higher Education

Paper Id 46

Punam¹, Harish Nagar¹

¹Department of Mathematics, Chandigarh University, Mohali, India
punam15092001@gmail.com, drharishngr@gmail.com

Abstract: Accurate prediction of a student's performance is beneficial in improving learning outcomes, while the conventional machine learning models are unable to reflect the progressive and pyramidal structure of learning. This paper presents Hierarchical Adaptive Neural Networks (HANN), a new algorithm that uses hierarchical learning in its architecture as well as modifies the architecture to better predict student performance. HANN utilizes a two-layer approach: One for student records and another for collective learning patterns capable of changing its neural structure at a given period in relation to the existing patterns. Precise evaluation of HANN over ten benchmarks of higher education data sets showcases the better performance of the proposed HANN model in comparison to the traditional models.

Keywords: Predictive analysis for students performance, Higher learning institution analysis, Artificial Neural Networks, Graph Neural Networks, Recurrent Neural Networks.

16. An Innovative Deep Neural Network-Based Method for Automated Cough Recognition and Diagnosis

Paper Id 50

Swati Hira¹

¹Department of Computer Science and Engineering, Indian Institute of Information Technology, Nagpur, Maharashtra, India

Abstract: Respiratory infections pose a significant global health burden, with cough being a prominent symptom across various illnesses. Our paper aims to revolutionize respiratory disease screening using an automated system powered by Convolutional Neural

Networks (CNNs). The system screens for bronchitis, asthma, pneumonia, and pertussis by analyzing raw cough audio. Mel-Frequency Cepstral Coefficients (MFCC) spectrograms are extracted from cough data, enabling accurate symptom identification. To ensure robustness, we augmented the dataset from 291 to 1,455 files through noise addition and time stretching. The CNN architecture includes convolutional and max-pooling layers for feature extraction, with dropout regularization to prevent overfitting. This approach ensures reliable performance and adaptability to real-world conditions. With a precision of 85.2% and test accuracy of 84.2%, the model shows great potential for integration into healthcare settings, addressing the global burden of respiratory illnesses. Future enhancements could allow broader accessibility, especially in remote or underserved areas.

Keywords: Respiratory infection, Deep learning, Convolutional Neural Networks, Cough Diagnosis.

17. Development of a Robust Multispectrum Surveillance System Using Geman McClure Norm Based Fractional Order Variational Optical Flow Model

Paper Id 51

Ankit Kumar¹, Pushpendra Kumar¹

¹Maulana Azad National Institute of Technology Bhopal-462003, India
2230401001@stu.manit.ac.in, pkumarfma@manit.ac.in

Abstract: Video surveillance is known as a fundamental task in computer vision, which aims to detect and track the moving objects in an image sequence (video). For this purpose, visible-visible spectrum system have been frequently used for various applications. However, it is not feasible for adverse environmental conditions such darkness, fog, snowfall and storms, etc. Thus, in order to address these challenges, this paper integrates the visible (color) and infrared (thermal) spectrum to provide a robust surveillance system. The object motion detection is performed in terms of optical flow, which is estimated using the Geman-McClure normbased fractional order variational model. This variational function is convex in nature and robust against outliers, and provides a dense flow field. The minimization of this variational function is done using Euler-Lagrange (EL) equations and numerically discretized based on the Grunwald-Letnikov (GL) derivative definition. The resulting non-linear system of equations is converted to a linear system using a fixed-point iteration scheme and finally solved by employing the efficient numerical scheme. The significance of the model is shown by performing the experiments on the fusion of image pairs, visible-thermal (VT), thermal thermal (TT) and visible-visible (VV) spectrum.

Keywords: Fractional order derivative (FOD), Geman-McClure norm, Optical flow, Thermal sensors, Video surveillance.

18. A Comparative Analysis of Classification with Explainability of Customer Churn Prediction

Paper Id 57

Sujoy Chatterjee¹, Suvra Jyoti Choudhury²

¹University of Campinas, Sao Paulo, Brazil

²Indian Institute of Information Technology, Nagpur, India

Abstract: The prediction of customer churn is a crucial aspect for business makers in retaining customers and improving turnover. In recent years, many studies have been performed on the classification aspect, and many cutting-edge deep-learning techniques have been introduced to solve the classification problem. This study introduces the comparative study that combines various machine learning classifiers along with oversampling methodologies to overcome the class imbalance problem in the datasets. To address the class imbalance problem, we explore three over sampling methods—SMOTE, ADASYN, and random oversampling—to enhance model performance, particularly in minority class prediction, and evaluate their effects on commonly used classifiers. Furthermore, using interpretability methods, we leverage the power of LIME and SHAP to identify the important characteristics in churn decisions, providing insights that support actionable business strategies. The experimental results demonstrate that oversampling techniques substantially improve prediction accuracy, and on the other hand, the interpretability analysis exhibits valuable feature importance rankings, and these allow organizations to focus on factors most predictive of churn. Future research may expand this approach by exploring real-time applications, advanced interpretability tools, and external data integration, which could further improve predictive power and decision-making in churn management.

Keywords: Customer Churn, Explainable AI, Class imbalance, Sampling.

19. Predicting Maternal Health Risks using Ensemble Model, Multilayer Perceptron, and PCA Features

Paper Id 58

R.Girija¹, N.Deepa²

¹Centre for Health Innovations, Manav Rachna International Institute of Research and Studies, Faridabad, India

²Post-Doctoral Fellow, Centre for Health Innovations, Manav Rachna International Institute of Research and Studies, Faridabad, India

drgirija.set@mriu.edu.in

Abstract: An essential part of public health, maternal healthcare looks after the expectant mother's health prenatal, perinatal, postnatal. It guarantees the best possible health for the growing fetus as well as the mother through its predictions. Maternity and the post-partum period present a multitude of risks and repercussions for the mother's health., and hence prompt identification of these risks can be extremely important to a woman's safety. A

strategy to anticipate hazards related to maternal health is proposed in this study. Principal component analysis (PCA) is the initial step in the process, which involves extracting important features from the dataset. To attain good performance, this study then uses a stacked ensemble voting classifier that includes one deep learning model and one machine learning model. By contrasting it with current state-of-the-art methods, the suggested model's efficacy is further verified. Comparison analysis was made with many Machine Learning (ML) models such as Random forest classifier, Logistic Regression, Decision tree classifier, Support vector classifier, and XGB classifier. Based on comprehensive investigation, the suggested deep learning model (one Machine Learning and one Deep Learning) yields superior prediction rates for high and low risk, with 84% and 86% of the accuracy, respectively.

Keywords: Maternal Health risks, Principal Component Analysis, Stacked ensemble voting classifier, Healthcare.

20. Analysis for an Unreliable Retrial Queueing System Under Threshold-Based Recovery Using ANFIS Approach

Paper Id 60

Nidhi¹, Sudeep Singh Sanga¹

¹Sardar Vallabhbhai National Institute of Technology, Gujarat, Surat, India
d22ma004@amhd.svnit.ac.in, ssanga@amhd.svnit.ac.in

Abstract: Throughout this work, we examine an unreliable retrial queueing system in which clients may balk, the server recovers based on a threshold, and maintenance takes place during idle times. The server is in charge of client service in this framework, although it is unreliable due to unpredictable breakdowns. Once a certain number of clients are in the system, the server can be repaired. When a client arrives and discovers that the server is busy, they are redirected to the retrial orbit, a virtual waiting area, where they must wait for the server to make itself accessible for service. The mathematical framework of the Chapman–Kolmogorov (C–K) equations is based on the birth and death process. Then, using a matrix method, steady-state probabilities are computed. Different probabilities are used to create performance metrics and simulations are performed to see how changing the parameters affects the system's performance. A cost function is developed for determining the optimal decision parameters and reducing the system cost by using particle swarm optimization (PSO). Moreover, we compare the outcomes of the numerical experiments with those obtained via a soft computing technique on the basis of an adaptive neuro-fuzzy inference system (ANFIS), providing valuable insights into the system's dynamics.

Keywords: Retrial Queue, Threshold-based Recovery, Maintenance Activity, Balking, ANFIS.

21. Review of Recent Advancements in Smart Clinical Surgery

Paper Id 62

Rudra Pratap Singh¹, Shrirang Savale¹, Akshat Singh Chauhan¹, Harsh Goud¹

¹Indian Institute of Information Technology, Nagpur, Maharashtra, India

Abstract: Surgical education has significantly evolved over the years, driven by advancements in technology and the increasing complexity of patient care, with traditional methods often falling short of meeting these demands. Innovations such as virtual reality (VR) systems augmented by machine learning (ML) have emerged as transformative solutions, providing on-demand training, integrating procedural checklists, and delivering personalized feedback through data-driven refinement. Early VR applications created immersive, risk-free environments for skill development, while ML analytics introduced objective performance assessments and predictive algorithms, enabling tailored training regimens that optimize learning and reduce patient risks. In clinical practice, ML has demonstrated its efficacy in assessing surgical invasiveness through biomarkers and inflammatory profiles, as well as enabling personalized treatment planning by addressing challenges like small sample sizes and high-dimensional data using feature selection and external validation. Studies report robust predictive performance, with areas under the curve (AUCs) of 0.87 for invasiveness scoring and 0.76 for personalized treatment prediction, showcasing ML's potential in personalized healthcare. This review explores the convergence of VR and ML in surgical education and practice, emphasizing their role as a transformative force in enhancing training outcomes and advancing cost-effective, patient-centered care.

Keywords: Machine Learning, Invasiveness, Spine Surgery, Medicine, Data Analysis.

22. Adaptive Learning EJAYA for Constrained Optimization Problem

Paper Id 65

Sandeep Kumar Mogha¹, Sonal Deshwal¹, Pravesh Kumar²

¹Department of Mathematics, Chandigarh University, Mohali (Punjab), India

²Department of Mathematics, Rajkiya Engineering College Bijnor, India

moghadma@gmail.com, sonaldeswal1995@gmail.com, praveshtomariitr@gmail.com

Abstract: A novel algorithm named Lejaya is introduced in this paper. Lejaya is an advanced optimization algorithm that builds upon the EJAYA method. Lejaya employs a two-phase structure—Adaptive Enhancement and EJAYA—to effectively balance exploration and exploitation within the search space, crucial for handling constraints in complex optimization tasks. The algorithm's performance was assessed on a set of 10 constrained benchmark functions. To validate its efficacy, Lejaya was compared against five prominent metaheuristics—TLBO, EJAYA, JAYA, Particle Swarm Optimization, and Genetic Algorithm—on constrained functions. Each algorithm underwent thirty trials across 1000 iter-

ations, with evaluations based on metrics such as best solution, mean, standard deviation, CPU time, and rank. The findings reveal that Lejaya excels in handling constraints, often reaching the global optimum and surpassing other algorithms, establishing it as a strong method for constrained optimization problems.

Keywords: Optimization, Jaya algorithm, EJAYA, Adaptive Enhancement, Constraints.

23. Performance Evaluation of Deep Learning Models using Transfer Learning on Ultrasound Images for Breast Cancer Detection

Paper Id 66

Laxmi Yadava¹, Girish Chandra¹, Divakar Yadav²

¹Department of Computer Science and Engineering, Institute of Engineering and Technology, Lucknow, India

²School of Computer and Information Sciences, Indira Gandhi National Open University, New Delhi, India

`laxmiyadav2796@gmail.com`, `girish.chandra@ietlucknow.ac.in`,
`divakar.yadav0@gmail.com`

Abstract: One of the most serious illnesses that affect women and can even be fatal is breast cancer. It has a major impact on their emotional and physical well-being. Breast calcifications or irregular tissue growth are major health concerns that lead to BC. Early diagnosis and treatment can significantly lower the death rate and are crucial for survival rates. Medical imaging techniques, particularly ultrasound, are widely used due to their non-invasive nature and effectiveness in identifying abnormal tissues. In this research paper, we propose a Breast Cancer (BC) detection approach using pre-trained models such as ResNet, GoogleNet, DenseNet, VGG16 and Xception leveraging Transfer Learning. DL models with the Transfer learning concept have proven quite effective in Breast Cancer detection in recent years. Transfer Learning is used to utilize the knowledge gained from large-scale image recognition tasks to improve the accuracy of cancer diagnosis and classification in the limited ultrasound imaging domain. This paper compares five deep-learning models based on the BUSI dataset of breast cancer, which is publicly available. The dataset consists of 780 images in PNG format, from which 210 images are cancerous, 437 are non-cancerous, and 133 are normal. However, GoogleNet's transfer learning performance is better than that of other existing models. The accuracy for the test and validation were 99.15% and 99.37%, respectively.

Keywords: Deep Learning, Transfer Learning, Ultrasound, GoogleNet, DenseNet121, ResNet50, VGG16 and Xception.

24. Efficient Multi-Objective Particle Swarm Optimization for Noisy Environments

Paper Id 70

Amit Kumar¹, Sushil Kumar¹, Hira Zaheer²

¹Department of Computer Engineering, National Institute of Technology Kurukshetra, Kurukshetra, 136119, Haryana, INDIA

²Department of Applied Science Maths, Greater Noida Institute of Technology, Greater Noida, 201301, Uttar Pradesh, INDIA

32213123@nitkkr.ac.in, skumar@nitkkr.ac.in, hirazaheeriitr@gmail.com

Abstract: Simultaneously optimizing two or more competing objectives is known as multi objective optimization, and it is a prevalent situation in real-world issues where trade-offs between objectives need to be carefully handled. For such problems, conventional single-objective optimization approaches are insufficient; instead Multi-objective techniques that can produce a wide range of solutions the Pareto front, which represents the best trade-offs between objectives are required. One well-known technique in this field is Multi-Objective Particle Swarm Optimization (MOPSO), which was inspired by the swarming social behavior of birds. MOPSO is very good in sifting through and taking advantage of the search space to find Pareto-optimal solutions. Nevertheless, in noisy settings where stochastic changes impact the objective functions, its performance may decrease, resulting in poor evaluations of the quality of the solutions and poor convergence. In this study, an updated Multi-objective Particle Swarm Optimization (MOPSO) algorithm is presented, which uses Mean and Wiener filters to reduce the negative effects of noise in the algorithm. Wiener filters, which are ideal in the sense of mean square error, further improve the noise reduction by taking into account both the signal and noise features. The mean filter decreases random fluctuations by averaging multiple evaluations. These filtering techniques improve the algorithm's adaptability, enabling it to have a more accurate Pareto front, although there is much noise in the problem.

Keywords: MOPSO, Wiener Filter, Mean Filter.

25. Precision Strontium Detection in Water: A Machine Learning Augmented Flame Photometric Approach

Paper Id 78

Prarthana Madhusoodanan¹, Sivakumar Rajagopal¹

¹School of Electronics Engineering, Vellore Institute of Technology, 632014 Tamil Nadu, India

Abstract: The focus of this research is primarily on developing the flame photometry method (which is a precise, rapid analytical method) for strontium detection in water, as

it is a suitable technique for routine determinations of alkali and alkaline earth metals. In this work, Python and machine learning are used to validate the properties of the instrument used as well as the importance of Strontium. This study, however, provided the means to quantify with accuracy even at low contamination levels by creating a calibration curve linking emission intensity to strontium concentration. Methodological changes were also applied to handle complicated water matrices with probable interaction between the polluting agents. According to estimates of accuracy, repeatability, and precision, Flame photometry was found to be a reliable and well founded detection method for low levels of strontium. They combined data from flame photometry with the output of machine learning to predict the drinkability of water by strontium. Models based on this data, using thresholds for strontium and other observed factors, provided strong basis for automated water quality evaluation. This combination method improves interpretation accuracy and allows for real time viewing of possible contamination hazards and water quality. This paper shows values for flame photometry, combined with predictive modeling, are a useful tool for strontium environmental monitoring which has solid meaning for water safety and public health.

26. Identification of Severity of Chronic Obstructive Pulmonary Disease (COPD) Using Machine Learning Models based on Spirometry Data

Paper Id 82

Pavan Reddy¹, K Adarsh¹, Sivakumar R¹

¹School of Electronics Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu, India

rsivakumar@vit.ac.in

Abstract: This paper is about developing machine learning models for identifying severity of Chronic Obstructive Pulmonary Disease (COPD) in patients. The motive is to try applying machine learning techniques in identification of severity of COPD which can be classified into 4 stages which have been discussed briefly in the introduction part. By using a dataset of patients with COPD which included the patient data as well as severity of the disease, a machine learning model was developed by using supervised learning. The developed models demonstrated good cross validation accuracy. The first model developed using Random Forest algorithm showed accuracy of 86% which was then improved to 90% using the XGBoost algorithm. The data set used in this study is, however, small with only 101 samples and a larger dataset could potentially help improve the performance of the ML models. The outcome of the paper is the potential of ML models in identifying the severity of COPD based on spirometry data. After this study we suggest that the use of machine learning models along with regular clinical diagnosis can enhance the accuracy of the diagnosis. Further work in this area can help develop machine learning models which can help in increasing the accuracy of diagnosis of severity of COPD in patients.

Keywords: COPD, Machine learning, severity, spirometry.

27. Real-time Healthcare Environment Monitoring Through Deep Learning: A Multi-Modal Sensor Fusion Implementation

Paper Id 83

Gokul Nittin A¹, Sivakumar Rajagopal¹

¹School of Electronics Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu-632104, India

`gokulnittin.a2022@vitstudent.ac.in, rsivakumar.vit.ac.in`

Abstract: Healthcare environment monitoring requires progressively advanced solutions for protecting patients and sustaining excellent care environments. The research implements a proof-of-concept method that uses deep learning technology to merge multiple sensor inputs by applying a properly optimized CNN model for analyzing healthcare environmental data. The study employs five essential environmental factors including temperature, relative humidity, PM2.5, TVOC and HCHO to advance monitoring methods through pure experimental work and architectural improvements. The developed system reaches 89.5% validation accuracy while reducing response time to environmental changes by 65% and lowering false alarm occurrences by 82%. The research confirms that deep learning technologies can power robust environmental surveillance systems in high-risk healthcare facilities which can serve as base models for superior proactive surveillance beyond threshold-based approaches.

Keywords: Healthcare Monitoring, Deep Learning, CNN, Sensor Fusion, Real-time Analytics, Healthcare Informatics, Environmental Monitoring.

28. Comparative Analysis of Random Forest and SVM for EMG-Based Gesture Recognition

Paper Id 84

Sarthak Krishak¹, Sivakumar Rajagopal¹

¹School of Electronics Engineering Department Vellore Institute of Technology, Vellore, Tamil Nadu 632014, India

`sarthak.krishak2022@vitstudent.ac.in, rsivakumar@vit.ac.in`

Abstract: This research delivers a comprehensive examination of Random Forest and SVM models for recognizing gestures through electromyography (EMG) signals. A strong signal processing pipeline was created, integrating bandpass filtering, normalization, and sophisticated feature extraction techniques such as Root Mean Square (RMS), Mean Absolute Value (MAV), Zero Crossing Rate (ZC), Waveform Length (WL), and Mean Frequency (MNF). The research utilized an eight-channel EMG dataset, employing a sophisticated windowing strategy to ensure optimal signal segmentation. Both classifiers achieved notable classification accuracy, underscoring their suitability for EMG-based gesture recognition tasks.

Comparative analysis, supported by cross-validation and hyperparameter optimization, offers valuable insights into the design and implementation of practical gesture recognition systems.

Keywords: Electromyography (EMG) Signal Processing, Gesture Recognition, Random Forest, Support Vector Machine (SVM), Feature Extraction, Machine Learning.

29. EMG Signal Classification in Lower Limbs using Machine Learning Techniques

Paper Id 86

Vivek Saha¹, Sivakumar Rajagopal¹

¹School of Electronics Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu
632014, India

vivek.saha2022@vitstudent.ac.in, rsivakumar@vit.ac.in

Abstract: This study presents a machine learning approach to classify electromyography (EMG) signals recorded from lower limb muscles, focusing on their application in distinguishing between various physical activities and physiological conditions. The primary objective is to differentiate between normal and abnormal muscle conditions and classify activities such as sitting, standing, and walking, based on EMG signal characteristics. Leveraging both Random Forest and Support Vector Machine (SVM) models, this study seeks to evaluate and compare the effectiveness of these algorithms in accurately classifying muscle activity across different conditions. On performing the two classifications we observe that Random forest classification gives a accuracy of 73% while Support vector machine gives an accuracy of 58%, proving that RF is much more suitable for this kind of non-linear data.

Keywords: EMG Classification, Electromyography (EMG), Muscle Activity Detection, Random Forest Classifier, Support Vector Machine (SVM), Machine Learning in Biomechanics.

30. Real-Time Virtual Meeting Architecture for Deaf People: Audio Transcription, Noise Processing, and Sign Language Translation Using LSTM Neural Networks

Paper Id 87

Aaryan Chaurasia¹, Sivakumar Rajagopal¹

¹School of Electronics Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu,
India

Aaryan.chaurasia2022@vitstudent.ac.in, rsivakumar@vit.ac.in

Abstract: This paper proposes an advanced architecture for the inclusion of deaf people in virtual meeting seamlessly, coupled with growing attention towards inclusivity in digital communication. This proposed architecture equips features such as audio processing and its transcription, translation along with text summarization in real-time with a sign language translator for completing a two-way communication bridge between hearing and deaf participants in a virtual meeting. The developed system utilizes advanced machine learning to provide natural, accessible, and scalable interactions in digital environments for deaf individuals. The proposed architectural model works in two stages, which are completely different from each other and integrated efficiently. The first stage features actual time sounds of a hearing participant from which noises have been filtered out for clearer signals. The audio is then transcribed into text using a pre-trained Machine learning model trained on a vast dataset with different dialect and speech patterns. For complete accessibility, the system then translates the transcription into a user preferred language for the deaf participants to ensure the personalized experience, further the participants are also given a summarization of text for concise comprehension. The Second part uses a camera module to register and recognize the gesture of Sign languages performed by the deaf participants using a LSTM based neural network model. Here the model provides an accurate interpretation of the gesture in textual format, thus completing a bidirectional and seamless communication bridge between the hearing and deaf participants. The key objective of this architecture is successfully enabling deaf individuals to participate in a virtual meeting environment promoting their inclusion in digital environments.

Keywords: Inclusive Digital Communication, Real-Time Transcription, Noise Reduction, Speech-to-Text Conversion, Text Summarization, Sign Language Recognition, Long Short-Term Memory (LSTM) Models, Gesture-to-Speech Translation, Machine Learning for Accessibility, Text-to-Speech Conversion and Virtual Meeting Architecture.

31. Comparative Study of CNN and LSTM Deep Learning Models for EMG Signals for Gesture Recognition

Paper Id 88

Ishaan Dighe¹, Sivakumar Rajagopal¹

¹School of Electronics Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu
632014, India

ishaan.dighe2022@vitstudent.ac.in, rsivakumar@vit.ac.in

Abstract: Electromyography (EMG) signals provide important information about muscle activation patterns linked to human gestures, forming a basis for progress in gesture recognition technology used in fields like prosthetics, human-computer interaction, and robotics. Deep learning architectures, especially Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks, have proven effective at analyzing these intricate bio-signals. This research offers a comparative evaluation of CNN and LSTM models for

gesture classification based on EMG signals, assessing their individual advantages in identifying spatial and temporal features that are crucial for understanding gestures. A collection of EMG signals related to different hand gestures was utilized to train and evaluate the performance of each model. The CNN model, recognized for its ability to detect spatial patterns, exhibited notable effectiveness in recognizing localized muscle activations linked to specific gestures. In contrast, the LSTM model's strengths in sequential processing allowed it to capture temporal dependencies more efficiently, resulting in improved accuracy for gestures that involved dynamic muscle activations. Experimental findings reveal that although the CNN model reached an accuracy of X% and demonstrated quicker training times, the LSTM model offered enhanced precision for intricate, sequential gestures, achieving an accuracy of Y%.

Keywords: Electromyography (EMG), Gesture recognition, Deep learning, Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM), Gesture cognition, Muscle activation patterns, Human-computer interaction (HCI), Prosthetics, Bio-signal processing.

32. Data-Driven Insights from High-Dimensional Time-Series Signals: A Comprehensive Analysis Approach

Paper Id 89

Ayushmaan Panda¹, Sivakumar Rajagopal¹

¹School of Electronics Engineering, Vellore Institute of Technology, Tamil Nadu 632014, India

ayushmaan.panda2022@vitstudent.ac.in, rsivakumar@vit.ac.in

Abstract: This study introduces a robust methodology for analysing high-dimensional time series signals, exemplified through Electrocardiogram (ECG) data analysis. By employing Python's scientific libraries, including scipy.io, matplotlib, NumPy, and seaborn, the approach focuses on signal visualization, statistical analysis, correlation, and frequency domain exploration. The findings unveil significant insights into physiological patterns, inter-patient variability, and dominant signal frequencies, paves the way for advanced data-driven research in ECG analysis and opens doors to potential clinical applications. By incorporating additional techniques and expanding the analysis scope, researchers can gain a deeper understanding of cardiovascular health and develop more sophisticated diagnostic tools.

33. Predictive Modeling of Sepsis Risk: Leveraging Clinical Parameters for Early Detection and Intervention

Paper Id 93

Mohit Kumar Jagwani¹, Sivakumar Rajagopal¹

¹School of Electronics Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu,
India

mohitkumar.jagwani2022@vitstudent.ac.in, rsivakumar@vit.ac.in

Abstract: Sepsis stays a significant worldwide health challenge, necessitating early detection to improve patient outcomes. This study utilizes clinical metrics such as heart rate, oxygen saturation, respiration rate, lactate levels, and ICU length-of-stay to evaluate sepsis risk. By analyzing these parameters, the study enables real-time detection of high-risk cases, offering actionable insights for prompt clinical intervention. The method seeks to help healthcare providers with reliable predictions, ensuring prompt and powerful patient care. Future work consists of integrating this model into hospital monitoring tools, expanding its scope to numerous patient demographics, and exploring its application in remote health management systems to enhance accessibility and diagnostic accuracy.

Keywords: Sepsis Prediction, Machine Learning, Remote Health Management.

34. Defending NLPP Solution Approaches: A Rebuttal to Bhatia et al. (2022) “Meher approach to solve neutrosophic linear programming problems using possibilistic mean”

Paper Id 97

Kailash Lachhwani¹

¹Department of Applied Science, National Institute of Technical Teachers Training and Research, Chandigarh, India

kailashclachhwani@nitttrchd.ac.in; kailashclachhwani@yahoo.com

Abstract: Neutrosophic linear programming problems (NLPPs) are uniquely defined linear programming problems under neutrosophic environment in which coefficients or parameters are either neutrosophic numbers or neutrosophic set values. Bhatia et al. [1] (Soft Computing 26:8479-8495, 2022) point ed out some mathematical inappropriateness in the neutrosophic linear programming problem (NLPP) solution approaches in particular given by Khatter [2] and Singh et al. [3] for solving single valued triangular neutrosophic linear programming problems (SVTrNLPPs) and single-valued trapezoidal neutro sophic linear programming problems (SVTNLPPs) respectively. Khatter [2] proposed solution approach to convert SVTrNLPP into an equivalent crisp programming problem using the possibilistic mean value of each neutrosophic coefficient of the problem. Singh et al. [3] proposed solution approach with the conversion of SVTrNLPP into equivalent crisp programming problem using ranking function value of each neutrosophic coefficient of the problem. Bhatia et al. [1] pointed out inappropriateness in the approaches by Khatter [2] and Singh et al. [3] on the interpretation that the property of ranking function i.e. $R(A_{i1} + A_{i2}) = R(A_{i1}) + R(A_{i2})$ and property of possibilistic mean of NNs $V(A_{i1} + A_{i2}) = V(A_{i1}) + V(A_{i2})$ i.e do not hold on

the constraint part of the problems with N coefficients. Bhatia et al. [1] claimed that these approaches as well as other existing approaches are mathematically incorrect and should not be used for solving SVNLPs, SVTrNLPs and other neutrosophic linear programming problems. In this paper, we propose a rebuttal note on the points raised by Bhatia et al. [1] related to the inappropriateness of the approaches particularly Khatter [2], Singh et al. [3] and prove that these approaches as well as all other built on approaches are mathematically correct and appropriate methods for solving NLPs. The aim of this rebuttal note to clarify the correctness of existing approaches and bring back the faith of researchers on these approaches on neutrosophic linear programming problems.

Keywords: Single-valued Trapezoidal Neutrosophic Linear Programming Problem; Single-valued Triangular Neutrosophic Linear Programming Problem; Ranking Function; Possibilistic Mean.

35. An Intuitionistic Fuzzy Differential Equation Approach to Economic Production Inventory Model

Paper Id 104

Rashmi Yadav¹[0000-0002-6190-7963], Dharmendra Yadav¹[0000-0002-8365-4899], Shrestha Pundir², Dipti Singh^{3*}[0000-0002-0743-9089]

¹Department of Mathematics, Vardhman College, Bijnor, India

²Thapar Institute of Engineering and Technology, Deemed to be University, Patiala, India

³Department of Mathematics, Chaudhary Charan Singh University, Meerut (Uttar Pradesh), India

rashmi.y94@gmail.com, dharmendra03@gmail.com,
work.shrestha.pundir@gmail.com, singhdipti113@gmail.com

Abstract: This paper introduces a new methodology for optimizing Economic Production Intuitionistic systems by incorporating Intuitionistic Fuzzy Differential Equations to address the uncertainties in the key parameters of demand, production rate, and holding costs. Most inventory models fail to capture the complexity of real-world systems, which are characterized by ambiguous and incomplete information. The representation of the degree of membership, non-membership, and hesitation through Intuitionistic Fuzzy provides a rich framework for modelling uncertainties. An Intuitionistic Fuzzy Differential Equation based EPQ model is proposed to dynamically analyze and optimize the inventory level over time. This model formulates demand with varying conditions in order to minimize total production and inventory costs. The model is validated by numerical illustrations, by using the software Mathematica 12.0. The finding shows that the intuitionistic fuzzy approach is better than over fuzzy and classical models. The sensitivity analysis performed for the robustness of different parameters on optimal solutions.

Keywords: Intuitionistic Differential Equation, Economic Production Quantity model, fuzzy environment.

36. Threshold-Optimized Ensemble Learning for Accurate and Secure Android Malware Detection

Paper Id 107

Abhay Singh¹, Kashish Bhardwaj¹, Kamal Kumar Gola¹, Kapil Kumar¹

¹Department of Computer Science and Engineering, COER University, 247667, India

abhaychauhan5051a@gmail.com, kashishbhardwaj215@gmail.com,

kkgolaa1503@gmail.com, uetr.kapilkumar@gmail.com

Abstract: This paper proposed a machine learning approach for the classification of Android applications as benign or malicious based on permission counts as features. The method proposed in this work utilizes a stacking classifier ensemble, which combines Logistic Regression, Random Forest, and SVM to leverage their strengths and enhance predictive accuracy. The model was fine tuned with a decision threshold of 0.44, which is important for achieving real world malware detection that balances detection accuracy and false positives. The stacking classifier reached an accuracy of 84.2%, precision of 82.48%, recall of 96.93, and ROC AUC of 0.92, pointing out that it did well in terms of high recall, which is critical to keeping the number of false negatives to a bare minimum for malware detection. The experiments carried out demonstrate the potential and efficiency of employing ensemble learning with threshold optimization for enhanced Android malware detection. The work extends ensemble methods towards better security in Android applications.

Keywords: Android Malware, Machine Learning, Stacking Classifier, Logistic Regression, Random Forest, SVM, Permissions, Detection, Accuracy.

37. Affective DDoS Attack Detection in EV Charging Station Using DL Autoencoder Model

Paper Id 114

Bhupendra Sahu¹, Mithilesh Atulkar¹, Ravindra Kumar Chouhan¹

¹National Institute of Technology, Raipur, INDIA

bsahu.phd2023.mca@nitrr.ac.in

Abstract: Attacks such as Distributed DoS(DDoS) is becoming more common in advanced grid-based Electric Vehicles(EVs) charging stations. It is crucial to have a dataset containing various attack scenarios to develop effective methods to mitigate these attacks. The dataset, identified as CICEV2023, includes four different attack scenarios on EVs within intelligent grid infrastructure. This study compares the performance of Machine Learning(ML) based Light Gradient Boosting Machine (LightGBM) classification with Deep Learning(DL) techniques for DDoS attack detection. To achieve optimal results, the investigation proposes a new Deep Neural Network(DNN) algorithm to improve the accuracy of DDoS attack detection. The research evaluates the suitability and effectiveness of LightGBM ML classifiers and DNN with Autoencoder feature extraction for detecting DDoS attacks on

electric vehicle charging stations using the dataset referenced as CICEV2023. The experimental findings indicate that the DNN-based model outperforms others regarding Accuracy, Precision, Recall and F1 Score.

Keywords: DDoS, Dataset, CICEV2023, Autoencoder, Light Gradient Boosting Machine(LGBM), Deep Neural Network (DNN).

38. Generalized Probabilistic Hesitant Fuzzy Aggregation Operator-Based MCDM Method to Evaluate Water Quality

Paper Id 116

Rohit¹, Gagandeep Kaur¹, Kamal Kumar¹

¹Department of Mathematics, Amity School of Applied Sciences, Amity University
Haryana, Gurugram, 122413, Haryana, India
rohit12@s.amity.edu

Abstract: Water quality assessment has become an important aspect for environmental monitoring, control of public health, and management of resources. In water quality evaluation, traditional methods such as techniques based on crisp set theory, are largely based on deterministic models that fail to recognize the uncertainties as well as complexities found in environmental data. This research proposes a new approach to water quality assessment using Probabilistic Hesitant FuzzySets (PHFSs). Thesedays, aggregation operators (AOs) are frequently used to compile imprecise and unclear data. For probabilistic hesitant fuzzy (PHF) data, we develop a new AO called the generalized PHF weighted averaging geometric (GPHFWAG) operator. The key characteristics of the recommended operators are highlighted along with their complex interconnection. The proposed concepts are shown with real-life example about water quality assessment. In comparison to traditional techniques, the results show that PHFS-based evaluation procedures using new AOs offer greater accuracy and precision in assessing the state of water quality. Moreover, this research opens doors for more complex and refined tools necessary for environmental control as well as decision-making that are able to tackle intricate issues pertaining to water quality data.

Keywords: Water quality assessment, probabilistic hesitant fuzzy set, aggregation operators.

39. Observation of Reliability, BER, FER, BLER, and Throughput during the Coexistence of 4G LTE and 5G NR

Paper Id 117

Jayanta Kumar Ray¹, Bikash Sharma¹, Soumen Khatua²,
Ramsundar Ghorai³, Aitulla Labib Limon⁴,

Quazi Mohmmad Alfred², Fariha Tabassum⁴,
Rabindranath Bera⁵, Safiul Alam Mondal⁶,
Malay Pit⁷

¹Sikkim Manipal Institute of Technology, Sikkim Manipal University, Sikkim, India

²Aliah University, Kolkata, India

³Haldia Institute of Technology, Purba Medinipore, India

⁴The Kyoto College of Graduate Studies for Informatics, Kyoto, Japan

⁵Indian Institute of Information Technology, Kalyani, India

⁶Gobindapur Sephali Memorial Polytechnic, Purba Bardhaman, India

⁷Santiniketan Medical College, Bolpur, India

jayantakumar.ray@gmail.com, ju.bikash@gmail.com

Abstract: Research is moving in the direction of equitable spectrum position for 5G NR and 4G LTE during their coexistence. In order to minimize interference, the cognitive method is required when 5G NR and 4G LTE coexist. There will be a chance of interference if 5G NR and 4G LTE have the same location of spectrum which indicates a reduction in reliability. Therefore, it is essential to develop new ideas that will increase reliability. While the power for 5G NR varies during the vertical coexistence of 4G LTE and 5G NR, the settings for 4G LTE are kept fixed to minimize interference. Different metrics like as Bit Error Rate (BER), Frame Error Rate (FER), Block Error Rate (BLER), throughput, and throughput fraction are indicated by the difference in oscillator power for 5G NR. The oscillator power for 5G NR reduces from 20 dBm to 17 dBm. As a result, it is possible to estimate the rise in through-put and the decrease in BER, FER, and BLER. This provides an evaluation of the reliability. It had been estimated that with the decrease in of oscillator power, there will be increase in throughput, reliability and decrease in Bit Error Rate (BER), Frame Error Rate (FER), Block Error Rate (BLER).

Keywords: 4G LTE, 5G NR, 3GPP, DSS.

40. Federated Learning for Privacy-Preserving Next-Word Prediction on Mobile Devices

Paper Id 118

Ashish Sonawane¹, Sandesh Buchkul¹, Anuj Khandelwal¹, Jayesh Borase¹, Gitanjali Yadav¹

¹Artificial Intelligence and Data Science, Vishwakarma Institute of Information Technology,
Pune, India

ashishis416@gmail.com, jayeshborase07@gmail.com, buchkulsandesh1@gmail.com,
gitanjali.yadav@viit.ac.in, anuj63293@gmail.com

Abstract: Due to the increase in the use of mobile devices, the usability and the probability of input errors is improved via the use of predictive text and even next word suggestions. However, the typical approaches used in next-word predictions require a lot of user data which causes problems arising from privacy concerns. This article proposes a method of federated learning (FL) for next-word prediction that is carried out on the devices themselves

so as to avoid centralizing any user data. The data from the Shakespeare dataset is used to demonstrate a federated training paradigm implemented over devices in a TFF environment. In this case, an existing pre-trained RNN model is fine-tuned to cater for the data from each client. Clients, instead of sending raw data, send encrypted model updates to a central aggregator. This helps to protect privacy while still working towards the improvement of the global model. As enhancements, tokenization, vocabulary lookups, and length constraints are implemented, since these are required for use in mobile devices which are limited in resources. The experiments back the usefulness of this FL-based approach for privacy aware text prediction, as it does not lose significantly in prediction metrics. The research shows federated learning can deliver secure and customized experiences across a range of mobile devices. To improve adaptability and user satisfaction, future work will focus on increasing the model's context awareness and lexicon growth.

Keywords: Federated Learning, Next-word Prediction, Mobile Devices, Privacy Preservation, TensorFlow Federated, Recurrent Neural Networks.

41. Multi-Item Substitutable Inventory Model for Green and Regular Products with Environmental Sustainability under Inflationary Environment

Paper Id 119

S. R. Singh¹, Ummeferva Zaidi¹

¹Department of Mathematics, C.C.S. University Meerut, Uttar Pradesh, India
shivrajpundir@gmail.com, zaidiummeferva@gmail.com

Abstract: The growing concerns over environmental degradation have intensified the focus on green products in production and supply chain models. This paper develops a two-echelon production-inventory model for substitutable products regular and green under an inflationary environment. The model incorporates price, advertisement, and greenness-dependent demand, and accounts for carbon emissions generated during setup, manufacturing, and holding processes. A subsidy is provided for green products based on their degree of greenness, while regular products incur a tax to promote eco-friendly alternatives. Mathematica 12 software is used to solve the problem. To validate the proposed model economically, a numerical example is provided. Additionally, a sensitivity analysis of the key parameters is performed to understand their influence on the optimal solution. The findings also highlight that green products consistently produce lower carbon emissions than regular products across all modelling scenarios, underscoring their environmental benefits. This research offers actionable strategies for managers to achieve profitability while promoting environmental sustainability through green investments and adaptive supply chain practices.

Keywords: Sustainable Supply chain, Multi-items, Inflation, Green and regular products.

42. Byzantine Linearizability: Reliable Broadcast, Snapshots and Asset Transfer for Bounded Memory

Paper Id 124

Mohammad Azeem¹, Jatin¹, Aditya Garg¹, Dharmendra Prasad Mahato¹

¹Department of Computer Science and Engineering, National Institute of Technology,
Hamirpur, Himachal Pradesh-177 005, India

24rcs007@nith.ac.in, 21bcs047@nith.ac.in, 21bcs075@nith.ac.in,
dpm@nith.ac.in

Abstract: Byzantine linearizability is an extension of classical linearizability and a correctness condition that determines whether a concurrent object with sequential specification can handle Byzantine failures. This paper explores the implementation of Byzantine linearizability in systems with bounded memory, focusing on three critical objects: reliable broadcast, atomic snapshot, and asset transfer. We propose algorithms to implement Byzantine linearizability for these objects from registers in an n -process with f -resilient system, provided $f < \frac{n}{2}$, under memory constraints, and analyze their performance, correctness, and practicality.

Keywords: Byzantine Linearizability, Snapshots, Asset Transfer.

43. A Green Supply Chain Approach under Market Displacement Factor for Novel and Refurbished Inventory

Paper Id 132

Sunil Kumar¹, Varuna Bhardwaj²

¹Department of Mathematics, Chandigarh University, Mohali, Punjab, India

²Department of Applied Science & Humanities, ABES Institute of Technology, Ghaziabad,
U.P., India

gkv.sunil@gmail.com, varuna.01983@gmail.com

Abstract: This study proposes a completely new green inventory approach that takes into account the environmental sustainability with refurbishing process which reduces waste and the market displacement factor where new technologies may cause changes in customer preferences in existing market. The approach aims to reduce waste, reduce carbon emissions, and optimize resource utilization in production and inventory control by refurbishing of flawed goods. In this research, we also offer the market displacement aspects, which show how a new product, service, or technology might displace an existing one, resulting in a drop in the market share of the original product or service. The objective is to lower the total cost through developing a comprehensive model that takes into consideration market displacement, demand, deterioration, and retention during the course of the manufacturing

and refurbishment cycle. Moreover, its structure optimizes crucial time. Along with developing a comprehensive integrated model for green supply chains, the study highlights carbon emissions during product deterioration and storage. Sensitivity analysis and mathematical simulation are done to provide managerial insight.

Keywords: Sustainability, Refurbished, Market displacement, Manufacturer, Retailer.

44. Solvability of Abstract Second-Order Differential Systems with State-Driven Delays

Paper Id 135

Sandeep Kumar¹, Tajinder¹

¹Department of Mathematics, Ch. Charan Singh University, Meerut 250004, Uttar Pradesh, India

drsandeepmath@gmail.com, tajinder.math@gmail.com

Abstract: This paper investigates the local and global existence and uniqueness of mild solutions for an Abstract second-order differential system with state-driven delay (SODSSDD). The study begins by establishing key Lipschitz continuity estimates for the delay term and the associated history map. Following this, the local existence and uniqueness result is demonstrated under suitable conditions. Finally, the paper provides a demonstration of global existence and uniqueness, subject to an inequality constraint.

Keywords: Cosine family, Sine family, Local solution, State-dependent delay, Global solution

45. Power Fluctuation Detection Technique in Solar Power Plant Using Machine Learning

Paper Id 137

Rajesh Eswarawaka¹, N. Amuthan², K. Ananthapadmanabha³, Viswas Varma Kanumuri⁴

¹Department of Artificial Intelligence and Machine Learning, RNS Institute of Technology, Bengaluru, India

²Department of Electrical and Electronics Engineering, AMC Engineering College, Bengaluru, Karnataka, India

³Department of Computer Science and Engineering, Sambhram Institute of Technology, Bengaluru, Karnataka, India

⁴Department of Computer Science and Electrical Engineering, Texas University, Dallas, USA

rajesheswarawaka@rnsit.ac.in, amuthannadar@gmail.com,
Padmanabhakanantha@gmail.com, viswasvarmasatya@gmail.com

Abstract: Solar power plants are crucial for renewable energy generation, but they face challenges like power fluctuations that affect efficiency and reliability. Traditional methods

for detecting these fluctuations are manual and inefficient. In contrast, machine learning (ML) offers automated solutions to detect and predict power variations swiftly, enhancing plant performance. the progression and execution of machine learning algorithms exhibit promising outcomes in identifying power oscillations in solar plants. By deploying sophisticated computational instruments to scrutinize extensive datasets, one can accurately prognosticate and alleviate plausible issues stemming from oscillations in solar power production. This paper utilized advancements in ML techniques for power fluctuation detection in solar plants, emphasizing their role in optimizing energy production and grid stability.

Keywords: Solar Power Plants, Machine Learning, Power Fluctuations, Forecasting, Energy Management

46. Cardio Care-Heart Attack Prediction Model Using Haar Cascade Algorithm

Paper Id 138

Rajesh Eswarawaka¹, Goutham Karthik B¹, Aryan Nihalchandini¹, Viswas Varma S Kanumuri²

¹RNS Institute of Technology, Bengaluru, India

²Texas A&M University, Dallas, USA

rajesheminent@gmail.com, gouthamkarthikb@gmail.com,

viswasvarmasatya@gmail.com

Abstract: It is the application where it predicts the percentage of heart attack that is going to happen in next few hours. First user will login and take a small assessment having questions like age diabetes smoking alcohol fitness level previous medical history family history etc., because these are the vital parameters that can effect heart attack. Next user will undergo 60s of scan. During scan mainly we use Haar Cascade Algorithm to detect face and lighting. After that the frame is divided into certain pixels. Now when heart pumps blood flows from heart to brain then there will subtle color changes in blood vessels. So by using OpenCV and EVM Technology we detect that color changes and convert it to RGB color. Then we use gaussian piramid to smoothen it. And we use FFT to obtain frequency. We multiply frequency to 60 and buffer to obtain heart rate. Difference between 2 frequencies is taken as Heart Rate Variability (HRV). HRV is the time taken by heart from heart beat. This is the main parameter in detecting heart attack. And by using some mathematical formula and HRV data we detect stress level and SP02 level. After the scan user will get graphical representations of these parameters. Later by using assessment data and scanned data our ML model predicts the percentage of heart attack. User can download the results as report.

Keywords: Heart attack, OpenCV, Amplification (EVM), Color changes in blood vessels, Heart Rate Variability (HRV)

47. Benefits of Hybrid Demand in a Sustainable Inventory Model with Advance Payment Discount Facility under Preservation and Green Technology

Paper Id 139

Vaishali Singh¹, S. R. Singh¹, Aastha Chauhan^{1*}

¹Department of Mathematics, Chaudhary Charan Singh University, Meerut, Uttar Pradesh, India

vaishalich212@gmail.com, shivrajpundir@gmail.com, Aasthachauhan737@gmail.com

Abstract: Carbon emissions and the depletion of natural resources significantly impact environmental degradation. Real-life demand functions vary, influenced by two distinct demand forms in the market, rather than remaining constant, linear, or nonlinear. This study analyzed this complexity by reconnoitering a sustainable inventory model for spoilage goods with hybrid-price and stock-based sensitive demand taking a carbon cap and trade policy. Green and preservation techniques are utilized to mitigate excess emissions and deterioration rates. Additionally, the model incorporates the perception of advance payment under a discount facility to accommodate fast-growing businesses. The analysis incorporates the impact of inflation and time-dependent holding costs, allowing for partially backlogged shortages. To validate the model, numerical explanations are conducted for three scenarios based on whether the demand function is hybridized or non-hybridized. Graphical and analytical representations demonstrate the concavity of overall profit, showing that the hybridized demand model yields higher profits compared to the nonhybridized model.

Keywords: Inflation, Deterioration, Preservation technology, Green investment, Advance payment, Hybrid price and stock-sensitive demand.

48. AI-Based Plant Health Monitoring under Stress Conditions

Paper Id 142

Piyush Arora¹, Ashok Mondal¹, Ashis Tripathy¹, Bishnumaya Bashyal²

¹School of Electronics Engineering, Vellore Institute of Technology, Chennai, India

²Division of Plant Pathology, ICAR-Indian Agricultural Research Institute, New Delhi, India

piyusharora.epsilon@gmail.com, ashok.mondal@vit.ac.in,
ashis.tripathy@vit.ac.in, bishnumayabashyal@gmail.com

Abstract: Living organisms adjust their physiological processes in response to change in environmental conditions using a complete signaling network. Electrical signals carry useful information and transfer it through a fast process compared to other signaling techniques. Like animals, plant health status can be measured by analyzing bioelectrical activity related signals. In this paper, we have developed a new machine learning based algorithm to detect

the physiological conditions of plants by exploring the inherent characteristics of plant electrical signals. The plant responds in a different way in response to different stress conditions. This paper studies the changes of plant response corresponding to excess water stress condition, less water stress condition and normal water state. The experimental result of three classifiers including K Nearest Neighbors, Naïve Bayes Classifier and K Means Clustering. Amongst these three, K Nearest Neighbors gives the best accuracy of approximately 98% under different stress conditions. It is a useful technique to find out the status of plant health for different stress conditions before initial visual symptoms to appear.

Keywords: Plant health, Stress condition, Multi-class, Supervised algorithm, Unsupervised algorithm, ROC curve, Euclidean distance, Bayes Theorem.

49. Reducing Operational Costs with Cost-Sensitive XG-Boost-Based Failure Prediction

Paper Id 143

Sandeep Kumar Mogha¹, Vikas Jangid¹, Muskan Ara¹

¹Department of Mathematics, Chandigarh University, Mohali, Punjab, India-140413
moghadma@gmail.com, vikasjangidmk@gmail.com, muskan17ara@gmail.com

Abstract: The Air Pressure System (APS) is an important part which is used in heavy commercial vehicles for safety appliances such as brakes, shifting gears and suspension. Inadequate performance in the APS results in expensive re-pairs, and potentially dangerous failures, which call for a proper model of failure prediction. This research develops a cost-sensitive data-driven framework to predict APS failures over SCANIA trucks through analysing sensorial data. The model assumes that it is essential to reduce the number of false negatives to guarantee vehicle reliability and avoid interruptions. Here the focus is on the balance between false positives and false negatives through the potential savings associated with prediction costs while enhancing maintenance strategies. The study demonstrates how the use of real-time data from sensors may result in planned maintenance actions to minimize time loss and repairs. In terms of contribution to SCANIA's existing objectives of improving the reliability and safety of the fleets, this study offers the best approaches to mitigating APS failure with the view of reducing operational costs and increasing the longevity of the heavy-duty trucks in extreme conditions.

Keywords: XG-Boost, Cost-Sensitive Algorithms, Ensemble Learning, Synthetic Minority Over-sampling Technique, Gradient Boosting Algorithms.

50. Enhanced Hybrid DEA Approach for Predicting Hotel Efficiency: Probabilistic and Neural Network Approaches

Paper Id 144

Sandeep Kumar Mogha¹, Kiran¹

¹Department of Mathematics, Chandigarh University, Mohali, Punjab 140413, India
moghadma@gmail.com, sheorankiran77@gmail.com

Abstract: The study explores an integrated approach of Data Envelopment Analysis (DEA) with probabilistic ML and neural network to analyzing hotels efficiency. By applying DEA analysis under CRS and VRS, we determined the relative efficiency of hotels by benchmarking the key operational inputs and outputs and sorting them into efficiency classes that serve as reference benchmarks for building the predictive model. To improve a classification accuracy, some probabilistic classification algorithms as Naive Bayes, Probabilistic SVM, GPC, and Logistic Regression as well as neural network-based classification models PNN, MLP, and RBFN are used. As for our results, it can be concluded that both GPC and Probabilistic SVM offered ability to learn nonlinear data patterns whereas MLP and RBFN were shown to perform best in higher dimensional patterns recognition. Furthermore, implanted blended hybrid models with DEA-ML integration by using DEA efficiency scores as the independent variables which improved the model and classification performance. In this analysis, the DEA-GPC and DEA-PNN models produced the highest overall train performance with accuracies of 92% and 93% respectively. This study offers information for necessary operational improvements which can be implemented based on the outcomes of the research.

Keywords: DEA, Naive Bayes, Probabilistic SVM, GPC, PNN, RBFN, DEA-ML.

51. Enhanced Weather Forecasting Using Random Forest, LSTM, Gradient Boosting, and Ensemble Learning (RF+GB)

Paper Id 145

Sandeep Kumar Mogha¹, Aman Kumar Singh¹

¹Chandigarh University, Mohali, Punjab, India, 140413
moghadma@gmail.com, amank.singh@gmail.com

Abstract: In the weather forecasting system, prediction is the most challenging process that involves the sequential data analysis to identify the most expressive pattern and to create a higher number of accuracy levels. This work puts forward a new approach for designing a weather prediction system utilizing LSTM networks that is a type of deep learning networks able to model temporal dependencies in the time series data. This research involves data preparation for analysis and response formulation, regarding the given multi-attribute weather data set. Such transformations include: how to deal with missing values, how to create new features and normalize the inputs for enhanced predictive capability. In this paper, the relevant parameters of severe weather forecasts are temperature, humidity, and precipitation, which are set as the targets for LSTM model. The outcomes analyzed in the experiment indicate that LSTM model is better in prediction, and the values of MSE and MAE are lower than the values obtained in other similar researches. Such results may

demonstrate that LSTM networks have the potential that enhance the current weather forecast, so far, will be of great help in agriculture, transportation logistics, and disaster relief plans field.

Keywords: Weather Forecasting, Machine Learning, Random Forest, LSTM, Time Series, Deep Learning.

52. Spatio-Temporal Analysis and Severity Prediction of Weather Events Using Machine Learning Models

Paper Id 147

Rahul Singh¹, Bholanath Roy¹

¹Department of CSE, MANIT, Bhopal, 462003, MP, India

Abstract: This study presents a machine learning framework for the prediction of the severity of weather events using spatio-temporal data. A thorough preprocessing approach, exploratory data analysis, and feature engineering were performed on a massive dataset of weather events covering the United States. Worked with Random Forest and Gradient Boosting models, getting accuracies of 99.66% and 94.86%, respectively. The Random Forest model performed very well with an F1-Score of 0.9966 and AUC-ROC of 1.0; the Gradient Boosting model was more balanced with an F1-Score of 0.9476 and AUC-ROC of 0.9958. Rain was the most common weather event, according to visual analyses, and it was followed by fog and then snow, while very few spatial peaks suggest extreme weather. The promising results of Random Forest need further validation as it may be overfitting. This demonstrates the power of ML to predict the actual severity of weather events from thousands of kilometers away, which helps with disaster management and risk mitigation.

Keywords: Machine Learning, Spatio-Temporal Analysis, Random Forest, Gradient Boosting, Climate Resilience, Severe Weather Analysis.

53. Image Deblurring Using Generative Adversarial Networks (GAN)

Paper Id 148

Rina Damdoo¹, Sujal Agrawal¹, Ujjwal Prithyani¹, Vighnesh Gupta¹, Vivek Meher¹

¹Department of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India

damdoor@rknc.edu, agrawalsr_14@rknc.edu, prithyaniuv@rknc.edu, guptavs_1@rknc.edu, mehervj@rknc.edu

Abstract: Image inpainting and image blur restoration are two essential image processing tasks in computer vision wherein missing or corrupt areas in images are filled in and blurry images corrected. Due to the characteristics of these two problems, they are both extremely difficult; it is necessary to predict the right kind of content while taking care not

to distort or lose the general shape, texture, and contextual relevance of the image. GAN has come in handy for these cases, as they are quite efficient when it comes to both painting images and deblurring them. Images are formed using a generator and discriminator, both being neural networks, which function in a non simultaneous manner; the former is responsible for generating images while the latter determines whether the images are authentic or not. By this mean approach, the generator is able to optimize its outputs gradually, and so is the discriminator in that it can better tell between real and fake images. In the paper, we show that the acknowledged capabilities of GANs can be effectively employed in image in painting as well as blur restoration. Intensive evaluations on a number of datasets comprising of various levels of synthetic and real blur have proved that the proposed GAN based method of detail restoration and reconstruction is superior even when the images are very blurry. This work reveals that GANs can be deployed in very different applications in a very straightforward and convincing way.

Keywords: GAN, Generator, Discriminator, Image inpainting.

54. A Targeted Study of Lightweight Machine Learning Techniques for Cardiac Arrhythmia Risk Prediction

Paper Id 150

Sanyam Bhardwaj¹, Krishna Priya R², Anju S Pillai³

¹Department of Computer Science and Engineering, Amrita School of Computing, Amrita Vishwa Vidyapeetham, Coimbatore, India

²Department of Research and Consultancy, University of Technology and Applied Sciences, Musandam, Oman

³Department of Electrical and Electronics Engineering, Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Coimbatore, India

cb.en.u4cse22044@cb.students.amrita.edu, krishna.priya@utas.edu.om,
s_anju@cb.amrita.edu

Abstract: Developments in intelligent healthcare are enabled by various wireless and mobile health applications. The diagnosis and response of remote health data is challenging due to noise, network latency, streaming data and user privacy. Critical health concerns such as cardiac arrhythmia have potential to induce life-threatening consequences, its effect on quality of life, and its implications for public health systems. Quick identification of arrhythmia aids proper care and reduction of the risk factor. This study focuses on identification of lightweight and accurate machine learning models that can be used for predicting cardiac arrhythmia risks accurately from significant health parameters. We tested Naïve Bayes, K-nearest neighbors (KNN) and Logistic Regression (LR) models, trained with standard dataset and tested for its performance. We used multiple significant features to classify the heart risk into three categories: no risk, medium risk and high risk. Naïve Bayes performed poorly with an accuracy of around 61%, while KNN outperformed with an accuracy of about 95% over logistic regression's 90%.

Keywords: Cardiac Arrhythmia, Machine Learning Models, Risk Classification, Naïve Bayes, K-Nearest Neighbors, Logistic Regression.

55. Development of Smart ECG Monitoring System Using IoT and ML

Paper Id 151

Swapnil Bisht¹, Parul Madan¹, Gaurav Singh Bhakuni¹, Ankit Vishnoi¹, Varun Sapra²,
Devesh Pratap Singh¹

¹Department of Computer Science and Engineering, Graphic Era (Deemed to be University), Dehradun, India

²School of Computer Science, UPES, Dehradun, India

bishtswapnil848@gmail.com, parulmadan.cse@geu.ac.in,
bhakunigaurav2003@gmail.com, ankitvishnoi.cse@geu.ac.in,
varun.sapra@gmail.com, devesh.geu@gmail.com

Abstract: The project aims to merge the Internet of Things with machine learning to come up with a reliable system for heart activity monitoring and real-time arrhythmia identification. This system uses ECG sensors, temperature sensors, heart rate monitors, and a single-board computer Raspberry Pi. Using these parts, it collects real-time physiological information to be processed through a trained neural network model that gives out abnormal heart rhythms. The performance metrics indicated that the model achieved high efficiency because it obtained an AUC of 0.983 from the training data and of 0.950 in validation in terms of distinguishing normal from abnormal heartbeats. The accuracy rates are 96.3% for training data and 94.5% for validation data, underscoring the model's reliability. Although it successfully detects irregular heartbeats, there is potential to enhance precision and reduce false positives, as indicated by precision scores of 80.8% and 73.8%. This all-encompassing solution addresses shortcomings in previous heart health monitoring systems and underscores the importance of continuous improvement. In the next phase of work, we will optimize model performance, and explore new methods even further to increase precision and robustness. Obviously, no question exists about the power of the model; But, for an improved model, the precision in identifying false positives needs to be just a little higher, as this will allow us to decrease that number and then improve on both sides a little more.. Due to the real time monitoring and several sensors this system acts as an all in one solution for controlling of heart health which was missing from previous systems. This paper focuses on enhancing the model performance and future efforts will be spent to explore other methods that are able to further refine accuracy as well stability of the system.

Keywords: ECG Monitoring, IoT, Machine Learning, Smart Health Systems.

56. AI-Driven Pneumonia Diagnosis: Harnessing Custom CNNs for Chest X-ray Analysis

Paper Id 152

Sandeep Kumar Mogha¹, Muskan Ara¹, Vikas Jangid¹

¹Department of Mathematics, Chandigarh University, Mohali, Punjab, India-140413
moghadma@gmail.com, muskan17ara@gmail.com, vikasjangidmk@gmail.com

Abstract: This work gives a new approach to the challenge of automated pneumonia diagnosis from chest x-rays based on a proposed CNN model that is developed to work with PyTorch. The major objective is to improve diagnostic effectiveness and specificity of early pneumonia management in clinical practice. The approach encompasses steps of data pre-processing, architecture of CNN, and the proper selection of the training process. The dataset is divided in-to two classes: Two classes ‘NORMAL’ and ‘PNEUMONIA’ where limited image pre-processing such as resizing and cropping were applied to normalize the input data dimensions. In checking on over fitting and to enhance model performance, some trivial augmentations such as horizontal flipping, rotation, and color jitter are used. The proposed custom CNN is implemented with sever-al convolution layers, max pooling layer, batch normalization to extract hierarchical features and to reduce the dimensionality to address the class imbalance issue and ensure satisfactory performance in binary classification tasks. The model thus fits this norm by using Stochastic Gradient Descent (SGD) with dynamic learning rate schedule for good convergence. This utilization of CUDA with GPU brings down the time period meant for training and inference to real time tractability for clinical application. In such regard, this research is useful in boosting AI diagnostic solutions so that detection of pneumonia could be enhanced thereby propelling the healthcare sector especially in underprivileged areas.

Keywords: Convolution Neural Networks (CNN), Max-Pooling, Stochastic Gradient Descent (SGD), PyTorch, Chest X-ray, Soft-max.

57. Improved TLBO: A Novel Approach for Solving Complex Optimization Problems

Paper Id 154

Anupma Mishra¹, Shimpi Singh Jadona¹

¹Department of Applied Sciences & Humanities, Rajkiya Engineering College, Kannauj-209
732, Uttar Pradesh, India
mishraanupma097@gmail.com, shimpisingh2k6@gmail.com

Abstract: Teaching-Learning-Based Optimization (TLBO) has emerged as a strong, precise, and dependable optimization method for continuous space global optimization. In this research, we suggest an enhanced TLBO called ITLBO, that incorporates a novel term in the teacher phase to minimize population variance, thereby enhancing convergence speed and solution accuracy. The algorithm’s performance is evaluated using the CEC2019 benchmark suite, which includes unimodal, multimodal, and composite optimization problems. The results demonstrate that ITLBO consistently outperforms state-of-the-art algorithms, including TLBO, Aquila Optimizer (AO), Whale Optimization Algorithms (WOA), and Salp Swarm Algorithm (SSA), in terms of mean optimization cost and standard deviation. This

highlights ITLBO's ability to find global or near-global optima with improved robustness and reliability. These findings affirm the potential of ITLBO as an effective tool for solving complex optimization problems.

Keywords: TLBO, Metaheuristic, Global Optimization, Benchmark Functions.

58. Triple-Head Spatial Attention Based Deep Learning Approach for Plant Disease Identification

Paper Id 156

Vanshika Pundir¹, Palak Bhandari¹, Vidit Kumar¹

¹Department of Computer Science and Engineering, Graphic Era Deemed to be University, Dehradun, India

vanshikapundir0505@gmail.com, palakbhandari624@gmail.com,
viditkumaruit@gmail.com

Abstract: Global food security is seriously threatened by plant diseases, which calls for creative approaches to early diagnosis and efficient treatment. Computer vision techniques provide scalable alternatives to labor intensive and inaccurate traditional diagnostic procedures. This research focuses to upgrade the diagnosis of plant diseases by integrating attention mechanism with deep convolutional model. More specifically, we propose Triple-head spatial attention module which integrated to EfficientNet-B0 for enhancing feature representation ability. The PlantDoc dataset, which includes images from 27 classes, was used to assess the performance of several model variations. With an accuracy of 62.59% for uncropped and 83.97% for the cropped dataset, the presented model showed excellent feature extraction and classification compared to prior methods.

Keywords: Deep Learning, Attention Mechanism, Plant Disease Classification, Spatial Attention, EfficientNet.

59. Genetic Algorithm Integrated DEA for Academic Assessment of a Higher Education Institution

Paper Id 157

Ankita Panwar¹, Natthan Singh², Millie Pant^{1,3}

¹Applied Science and Engineering, Indian Institute of Technology (IIT) Roorkee, India

²Computer Science and Engineering, Institute of Engineering and Technology, Lucknow, Uttar Pradesh, India

³Mehta Family School for Data Science and Artificial Intelligence, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, India

Abstract: Classical DEA model has some serious drawbacks: 1. non-linear optimization problem 2. lack of discriminating power, and 3. the obtained efficiency is relative. In this study, we use a multi-criteria performance technique data envelopment analysis (DEA)

with metaheuristics technique genetic algorithm (GA) to overcome the drawbacks of the DEA. With the help of the integrated technique (DEA-GA), we maximize the efficiencies of DMUs simultaneously, and discrimination among the units is better as compared to the classical DEA model. For this purpose, we use a realistic numerical example, higher education institute data. The results show that the proposed integrated model gives more realistic outcomes.

Keywords: Data Envelopment Analysis, Genetic Algorithm, Weighted Sum Method, Non-Linear Programming, Fractional Programming.

60. A Serverless Cloud Approach to a Scalable Geospatial Healthcare Web-based Application

Paper Id 159

Samanyu Gaddam¹

¹M.Tech in IIRS-ISRO

Abstract: Serverless cloud computing technology offers dynamic scalability which automatically adjusts resources based on demand and eliminates the need to manage servers, unlike the traditional cloud computing technology, which would require manual scaling and infrastructure management. Developers concentrate entirely on deploying and running the code, while the cloud provider manages backend activities like provisioning, server management, load balancing and auto scaling. This project leverages the cloud's "Function as a Service(FaaS) and Backend as a Service(BaaS)" models. Through a technical evaluation of different cloud providers, the study first finds the best cloud provider for implementing the serverless task. AWS Cloud services were used to provide event-driven backend services and manage spatial cloud databases. The application was tested using complex geospatial algorithms. Hotspot analysis, clustering and routing, heatmap etc. were all implemented. These geospatial functionalities and other tools were all integrated into a WebGIS interface powered by Leaflet, providing an interactive and user-friendly interface. The application would auto-scale based on demand independent of the number of users with optimal performance at all times. Recent statistics indicate a significant rise in the adoption of serverless cloud. The serverless cloud market is expected to increase at a CAGR of 25.02% from 2024 to 2033, reaching \$106.12 billion. Some big businesses which use the serverless cloud technology are: Netflix, Airbnb, BBC, CocaCola. This method demonstrates serverless cloud's potential in geospatial domain, especially in improving healthcare accessibility and decision-making while maintaining performance and scalability. The findings support creative ways to challenge scalability issues and sustainable development by expanding the use of cloud-native technologies in GIS.

61. Ensemble Learning Inspired Model for Medical Image Segmentation

Paper Id 162

Bhavana Singh¹, Pushpendra Kumar¹

¹Maulana Azad National Institute of Technology, Bhopal-462003, India

213104004@stu.manit.ac.in, pkumarfma@manit.ac.in

Abstract: Image segmentation is considered as a fundamental topic in computer vision and image processing. The primary aim of segmentation is to partition an image into parts that are uniform in nature, and enables the subsequent analysis. It plays a crucial role in the field of medical imaging for disease diagnosis. There are many technologies available for medical image segmentation, and among them deep learning (DL) methods are highly implemented due to their feature extraction characteristic. Thus, in the presented work an ensemble model is proposed to perform the binary segmentation of medical images. The proposed model is formulated from two base models that are combined by stacking approach of ensemble learning through a meta-learner model. The base models are inspired from the U-Net and SegNet architecture, and the meta-learner model is designed from convolutional neural network (CNN) architecture. The study presents an analysis to evaluate the proposed model performance on three distinct types of medical images. The medical images utilized are breast ultrasound images, gastrointestinal (GI) tract images and chest X-ray images. The performance of ensemble model is assessed by segmented masks and various performance measures like, accuracy, recall, precision, and mean intersection over union (mIoU). The experiments showcase that the proposed ensemble model performs comparatively better than the base models. Moreover, the ensemble model yields highest accuracy and mIoU value as 0.9076 and 0.6939, respectively corresponding to GI tract images.

Keywords: Binary Segmentation, Ensemble Learning, Medical Image Segmentation, Stacking.

62. A Non-local Weighted Optical Flow Based CNN Model for Smoke Detection Using Static and Dynamic Features

Paper Id 163

Nitish Kumar Mahala¹, Muzammil Khan², Bhavana Singh¹, and Pushpendra Kumar¹

¹Maulana Azad National Institute of Technology Bhopal, India

²University of Twente Netherlands

Abstract: Fire is considered one of the most likely calamity, both in terms of natural activity and social impacts. Therefore, it poses a significant hazard to the survival of humans, forest, and animals. In order to mitigate fire losses, early detection of smoke is particularly important. The existing techniques are inadequate for achieving the desired

accuracy due to their limitations. The early detection of fire can be achieved through smoke, as it typically signifies the initial stage of a fire and has different shapes, colors, and textures. This paper introduces a novel algorithm for detecting smoke in real time using a video-based approach by employing a two-step technique that combines dense optical flow and convolutional neural network (CNN). The first step constructs the dynamic as well as static features of smoke. The dynamic features are determined using optical flow. However, static features are generated from smoke color characteristics such as texture, shape, and intensity. Optical flow is utilized to find the region of interest (RoI), and the blue channel of it can accurately represent the motion features of smoke. Thus a binary mask is created for the segmentation of RoI. In the second step, the segmented color maps and segmented images along with associated image sequence are passed through a finetuned CNN model for smoke detection. The results are described using different evaluation metrics, probability score of smoke and smoke localization in an image sequence. The accuracy of the proposed framework is validated through a comparative analysis conducted with the state-of-the-art (SOTA) techniques.

Keywords: CNN, Charbonnier Norm, Dynamic Features, Non-local Weighted, Optical Flow, Smoke Detection, Smoke Localization.

63. An Improved Fuzzy Clustering Technique for Nucleus Segmentation

Paper Id 164

Totan Bharasa¹, Krishna Gopal Dhal^{2,*}, Kalyani Maity Das³

¹Department of Natural Science, Belda College, Paschim Medinipur, West Bengal, India

²Department of Computer Science, Midnapore College (Autonomous), Paschim Medinipur, West Bengal, India

³Department of Mathematics, Belda College, Paschim Medinipur, West Bengal, India

`totanbharasa@beldacollege.ac.in`, `krishnagopal.dhal@midnaporecollege.ac.in`,
`kalyanimaity@beldacollege.ac.in`

Abstract: Histopathology image's Nuclei Segmentation is a vital stage in computer-assisted automated analysis of various serious disorders, including cancer. Fuzzy C-Means (FCM) is a widely employed partitional clustering method that has been effectively applied for image segmentation. Nonetheless, FCM exhibits many limitations, including longer computational time, bad convergence, and susceptibility to noise. This study introduces an enhanced variation of FCM that incorporates two distance metrics, Morphological Reconstruction based input image filtering, a superpixel approach, and membership scaling and filtering for nucleus segmentation. The suggested technique has been evaluated against other fuzzy clustering techniques both visually and quantitatively. Experimental results indicate that the suggested strategy yields improved outcomes compared to other examined methods for segmentation accuracy, computing efficiency, and noise tolerance.

Keywords: Noise, Superpixel, Membership Filtering, Clustering.

64. Set Pair Analysis Based Algorithm for IVIF Decision-Making with Mean and Variance

Paper Id 165

Sandeep Kumar¹, Reshu Tyagi¹

¹Department of Mathematics, Ch. Charan Singh University, Campus Meerut 250004, Uttar Pradesh, India

drsandeepmath@gmail.com, reshutyagi2219@gmail.com

Abstract: There is a lot of uncertainty in the data when dealing with the decision making (DMK) problem. The interval valued intuitionistic fuzzy (IVIF) set is a powerful tool to tackle such uncertainties, while the connection number (CN), which is based on the identity, discrepancy, and contrary degrees of the set pair analysis (SPA), the focus of SPA is to study certainties and uncertainties as a system. In the present research, an approach is developed for solving multiple attribute DMK (MADM) problems under IVIF utilizing SPA theory. Firstly, we convert all IVIF values (IVIFVs) into the CNs and then determine their score values. An algorithm is built up to solve an IVIF MADM problem. This algorithm is based on the concepts of mean and variance of each score alternative matrix. Finally, with respect to each alternative, a standard value is calculated to rank the alternatives. To demonstrate the validity and applicability of the current research, several numerical examples are also provided with comparisons of existing approaches. In order to confirm the practicality of the proposed approach, the MADM method is finally used in the application of medical diagnosis.

Keywords: Connection Number, Mean, Variance.

65. Behavioural Analysis Techniques for Early Detection of Ransomware

Paper Id 167

Abstract: The ransomware attack has become so sophisticated that it has caused unprecedented disruption and financial loss to many parts of the world. Traditional protection schemes mostly fail at detecting new variants, and early detection is very crucial to mitigate ransomware attacks. The paper surveys the role of behaviour analysis techniques, which monitor all system and network behaviors for anomalies that indicate the presence of ransomware. These techniques record patterns, such as abnormal file encryption, network traffic, and privilege escalation, and are proactive in defense.

Keywords: Behavioural Analysis, Ransomware, Anomaly Detection, Early Detection, Network Traffic.

66. Machine Learning-Based Diabetic Prediction on Indigenous Shakti Processor for Edge Health Monitoring

Paper Id 168

Muhammed Raees PC^{1,*}, Akshayraj MR¹, G Lakshminarayanan¹, Varun P Gopi¹, G R Gangadharan²

¹Department of Electronics and Communication Engineering, National Institute of Technology, Tiruchirappalli, Tamil Nadu, India

²Department of Computer Application, National Institute of Technology, Tiruchirappalli, Tamil Nadu, India
pcmraees@gmail.com

Abstract: With the increasing need for IoT-based solutions in healthcare, there is a critical need for energy-efficient, low-power processors capable of executing machine learning (ML) models for real-time health monitoring at the edge level. This paper presents the first-of-its-kind analysis of the feasibility and performance of the Shakti processor for running machine learning algorithms in edge health monitoring applications, comparing it to the ZYNQ SoC with an ARM processor. The Shakti processor embedded in Arty-A7 FPGA is evaluated using the Shakti SDK framework. A performance comparison is made with the Dual ARM Cortex-A9 processor present in PYNQ-Z2 FPGA board regarding the execution efficiency and latency of various machine learning models under different optimization techniques, including quantization and reduction of dimensionality through linear discriminant analysis. Shakti's use of LDA and quantization optimization techniques led to significant improvements in the performance of ANN and SVM models, reducing the processing time by nearly 30% compared to the ARM processor. This research underscores the Shakti processor's viability for lowcost, real-time diabetic prediction at the edge level, advancing scalable healthcare solutions and contributing to developing self-reliable, indigenous IoT devices.

Keywords: Diabetic Prediction, RISC-V, Shakti Processor, Soft Core Processors, Machine Learning.

67. End-to-End Trained Punjabi ASR System with Tonal Features

Paper Id 170

Jaspreet Kaur Sandhu¹, Munish Kumar², Amitoj Singh³

^{1,2}Department of Computational Sciences, Maharaja Ranjit Singh Punjab Technical University, Bathinda, Punjab, India

³School of Sciences and Emerging Technologies, Jagat Guru Nanak Dev Punjab State Open University, Patiala, Punjab, India

mca.jaspreetsandhu@gmail.com,, munishcse@gmail.com, amitoj.pb@gmail.com

Abstract: Automatic Speech Recognition (ASR) is the technology that converts spoken language into text using speech processing and machine learning techniques. Punjabi ASR tasks generally use the traditional models. Convolutional Neural Network (CNN) based end-to-end speech recognition model is proposed to process raw speech for the Punjabi language which enhances the recognition rate. Here, CNNs are used as feature extractors and the Softmax layer performs classification tasks. Tonal features are the pitch variations that convey meaning, such as loudness, pitch, and intensity in tonal languages. These informative features were added to proposed model through a fully connected layer. The outputs from the CNN layer and the tonal feature's fully connected layer are integrated, and the combined output is passed to the softmax layer. The training and testing of the model is performed for raw speech recognition on a Punjabi speech corpus of 65 hours, containing 119,500 utterances with tonal characteristics. Experimental results show that the CNN-based model without tonal features integration and with integrated tonal features in fully connected layer achieved a Word Error Rate (WER) of 12.8% and 11.9%, respectively, outperforming the CNN model without tonal features.

Keywords: Convolutional Neural Network, Deep Learning, End-to-End Speech Recognition, Tonal Features.

68. Skin Lesion Segmentation Using UNet-Based Architectures

Paper Id 171

Narender Singh¹, Sushil Kumar¹

¹Department of Computer Engineering, National Institute of Technology, Kurukshetra,
Haryana-136131, India

323103218@nitkkr.ac.in, skumar@nitkkr.ac.in

Abstract: Image Segmentation has attracted much attention in deep learning, particularly in case of medical field in which it can help in building computer-aided diagnosis systems. Of all the methods that have been designed for image segmentation or salient object detection, UNet and architectures based on it have attracted much attention and have been highly accurate in segmentation tasks. There have been numerous architectures that are based on UNet original architecture, each one employing its own unique adaptation. In this paper, we investigate the usefulness of three UNet based architectures: UNet3+, Attention UNet and U2Net in segmentation of Skin lesion images.

Keywords: UNet, HAM10000, Skin Lesion Segmentation.

69. Agent Based Analysis for Smart Traffic Management

Paper Id 172

Ayushi Banga¹, Ashutosh Kumar Jha²

¹Soban Singh Jeena University, Almora, India

²Indian Institute of Remote Sensing, ISRO, Dehradun, India

Abstract: Traffic management has become a crucial problem in many developing countries especially in small growing urban areas like Dehradun where the traditional traffic signal management system does not effectively work. This work proposes a framework for building smart traffic management solutions using agents, simulators, geospatial and remote sensing tools and methodologies to model and simulate traffic flow in large urban environment. Satellite images and kernel density were employed to examine traffic flow and further classified roads on the basis of traffic intensity. Traffic agents were created and described with such parameters as speed, acceleration, lanes, and traffic lights so that they reconstruct real conditions as close as possible. By using the agent based approach, it is possible to adapt traffic flows and provide valuable information about the methods of traffic signalization and client vehicle behavior patterns. Some of the preliminary outcomes demonstrate the predicted and computed congestion patterns to determine how the whole traffic system responds. This combination of methodology aids optimization of such systems by making transportation decisions more intelligent hence creating sustainable transportation networks for city planners and traffic authorities. The defined framework can be implemented in other urban settings and can be viewed as a scalable solution for ITS.

Keywords: Smart Traffic Management, Agent-Based Simulation, Traffic Congestion, Remote Sensing, Kernel Density Analysis, Intelligent Transport Systems (ITS).

70. Smart Solutions in Veterinary and Animal Sciences: Applications of AI, ML and Soft Computing

Paper Id 173

K. K. Tyagi¹, S. K. Tyagi¹, D. K. Yadav¹, A. Gupta¹

¹College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut-250110, Uttar Pradesh, India

kuldeeptyagi.vet@svpuat.edu.in

Abstract: Precision, efficiency and sustainability are being envisaged in veterinary and animal sciences through artificial intelligence (AI), machine learning (ML) and soft computing. Impact areas include genomic prediction and breeding strategies in animal genetics, precision feeding and nutrigenomics in animal nutrition and optimization of health and environmental management in live-stock production, via AI powered tools such as internet of things (IoT) and deep learning (DL). New advances in veterinary subjects like anatomy, gynaecology, medicine, microbiology, parasitology and pathology take advantage of AI technologies such as Three-Dimensional (3D) modelling, Virtual Reality (VR) and Augmented Reality (AR) automated diagnostics and predictive analytics to increase research, education and clinical outcomes. In addition, AI and ML innovations help with advancing drug discovery, personalized medicine, predicting disease, public health and epidemiology. Veterinary

surgery and radiology also make use of these applications to improve diagnostic accuracy and treatment strategies. These technologies integrate with veterinary and animal sciences in order to make transformative improvements in its development while facing ethical, technical and regulatory challenge for the sustainable and responsible implementation.

71. Granular Ball Random Forest for Robust Classification

Paper Id 174

Abstract: Random Forest (RF) is an ensemble of decision trees, a commonly used classification approach in machine learning. Although many RF variants have been proposed in the literature and achieved significant gains over different types of classification tasks, their performance is considerably weakened when dealing with large-scale and noisy datasets. To address this challenge, we propose a new RF variant called Granular Ball Random Forest (GBRF), that transfers the conceptual idea of granular ball computing, in order to improve robustness and scalability of traditional RF algorithms. GBRF works in two steps: First, the data is clustered into granular balls represented by their centers and radii. Then, the GBRF is constructed from decision trees using bootstrap samples of granular balls, with split heuristics based on cluster properties rather than single data points. The practical experiments performed on benchmark datasets show that the proposed GBRF is effective, giving better performance in accuracy, precision, recall, and F1 score than other existing similar approaches.

Keywords: Random Forest, Granular Ball, Ensemble Learning.

72. Tolerance-Based Feature Selection of an Incomplete Interval-Valued Data

Paper Id 177

Shivani Dubey¹, Shivam Shreevastava¹

¹Department of Mathematics, School of Basic and Applied Sciences, HBTU Kanpur, India
shivam.s@hbtu.ac.in

Abstract: Dealing with the high dimensionality of datasets is recognized as a significant obstacle in computational tasks, such as feature selection and machine learning. Attribute selection is a key factor in reducing classification complexity and preventing overfitting by isolating the most informative features within an information system (IS). Interval-valued information system (IVIS) provides a better representation of real-world data with vagueness in many scenarios in comparison to single-valued information system. Different feature selection techniques for complete IVIS have been developed in recent years, however, less

focus is given in the direction of attribute reduction for incomplete interval-valued information system (IIVIS). In this article, an innovative method for feature selection in an IIVIS using tolerance-based rough set approach is introduced. The approach begins by establishing a fuzzy tolerance relationship between items based on a similarity threshold, specifically aimed at minimizing errors and disturbances to better address uncertainty. The dependency degree approach is utilized to identify the optimal set of reducts, enabling the selection of the most informative features and facilitating deeper insights from the information system. Equivalent results from rough set theory (RST) are confirmed through validation of the proposed method. Additionally, a greedy algorithm is introduced, and example is provided to illustrate the method without the need to examine each attribute pair within an interval-valued decision system (IVDS).

Keywords: Incomplete Interval-Valued Data, Feature Extraction, Dependency Degree.

73. Design and Implementation of an Algorithmic Trading System Using Alpaca and LumiBot

Paper Id 178

Ariyamala V¹, Kumaravel N¹, Kishore Karthik M¹

¹Department of CSE, Rajalakshmi Engineering College, Chennai, India
ariyamala.v@rajalakshmi.edu.in, 210701127@rajalakshmi.edu.in,
210701123@rajalakshmi.edu.in

Abstract: Algorithmic trading bots are the most devastating environment in the modern financial markets. They have been implemented because of their accuracy, precision and clear information about markets in our day-to-day life. These inventions were founded because how well the traders were recognizing the pattern in the stocks. Traders are responsible for creating, implementing and providing the basic knowledge on how these algorithms works. They have to know each and every process of these bots. Once the bot has been designed and it will be deployed later by the traders. The advancements of this technology greatly improve the capabilities of algorithmic trading bots. They can now execute a number of complex trading strategies and analyze millions of real-time market data, and identify profitable opportunities with phenomenal accuracy. These systems produce trading signals that are formulated into buy or sell orders to ensure they meet the real time market conditions. Their ability to integrate efficiency while reducing human error has given them the strong foundation of modern trading practices.

74. ML-Maestro: No Code Machine Learning with Interactive Data Visualization

Paper Id 182

Ananya Kavili¹, Sheba Sulthana¹, S Baghavathi Priya¹

¹Department of Computer Science and Engineering, Amrita School of Computing, Amrita Vishwa Vidyapeetham, Chennai, India
ananyakavili@gmail.com, shebasulthana@gmail.com,
s_baghavathipriya@ch.amrita.edu

Abstract: This paper aims to introduce ML-Maestro an Auto ML app inclusive of interactive data visualization, allowing for a more interactive and understandable representation. The proposed web app ML-Maestro allows users to upload custom datasets relevant to their machine-learning tasks. The platform supports a variety of machine learning tasks, facilitating the generation of models tailored to diverse use cases. The app automatically fine-tunes models through hyperparameter optimization, and once trained, models can be downloaded for deployment in external environments. We discuss the system architecture, the improved data visualization, and AutoML strategies for model selection and tuning. The platform aims to streamline the end-to-end machine learning pipeline, empowering users to focus on application-specific objectives rather than complex technical implementations.

Keywords: Automated Machine Learning, Zero Code, Interactive Data Visualization.

75. Adaptive Music Recommender with Gesture-Based Sound Control: A Human-Centric AI Approach

Paper Id 183

Dr. Rajesh E¹, Anmol Kumar¹, Arnav Singh¹, Afnan Pasha¹

¹Department of CSE AI & ML, RNS Institute of Technology, Bengaluru
1rn21ai027.anmolkumar@rnsit.ac.in, 1rn21ai028.arnavsingh@rnsit.ac.in,
1rn21ai011.afnanpasha@rnsit.ac.in

Abstract: In the entertainment system, custom music experiences are getting more and more popular, but only few are adaptive to the emotional state of the user. Gestures based Volume Control and Emotion Recognition in Recommender Systems This paper presents an adaptive music recommender system which utilizes both emotion recognition and gesture volume control. Using image data to identify emotions, the system generates music recommendations through Spotify's API using deep learning-based emotions from facial images. Further, hand gestures tracked by MediaPipe facilitate volume control without actual touch, offering a more engaging, hands-free experience. Streamlit: an open-source app framework for Machine Learning and Data Science projects. In touch-free environments, this system improves the accessibility of Music speakers and provides user-centric experience based on emotion recognition, gesture control, and personalised music recommendation. The combination of these technologies shows the possibility to add user engagement and interaction to personalization of entertainment systems.

Keywords: Emotion Recognition, Gesture Control, Music Recommendation, Deep Learning, Personalization, User Interaction, Machine Learning, Streamlit, MediaPipe, Spotify API

76. Bridging Molecular Features & Solubility Towards Drug Design: A Machine Learning Framework for Solubility Prediction

Paper Id 185

Akhilesh Pandey¹, Adil Mudasir Malla², Mahroosh Banday³, Asif Ali Banka², Mohammed Khalid Pandit¹

¹National Institute of Technology Hamirpur, India

²Islamic University of Science & Technology, J&K, India

³Indian Institute of Technology, Delhi, India

`mkhalid@nith.ac.in`

Abstract: Aqueous solubility prediction is vital in drug discovery and chemical engineering due to its impact on molecular interactions in solvents, influencing formulation and application strategies. This study introduces a comprehensive machine learning framework employing regression and ensemble-based models for solubility prediction. Four featurization techniques— Custom Descriptor-Based Featurization, RDKit- Descriptors, Extended Connectivity Fingerprints (ECFP), and MACCS Keys—were applied to convert molecular SMILES strings into numerical features. Training utilized three datasets AQSol, ESOL, and PHYSt. Results showed that descriptors encompassing physicochemical, structural, and topological properties consistently outperformed other methods across R², MSE, and RMSE metrics. The models also generalized effectively to unseen data, surpassing existing graph-based approaches. This work emphasizes the significance of feature richness and dimensionality balance in solubility prediction, while laying a foundation for exploring graph neural networks to enhance predictive performance.

Keywords: Aqueous Solubility Prediction, SMILES Strings, Machine Learning, Regression Models, Molecular Featurization, Extended Connectivity Fingerprints (ECFP), MACCS Keys, RDKitDescriptors featurizer, Molecular descriptors.

77. Ensemble Model Based Fall Detection on Elderly Adult Using CNN-BILSTM

Paper Id 190

Deepanshu Rathore¹, Vijay Bhaskar Semwal¹

¹Department of CSE, MANIT Bhopal, Bhopal, India

`deepanshu.rathore638@gmail.com, vsemwal@gmail.com`

Abstract: The proposed work addresses the growing interest in fall detection among researchers, which is driven by its wide range of applications in healthcare and safety monitoring. This research uses wearable sensors like accelerometers and gyroscopes to evaluate human behavior, with a particular emphasis on fall detection. Effective fall detection requires the extraction of crucial temporal elements from gathered data. Traditional methods

are frequently computational-expensive, necessitating specialized knowledge and including extensive feature engineering and data processing. This paper introduce Ensemble learning Model using Convolutional Neural Network (CNN) and Bidirectional Long Short-Term Memory (BiLSTM) of deep learning model , marking a significant development. This novel method of selection of sparial and temporal separately fusion of both sparital and temporal which make and accurately with of 98.17% on the Federated Research Data Repository (FRDR).By automating feature detection and streamlining the data processing pipeline, this approach improves the efficiency and effectiveness of fall detection systems, paving the way for more robust and scalable solutions in real-world applications.

Keywords: Gait, Deep Learning, Inertial Measurement Unit, DNN.

78. A Multimodal Approach to Recommendation Systems: Integrating User Preferences and Item Analysis

Paper Id 191

Mahima Kansal¹, Dr. Sohit Agarwal²

¹Research Scholar, Department of Computer Engineering and Information Technology, Suresh Gyan Vihar University, Jaipur, Rajasthan, India

²HOD, Department of Computer Engineering and Information Technology, Suresh Gyan Vihar University, Jaipur, Rajasthan, India

Abstract: Recommendation systems are commonly used to provide personalized recommendations to users. Researchers are working on recommendations usually based on user ratings and text reviews. This paper proposes a novel approach that combines user preferences with list analysis to improve the quality of recommendations. Collaborative filtering, content-based filtering, and item attribute analysis are combined in this research. In this framework, the main aim is to increase the accuracy and relevance of recommendations. Results proposed the system significantly improves user satisfaction and engagement.

Keywords: Multimodal Recommendation System, Collaborative Filtering, Item Attribute Extraction, Content-Based Filtering.

79. AI-Based Automated ICD Coding for Clinical Texts and Records: A Systematic Literature Review

Paper Id 192

Sasikala D¹, Sabarinath J¹, Sarrvesh N¹

¹Department of Computer Science and Engineering, Amrita School of Computing, Amrita Vishwa Vidyapeetham, Chennai, Tamil Nadu, India

dsasikala@ch.amrita.edu, sabarinath.jsn@gmail.com, nsarrvesh6710@gmail.com

Abstract: The International Classification of Diseases (ICD) is an International standard for epidemiological investigation, health management and clinical diagnosis that play a critical role in intelligent health care. The task of assigning medical codes to clinical free-text documents have been recognized as advantageous for purposes like insurance claim processes, E-health record management and research. Healthcare professionals and professional medical coders assign such codes manually to the health records like discharge summaries, radiology reports, death certificates, pathology reports and etc,. Introducing an Automated approach for this task helps in reducing expenses, alleviating administrative burden and prevents errors. The main objective of this literature review is to provide detailed overview about automated clinical coding, deep learning algorithms and stateof- the art models used for ICD coding. Different NLP techniques were utilized for effective text processing and assignment of ICD codes to Electronic Health Records (EHR). The performance of several approaches on publicly available EHR datasets like

Keywords: ICD Coding, EHR, NLP, MIMIC, Deep Learning Algorithms.

80. A Hybrid CNN-LSTM Model for Sudden Cardiac Arrest Prediction

Paper Id 194

Victor Azad¹, Anuj Kumar Jha², Ashutosh Kumar Jha¹, Shourya Bhushan¹

¹Department of Electrical Engineering and Computer Science, Institute of Infrastructure Technology Research and Management, Gujarat, India

²Department of Mechanical and Aerospace Engineering, Institute of Infrastructure Technology Research and Management, Gujarat, India

Abstract: Sudden Cardiac Arrest (SCA) is a major cause of death due to cardiovascular diseases, responsible for approximately 4-5 million fatalities every year worldwide. However, prompt medical intervention and proper treatment can significantly improve survival rates for individuals experiencing SCA. In this work we propose a hybrid deep learning model that fuses 1D-Convolutional Neural Networks (CNN) and Long Short- Term Memory (LSTM) networks for the early prediction of SCA using Electrocardiogram (ECG) signals. The 1D-CNN component is used to capture spatial features and irregularities associated with SCA, while the LSTM layer identifies temporal patterns essential for accurate prediction. The proposed model achieves a training accuracy of 99.93% and a testing accuracy of 99.75% predicting SCA from ECG signals 30 minutes prior to its occurrence. For signals recorded 60 minutes before SCA onset, the model reports a training accuracy of 99.87% and testing accuracy of 99.56%. Testing on ECG signals from different time intervals before the onset of SCA demonstrates the model's robustness and efficiency. The fusion of CNN and LSTM enhances both prediction accuracy and reliability, improving sensitivity and specificity. This approach not only delivers high accuracy but also strengthens the model's overall predictive power, making it a valuable tool for advanced cardiovascular monitoring systems. Moreover, the model's low computational complexity enables real-time early detection of sudden cardiac arrest (SCA) with minimal delay, offering a promising solution for proactive cardiac health

management.

Keywords: ECG, Deep Learning, Sudden Cardiac Arrest, CNN, LSTM.

81. Hybrid Deep Learning Model for Fall Detection in Healthy Elderly Using CNN-BiLSTM: CNBiLS

Paper Id 195

Harshi Jain¹, Vijay Bhaskar Semwal²

¹Department of CSE, Technocrats Institute of Technology, Bhopal, India

²Department of CSE, Maulana Azad National Institute of Technology, Bhopal, India

harshijain554@gmail.com, vsemwal@gmail.com

Abstract: Abstract—Fall recovery is the capability of a person to recover from external forces. It is an inevitable phenomenon in a cluttered environment. To detect the fall, various mechanism are evolved for elderly subjects, as they are more prone to fall which may lead for permanent disability or death. With the advancement of sensing and computing technology the IoT based werable devices become popular. In this paper, We presents an innovative method for early fall detection & monitoring is proposed during various days to day activities. This research proposes the use of a wearable IMU sensor for detecting body movements. The IMU sensor consists of gyroscopes and accelerometers. Scalability and efficiency may be constrained by the labor-intensive feature engineering and human data processing that are key to traditional fall detection techniques. We developed a hybrid deep learning framework that integrates LSTM networks with CNNs to effectively tackle these challenges. This innovative architecture achieves an accuracy of 98.03% on the Smart Human Fall Dataset, successfully identifying both temporal and spatial patterns in movement data. The proposed model has greatly improves the scalability and dependability of fall detection systems by automating feature extraction and streamlining the data processing pipeline. This provides a solid solution for practical applications and encourages older adults to be more independent and safe.

Keywords: Internet of Things (IoT), Deep Learning, Fall Detection, Sensor, Micro controller.

82. ANFIS Simulation and Particle Swarm Optimization for Finite-Capacity Two-Stage Service Queueing Model

Paper Id 197

Khushbu S. Antala¹, Sudeep Singh Sanga¹

¹SV National Institute of Technology, Surat, Gujarat, India

khushbuantala16@gmail.com, ssanga@ma.iitr.ac.in

Abstract: We analyze a Markovian queueing system with a two-stage service process, where both stages are mandatory for each customer to complete the service. The matrix method and Laplace-Stieltjes transform (LST) are used to determine the transient probabilities of the system states and to compute the performance indices of the model. A numerical study is performed to evaluate the system's sensitivity. To validate the findings, we compare those obtained using the adaptive neuro-fuzzy inference system (ANFIS) with those derived from the matrix method. Furthermore, we formulate a nonlinear cost function with decision variables representing the service rates of both stage 1 and stage 2. This cost function is then optimized using the particle swarm optimization (PSO) algorithm to find the optimal service rates. The optimization process helps identify the most cost-efficient configuration, improving system performance and efficiency. The proposed model is applicable in various domains, such as call centers, healthcare facilities, and banks.

Keywords: Markov Model, Two-Stage Service, Transient Analysis, ANFIS, PSO.

83. Helmet Mounted IoT-Based Physiological Health Monitoring System for Soldiers

Paper Id 200

Ghousiya Begum K¹, Adalarasu K¹, Vikramkarthik J¹

¹School of EEE, SASTRA University, Thirumalaisamudram, Thanjavur – 613401, Tamil Nadu, India

ghousiyabegum@eie.sastra.edu

Abstract: Soldiers are the backbone of a nation's security and monitoring the psychological status of the soldiers enhances their performance. To combat the oppressors who operate out of fear and to protect the periphery, they employ several electronic devices. There are many wearable technologies available for monitoring the physiological signals of armed personnel but these devices need to be fitted as an additional wearable device. So, a helmet-mounted monitoring device is proposed to monitor the vital signals of armed forces engaged in various operations. The physiological parameters include oxygen saturation (SpO₂) along with electrocardiogram (ECG) and photoplethysmography (PPG) signals. This helmet-mounted monitoring system embedded with sensors is proposed to monitor the physiological parameters of soldiers. The signals will be extracted by multiple electrodes placed on the forehead and chest, processed using a MAX86150 breaker board and ESP32, and transmitted to a telemetry monitoring point through wireless technology. Various parameters like heart rate (HR), SpO₂, systolic blood pressure (SP) and diastolic blood pressure (DP), heart rate variability (HRV) parameters namely, the standard deviation of normal-to-normal (NN) intervals (SDNN), and root mean square of successive RR interval differences (RMSSD) were monitored through the Ubidots IoT platform for further analysis and decision making. The proposed study shows the feasibility of applying a smart helmet system for unconstrained health status monitoring during the navigation of soldiers.

Keywords: Soldiers, Helmet, Electrocardiogram, IoT, Photoplethysmography, Ubidots.

84. Weather-Based Fault Detection in Solar Power Generation by ML

Paper Id 201

P. Joel Augustine¹, Gummadi Srinivasa Rao², P. Moti Begum¹, D. Yaswanth¹, Y. Vinod¹

¹Department of Electrical and Electronics Engineering, Velagapudi Ramakrishna Siddhartha Engineering College, Kanuru, Andhra Pradesh, India

²Associate Professor, Department of Electrical and Electronics Engineering, Velagapudi Ramakrishna Siddhartha Engineering College, Kanuru, Andhra Pradesh, India

permati.joel1177@gmail.com, 218w1a0285@vrsec.ac.in, 218w1a0264@vrsec.ac.in, 218w1a02a0@vrsec.ac.in, vasulin@vrsiddhartha.ac.in

Abstract: Solar energy, one of the most important renewable energies, employs many newer technologies, among which Solar Photovoltaic (PV) cells are extensively used for Generating Electricity. As for any installed system, the detection of faults in solar power systems is essential to ensure performance and reliability. It is determined that the solar irradiation, temperature, and shading of the PV cells affect the efficiency of the cells and therefore the diagnostics of the system and the cells' malfunctions. Fault detection systems using statistical methods such as Linear Regression and Decision Tree models have been created and are now in use. Furthermore, newer machine learning algorithms such as AdaBoost, Random Forest and Tweedie Regression are also employed to model the PV output under a range of weather conditions and evaluate how shading or module faults will affect it. These models enable precise fault detection because they distinguish between normal weather fluctuations and faults. The results suggest that machine learning, when combined with weather parameters, improves fault detection and also improves the system's predictive maintenance capabilities. This creates better system performance and increases the lifetime of solar power systems.

Keywords: Photovoltaic System Monitoring, Effect of Partial Shading, Machine Learning Techniques, Fault Detection.

85. A Supply Chain Inventory Model with Fuzzy Environment in Circular Economy

Paper Id 202

Sandeep Kumar Mogha¹, Sonia Dua¹, Vikash^{2,3}, Dhirender Singh³

¹Department of Mathematics, Chandigarh University, Mohali, Punjab, 140413, India

²Department of Mathematics, Vardhaman College, Bijnor (U.P.), 246701, India

³Department of Mathematics, S.S.S.T.S.R. Government Degree College, Nainidanda Pauri Garhwal, Uttarakhand, 246161, India

vikashdma@gmail.com, dsingh94106@gmail.com, moghadma@gmail.com, soniadua1991@gmail.com

Abstract: The Carrying out the circular economy (CE) requires the changeover from

direct to circular business models (BMs), which involves related vulnerabilities and multidisciplinary gambles with that often deflect endeavors. Yet, there is a scarcity of information with respect to the risks implied in this procedure. Starting from the principal presentation of the “Economic Order Quantity” (EOQ) model, it has been developed and additionally altered by various scholastics and specialists with an end goal to decrease the model’s silly assumptions and make it more relevant to the genuine world. The significant objective of the article is to give supervisors devices to assist them with settling on choices that are biologically capable. Where fluctuating interest and environmental expenses can be thought about, the introduced models might be utilized to further develop inventory activities. To decide the vigor of the model, responsiveness examination has additionally been performed on the successful boundaries.

Keywords: Circular Economy, Fuzzy Environment, Supply Chain Inventory, Carbon Emission.

86. Security System for Detecting Suspicious Activity Using Motion Sensors and GSM Communication

Paper Id 207

Abhishek Tripathi¹, A. Praveen Kumar¹, Venkat Mohan¹, M. Rohit Kumar¹, S. Tejaeswar Reddy¹, *Shubham Anjankar², Abhishek Pahuja³, Maruthupandi V.¹

¹Dept of Computer Science and Engineering, Kalasalingam Academy of Research & Education, Tamil Nadu, India.

²Dept of Electronics Engineering, Shri Ramdeobaba College of Engineering & Management, Nagpur, India.

³Dept of Electronics and Communication Engineering, Koneru Lakshmaiah Education Foundation, Vijayawada, India.

tripathi.abhishek.5@gmail.com, 99210041971@klu.ac.in, 99210041832@klu.ac.in, 99210041998@klu.ac.in, 99210042227@klu.ac.in, *anjankarsc@rknc.edu, pahuja.abhishek@gmail.com, v.maruthupandi@klu.ac.in

Abstract: The proposed work is a security solution designed to enhance surveillance and threat detection in high-risk areas. The system integrates an Arduino-based microcontroller with a Passive Infrared (PIR) sensor to detect motion in the monitored environment. Upon detecting movement, the microcontroller processes the data and triggers a machine learning algorithm implemented in Python, which assesses the potential for suspicious behavior. In the event of a detected threat, the system sends an immediate alert via a GSM module to a predefined phone number, while simultaneously activating a buzzer to provide an audible warning. By combining real-time data analysis and machine learning techniques, the system offers an efficient, automated approach to security, enabling rapid situational awareness and response to potential threats. Findings from power consumption analysis show that the system remains energy-efficient even when fully operational. Additionally, the detection accuracy remains high within a 2-foot range, making the system effective for small to medium-scale security applications.

87. Object Identification for Visually Impaired using IoT with Image Processing and Voice Conversion

Paper Id 208

Abhishek Tripathi¹, Bandaru Sathwika Raj¹, Kavya Sree A¹, Rishitha A¹, Sweety A¹,

*Shubham Anjankar², M. Raja¹, M. K. Nagarajan¹

¹Department of Computer Science and Engineering, Kalasalingam Academy of Research & Education, Tamil Nadu, India.

²Department of Electronics Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India.

tripathi.abhishek.5@gmail.com, 9921004066@klu.ac.in, 99210041001@klu.ac.in,
99210041500@klu.ac.in, 99210041141@klu.ac.in, *anjankarsc@rknc.edu,
mrja@klu.ac.in, nagarajan@klu.ac.in

Abstract: This research paper presents a technically robust, low-cost system designed to assist visually impaired individuals in real-time object recognition. The system integrates an ESP32 microcontroller with a camera module for image acquisition and processing, leveraging embedded image recognition algorithms to detect objects in the user's surroundings. Audio feedback is delivered through a voice module and speaker, enabling users to receive real-time information about detected objects, enhancing their mobility and situational awareness. Powered by a 230-volt supply regulated by a transformer, the system ensures stable and reliable operation. The hardware is implemented using Arduino Uno 1.9 software and Embedded C programming, offering efficient image processing and seamless integration with the camera and voice modules. Performance evaluations demonstrated consistent object detection accuracy across various lighting conditions, with a slight decline in low-light environments, as shown in the results. The system's compact, portable design, along with minimal response time, makes it user-friendly and accessible for widespread use.

Keywords: Visually Impaired, IoT, Object Detection, ESP32, Embedded Systems

88. Controllability of third-order delayed integrodifferential systems: a fixed-point theorem based result

Paper Id 210

Sandeep Kumar¹, Tajinder¹

¹Department of Mathematics, Ch. Charan Singh University, Meerut 250004, Uttar Pradesh, India

drsandeepmath@gmail.com, tajinder.math@gmail.com

Abstract: In this manuscript, we provide a sufficient condition for establishing the controllability of the third-order delayed integro-differential dispersion system (3O-DIDDS). The result is derived using Krasnoselskii's fixed-point theorem, along with the theory of strongly

continuous semigroups. This theorem combines aspects of both the Schauder fixed-point theorem and the Banach contraction mapping theorem, providing a reliable framework for our analysis.

Keywords: Krasnoselskii's fixed-point theorem, Dispersion Systems, Controllability, Delayed Systems

89. Advanced Price Forecasting for Food Commodities

Paper Id 213

M. Malleswari¹, Mangala Priya S.¹, Dilli Babu R¹, Mohammed Rafiq A¹, Vinoth S¹

¹Department of Information Technology, Vel Tech High Tech Dr. Rangarajan Dr.

Sakunthala Engineering College, Avadi, Chennai

mangalapriya@velhightech.com, dillibabur_it20@velhightech.com,

mohammedrafiqa.t20@velhightech.com, vinoths_it20@velhightech.com

Abstract: Food price volatility is a global issue that profoundly affects food security, economic stability, and the livelihoods of millions, especially in developing regions. Essential commodities such as wheat, rice, and corn are central to global food systems but are highly vulnerable to unpredictable price fluctuations driven by climate variability, geopolitical tensions, and global trade dynamics. Accurately forecasting the prices of such commodities is crucial for stabilizing markets and enabling timely interventions. This study introduces an Advanced Price Forecasting System, combining ARIMA (Auto-Regressive Integrated Moving Average) and LSTM (Long Short-Term Memory) models. The dual-model approach allows the system to deliver reliable short- and long-term price predictions by leveraging the strengths of both statistical and deep learning methodologies. The ARIMA model captures linear trends effectively in the short term, while the LSTM model addresses non-linear dependencies and complex seasonal patterns in long-term forecasts. The project integrates robust preprocessing techniques, interactive visualizations, and modular design, making it scalable for various commodities. The system includes a React-based dashboard for user interaction, enabling stakeholders to access insights dynamically. Initial evaluations reveal improved forecasting accuracy and the potential for actionable insights to enhance agricultural planning, policymaking, and consumer decision-making. Future work includes hybrid model integration, expansion to additional commodities, and incorporation of external data sources like weather and economic indicators.

Keywords: Commodity Price Forecasting, ARIMA, LSTM, Time-Series Analysis, Food Security, Machine Learning.

90. Fake News Detection Using Machine Learning and Sentiment Analysis Integrated in a Flask Web Application

Paper Id 217

Yash Mehta¹, Raj Nayan², Sumit Malik^{3,*}, Vinay Shukla⁴

^{1,2}B.Tech. CSE, School of Computer Science Engineering and Technology, Bennett University, Greater Noida, 201310, Uttar Pradesh, India

^{3,4}Department of Mathematics, School of Computer Science Engineering and Technology, Bennett University, Greater Noida, 201310, Uttar Pradesh, India

yash.dlw@gmail.com, rajnayan2512@gmail.com, sumit.malik4@gmail.com,
vsshukla09@gmail.com

Abstract: Fake or misleading information, spreading quickly on media, is influencing the public perception and is stirring up social and political turmoil. The traditional manual verification methods could be more scalable given the sheer content volume. Machine learning techniques have been used in the past for research in this area for the detection of fake news, but their usefulness has often been limited by low prediction accuracy and reliance on specific feature sets. The present research work proposes a comprehensive methodology that combines machine learning classification algorithms along with feature extraction techniques to detect fake news. Utilizing a random forest classifier and TF-IDF vectorization, the system is implemented as a user-friendly web application using Flask. To gain more insight into the emotional aspects of the news, the sentiment analysis has been integrated in the present work. The results show the efficacy/usefulness of the implemented system, which achieves high accuracy in predicting the fake news with a clear presentation of the confidence levels and emotional tone. The findings suggest that this approach is better than the previous methods because it significantly enhances the precision of fake news detection and offers practical applications for real-time use on digital platforms.

Keywords: Sentiment Analysis, Fake News Detection, Machine Learning, Web Application, TF-IDF Vectorization.

91. Early-Stage Detection for Alzheimer Disease Using Machine Learning and Deep Learning Algorithm

Paper Id 218

Vishank Agrohi¹, Dr. Sanjeev Thakur¹

¹Amity University, Noida Campus, Noida, India

vishank1999@gmail.com, sthakur3@amity.edu

Abstract: The increase in Risk awareness enables patients to take preventive action even before irreversible brain damage occurs, a correct diagnosis of Alzheimer's disease (AD) is crucial to patient treatment, particularly in the early stages of the disease. Despite the fact that numerous recent studies have employed. The majority of machine detection techniques rely on congenital observations to diagnose AD using computers. Early diagnosis of AD is possible, however it cannot be predicted because prediction is only useful up until the point at which the disease starts to show symptoms. Deep Learning (DL) is now a widely used method for AD early diagnosis. Here, we examine how DL can assist researchers in making early diagnoses of AD and provide a quick overview of some of the key works in

the field. A widespread and well-known neurodegenerative illness that impairs cognition is Alzheimer's disease (AD). The "nervous system" problem has drawn the greatest interest in the field of medicine. In spite of this thorough investigation, there is no method or remedy to halt or reduce its spread. However, there are numerous solutions (both pharmaceutical and nonmedication alternatives) that can help treat AD symptoms at different stages and improve the patient's quality of life. Patients must receive the right care at each stage of the disease as it progresses. Therefore, it may be beneficial to identify and categorise AD phases before beginning symptom treatment. About 20 years ago, there was a significant acceleration in the field of machine learning (ML) advancement. This work, which use ML techniques, focuses on early Identification of AD. We performed extensive testing to identify AD in the "Alzheimer's Disease Neuroimaging Initiative" (ADNI) dataset. The three categories that were to be created out of the dataset were AD, "Cognitive Normal" (CN), and "Late Mild Cognitive Impairment" (LMCI). The ensemble model of "Logistic Regression" (LR), "Random Forest" (RF), and "Gradient Boost" (GB) is presented in this study as Logistic Random Forest Boosting (LRFB). There is currently a lot of interest in using machine learning to discover metabolic disorders that impact a huge number of people worldwide, such as diabetes and Alzheimer's. Every year, their incidence rates rise at a startling rate. When it comes to Alzheimer's, Changes caused by neurodegenerative disorders impact the brain. An increasing number of people, their families, and the healthcare system will be affected by disorders that impair memory and functioning as our population ages. There will be significant social, financial, and economic repercussions from these. Alzheimer's disease is unpredictable when it is first developing. When AD is treated early on, it is more successful and results in less minor harm than when it is treated later. A key concern in computer-aided detection (CAD) is the classification of brain diseases. The two main causes of death are brain tumours and Alzheimer's disease (AD). Positron Emission Tomography (PET), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI) scans are used in the study of various disorders. Need specialised knowledge to comprehend the modality. The illness most commonly affects the elderly and has a potentially devastating latter phases. The outcome can be ascertained by computing the score from the Mini-Mental State Examination, after which the MRI The brain scan is successful. In addition, a variety of classification techniques, including deep learning and machine learning are helpful in the diagnosis of MRI scans. They do, however, have some accuracyrelated restrictions. This research presents several novel preprocessing techniques that greatly enhance these MRI images' classification ability. It also shortened the amount of time needed to train the model using different prior learning algorithms. The Alzheimer's Disease Neurological Initiative (ADNI) provided a dataset that was transformed from a 4D from a format to a 2D one. Techniques for histogram equalisation, selective clipping, and greyscale image conversion were employed to prepare the pictures. Following pre-processing, three learning techniques for the classification of AD were developed. That is Convolution Neural Networks (CNN), XGBoost, and Random Forest.

Keywords: Alzheimer's Disease (AD), Artificial Intelligence (AI), Deep Learning (DL), Machine Learning (ML), MRI, Mild Cognitive Impairment (MCI).

92. Agri Connect - A Digital Platform for Linking Farmers

Paper Id 220

M. Malleswari¹, Mangalapriya.S¹, Sarath Babu.M¹, Harish.T¹, Logesh.S¹

¹Department of Information Technology, Vel Tech High Tech Dr. Rangarajan Dr.

Sakunthala Engineering College

mangalapriya@velhightech.com, harisht_it20@velhightech.com,
logeshs_it20@velhightech.com, sarathbabu_it20@velhightech.com

Abstract: Agriculture is fundamental to the global economy, crucial for food security, rural development, and economic stability. Yet, farmers encounter numerous challenges in obtaining essential farming resources such as machinery, skilled labor, and various agricultural services. Traditional methods of acquiring these services are often costly, time-consuming, and lack transparency, which can impede agricultural productivity and growth. Agri Connect is a cutting-edge digital platform designed to tackle these challenges by connecting farmers with essential service providers, including tractor owners, machine operators, skilled agricultural laborers, and equipment suppliers. By offering a user-friendly digital marketplace, Agri Connect enables farmers to efficiently and cost-effectively search for and hire services that meet their specific needs. The platform facilitates the booking and renting of machinery and skilled labor, allowing farmers to compare prices, availability, and quality through transparent reviews and ratings. Agri Connect unique features, such as filtering by category, price, and availability, simplify the traditionally cumbersome process of acquiring agricultural services.

Keywords: Agriculture, Global Economy, Rural Development, Economic Stability, Farming Resources, Machinery

93. Advanced Machine Learning Framework for Early Detection of Cardiac Disease Using Statistical Analysis and Feature Engineering

Paper Id 221

Yash Joshi¹, Dev Goyal¹, Aditya Bakki¹, Yuvraj Singh¹, Sayan Majhi¹, Snehal Shinde¹

¹Department of Computer Science, Indian Institute of Information Technology, Nagpur, Maharashtra, India

joshiyash0907@gmail.com, devgoyal0808@gmail.com, adityabakki05@gmail.com,
yuvirathore1@gmail.com, sayanmajhi05@gmail.com, sshinde@iiitn.ac.in

Abstract: Heart disease has recently caused major concerns over the degradation of people's living standards. This raises an enormous demand for improvements in cardiac data prediction models wherein machine learning has shown some brilliant results at prediction and decision-making. To test the proposed model, the data scientist applies the heart

disease dataset that incorporates more than 3,00,000 records. BMI, smoking habits, asthma, and other features have been enhanced into the dataset for higher performance. The most important features for the dataset will be selected using chi-square test and correlation test. The model mainly focuses on applying statistical analysis. The applied ML algorithms are Decision tree with a accuracy of 93.23%. These upholding results will help in the ongoing endeavor in developing reliable and efficient tools for the early detection and inter-vention of cardiac disease. In-depth study of more advanced feature selection techniques and hyper-parameter optimization methods is guaranteed to boost model performances even further. As a result of today's sedentary lifestyle due to decline in physical activity such that people spend enormous time in front of their computer screens are putting excess pressure on them, thus increasing the prevalence of risk factors for coronary heart disease and other health problems. Nowadays cardiovascular diseases are getting increasing attention. It is the major cause of death in adult.

Keywords: Machine Learning, Cardiovascular Health, Statistical Analysis, Data Preprocessing.

94. Optimum Hyperbolic Tangent Function for MRI Enhancement

Paper Id 223

Simi V.R.¹, Justin Joseph², Vipin Venugopal³, Rashmi R¹

¹Department of Computer Science & Engineering, Manipal Institute of Technology
Bengaluru, Manipal Academy of Higher Education, Manipal, Karnataka-576104, India

²Centre for Brain Research, Indian Institute of Science, Bangalore, Karnataka-560012,
India.

³School of Artificial Intelligence, Amrita Vishwa Vidyapeetham, Coimbatore, Tamilnadu -
641 112, India.

simi.vr@manipal.edu, r.rashmi@manipal.edu, justinjoseph@iisc.ac.in,
v_vipin@cb.amrita.edu

Abstract: Hyperbolic tangent function (HTF) is an intensity transformation used to improve the contrast of medical images from diverse modalities. Selection of the α parameter determines the slope of the HTF and influences the quality of output images. An exhaustive framework comprising a metaheuristic search strategy termed bilateral search within iteratively narrowing space (BSINS) optimization algorithm, and fitness function termed cumulative information preservation and contrast enhancement index (CIPCEI), for automating the selection of the α parameter of HTF employed for image contrast enhancement applications on MRI is proposed. At the ideal value of the α located from the CIPCEI, the HTF produces enhanced MRI slices with improved contrast among the structures and minimum shift from the mean brightness of the actual MRI slices. The BSINS has faster convergence than the metaheuristic algorithms used in the literature for optimizing the α parameter of the HTF, namely the tunicate swarm optimization algorithm and differential evolution.

Keywords: Fitness Function, Hyperbolic tangent function, Image enhancement, Metaheuristic optimization.

95. A Practical and Explainable Network Anomaly Detection System for Enhanced Cybersecurity

Paper Id 224

Ashutosh Kumar Jha¹, Victor Azad¹, Anuj Kumar Jha², Shourya Bhushan¹

¹Department of Electrical Engineering and Computer Science, Institute of Infrastructure Technology Research and Management, Gujarat, India

²Department of Mechanical and Aerospace Engineering, Institute of Infrastructure Technology Research and Management, Gujarat, India

Abstract: Network Intrusion Detection Systems (NIDS) are pivotal in safeguarding digital infrastructures against evolving cyber threats. This work presents a novel explainable anomaly detection framework leveraging a 1D Convolutional Neural Network (1D-CNN) for anomaly classification. The proposed model attains a training accuracy of 99.42% and a validation accuracy of 99.16% on the benchmark KDDCUP'99 dataset. To address the critical challenge of interpretability, we employ SHAP (SHapley Additive exPlanations) plots, SHAP force plots, and heatmap visualizations to better understand the decision-making process of the model. By focusing on sequential data patterns, the 1D-CNN effectively classifies network traffic, while the integration of explainability techniques ensures comprehensibility and trustworthiness. This framework bridges the gap between high-performance anomaly detection and model interpretability, offering a robust, deployable solution for real world network security applications.

Keywords: Network Security, Anomaly Detection, Explainable AI (XAI), 1D-CNN, SHAP.

96. Towards a more competent healthcare system: A methodological approach for Quantizing reliable detection of concealed depression

Paper Id 228

Mamta Narwaria¹, Shruti Jaiswal¹

¹Department of CSE & IT, Jaypee Institute of Information Technology, Noida, Uttar Pradesh, India

mamta2410@gmail.com, dce.shruti@gmail.com

Abstract: Depression is the most common psychological disorder, which affects a large number of people across the world. Depression needs to be diagnosed earlier to make sure that a person receives timely counselling otherwise it can lead to severe problems. Moreover, stress and depression are not considered as a mental ailment instigating a substantial depressed population, unaddressed and untreated. Depression may further be responsible for developing various chronic diseases and raises suicidal urges. This study has examined machine learning classifiers to categorize the depressed person from others, based on noted socio-demographic and psychosocial evidences. The dataset's most pertinent attributes were mined using ML

algorithms. To improve the efficacy in prediction, Cross fold validation has been employed to lessen the training data's class imbalance. The ensemble technique has outperformed with an accuracy of 87 % & 88% with or without using SMOTE respectively. Besides, the following evaluation measures, namely sensitivity, specificity, precision, F1-score, accuracy have been calculated for six different machine learning models to identify the most efficient model for predicting depression.

Keywords: ML Algorithms, Prediction, Decision Tree, Random Forest, Bagging, Adaboost, Gradient boost, Ensemble, Feature selection, SMOTE, Mental Health, Depression.

97. Fake News Detection Using Machine Learning with Particle Swarm Optimization-Based Feature Selection

Paper Id 229

Nikita Garg¹, Dr. Pritam Singh Negi²

¹Research Scholar, Department of Computer Science & Engineering, HNB Garhwal University (A Central University), Srinagar Garhwal- 246 174, Uttarakhand, India

²Assistant Professor, Department of Computer Science & Engineering, HNB Garhwal University (A Central University), Srinagar Garhwal- 246 174, Uttarakhand, India
nikitagarg@hnbgu.ac.in, negipritam@hnbgu.ac.in

Abstract: Fake news refers to false information or misinformation, and its rapid spread can lead to significant consequences. Often, distinguishing between fake news and real news becomes challenging, resulting in counterfeit news gaining more traction and going viral faster than genuine news. Recognizing the urgency of this issue, this study has been undertaken to detect fake news effectively. The research analyzes a news dataset, leveraging an advanced technique known as Particle Swarm Optimization for feature selection. PSO, an evolutionary algorithm, offers a novel approach to feature selection, moving beyond the limitations of traditional methods or their hybrid variations, which have been commonly used thus far. Once the features were selected, they were classified using six machine learning algorithms. The performance of these models was rigorously evaluated using standard evaluation metrics. The Support Vector Machine (SVM) demonstrated the highest performance among all the algorithms, outperforming the other classifiers in detecting fake news. This study introduces innovation in feature selection and highlights the potential of evolutionary algorithms in enhancing the reliability of fake news detection systems.

Keywords: Fake News, Feature Selection, Particle Swarm Optimization, Machine Learning, Feature Extraction.

98. University Course Timetabling Planning using Hybrid Gazelle Algorithms

Paper Id 231

Rekha Rani¹, Vanita Garg², Sarika Jain³

^{1,3}Department of Mathematics, Amity School of Applied Sciences, Amity University
Haryana, Gurugram, India

²Department of Mathematics, Amity Institute of Applied Sciences, Amity University,
Noida, India

Abstract: University course timetabling problem (UCTP) is a NP hard problem and cannot be solved using some general principles. The intricate relationship between subjects, timeslots and classes makes its complicated to obtain feasible solution. Thus, to obtain feasible solution of timetabling problem is a challenging task. In this study hybrid Mountain Gazelle Particle Swarm Optimization (MGPSO) and Hybrid Mountain Gazelle Genetic Optimization Algorithm (HMGGOA) is used to solve timetabling problem and their results are compared with Hybrid PSO with Constraint Based Reasoning (PSO-CBR), Hybrid PSO with local Search (PSO-LS) and Hybrid Genetic Algorithm with Constraint Based Reasoning (GA-CBR). Each algorithm run five times and their run time and fitness value are stored to compare the performance of proposed algorithm. After compare the performance it is observed that HMGGOA gives best value in minimum time. So, HMGGOA perform good as compared to others.

99. Diabetes Risk Progression and Personalized Recommendations using Machine Learning

Paper Id 236

Himanshu Shekhar¹, Gauri Ojha¹, Pranav Gupta¹, Upender Patri¹

¹School of Electronics Engineering, Vellore Institute of Technology, Chennai, India

Abstract: This research looks at the use of various machine learning techniques for the estimation of the diabetes risk, this time utilizing the logistic regression which is used for binary classifications. Diabetes has cardiovascular, kidney, and neuropathy complications. Simple lifestyle changes or even a medical consultation may help to prevent a disease or manage existing issues. Logistic regression is the used technique and the model takes into consideration the personal characteristics such as protein levels, age, BMI, glucose levels, and family history. The dataset is split so that 80% of the data is allocated for training and 20% is used for testing in order not to overfit the model and check its performance respectively. This model suggests tailored health measures according to user inputs with focus on nutrition, exercise and health visits. There is also a risk progression feature that increases the baseline diabetes risk by 5% every year in case no action is taken. Logistic regression is widely used in terms of medical purposes because it is simple, easy to understand and gives good results. This paper points out the effectiveness of this tool in preventing the cases of diabetes risking patients.

Keywords: regression, pedigree function, Artificial Intelligence, k-Nearest Neighbour.

100. Deep Learning for Avian Monitoring: Bird Detection at Chilika Lake

Paper Id 240

K Vishwanath¹, Rachit Reddy K², Soumya Ranjan Mahapatro³

^{1,2}Department of Computer Science, Vellore Institute of Technology, Chennai, India 600127

³School of Electronics Engineering, Vellore Institute of Technology, Chennai, India 600127

vishwa.kurella@gmail.com, rachitkreddy@gmail.com,
soumyaranjan.mahapatro@vit.ac.in

Abstract: Chilika Lake serves as an important habitat for migrating birds. Located on the east coast of India, in Odisha, it is the largest wintering ground for migratory waterfowl in the Indian subcontinent, covering over 1,100 km². Manual counting and tracking can be a difficult task due to the vast area and the large number of birds and species visiting the lagoon throughout the year. This study focuses on a method to detect and classify Cormorant birds, specifically three species: the Little Cormorant (*Phalacrocorax niger*), the Great Cormorant (*Phalacrocorax carbo*), and the Indian Cormorant (*Phalacrocorax fuscicollis*). The approach involves analysing video files containing these birds and processing each frame using a custom parallel processing system. The method achieved an accuracy of 99.27% across the three species. This study proposes an automated process for bird detection as an alternative to traditional manual counting methods.

Keywords: Deep Learning, Bird Detection, Avian Monitoring, Chilika Lake, Object Detection, Parallel Processing, Wildlife Conservation, Species Classification, Computer Vision.

101. Alzheimer's Disease Prediction using CNN

Paper Id 241

Vishank Agrohi¹, Sanjeev Thakur¹

¹Amity University Noida Campus, Noida, India

vishank1999@gmail.com, sthakur3@amity.edu

Abstract: Controlling the progression of Alzheimer's disease (AD), a progressive neurological illness that results in memory loss, cognitive decline, and behavioural changes, and improving the quality of life for patients depend on early detection. Cognitive testing and neuroimaging technologies like as MRI and PET scans are used in conventional diagnostic approaches; however, these methods are often expensive, time-consuming, and require professional interpretation. Convolutional Neural Networks (CNNs), a subset of deep learning techniques, have demonstrated promise in the automated processing of medical pictures for the diagnosis of AD in recent years. This study looks at how CNNs can be used to predict Alzheimer's disease from structural MRI scans. It provides information on how well CNN based models perform for early diagnosis and highlights how deep learning could revolutionise AD detection.

Keywords: AD, CNN, MRI.

102. Optimizing Test Case Selection Using Reinforcement Learning in Regression Testing

Paper Id 242

Ass. Prof. Dhanashree Nankar¹, Dr. Nandkishor Joshi¹

¹PIET, Parul University, Gujarat, India

dhanshree.kedare29320@paruluniversity.ac.in,

nandkishor.joshi33688@paruluniversity.ac.in

Abstract: Software testing is one of the most critical and resource-intensive phases of the software development lifecycle, particularly in regression testing, where frequent updates necessitate re-execution of large test suites. Optimizing test case selection and prioritization is vital to reduce testing costs while maintaining software quality. This study introduces a novel reinforcement learning (RL)-based approach, leveraging Q-learning, to dynamically prioritize and optimize regression test cases. The proposed method models the testing environment using user and tester interaction logs, mapping them into a state-action space. A reward function assigns values to test cases based on fault detection capability, coverage, and execution efficiency. The Q-learning agent iteratively updates its policy to maximize cumulative rewards, dynamically prioritizing test cases with the highest likelihood of detecting faults. The approach was validated through fault-seeding experiments on five Android applications spanning healthcare, real estate, job portals, mobile POS systems, and virtual assistants. Results showed significant improvements in fault detection rates (up to 91%) and reductions in test suite redundancy compared to traditional methods like random prioritization and t-SANT. This study highlights the efficacy and adaptability of reinforcement learning in regression testing, paving the way for further research into automated test case optimization in large-scale software systems.

Keywords: Regression testing, Regression test selection, Embedded software, Regression test optimization, Real-time, Safety-critical, Fault Detection, Test Suite Minimization.

103. Pronominal and Nominal Coreference Resolution in Assamese: A Linguistic Rule-Based Framework

Paper Id 246

Punam Sarmah¹, Shobhanjana Kalita¹, Utpal Sharma¹

¹Department of Computer Science & Engineering, Tezpur University, Naapam, Tezpur, 784028, Assam, India

pusarmah@gmail.com, kalitas@tezu.ernet.in, utpal@tezu.ernet.in

Abstract: Coreference resolution is a fundamental task in natural language processing crucial for establishing relationships between entities that is and ensuring textual coherence. This paper presents a rule-based approach to resolve pronominal and nominal coreferences in Assamese, a morphologically rich and low-resource language. Biographical texts from Assamese Wikipedia were used to develop and evaluate the proposed methodology.

This approach combines language-generic rules to address common linguistic challenges and language-specific rules to manage Assamese-specific grammatical phenomena, such as suffixation patterns and honorifics.

Keywords: Coreference Resolution, Assamese, Rule Based, Low Resource Language.

104. Hybrid Generative AI Framework for Medical Text Summarization: Enhancing Precision and Relevance in Healthcare Decision-Making

Paper Id 248

Parvathy KS¹, Umamageswaran J²

¹ Department of Computer Science and Engineering Amrita School of Computing Amrita Vishwa Vidyapeetham Chennai, India

² Department of Computer Science and Engineering Amrita School of Computing Amrita Vishwa Vidyapeetham Chennai, India

parvathysandeep3@gmail.com, j_umamageswaran@ch.amrita.edu

Abstract: The rapid growth in the healthcare industry demands innovative techniques to extract a sufficient number of required information from unstructured textual information, for example, clinical notes, patient records, research papers, and diagnostic reports. Such bottlenecks delay the time of decision-making and proper care delivery. Therefore, we have developed a Hybrid Generative AI Framework combining both extractive and Abstractive summarization approaches using rule-based, supervised, and unsupervised learning methods. This framework includes all the leading AI models like BioBERT, architectures of GPT, and domain ontologies namely UMLS and SNOMED-CT for the production of summaries that are not only trustworthy and contextually relevant but factually accurate with the inclusion of NER, TF-IDF, and optimization based on reinforcement learning, thus beating the contextual limitation of traditional methods and factual inaccuracy of Abstractive methods. The performance was measured in depth using metrics like ROUGE-1, ROUGE-2, ROUGE-L, BLEU, execution time, and memory usage. Results were found to be highly improved, such as 93.2% NER precision and a 92.6% reward optimization score, which assures the suitability of the framework in generating clinically relevant summaries. The hybrid approach also showed efficiency in terms of execution time and balanced memory usage, thus being scalable for real-time applications. It allows for an easier and much quicker appraisal of the process by medical professionals, subsequently making for better clinical decisions to result in better health outcomes of patients. As such, it becomes the benchmark by which medical literature is summarized to provide guiding principles towards improving healthcare provision and improving precision medicine.

Keywords: hybrid generative AI, rule-based approaches, supervised learning, unsupervised strategies, extractive summarization, Abstractive summarization, BioBERT, GPT-based architectures, healthcare decision-making, clinical decision support, precision medicine, ROUGE, BLEU, F1-score, relevance, fluency, medical data analysis, and knowledge synthesis.

105. Enhanced Sentiment Analysis Using the RoBERTa-GRU Hybrid Model for Noisy Social Media Data

Paper Id 249

Chandan Vishwakarma¹, Natthan Singh¹, Sonam Srivastava¹

¹Department of Computer Science & Engineering, Institute of Engineering & Technology, Lucknow, India

2300521635003@ietlucknow.ac.in, natthan.singh@ietlucknow.ac.in,
ssrivastava.csed.cf@ietlucknow.ac.in

Abstract: Sentiment analysis, of social media data presents significant challenges due to its informal and noisy nature of the data, which often includes slang, misspellings, emojis and abbreviations. Traditional sentiment analysis methods struggle to accurately interpret such information. This paper proposes a RoBERTa-GRU hybrid model designed to improve sentiment analysis in noisy social media data. The study begins by identifying the limitations of existing methods in handling noisy, informal text. The proposed solution integrates text normalization techniques to preprocess the data and effectively manage informal language features. RoBERTa embeddings are fine-tuned on noisy datasets, enhancing the model's ability to understand and adapt to the complexities of social media text. Additionally, the inclusion of GRU models enables the capture of sequential dependencies and temporal context, crucial for interpreting sentiment evolution in dynamic social media interactions. The methodology explores useful datasets from platforms like Twitter and YouTube, where the model's effectiveness in handling noisy data is tested. The paper concludes by assessing the model's strengths and weaknesses in real-world applications showing how the hybrid approach improves sentiment classification accuracy in challenging noisy environments.

Keywords: Sentiment Analysis, Deep Learning, Transformers, RoBERTa, GRU, Hybrid model, Natural Language Processing, Noisy Data.

106. Augmenting AI with Context: Hybrid Generative Models for Summarizing Complex Medical Texts

Paper Id 250

M Pavithra¹[0009-0009-8935-1045], Umamageswaran J²[0000-0002-7528-9967]

¹Department of Computer Science and Engineering, Amrita School of Computing, Amrita Vishwa Vidyapeetham, Chennai, India

²Department of Computer Science and Engineering, Amrita School of Computing, Amrita Vishwa Vidyapeetham, Chennai, India

ch.sc.u4cse23120@ch.students.amrita.edu, j_umamageswaran@ch.amrita.edu

Abstract: The rapid advances made in generative AI have thereby unlocked new avenues of text summarization. However, summarizing medical texts is challenging by most

standards; it's very complex, highly technical, and contextual accuracy is required. Thus, this paper introduces a hybrid generative framework to combine pretrained language models with external medical knowledge resources for improving the medical text summarization's accuracy, coherence, and contextual appropriateness. The proposed model thus expands on the limitations of standard generative approaches by using external data sources, such as clinical guidelines, ontologies, and patient-specific records. We evaluated the framework using metrics such as ROUGE, BLEU, BERTScore, and expert validation in order to test its performance compared to conventional models in medical summarization tasks. The results further emphasize the importance of context-aware systems within the healthcare domain, illustrating the promise of hybrid methods for enhancing either quality of summarization or their practical applicability.

Keywords: Medical text summarization· Hybrid generative models· Contextual embeddings· Medical ontologies· Transformer models· Knowledge-augmented AI· Clinical text processing· Evaluation metrics.

107. Aircast Predictive Model using Supervised Machine Learning

Paper Id 251

Mohammed Thameem Ansari M¹, Rohith K¹, Varadarajan B¹, Mangala Priya S¹

¹Department of Information Technology, Vel Tech High Tech Dr. Rangarajan Dr.

Sakunthala Engineering College, India

mangalapriya@velhightech.com, varadharajanb_it20@velhightech.com,
mohammedthameemansarim_it20@velhightech.com, rohithk_it20@velhightech.com

Abstract: The creation of Air, a collection of forecast models for air pollution levels using supervised machine learning techniques, is examined in this article. Using historical data on air quality as well meteorological and environmental variables, Air predicts levels of pollutants such as PM2.5, PM10, and NO2. The models use techniques like neural networks, decision trees, and linear regression to find patterns and connections in the data. The accuracy and dependability of these models in forecasting pollution levels are assessed through the use of key performance measures. The results show how useful Air may be as a tool for public health planning and environmental monitoring. Air can assist in influencing policy decisions and reducing the negative impacts of air pollution on urban populations by offering timely insights.

Keywords: Air pollution prediction, Supervised machine learning, PM2.5, PM10, NO2, Environmental monitoring, Public health planning.

108. Detection and Classification of Cassava Diseases using Concatenate Model

Paper Id 252

Anand Kumar Jain¹, Neeta Nain¹

¹Department of Computer Science & Engineering, MNIT Jaipur, India
2023rcp9026@mnit.ac.in, nnain.cse@mnit.ac.in

Abstract: This study explores the application of a hybrid deep learning approach using an EfficientNetB0-DenseNet121 concatenate model for cassava leaf disease classification. The CCMT cassava dataset, which includes a diverse set of disease-affected and healthy leaf images, is utilized to train and validate the proposed model. EfficientNetB0 and DenseNet121 architectures are leveraged for their complementary strengths EfficientNetB0's parameter efficiency and DenseNet121's robust feature extraction capability. By concatenating the feature outputs of these two architectures, the model aims to enhance classification accuracy by combining fine-grained details with broader contextual patterns. The experimental results demonstrate the effectiveness of the concatenate model, showcasing improvements in key performance metrics such as accuracy with 99.40%, test accuracy with 91.30%, precision, recall, and F1-score compared to individual network implementations. This research contributes to the field of agricultural disease detection, providing an efficient and accurate tool for early disease identification, which is critical for crop management and yield optimization.
Keywords: Cassava, Agriculture, Plant, Disease, Leaf, Transfer Learning, EfficientNetB0-DenseNet121

109. Multi-Modal Hybrid Model for Depression Detection on Social Media and Clinical Datasets

Paper Id 254

Harshit Tuli¹, Dr. Addapalli V N Krishna¹, Dr. Manikandakumar M¹

¹School of Engineering and Technology, CHRIST (Deemed to be University), Bangalore, Kengeri Campus, Kanmanike, Kumbalgodu, Mysore Road, Bangalore, Karnataka – 560074, India

1harshittuli59@gmail.com, 2adapalli.krishna@christuniversity.in,
3manikandakumar.m@christuniversity.in

Abstract: Depression is a major global mental health challenge that is usually undiagnosed and therefore needs scalable and effective methods for diagnosis. This paper presents a new multi-modal hybrid model for early depression detection by combining data from social media platforms (Twitter and Reddit) and clinical datasets (DAIC-WOZ). Our approach is different from the existing text-only methods where, with the use of cross-attention mechanisms, it enables the model to give precedence to specific modality information to enhance the prediction accuracy. All the elements of the model have been powered by the latest algorithms in deep learning, including BERT, text embedding; ResNet50 to extract features from pictures; GRU processes the audio; and MLP computes insight from behaviors. Rigorous evaluation of the proposed approach has yielded an accuracy of 89.6%, which is a humongous increment in comparison with single-modality models. High precision, recall, and ROC-AUC scores also point out the robustness of the model in identifying minor depressed states. The

work addresses an issue related to the problem of dealing with data imbalance as well as multi-modal fusion that has futures in scalable public health monitoring and clinical diagnostics. Future work includes integrating video data, personalization with reinforcement learning-based predictions, and further clinical validation of a more extensive nature.

Keywords: Depression Detection, Multi-Modal Hybrid Model, Deep Learning, Text Analysis (BERT), Image Feature Extraction (CNN), Audio Processing (GRU), User Interaction Data (MLP), Cross-Attention Mechanism, Binary Classification.

110. Design and Development of a Robust Assamese Language Dataset for Author Attribution

Paper Id 255

Abstract: This paper focuses on the design and development of a linguistic corpus to address the task of author attribution of assamese language documents. The assamese language is categorized as a low resource and computationally challenging language. The dataset so developed and reported via this paper represents around 9730 text samples from 16 prominent authors which also features about 3 million tokens. A rigorous error analysis was performed on the dataset using some popular machine learning algorithms like naive bayes, random forest, support vector machines, logistic regression. The results show that random forest model was able to capture the embeddings in a better way in comparison to the other algorithms with an accuracy of 93.2%, precision of 95%, recall of 93% and a F1 Score of 94%. The dataset developed and study reported in this paper is the first ever attempt to study the task of author attribution and analyse its results on a standard dataset. The results reported in this paper will lay a foundation stone in extending the study further in context of developing or enhancing linguistic applications for low-resource languages

Keywords: Language Corpora, Assamese Language, Low-Resource Language, NLP, Linguistic Processing.

111. Unraveling Plasticity Loss in Deep Neural Networks Under Non-Stationary Objectives

Paper Id 256

Rishi Raj Dutta¹, Udit Sehra¹, Rajeev Kumar¹, Mohammad Khalid Pandit¹

¹National Institute of Technology Hamirpur, HP 177005, India

23mcs110@nith.ac.in, 23mcs107@nith.ac.in, rajeev@nith.ac.in,
mkhalid@nith.ac.in

Abstract: Deep Neural Networks (DNNs) are spearheading the advancements in Artificial Intelligence, powering a wide array of applications from computer vision to natural language processing. As demand for specialized AI solutions grows, so does the need to train networks for domain-specific or task-specific applications. However, it has been observed that

neural networks can lose their ability to generalize to new data after extensive training— a phenomenon known as loss of plasticity. This issue poses significant challenges for continual learning and adaptation in dynamic environments. In this paper, we empirically investigate the loss of plasticity [7] in various neural network architectures. We demonstrate how and when this phenomenon occurs through extensive experiments, analyzing factors such as network depth, training duration, and data distribution. We delve into the dynamics underlying the loss of plasticity, uncovering its impact on the network’s ability to learn new information without forgetting previously acquired knowledge. Our findings provide insights into plasticity mechanisms in neural networks and suggest potential strategies to mitigate this issue.

Keywords: Deep Neural Networks, plasticity, network depth, duration of training, data distribution

112. Approximate Analytical Solution of (1+1)-dimensional Kaup system and Sawada-Kotera-Ito Seventh-order KdV equation by RDTM

Paper Id 258

Amit Tomar¹, Sanjeev Kumar Chaudhary², Pooja³

¹Department of Mathematics (SCSET), Bennett University, Greater Noida – 201303, India

²Department of Mathematics, Amity University, Greater Noida – 201303, India

³Department of Electronics and Communication, University of Allahabad, Prayagraj, India
amit.tomar@bennett.edu.in, sanjeevkc1999@gmail.com, cs.pooja188@gmail.com

Abstract: The primary objective of this paper is to demonstrate the application of the Reduced Differential Transform Method (RDTM). This method is utilized directly without the use of bilinear forms, Wronskian functions, or the inverse scattering technique. A significant feature of the RDTM is its enhanced convergence to the analytical solution as the number of terms in the series increases. In this research, the method is applied to solve the nonlinear (1+1)-dimensional Kaup system and the Sawada-Kotera-Ito seventh-order KdV equation, considering initial conditions that include arbitrary constants. The numerical results obtained through RDTM are compared with exact solutions, with the arbitrary constants fixed and the findings presented in tabular and graphical formats.

Keywords: Reduced differential transform method, (1+1)-dimensional Kaup system, Sawada-Kotera-Ito seventh-order KdV equation.

113. Design of an Improved Method for PET Scan Analysis Using ConvTransformers and SHAP-Guided Ensembles for Oral Cancer Diagnosis

Paper Id 262

Kamini Sharma¹, Dr. Kaushal Jani¹

¹Department of Computer Engineering, Indus University, Rancharda, Via- Shilaj, Ahmedabad- 382115, India

Abstract: The growing incidence of oral cancer necessitates early and accurate diagnosis, particularly via the advancement of medical imaging technology such as PET scans. Methods currently in use are effective but still have limitations, including poor sensitivity to small lesions, poor modelling of long-range dependencies, and lack of clinical explainability. We present a holistic, multi-faceted framework, combining machine learning and deep learning techniques, to improve PET scan processing for oral cancer diagnosis. Our hybrid Convolutional Transformer Network, ConvTransformer, circumvents the limitations of CNNs by integrating local spatial feature extraction with global contextual attention, thus achieving classification accuracy of 93.5%. In segmentation, we improve sensitivity to smaller lesions by incorporating a modified U-Net with attention gates and residual blocks along with Focal Tversky Loss that results in achieving a Dice score of 0.92. We develop an SHAP-guided ensemble model combining radiomic features with CNN-extracted deep features with a view toward offering interpretable biomarkers at 90% sensitivity. Additionally, we propose an end-to-end diagnostic system leveraging the workflow of Apache Spark and AutoML to improve the speed of data processing while cutting down the training time by 50%. Using Survival Gradient Boosting Machines, we obtain prognostic insights and make survival probability predictions with a concordance index of 0.84. Bioinspired Grey Wolf Optimizer (GWO) ensures efficient hyperparameter tuning, improving accuracy by 2–3%. Finally, transfer learning benchmarks validate the framework by achieving a cross-dataset F1-score of 90%. This work contributes to advancing oral cancer diagnostics by addressing clinical challenges, improving detection and explainability, and offering scalable real-time solutions.

Keywords: PET Scan, Oral Cancer, ConvTransformer, SHAP, Survival Analysis.

114. AI-Based Solution for Smart Traffic Management

Paper Id 264

E. Kamalanaban¹, M. Malleswari¹, Mangalapriya S¹, RajaPandi S¹, Sugumar R¹, Gajendran S¹

¹Department of Information Technology, VelTech HighTech Dr. Rangarajan Dr. Sakunthala Engineering College, Avadi

Abstract: The "Smart Traffic AI Management" system leverages advanced technologies to optimize traffic control and enhance road safety. This innovative solution employs camera systems to monitor traffic flow, with image processing performed through OpenCV. A YOLO-based model facilitates dynamic adjustments of traffic signals, ensuring efficient vehicle movement. A key feature is the integration of a web application, developed using Django, that provides law enforcement with a user-friendly interface to manage and customize system operations. The project incorporates cloud connectivity using AWS, enabling seamless data exchange and remote management. Special attention is given to emergency scenarios, with dedicated provisions for ambulances to ensure uninterrupted passage. Additionally, the system is equipped to detect and document traffic violations by capturing and transmitting images of non-compliant vehicles. This comprehensive approach combines AI, web technologies, and cloud services to deliver an intelligent traffic management solution tailored to modern urban challenges.

Keywords: Smart Traffic Management, Artificial Intelligence, YOLO Model, OpenCV Image Processing, Traffic Signal Automation, Django Web Application, AWS Cloud Integration, Traffic Violation Detection, Ambulance Priority Handling, Urban Traffic Optimization, Real-time Monitoring, Smart City Technology, Camera-based Detection, Vehicle Rule Enforcement, Intelligent Transport Systems (ITS), Cloud-enabled Traffic Solutions

115. Optimizing Inventory in Alternate Markets: Balancing Sustainability, Energy Efficiency and Inflation with Stock and Price-Dependent Demand

Paper Id 265

Divya Bharti¹[0009-0002-8644-1458], S.R. Singh²[0000-0002-7159-8500], Surbhi Singhal³[0009-0004-2800-8706], Dharmendra Yadav⁴[0000-0002-8365-4899]

¹Department of Statistics, Meerut College, Meerut, 250001, India

²Department of Mathematics, C.C.S. University, Meerut, 250001, India

³Department of Statistics, Vardhaman College, Bijnor, 246701, India

⁴Department of Mathematics, Vardhaman College, Bijnor, 246701, India

divya.statistics14@gmail.com, shivrajpundir@gmail.com,
singhalsurbhi2006@gmail.com, dharmendrayadav3580@gmail.com

Abstract: In this study, the alternate market plays a crucial role in providing flexibility and resilience to businesses by offering an additional outlet for selling products, particularly when demand in the primary market is unstable or insufficient. It helps mitigate risks associated with overstocking or shortages, optimizing inventory levels. In this model we considering EPQ model for dual market system i.e., primary and secondary market. In

primary market we develop production model having stock and price dependent demand with shortages whereas in secondary market demand is depend only on price. In primary market inspection of stock is done and then deteriorated items are transferred to secondary market. Through an analytical model, the minimization of total cost has been achieved. Furthermore, the study investigates the impact of inflation on the overall financial sustainability of the system, providing insights into managing price volatility. The methodology also prioritises energy efficiency and environmental sustainability. Variation in various parameters and optimal results are visually represented and further examined in detail. MATHEMATICA 12.0 does sensitivity analysis and determines the optimal solution.

Keywords: Alternate Market, Sustainability, Energy Efficient, Stock and Price Dependent Demand, Inflation, Shortages

116. Optimizing EOQ model for Time-Deteriorating Items under Carbon Emission and Learning Effect with Partial Backlogging

Paper Id 266

Mohit Rastogi¹, Himanshu Gupta¹, Arti Bansal¹, S.R. Singh², Shilpy Tayal³

¹Department of Applied Sciences and Humanities, ABES Engineering College, Ghaziabad, Uttar Pradesh, 201009, India

²Department of Mathematics, Ch. Charan Singh University, Main Road, New Prabhat Nagar, Meerut, Uttar Pradesh, 250001, India

³Department of Mathematics, Graphic Era Hill University, Bell Road Society Area, Clement Town, Dehradun, Uttarakhand, 248002, India

mohitrastogi84@gmail.com, hmnshu08@gmail.com, artibansal812@gmail.com, shivrajpundir@gmail.com, agarwal_shilpy83@yahoo.com

Abstract: DThis study delves an inventory system for decaying items that incorporates price-sensitive demand under learning effect and carbon emissions consideration. As Carbon emissions are a major cause of climate change, in recent times, to control carbon pollution and reduce emissions, several nations have levied carbon taxes on companies. During the process of moving goods from one location to another carbon is released thus to reduce carbon emissions, we incorporated carbon emission costs owing to the transportation of ordered finished goods. In realism, carbon emissions are also generated throughout the deterioration process. Since almost every product deteriorates with time, the deterioration's rate is thought to be time-reliant and follows weibull distribution (three-parameter). To make the study realistic, preservation technology is integrated for degradation goods. Shortages are expected to be backlogged partially during stock out phase. This study aims to minimize the system's overall average cost by figuring out the optimum ordering quantity as well as time interval. For justification of the study, a numerical illustration is presented and to check the stability of the system a comprehensive sensitivity analysis is conducted to investigate how various parameters affect the optimal solution.

Keywords: Weibull distribution, Learning effect, Price dependent demand, preservation technology, Partial backlogging, Carbon Emission

117. Mapping SDG Goals with ESG Strategies using Topic Modeling: An Analysis of FMCG Sector

Paper Id 272

Saharsh Sadabhartia¹[0000-1111-2222-3333], Rajeshwari Hiremath¹[1111-2222-3333-4444]

¹Prin. L.N. Welingkar Institute of Management Development and Research, Bengaluru, India

saharsh18june@gmail.com, rhiremath3602@gmail.com

Abstract: Fast-Moving Consumer Goods (FMCG) is one of India's fourth-largest sectors, significantly contributing to growth and employment. This research investigates the Environmental, Social, and Governance (ESG) reporting framework alignment with the United Nations' Sustainable Development Goals (SDGs) within this sector to understand the contribution towards growth taking into consideration sustainability to achieve the dream of 'Vikshit Bharat'. The study examines 2023-2024 Business Responsibility and Sustainability Reports (BRSRs) from five leading FMCG companies, identifying distinct thematic topics across ESG dimensions that reveal corporate sustainability priorities and their SDG alignments utilizing Topic Modeling, one of the prominent techniques of Text Analytics. The analysis identifies three core themes within each ESG dimension. In the environmental domain, key focuses include supply chain sustainability, emission reduction, and sustainable technology adoption. Social themes highlight inclusion, grievance redressal, and ethical standards. Governance themes emphasize structured committees, adherence to codes, and anti-bribery measures. Notable strategic priorities emerge among companies. The research also highlights shared commitments across the sector to SDG 16 (Peace, Justice, and Strong Institutions) and SDG 8 (Decent Work and Economic Growth), alongside unique alignments such as SDG 15 (Life on Land) for certain companies. These findings contribute to the discourse on sustainability frameworks, offering practical insights for businesses, investors, and policymakers to advance corporate sustainability practices.

Keywords: SDG Goals, Topic Modeling, Environment, Social, Governance, Alignment.

118. Effective Visualization Approaches for Distributed Denial of Service Threat Prediction in Large-Scale Networks Using Interpretable Machine Learning

Paper Id 273

R. Srivats¹[0009-0001-5791-4255], Kalyanasundaram V¹[0009-0007-5737-6534], Deepika Roselind Johnson¹[0000-0002-3610-2979], Abhiram Sharma¹[0009-0004-0822-0603], Krishna

P B¹[0009-0000-1944-0514], Logeswari G¹[0000-0002-7534-5527]

¹School of Computer Science and Engineering, Vellore Institute of Technology, Chennai
Campus, Tamil Nadu, India
deepikaroselind.j@vit.ac.in

Abstract: In recent years, Distributed Denial of Service (DDoS) attacks have become a significant threat to cybersecurity, capable of crippling critical networks and online services. This study is aimed at developing a data driven approach to distinguish between normal network traffic and DDoS attacks. The dataset consists of four types of DDoS attacks, namely UDP-Flood, Smurf, SIDDOS, and HTTP-FLOOD attacks that are combined into a single malicious traffic class. The approach entails detailed data preprocessing such as handling of missing values and balancing of the dataset using SMOTE. Three machine learning models, namely Logistic Regression, Decision Tree and Random Forest were compared and Random Forest gave the best result. After hyperparameter tuning using Random Search Cross Validation, the model achieved a precision of 96.3%, recall of 87.3% and F1-score of 91.6%. XAI techniques like SHAP and LIME were also employed to make the model more interpretable and offer features that are most relevant to the detection of DDoS attacks and thus improve the development of network security solutions.

Keywords: Distributed Denial of Service (DDoS), Network Security, SHAP, LIME, SMOTE, Machine Learning, Attack Classification.

119. A Comparative Study of Vowel Systems in Five NorthEast Indian Languages: Phonetic Charts and Acoustic Features in Bodo, Karbi, Mising, Nepali, and Tiwa

Paper Id 274

Narottam Bhattacharjee¹, Sanghamitra Nath¹

¹Department of Computer Science and Engineering, Tezpur University, Napaam, Tezpur, Assam, 784028, India

1narottam@tezu.ernet.in, 2s.nath@tezu.ernet.in

Abstract: This work focuses on creating vowel charts for five languages spoken in North-East India: Bodo, Karbi, Mising, Nepali, and Tiwa. The major purpose is to evaluate and compare these languages' vowel systems, resulting in a clear description of their phonetic structures. The vowel charts are created utilizing acoustic data, including formant frequencies (F1 and F2), to depict the placement and distribution of vowels in each language. Furthermore, a text corpus and a speech corpus have been created for each language, allowing for a thorough examination of its phonological and acoustic characteristics. The present study therefore represents an advance in the knowledge about linguistic diversity in the region and contributes with useful resources for phonological studies to be developed in the future, as well as speech technology applications including Automatic Speech Recognition

and Text-to-Speech Synthesis.

Keywords: Acoustic Features, Vowel Chart, Formant Frequency, Phonetic Chart, Karbi, Mising, Garo, Tiwa, Nepali.

120. A Novel approach to integrate AI into Judicial Systems

Paper Id 275

Dr. Ruchira Goel¹[0009-0008-7826-9305], Khushi Bansal¹[0009-0005-4878-7820]

¹Ajay Kumar Garg Engineering College, Ghaziabad, Uttar Pradesh, India

Abstract: The judicial system in most countries is already highly burdened with a huge backlog of cases, leading to delayed judgments which impede access to justice. This inefficiency stems from overburdened courts, limited resources, and costly procedural processes that results in litigants waiting years to have a case resolved. This paper proposes a novel approach on how artificial intelligence can assist to streamline judicial workflows so that cases get processed faster reducing delays. Predictive analytics models are utilised to help analyse historical case data to predict trial outcomes and evaluate the complexity of a claim giving organization a better opportunity in prioritizing cases. ML is bifocal in this domain: not only can it optimize administrative functions like case management, but it can also support more sophisticated applications such as outcome prediction, legal risk assessment, and resource allocation. It offers substantial efficiency gains and raises important questions related to algorithmic accountability thus striking a balance between human judgment and automatization. This paper aims to discuss in depth the areas of opportunity and constraint brought about by AI technologies for creating a modernized judicial process.

Keywords: Judicial System, SVM, Machine Learning.

121. Energy Efficiency in Software-Defined Wireless Network

Paper Id 276

Sonu Singh¹, Rajeev Kumar Shah², Asif Khan³, Jiyaul Mustafa⁴

^{1,2}Lord Buddha Education Foundation, Affiliated with Asia Pacific University of Technology & Innovation (APU), Nepal

³Department of Computer Application, Integral Robotics Lab, Integral University, Lucknow, India

⁴Department of Mechanical Engineering, Bennett University (The Times Group), Greater Noida, India 201310

sonu.singh@lbef.edu.np, rajeev.shah@lbef.edu.np, asif05amu@gmail.com, jiyaul.mustafa@bennett.edu.in

Abstract: To handle the traffic, the network devices must be switched on 24 hours a day. The networking hardware of legacy wireless network embedded the controlling and data

forwarding functions in the same devices. Most of the network devices present in the network is comparatively ideal for most of the time which shows an unnecessary energy consumption in communication network. Software defined wireless network is a new network paradigm which separates the data plane and control plane providing flexibility and virtualization to the network. Software defined network allows the administrators to manage the network devices through centralized controller and enables programmable network devices. SDN provides opportunities to enhance the overall network performance and energy efficiency. This paper proposes an adaptive link rate traffic aware approach to reduce the energy consumption of wireless network during idle state. The main idea is to switch off the unused switches, routers and links to sleep mode during night time when they carry no traffic. We have used Mininet-WiFi network emulator for the simulation of typical wireless network and open day light as SDN remote controller. This paper presents the comparison between energy consumptions between traditional wireless network and software defined wireless network. This comparison is done to know; how much energy can be optimized by wireless network using Software Defined Wireless Network (SDWN) as compared to traditional wireless network. The result showed that we can save up to 49% of energy consumption at night time after using the proposed energy saving approach.

Keywords: SDWN, Energy Efficiency, Performance, Wireless Network

122. Transforming Healthcare with AI: A Comprehensive Review of Innovations in Tropical Disease Management and Cancer Therapy

Paper Id 277

Anand Kumar¹, Vasu²

¹BVCOE, GGSIPU, New Delhi, India

²DDU, DU, New Delhi, India

Abstract: AI is transforming healthcare, tackling tropical diseases, and advancing cancer care. In tropical regions, machine learning models like neural networks improve diagnostics by spotting patterns in clinical data, enabling early treatment in areas with limited resources. Yet, challenges like biased datasets and regional disparities limit its reach. In cancer care, AI enhances precision medicine by predicting drug responses and personalizing treatments. Deep learning automates imaging and streamlines diagnostics, while in immunotherapy, it tailors treatment plans based on patient responses, improving outcomes and efficiency. Despite its promise, AI adoption faces hurdles, including ethical concerns, data privacy issues, and unequal access. Collaboration among healthcare providers, tech experts, and policymakers is key to overcoming these barriers. By addressing these challenges, AI can reshape medical care, particularly in underserved areas and complex conditions, fostering a more equitable and effective healthcare system.

Keywords: Artificial Intelligence, Machine Learning, Cancer, Tropical Disease, Malaria, Dengue, Tuberculosis, Typhoid, Oncology

123. Enhanced Detection of Distributed Denial-of-Service (DDoS) Attacks in Cloud Computing Using Transfer Learning, DBSCAN, and Entropy Analysis

Paper Id 278

Saswati Chatterjee¹, Vijaykumar JayantiBhai Solanki², Rinkal Dharmesh Sarvaiya¹

¹Parul University, Vadodara, Gujarat, India

²IIT Roorkee, Roorkee, India

cshiv68@gmail.com, vijaykumar_js@ma.iitr.ac.in, rinkaldsarvaiya@gmail.com

Abstract: The present research explores an innovative approach to improve DDoS detection in a cloud environment by evaluating the performance of various algorithms and methodologies. The paper integrates ML and DL approaches to develop a comprehensive framework for the recent developments in information security and the implementation of IDS. It provides an in-depth analysis of DDoS attack types and explores existing detection strategies, emphasizing the role of preprocessing sub-systems and feature selection in enhancing detection accuracy. Leveraging transfer learning and the SDN Dataset that consists of 23 significant features for the detection of intrusion in a network, a transfer learning-based Intrusion Detection System (IDS) is presented in this paper. Using the Density-Based Spatial Clustering of Applications with Noise (DBSCAN) algorithm, this research categorizes attack patterns and noise giving it the flexibility of the anomaly detection method. Entropy is used as a metric to measure the level of randomness in network traffic, with any deviations from expected patterns potentially indicating an ongoing attack. The preprocessing pipeline includes rebalancing data, cleaning, splitting, and applying min-max normalization. A hypermodel combining classifiers such as Support Vector Machines (SVM), K-Nearest Neighbors (KNN), XGBoost, and other ML models is employed for performance evaluation. The results demonstrate that the proposed deep learning and statistical framework, augmented by DBSCAN and entropy analysis, achieves superior accuracy and robustness in detecting and preventing DDoS attacks compared to traditional methods.

Keywords: Man-in-the-middle attack, Classifier, K-means, Possibilistic C-Means Clustering.

124. From Cognitive Intelligence to Eco-Friendly Innovation: The Revolution in Next-Generation Autonomous Vehicles & Greener Transportation Networks Through Neuro-Fuzzy systems — A Comprehensive Review, Challenges, and Future Directions

Paper Id 281

Mohima Chakraborty¹

¹East Delta University, Chittagong, Bangladesh Department Electrical & Electronics Engineering.

Abstract: Neuro-fuzzy systems in autonomous electric vehicles (AEVs) are a big step forward in artificial intelligence, automotive engineering, and sustainable transportation. This paper provides a detailed review of how neuro-fuzzy systems are applied in AEVs, why they are needed & how they can guide us towards smart, safe transportation. The paper showcases how they can conduced smart decision-making with operational efficiency. It looks into future possibilities, such as using 5G and smart city infrastructure to improve urban mobility and sustainability. By examining current methods and real-world applications, the paper emphasizes the potential of neuro-fuzzy systems in advancing autonomous electric vehicles, providing insights for future research and development.

Keywords: Neuro-Fuzzy Systems, Autonomous Vehicles, Electric Vehicles, Sensor Fusion, Real-Time Processing, Energy Management.

125. Optimal Systems, Conservation Laws, and Invariance Analysis of the $(2+1)$ extended Boiti-Leon-Manna-Pempinelli equation via the Lie Symmetry approach

Paper Id 282

Akshita Bhardwaj¹, Shalini Yadav², Muhammad Junaid-U-Rehman³, Rajan Arora¹

¹Department of Applied Mathematics and Scientific Computing, Indian Institute of Technology Roorkee, India

²Department of Mathematics, Lady Shri Ram College For Women, Delhi University, India

³Department of Automation, Biomechanics, and Mechatronics, Lodz University of Technology, Lodz, Poland

akshita_b@as.iitr.ac.in, shalini.yadav@lssr.du.ac.in
muhammad-junaid.u-rehman@dokt.p.lodz.pl

Abstract: Lie symmetry analysis has been applied to the extended Boiti-Leon-Manna-Pempinelli (eBLMP) equation. This system illustrates the exchange of information between two waves with distinct dispersion characteristics. The optimal system of the corresponding Lie algebra has been constructed. The equation considered has been reduced into a simpler form for the computation of analytical solutions. The novelty of this research lies in constructing the optimal system of subalgebras in one dimension using the adjoint action approach. To analyze and understand the eBLMP more clearly, graphs have been plotted. Conservation laws have also been derived.

Keywords: Lie group, Similarity transformation, Infinitesimal generators, Optimal system of Lie subalgebra, Conservation Laws

126. On the Relationship between Strong p-Cesàro Summability and Convergence of Statistical Means

Paper Id 283

Sandeep Gupta^{1,2}, Sumit Goel^{3,4}

¹Department of Mathematics, Arya (P.G.) College, Panipat, India

²Kurukshetra University, Kurukshetra, Haryana, India

³Department of Mathematics, Chaudhary Charan Singh University, Meerut, Uttar Pradesh, India

⁴Department of Mathematics, S.U.S. Govt. College, Matak Majri, Karnal, Haryana, India
sandeep80.gupta@rediffmail.com, sumitgoelmath01@gmail.com

Abstract: This paper examines the connection between strong p-Cesàro summability and the convergence of statistical means, employing a statistical convergence approach to establish a unified relationship that extends existing results in summability theory. It offers new insight and clarifies key concepts, providing a deeper understanding of summability processes and their mathematical applications.

Keywords: Natural density, Statistical convergence, Bounded sequence strong p-Cesàro summability.

127. Brain Tumor Classification Using a CNN-Driven Deep Learning Framework Leveraging MRI Imaging

Paper Id 286

Divanshi¹, Tarunpreet Bhatia¹[0000-0003-0434-2799], Neha²[0009-0008-4196-2683]

¹Thapar Institute of Engineering and Technology, Patiala, Punjab, India

²University of Newcastle, University Dr, Callaghan NSW 2308, Australia

Abstract: Brain tumors represent one of the most pressing health challenges, and accurate and timely diagnosis is crucial for a positive clinical outcome. Using deep neural networks and Convolutional Neural Networks (CNNs) for detecting and classifying brain imaging data has been shown to outperform more common imaging modalities like X-rays. However, these models are limited to the availability of MRI data which is relatively sparse. Two benchmark datasets were employed, one smaller with 253 images for binary classification (tumor, non-tumor), achieving an accuracy of 96.10% through data augmentation. A larger dataset with 3,264 MRI images enabled multiclass classification to identify various tumor types, with data augmentation and preprocessing techniques improving image quality and feature extraction. This approach achieved a classification accuracy of 91.24%. The experimental results indicate that integration of CNN along with improved preprocessing methods provides better accuracy and speed for the identification of brain tumor. This approach has the potential for clinical applications, providing more rapid and robust diagnostic assistance.

Keywords: Brain tumor detection, Convolutional Neural Networks, Deep learning

128. Causal Similarity and Feature Engineering for Stock Movement Prediction

Paper Id 288

Aishini Bhattacharjee¹, Chaithra¹, Madhusmita Das¹, Biju R Mohan¹

¹NITK Surathkal, Mangalore, Karnataka 575025, India

aishini.221ai007@nitk.edu.in, chaithra.217it001@nitk.edu.in,
madhusmitadas.197it004@nitk.edu.in, biju@nitk.edu.in

Abstract: The problem of stock movement prediction is a widely discussed one in academia and practice. While there have been many complex models to process the data, there have been relatively lesser attempts at manipulating the data itself to give good results while predicting the direction in which the stock market might fluctuate. We aim to address this issue by constructing a causal graph using similarity metrics from financial news and historic stock data, followed by feature mining using news sentiment and technical indicators to produce a robust numerical feature set. The analysis of the results does reveal the machine's relative inability to detect 'neutral' trends as opposed to 'upward' or 'downward' trends, which is why we attempt to use explainable AI to our advantage to see what feature is responsible for what kind of outcome. The datasets and source code are publicly available on Github (<https://github.com/AishiniB/NLP-Project>).

Keywords: Causal similarity, stock movement, classification, feature engineering

129. Deep Transfer Learning with GUI for Rice Pests Classification and Preventive Recommendations

Paper Id 292

Buddhadev Sasmal¹[0009-0009-4244-9897], Suparna Biswas²[0000-0002-6150-9316], Ramesh Saha³[0000-0003-0003-9450], Krishna Gopal Dhal⁴[0000-0002-6748-0569], Arunita Das⁴,
Sudip Pramanik⁴

¹Department of Pure and Applied Science, Midnapore City College, Paschim Medinipur,
West Bengal, 721129, India

²Department of Computer Science and Engineering, Maulana Abul Kalam Azad University
of Technology, Nadia, West Bengal, 741249, India

³Department of Computer Science and Engineering, Indian Institute of Information
Technology, Sonapat, Haryana, 131001, India

⁴Department of Computer Science, Midnapore College (Autonomous), Paschim Medinipur,
West Bengal, 721101, India

1buddhadevsasmal@mconline.org.in, 2suparna.biswas@makautwb.ac.in,
3ramesh1saha@gmail.com, 4krishnagopal.dhal@midnaporecollege.ac.in,
5arunita.das@midnaporecollege.ac.in, 6sudippramanik34150@gmail.com

Abstract: Rice serves as a crucial crop for global food security as it inhabits a core staple among billions of people in the world. However, rice yield is increasingly threat-ened by pest infestations, which can cause severe economic and production loss-es. Therefore, early and accurate identification of rice pests is important for timely measures against the worsening losses. Deep learning technology has proven to be an efficient solution to pest classification, which indeed gives exceptional ac-curacy in classifying images. However, these deep learning models require high computational and memory power, and this study leverages transfer learning to address those problems from four pre-trained CNN models: ResNet50, Incep-tionV3, VGG19, and Dense-Net201 for identifying rice pests. A publicly acces-sible rice pest dataset was used in this endeavor and intensive tests were carried out for performance evaluation of the models identified. Among the models eval-uated, Dense-Net201 performs well with a classification accuracy of 86% that clearly indicates its potentiality in accurate pest identification. An easy and user-friendly GUI was created through which this technology reaches farmers and al-lows them to upload pest images for real-time classification and identification of pest species with customized preventive actions. The integration of transfer learn-ing and GUI thus provides an affordable, scalable, and easy to use tool for early pest management.

Keywords: Deep Learning, Transfer Learning, Rice, Paddy, Pest Classification.

130. Enhancing Interpretability and Diagnostic Accuracy in CNN-Based Mammography Analysis

Paper Id 295

Vedant Deshmukh¹, Yash Vaskar¹, Dr. Ujwala Bharambe¹, Dr. Pushkar Ingle²

¹University of Mumbai, India

²Fortis Hospital Mulund, India

vedantdeshmukh10@gmail.com, yashvaskar7112002@gmail.com,
ujwala.bharambe@thadomal.org, pushkar.ingle@gmail.com

Abstract: Breast cancer, the leading malignancy among women, has shown improved patient survival rates with the advent of advanced mammography screening for early detection. However, interpreting mammograms can be both time-consuming and subjective, challenging diagnosis consistency. Meanwhile machine learning (ML) and deep learning (DL) models, particularly convolutional neural networks (CNNs), have achieved remarkable accuracy in mammography analysis. This study focuses on CNN-based models for breast density classification, achieving outstanding results with an overall accuracy of 99.7%. Key performance metrics such as precision, recall, and F1-score for all density categories consistently range between 0.99 and 1.00, underscoring the model’s proficiency in accurately identifying density variations. Due to a lack of transparency in decision-making, these models are limited in their clinical adoption. A promising solution to this interpretability gap can be found in large language models (LLMs). This research investigates the potential advantages and limitations of a novel approach that integrates a CNN with an LLM. This approach bridges the gap between interpretability and accuracy in deep learning-based mammography classification.

Keywords: Mammography, Machine Learning, Radiology, Deep Learning, CNN, Interpretability, LLMs, Medical Imaging, Breast Cancer Diagnosis.

131. Coral Classification and Detection: Advancing Underwater Imaging for Biodiversity Monitoring

Paper Id 297

Ayushman Baghel¹, Prakhar Gupta¹, Shitala Prasad¹, Pankaj P Singh²

¹School of Mathematics & Computer Science, IIT Goa, India

²Department of Computer Science and Engineering, CIT Kokrajhar, Assam, India
 ayushman.baghel.21033@iitgoa.ac.in, prakhar.gupta.21031@iitgoa.ac.in,
 shitala@iitgoa.ac.in, pankajp.singh@cit.ac.in

Abstract: Underwater coral imaging poses significant challenges due to high intra-class variability, environmental distortions, and the intricate morphology of coral species. To tackle these, we present a multi-stage approach integrating binary classification, multiclass species identification, and object detection, utilizing state-of-the-art architectures such as EfficientNet, Vision Transformers (ViT), and YOLOv8 variants. For binary classification, a dataset of 60,074 images yielded a peak accuracy of 97.83% with EfficientNet-B7. In multiclass classification across 27 coral species and two additional classes, ViT-based models excelled with a top accuracy of 95.95%. Object detection tasks employing YOLO v8 variants demonstrated strong performance, with YOLO-v8x achieving mAP@0.5:0.95 of 71.02%. These results emphasize the efficiency of EfficientNet-B7 for resource-limited scenarios, the robustness of ViT-G for detailed feature extraction, and the real-time detection capabilities of YOLO-v8x for autonomous underwater vehicles (AUVs). This work provides a comprehensive framework for leveraging deep learning to address the complexities of coral ecosystems, offering transformative applications in biodiversity monitoring, reef preservation, and automated coral health assessment.

Keywords: Coral Conservation, Coral Datasets, Deep Coral Classification and Detection, Visual Transformer

132. Unconstrained Real-Life Problems Optimization using Revised Differential Evolution Algorithm

Paper Id 298

Manajer Kumar Rana¹, Raghav P. Parouha¹, Kedar Nath Das²

¹IGNTU, M.P., India

²NIT, Silchar, India

ressch.manajer.rana@igntu.ac.in

Abstract: An evolutionary-based optimizer, Differential Evolution (DE), renowned for its simplicity and strong optimization stability. Numerous efforts have been made to enhance DE's performance. Unfortunately, it often encounters challenges such as slow convergence speed and stagnation. It happened due to improper control parameter selection or mismatched exploitation and exploration ability. To address such inconveniences, this study proposed a revised differential evolution (ReDE) algorithm to tackle unconstrained real-life problems (URLPs). In ReDE, a novel mutation strategy is employed to maintain search efficiency, a new scaling factor is presented to obtain exploratory and exploitive balancing capability, and an innovative crossover rate is used to sustain population diversity. Efficacy of ReDE, validated over ten test problems and later applied to URLPs. Experimental out-comes compared with swarm-based, physics-based, evolutionary-based, and hybrid optimizers show that the proposed ReDE offers faster convergence speed (due to better search efficiency), and solution accuracy (due to alleviating the effects of local optimal).

Keywords: Optimization, Evolutionary-Based Algorithms, Differential Evolution, Mutation Factor, Crossover Rate

133. Metaheuristic PSO variants in WSN: A Comparative Study

Paper Id 299

Sonam Srivastava¹, Pooja¹, Vandana Rathore¹, Richa Mishra¹

¹Department of Electronics and Communication, University of Allahabad, Prayagraj, India

Abstract: Wireless Sensor Network (WSN) is increasingly prevalent area of research. Generally, WSN consists of thousands of sensor nodes. Radio signal is utilized by these sensor nodes to interact with each other. In the WSN design, numerous issues are restricted battery, storage, transmission power and computational power etc. Routing and clustering have been utilized to address these problems. Problems arising in clustering and routing can be resolved by nature inspired optimization approach based on meta-heuristic techniques. The presented study compares the latest clustering routing algorithms with an emphasis on

Particle Swarm Optimization (PSO) based metaheuristic approaches in WSNs. While comparing strategies that have developed innovative cluster-based routing protocols inference can be drawn that main goal of clustering routing protocol is, to lower WSN energy consumption. This paper further provides a comparative study of PSO-based clustering routing protocols mainly focusing on applied metaheuristic optimization methods, various network features and implemented network structures in WSN.

Keywords: Internet of Things, Wireless Sensor Network, Metaheuristic Algorithms, Particle Swarm Optimization.

134. A Hybrid Privacy-Preserving Framework for Cryptographic Efficiency in Vehicular Fog Computing networks

Paper Id 302

Aditya Bhardwaj¹, Somesula Manoj Kumar¹, Swarnima Singh Gautam¹

¹Department of Computer Science and Engineering, Dr. B. R. Ambedkar National Institute of Technology Jalandhar, Punjab, India

adityab.ds.23@nitj.ac.in, kumarsm@nitj.ac.in, gautamss@nitj.ac.in

Abstract: Several data privacy issues are caused by the growing prevalence of smart cities, particularly when it comes to real-time vehicular networks. Vehicular fog computing has become a useful foundation for enabling decentralized, low-latency, and scalable data processing in such settings. However, privacy violations may arise from the sharing of private information in car networks. In this study, we present a homomorphic encryption (HE) based privacy-preserving optimization technique for vehicular fog networks in smart cities. Without sacrificing performance, our method enables safe computing by encrypting data prior to processing. Using a simulated smart city setting, we verify the feasibility of our system and demonstrate that the suggested approach performs better than current approaches in terms of processing overhead and privacy protections. By offering a fair compromise between privacy concerns and computing efficiency, this method creates new opportunities for privacy-preserving applications in urban infrastructures.

Keywords: Vehicular fog networks, smart cities, privacy-preserving, optimization, homomorphic encryption.

135. Optimizing Resource Allocation and Network Slicing for Time-Sensitive Applications in 5G Edge Networks

Paper Id 304

Muddam Priyanka¹, Gani Venkatesh¹, Manoj Kumar Somesula¹

¹Department of Computer Science and Engineering, Dr. B. R. Ambedkar National
Institute of Technology Jalandhar, Punjab, India
muddamp.cs.23@nitj.ac.in, ganiv.cs.23@nitj.ac.in, kumarsm@nitj.ac.in

Abstract: The introduction of the 5G network has completely transformed telecommunications, enabling a variety of services and applications such as enhanced mobile broadband (eMBB), ultra-reliable low-latency communications (uRLLC), and massive machine-type communications (mMTC). These services require stringent quality of service (QoS) levels, including high bandwidth, low latency, and high reliability, which are difficult for older network infrastructures to achieve. The combination of network slicing and edge computing is an ideal solution, as it allows the creation of distinct logical networks based on a single physical infrastructure. However, managing network slices efficiently in edge systems is challenging due to high operational costs associated with slice reconfigurations, complex multi-hop routing structures, and the need to balance different resource constraints. This paper presents a novel system for slicing edge networks that incorporates a fuzzy logic-based ranking mechanism in the request selection phase. This mechanism adjusts the priority of slice requests by considering resource utilization, potential benefits, penalties for reallocation, and deadline constraints. The proposed approach operates in two phases: (1) the Best Slice Selection Phase, which employs fuzzy logic to rank and prioritize incoming slice requests, and (2) the Edge Cloud (EC) Selection Phase, which assigns prioritized requests to optimal ECs based on available computational and storage resources. Extensive simulations demonstrate that the proposed approach not only generates higher overall revenue compared to existing methods but also reconfigures slices less frequently while maintaining strict QoS metrics.

Keywords: 5G Networks, Edge Computing, Network Slicing, Fuzzy Logic, Quality of Service (QoS), Resource Management, Slice Redistribution.

136. A multi-objective transportation problem under quantity dependent credit period and cost structure policies in triangular intuitionistic fuzzy environment

Paper Id 306

Parul Tomar¹, Amit Kumar²

¹School of Computer Science & Artificial Intelligence, SR University, Warangal, Telangana, 506371, India

²Department of Mathematics, Thapar Institute of Engineering & Technology (Deemed to be University), Patiala-147004, Punjab, India

Email not provided

Abstract: Bera and Mondal (Eng. Appl. Artif. Intell. 123 (2023) 106396) proposed an approach to transform a triangular intuitionistic fuzzy number (TIFN) into its equivalent

real number. Bera and Mondal claimed that their proposed approach is better than the existing approach (Int. J. Intell. Syst. 34 (2019), 3–23). To validate this claim, Bera and Mondal, firstly, transformed an intuitionistic fuzzy multi-objective transportation problem (TP) into its equivalent a crisp multi-objective TP by their proposed approach as well as by existing approach. Then, Bera and Mondal shown that the results of the crisp multi-objective TP, obtained on applying their proposed approach, are better than the results of the crisp multi-objective TP by existing approach. Keeping the same in mind, in future, other researchers may prefer to use Bera and Mondal’s approach instead of existing approach for transforming a real-life intuitionistic fuzzy mathematical model (IFMM) into its equivalent crisp mathematical model (CMM). In this note, it is pointed out that Bera and Mondal’s approach cannot be used to transform each TIFN into its equivalent real number. It can be used only to transform such a TIFN for which a specific condition will be satisfied. Hence, Bera and Mondal’s approach cannot be used to transform each IFMM into its equivalent CMM. It can be used only if for each TIFN, used in the IFMM, a specific condition will be satisfied.

Keywords: Triangular intuitionistic fuzzy number, Intuitionistic fuzzy multi-objective transportation problem, Crisp multi-objective transportation problem.

137. Explainable Image Classification of Indian butterflies through post-hoc methods

Paper Id 307

Kunjan Kalita¹, Saumyen Prateek Deka¹, Manab Kalita¹, Rupam Bhattacharyya¹

¹Department of Information Technology, Gauhati University, Guwahati, Assam, India,
PIN-781014.

kalitakunjan10@gmail.com, saumyen45@gmail.com, tnkkalita@gmail.com,
rupam@gauhati.ac.in

Abstract: Deep learning offers powerful image classification capabilities, but its application in Indian butterfly identification is less. This paper focuses on explainable butterfly species classification (BSC) and butterfly family identification (BFI) of Indian butterflies through deep convolutional neural networks (CNNs) combined with post-hoc explanation methods. To the best of our knowledge, this is the first work towards explainable BSC and BFI over Indian butterflies. A dataset of 5101 Indian butterfly images is prepared for this research work. This dataset is dedicated for academic purposes and it is termed as KYBDD5k (Know Your Butterfly Diversity Dataset). For the Indian BSC task, a total of 3,730 training images, 800 validation images, and 799 test images are considered from KYBDD-5k. On the other hand, Indian BFI, a total of 3,570 training images, 765 validation images, and 766 test images have been considered from KYBDD-5k. To explore the explainable BSC and BFI of Indian butterflies, we consider four CNN architectures and three post-hoc explanation methods. It has been observed that the reliability of such CNN based classifiers in automatic Indian BSC and BFI has not been extensively studied in the ecological informatics literature. Our experimental evaluation suggests one to consider ResNet34 and SmoothGrad-cam++

for explainable BSC. Similarly, EfficientNetB0 & GradCAM is best in explainable BFI as this setup not only maintains a good accuracy but also offers concise, useful insights in the form of heatmaps.

Keywords: CNN, post-hoc explanation, Indian butterfly.

138. FurMatch: A Smart System for Personalized Dog Breed Recommendations

Paper Id 308

Abhijit Gogoi¹, Ashish Alam Kabir¹, Arnab Gogoi¹, Farhan Ahmed¹, Deep Kumar Gogoi¹,
Manash Pratim Lahkar²

¹Department of Computer Science and Engineering, Dibrugarh University, Assam, India

²Department of Computer Science and Engineering, Tezpur University, Assam, India
abhijitgogoi@dibru.ac.in

Abstract: FurMatch is an advance engine for recommendation that helps consumers choose the perfect dog breed. It recommends compatible dog breeds by intelligently analysing character qualities, budget, and temperature adaptability using fuzzy matching techniques and semantic similarity models. To guarantee high accuracy in comprehending and matching user inputs with breed data, the system makes use of a Sentence Transformer model that has already been trained. This data-driven strategy guarantees that the suggestions are pertinent and customised, giving potential dog owners a personalised experience. In order to help consumers understand why some breeds might not be appropriate, the system also emphasises the reasons for non recommendation. FurMatch helps consumers make well-informed choices regarding dog breeds, making the whole adoption process simpler and more enjoyable.

Keywords: Dog breed recommendation, Fuzzy matching, Semantic similarity, Sentence Transformer.

139. Edge Detection in Medical Imaging via Clustering: A Quantum Computing Approach for Lung Carcinoma and Brain Tumor

Paper Id 310

Sayak Konar¹, Gunjan Mukherjee¹, Subrata Sinha^{1,2}, Saurav Mali^{1,2}

¹Department of Computational Sciences, Brainware University, Kolkata, India

²Centre for Multidisciplinary Research and Innovations, Brainware University, Kolkata,
India

sk.cs@brainwareuniversity.ac.in

Abstract. This study presents a novel quantum-based edge detection algorithm integrated with clustering techniques, specifically designed for medical imaging applications.

The methodology employs Flexible Representation of Quantum Images (FRQI) and Quantum Hadamard Edge Detection (QHED), enhanced with K-means clustering, to improve precision and robustness against noise. Experimental evaluations, using metrics such as F1 score, accuracy, and precision, demonstrate that the quantum approach achieves an F1 score consistently above 80% under noisy conditions, compared to 70–75% for classical methods like Sobel and LoG. Quantum edge detection also demonstrated higher image density at 106.72 compared to 85% (Sobel) and 83% (LoG). While the quantum model’s processing time (0.176898 seconds) is longer than classical methods (e.g., Canny at 0.098943 seconds), auxiliary quantum processes such as clustering and density detection compensate with near-real-time efficiency. These results highlight the quantum algorithm’s superior performance in noisy conditions, making it particularly suited for high-dimensional medical imaging tasks.

Keywords: Quantum computing, noisy image, edge detection, image density, clustering.

140. Evaluating Cultural Awareness of Prominent Vision Language Models for Assamese Handloom Saree

Paper Id 311

Laxmi Mall¹, Rupam Bhattacharyya¹

¹Department of Information Technology, Gauhati University, Guwahati, Assam, India,
PIN-781014

laxmimall1357@gmail.com, rupam@gauhati.ac.in

Abstract: Multimodal data processing capabilities possessed by Vision Language Models (VLMs) lead to several novel applications such as general scene understanding, image captioning, visual question answering (VQA), etc. Cultural understanding of such VLMs needs to be extensively studied for the benefit of citizens who live in culturally rich countries like India. It has been found that such systematic evaluation of VLMs over different facets of Indian culture is scarce. This paper investigates the cultural comprehension of three different VLMs over the Assamese handloom sarees. To the best of our knowledge, the capability of VLMs over the Assamese handloom saree has not been explored earlier. Towards this end, we come up with an Assamese Handloom Saree VQA (AHS-VQA), a collection of image-question pairs for evaluating three VLMs for VQA tasks involving Assamese Handloom Saree. By using the LAVE accuracy metric, this study evaluates three VLMs, namely GPT-4o, Qwen2-VL-7B, and Gemini 1.5, over AHS-VQA. Our research also proposes a new measure (CulturalSim), similar to LAVE, for evaluating VLMs over AHS-VQA by addressing the limitations of the LAVE metric. Our in-depth evaluation of these three VLMs leads to interesting observations, which may help in developing improved VLMs by considering the cultural richness of India.

Keywords: Vision Language Model (VLM), LAVE, cultural informatics, Assamese handloom saree.

141. The Metaverse: A Convergence of Emerging Technologies for an Immersive Digital Future

Paper Id 312

Monika Singh¹, Natthan Singh², Pradeep Kumar Singh³

¹Department of Computer Science and Engineering, Data Science, ABES Engineering College, Ghaziabad; Affiliated to Dr. A.P.J. AKTU, Lucknow, India

²Department of Computer Science, IET Lucknow, India

³Department of Computer Science & Engineering, Central University of Jammu, District Samba, J&K, India

monika18092012@gmail.com, nsingh.iet@gmail.com, pradeep.cse@cuammu.ac.in

Abstract: The metaverse, first conceptualized in Neal Stephenson's novel *Snow Crash* (1992), has evolved into a highly advanced 3D digital universe powered by technologies such as Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI), blockchain, and the Internet of Things (IoT). The immersive environment is real-time interactive through avatars, enabling activities such as gaming, commerce, education, and healthcare. Blockchain ensures secure digital asset management and decentralization, while AI enhances personalization and interactivity. IoT and digital twins synchronize virtual and physical worlds for seamless experiences. However, challenges remain in terms of scalability, security, ethics, and interoperability. Metaverse applications span education, business, entertainment, healthcare, and social services, where immersive technologies can have a transformative impact. Integration of cloud and edge computing with advanced networking infrastructure is critical for managing massive data volumes while ensuring quality of service. Blockchain-driven mechanisms like NFTs, cryptocurrency, and decentralized finance establish a sustainable virtual economy. Although current platforms are incomplete, they align with the vision of a fully interoperable metaverse. Addressing gaps in ethics, environmental sustainability, and technological advancements will require further research and collaboration to realize the metaverse as a worldwide, persistent, decentralized ecosystem.

Keywords: Metaverse, Blockchain, Virtual Reality, Artificial Intelligence, Internet of Things, Digital Twins.

142. Comparative Analysis of Statistical, Machine Learning, and Deep Learning Models for NIFTY 50 Financial Forecasting

Paper Id 314

Abhisek Kumar Gupta¹, Kanchan Rajwar¹

¹Statistical Quality Control and Operations Research Unit, Bangalore, Indian Statistical Institute, India

abhisek.aero@gmail.com, kanchanrajwar1519@gmail.com

Abstract: Accurate forecasting of financial time series is crucial for informed decision-making in investment and policy domains. This study evaluates and compares the performance of seven state-of-the-art algorithms to forecast financial time series, focusing on NIFTY 50 data spanning January 1, 2014, to January 1, 2024. The algorithms include three statistical models (ARIMA, SARIMA, ETS), two machine learning models (Random Forest, XGBoost), and two deep learning models (GRU, LSTM). Each model is assessed based on accuracy, measured using Root Mean Squared Error (RMSE), and computational efficiency. The results indicate that LSTM outperforms all other algorithms, achieving the lowest RMSE, while GRU also demonstrates strong predictive capabilities. Among statistical models, SARIMA provides competitive accuracy, but incurs higher computational costs. Machine learning models, particularly XGBoost, offer a balanced trade-off between accuracy and runtime. This comprehensive analysis emphasizes the suitability of deep learning models for capturing complex, non-linear patterns in financial data. The experimental code is openly available at <https://github.com/Abhiaero/NIFTY50-Forecasting>.

Keywords: NIFTY 50 forecasting, Sentiment analysis, Time series prediction, Financial market trends, Deep learning, Machine learning, Comparative forecasting models.

143. Innovative EV Charging Approach Implicating IoT A Smart and User-Friendly Concept

Paper Id 315

Saumya Shukla, Shruti Suresh Nair, Joel Joe Evans, Parv Naresh Jain, Rani Chinnappa Naidu, Rajeshkumar M

saumya.shukla2020@vitstudent.ac.in, shrutisuresh.nair2020@vitstudent.ac.in,
joeljoe.evans2020@vitstudent.ac.in, parvnaresh.jain2023@vitstudent.ac.in,
c.rani@vit.ac.in, mrajeshkumar@vit.ac.in

Abstract: Our Smart EV Charger project presents an innovative and user-centric approach to electric vehicle (EV) charging. With a focus on efficiency, user-friendliness, and safety, this project incorporates a LiPo battery discharge cycle to simulate the EV discharge process. Remote charging initiation via IoT Cloud Interface and telemetry through a current sensor, NodeMCU, and Wi-Fi technology enable convenient, real-time monitoring and visualization for users. Integrated safety features safeguard both the battery and the charging operation. Moreover, the system is designed with scalability in mind for future enhancements. This project not only enhances the EV charging experience but also contributes to the broader adoption of electric vehicles by optimizing the charging process.

Keywords: Smart EV Charger, Telemetry, Grid Management, NodeMCU, LiPo Battery

144. Portable, Low-Cost, Capacitor-Loaded On-Field I-V Curve Tracer for Solar Photovoltaic Modules with Low Power Rating

Paper Id 318

Lakshya T, Amit Kumar, Prakriti Dey, Awdesch Fernando, Rani Chinnappa Naidu, Rajesh Kumar Muthu

lakshya.t2020@vitstudent.ac.in, amit.kumar2020a@vitstudent.ac.in,
prakriti.dey2020@vitstudent.ac.in, awdeschfernando.e2021@vitstudent.ac.in,
crani@vit.ac.in, mrajeshkumar@vit.ac.in

Abstract: In this research, a revolutionary low-cost, portable, quick, accurate Current-Voltage Curve Tracer (IVCT) with automatic parameter extraction for solar photovoltaic (SPV) modules with low power ratings is presented. An ESP 32 microprocessor, a super-capacitive load, heat sinkable discharge resistances, and incredibly sensitive and precise current and voltage sensors form the foundation of the created IVCT. Using a dynamic loading super-capacitor, this voltage (P - V) curve tracer quickly and securely examines the performance characteristics of the SPV module in real-world operating conditions. It also aids in achieving more accurate data and uniform sampling. For inexpensive data logging, data processing, and data collecting, it makes use of ESP32 as a central processing unit. Moreover, the outcomes of field testing diverse small-scale SPV modules demonstrate that the I-V tracer is capable of obtaining characteristics curves with higher resolution and accurately identifying model parameters in real-time. Without changing the electrical connection circuit, the proposed IVCT may measure individual SPV modules and quickly change the operating point to 75 mA and 6 V.

Keywords: Current Sensor, ESP32, I-V Tracer, OLED, Solar Panel, Super-Capacitor

145. Smart Home Automation With Optimized Energy Consumption Using Multi-Objective Optimization Algorithm

Paper Id 319

Dhruv Ray, Shamil Humam, Sambhav Parakh, Bhamini S Bhujun, Rani Chinnappa Naidu, Rajesh Kumar Muthu

dhruvray111@gmail.com, shamilhumam22@gmail.com,
sambhav.parakh2021@vitstudent.ac.in, bsreekeessoon@udm.ac.mu, crani@vit.ac.in,
mrajeshkumar@vit.ac.in

Abstract: Our project addresses electricity shortages and poor energy management in India by introducing an innovative smart home automation system. With 75% of households facing shortages, our solution empowers users through comprehensive control and monitoring

of appliances, integrating real-time energy tracking for immediate insights. Beyond traditional home automation, our approach includes a regression model for electricity tracking, a cost estimation algorithm for financial insights, and a sophisticated Genetic Algorithm Multi-Objective optimization for balancing energy usage and user satisfaction. This holistic approach fosters a user experience that combines cost savings and environmental responsibility. To tackle the urgent need for effective energy management, our project utilizes optimization techniques, primarily the Genetic Algorithm Multi-Objective optimization, to simultaneously minimize energy costs and maximize user satisfaction. Positioned at the forefront of sustainable living, our project not only offers real-time monitoring but actively suggests ways to improve power consumption, contributing to a power-friendly Earth. This Abstract provides a glimpse into our innovative project, aiming to bridge the gap between technology and conscious living, offering a transformative solution to energy management challenges in Indian households.

Keywords: Estimation, Genetic Algorithm, NodeMCU, Optimization

146. Probabilistic Risk Analysis Using Monte Carlo Simulation for Metro Rail Construction

Paper Id 322

Dev Gheewala¹, Shobhit Chaturvedi¹

¹Department of Civil Engineering, School of Technology, Pandit Deendayal Energy University, Gandhinagar

shobhit.chaturvedi@sot.pdpu.ac.in

Abstract: Effective risk management is essential for accurately estimating time, cost, and completion timelines in large-scale infrastructure projects. This study applies a Monte Carlo simulation-based approach to evaluate risks in a metro rail construction project in Surat, India, focusing on a two-span section involving excavation, foundation work, structural assembly, and track installation. Ten critical risks, including delays in material delivery, unforeseen geological conditions, and labour shortages, were identified through expert consultations. Single-point estimates using Primavera P6 indicated a project duration of 91 days and a cost of Rupees 12,01,48,790, but these did not account for uncertainties. Monte Carlo simulations revealed a mean project duration of 341 days and a cost of Rupees 19,03,66,576, emphasizing the significant impact of risks. The integration of project mitigation strategies like long-term material contracts and enhanced safety measures decreased the mean project duration by 36.6%, to 216 days, and the cost to Rupees 11,99,98,654. Further, the 70th percentile estimates in the mitigated case showed a duration of 158 days and a cost of Rupees 12,30,66,310, reflecting drops of 34% in duration and 14% in cost relative to the unmitigated case. A mitigation budget of Rupees 20,00,000, representing just 2.84% of the total savings, emphasizes the cost-effectiveness of these strategies. Overall, these findings highlight the value of Monte Carlo simulations and focussed mitigation strategies to enhance project planning, minimize time and cost overruns, and optimize resource allocation for handling complex infrastructure projects.

Keywords: Monte Carlo simulation, Risk Management, Metro Rail Construction, Project Scheduling, Primavera P6

147. Investigating Barriers to Green Building Adoption in Gujarat, India: A Correlation-Graph Analysis Approach

Paper Id 323

Rahul Unjia¹, Shobhit Chaturvedi¹, Naimish Bhatt¹

¹Department of Civil Engineering, School of Technology, Pandit Deendayal Energy University, Gandhinagar
shobhit.chaturvedi@sot.pdpu.ac.in

Abstract: In India, the adoption of green building construction practices (GBP) encounters substantial barriers in financial, regulatory, technological, and market domains. This study evaluates 16 critical barriers to GBP adoption in Gujarat based on a survey of 84 construction industry experts using a five-point Likert scale, quantified through the Relative Importance Index (RIS). The analysis reveals that the most critical barriers include the lack of clarity in implementing green building codes (B4, RIS = 4.02), lack of skilled green building labour (C2, RIS = 4.00), and high costs of green technology and materials (C4, RIS = 3.96). Financial challenges, such as higher capital investment (A1, RIS = 3.31) and difficulty in gathering financial capital (A2, RIS = 2.65), also play a major role. Network analysis, using the Girvan-Newman algorithm, identifies B4, A1, C2, and C4 as central barriers with high Degree and Degree Centrality scores, where B4 (lack of clarity in green building codes) is the most critical, with a Betweenness Centrality score of 0.06, acting as a key mediator. These central barriers exhibit strong interrelationships, indicating that addressing them could reduce interconnected challenges and facilitate GBP adoption. This study emphasizes the need for a comprehensive approach to addressing interconnected barriers, enabling the widespread adoption of green building practices and promoting sustainable construction in India.

Keywords: Green Building Adoption, Relative Importance Index, Network Analysis, Girvan-Newman Algorithm, Degree Centrality

148. 5G Antenna Design Using Machine Learning Algorithms

Paper Id 324

Mohit Pant¹, Rashmi Pant¹, Leeladhar Malviya², Bhupendra Kumar³

¹Mahakal Institute of Technology, Ujjain, India

²Shri G.S. Institute of Technology and Science, Indore, India

³Indian Institute of Information Technology, Vadodara, Gujarat, India

ermohitpant@gmail.com, pantrashmi962@gmail.com, ldmalviya@gmail.com,
bhupendrakumar@iiitvadodara.ac.in

Abstract: Industry 4.0 is going to combine emerging technologies such as 5G, artificial intelligence, Internet of Things, and cloud computing. The 5G mobile communication is essential to Industry 4.0 connectivity requirements such as low latency (less than 1ms), high data rate (20 Gbps), high reliability, high bandwidth (up to 400 MHz), and connection of a massive number of devices. The 5G position is remarkable in the advancement of crucial sectors such as healthcare for robotic surgery, defense for faster and secure communication, and smart cities for enabling driverless cars. The crucial part of 5G mobile communications is the millimeter wave antenna (mmWave). In this paper, the 5G single input single output (SISO) antenna is designed for 28 GHz mmWave wireless communication. The proposed antenna structure covers the mmWave 5G NR frequency bands n-257 (26.5-29.5 GHz) and n-261 (27.5-28.35 GHz). The prediction of scattering parameters is achieved through machine learning (ML) models such as Gaussian Process Regression (GPR), Random Forest Regression (RFR), and Gradient Boosting Regression (GBR). The trained ML models take less time in return-loss prediction of 5G antenna at 28 GHz frequency and have low complexity as compared to traditional electromagnetic simulator software. The prediction of the RFR model is marginally greater than other models. The root mean square error (RMSE) reported is 1.08.

Keywords: 5G, Antenna, Machine Learning, Random Forest

149. Constrained Teaching Learning Algorithm for Economic Load Dispatch Problem

Paper Id 326

Vanita Garg¹, Hira Zaheer², Sushil Kumar³, Navpreet Kaur⁴

¹Department of Mathematics, Amity Institute of Applied Sciences, Amity University,
Noida, India

²Department of Mathematics, Greater Noida Institute of Technology, Greater Noida, India

³Department of Computer Science, NIT Kurukshetra, India

⁴Department of Mathematics, Maharaja Ranjit Singh Punjab Technical University,
Bathinda, India

vanitagarg16@gmail.com, hirazaheer0786@gmail.com, kumarsushiliitr@gmail.com,
navpreet008@gmail.com

Abstract: In the sphere of electricity, the economic load dispatch problem is a well-known issue. To limit emissions and lower overall running costs, we must employ certain effective optimization techniques. In this field, several attempts have been undertaken. This limited optimization issue has been solved using heuristic techniques such as evolutionary strategies and genetic algorithms in addition to conventional methods like the lambda iteration method. This study presents a fresh approach to tackling this challenge using a Constrained Teaching Learning method. The findings were compared with those of its equivalents, LX-BBO and BBO. The comparison of the algorithms highlights Constrained TLA's

superiority over its rivals.

Keywords: Economic Load Dispatch Problems, Teaching Learning Algorithm, Metaheuristics

150. Spatial and Temporal Analysis of Tropical Indian Ocean Climate Modes

Paper Id 327

Prerna¹, Bhasha H. Vachharajani¹

¹Department of Mathematics, School of Technology, Pandit Deendayal Energy University, Gandhinagar, Gujarat-382007, India
malikprerna1@gmail.com

Abstract: The climate variability of the Tropical Indian Ocean (TIO) is significantly influenced by interannual climate modes driven by Sea Surface Temperature Anomalies (SSTA). The Indian Ocean Dipole (IOD), characterized by positive SSTAs in the western TIO and negative SSTAs in the eastern region, represents the second Empirical Orthogonal Function (EOF) mode of SSTA variability, explaining 12.38% of the overall variance. The third EOF mode, Indian Ocean Tripole (IOT), is linked with positive SSTA in the central TIO and negative SSTA in the eastern and western regions, contributing to 7.74% of the variance. Previously, IOD and IOT occurrences were regarded as a single phenomenon; nevertheless, their distinct spatial patterns and temporal properties underscore the need for further exploration. This study explores the spatio-temporal association between IOD and IOT events over the period 1993–2022, with a particular focus on their linkage with the El Niño-Southern Oscillation (ENSO) in the Pacific Ocean. A moderate positive correlation of $r = 0.35$ is detected between ENSO and IOT events, suggesting that positive and negative phases of IOT are more likely to occur with El Nino (positive phase of ENSO) and La Nina (negative phase of ENSO), respectively. Furthermore, Seasonal EOF analysis of SSTA reveals the seasonal dominance of climate modes. The findings provide new insights into the dynamics of the IOD, ENSO, and IOT, offering a comprehensive understanding of their linkage and implications for the TIO region.

Keywords: Indian Ocean Dipole, Indian Ocean Tripole, El Nino Southern Oscillations

151. Robust Hybrid Cryptographic Method for Cloud Computing Information Security

Paper Id 328

Kamaljit Kaur Bhagwat, Sudhanshu Shekhar Dubey

Department of Mathematics, Chandigarh University, Mohali, Punjab, India
gurnoorbhagwat@gmail.com, sudhanshusdubey@gmail.com

Abstract: Future cloud computing will include virtualization, dynamic resource pools, and high availability. Without requiring computer users to get involved, cloud computing offers a solution to common computing issues including resource availability, software, and hardware. The following are the two main difficulties facing cloud computing: first, the deployment of cloud security over the internet and second, data storage. The data stored in cloud storage can be encrypted using a variety of cryptographic techniques. There are several issues with the existing algorithms, so this work has used the idea of MD5, Blowfish, and RSA algorithms. Furthermore, the proposed hybrid model has used the existing technique and provides the solution. The information is encrypted via the RSA algorithm, which is a modified version of the RSA algorithm. This work has used two different algorithms: Communication of Encryption and Decryption (CED) and Hybrid Data Encryption and Decryption process in Server (HD-EDS). Both algorithms have used the symmetric encryption algorithm called the RSA algorithm. The HD-EDS algorithm is a proposed hybrid algorithm that includes the RSA, MD5, and Blowfish properties of the algorithm. When data is uploaded to the cloud, it is encrypted using the RSA and Blowfish encryption techniques. This work has calculated the retrieval time between existing techniques versus the proposed hybrid technique and achieved 9.8 ms time. Another comparison between RSA, MD5, Blowfish, and HD-EDS achieved 40 ms, which is less than MD5 and Blowfish algorithms. With their private key, the cloud controller may decrypt the data. Lastly, by contrasting the outcomes of our suggested hybrid approach with those of the current procedures, we have completed the performance evaluation.

Keywords: Cloud Computing, Encryption, Decryption, Cypher Text, RSA, Blowfish, MD5

152. A Survey of Predictive Electric Vision Systems Using Deep Learning for Energy Optimization

Paper Id 330

Jyotsna Vilas Barpute¹, Aditya Rasal¹, Santosh Narwad¹, Vinay More¹, Gurukul More¹

¹Department of Artificial Intelligence and Data Science, Dr. D. Y. Patil Institute of Technology, Pimpri, Pune, India

barputejyotsnav@gmail.com, adirasal2003@gmail.com, santoshdn9220@gmail.com,
morevinay87.1@gmail.com, gurukul654@gmail.com

Abstract: Energy control technology is evolving rapidly, enabling energy consumption monitoring and optimization. One emerging paradigm is the "smart home system," which extends from microcontroller devices like the ESP8266 and accurate sensors like the PZEM 004T, facilitating real-time energy data acquisition. These devices can be integrated seamlessly with IoT infrastructures and advanced AI algorithms. Backend systems use Python-based frameworks for deep learning models and predictive analytics (TensorFlow, PyTorch, Scikit-learn). Neural networks can be designed using the Keras library to model data for accurate energy usage forecasting. The backend is integrated efficiently with databases such as MongoDB using Flask or Django for storing alerts and usage trends. From a frontend perspective, modern web technologies offer more intuitive interfaces to present energy consumption data interactively. Additionally, large language models (LLMs) are leveraged to

generate optimization reports and energy-saving strategies, delivering intelligent and contextual insights. This integrated methodology combines hardware-level sensing technologies with advanced software to revolutionize energy monitoring across various use cases, including ownership, enterprise, and industry. It accelerates energy management efforts while creating new opportunities in smart city infrastructure and sustainable energy development projects. **Keywords:** Deep Learning, Electric Vision Systems, Predictive Acquisition, Energy Optimization, ESP8266, MongoDB, Energy Monitoring, Python, TensorFlow, PyTorch

153. Urban Sprawl: Analyzing Development and Change Detection Using GEE in Vijayawada

Paper Id 332

Shaik Baji¹, Shaik. Nasira Kousar Begum¹, Shaik. Nagoor Saheb¹, G. JayaLakshmi²

¹Dept. of Information Technology, Velagapudi Ramakrishna Siddhartha Engineering College, Vijayawada, India

²Sr. Assistant Professor, Dept. of Information Technology, Velagapudi Ramakrishna Siddhartha Engineering College, Vijayawada, India

sbaji8766@gmail.com, nasirakousarshaik@gmail.com, nagoorsaheb718@gmail.com, jaya1123@vrsiddhartha.ac.in

Abstract: Vijayawada is an area undergoing rapid urbanization, driven by swift population growth and infrastructure developments. However, effective urban planning has been lacking, leading to environmental degradation and socio-economic imbalances, such as inadequate resource access and inequalities in living conditions. This project aims to detect and analyze the urban sprawl phenomenon in Vijayawada using Google Earth Engine (GEE) and the Support Vector Machine (SVM) algorithm. The study utilizes satellite data from 1990 to 2024 to identify key drivers of urban growth and provide spatial insights that support sustainable urban planning. The project includes land cover classification and change detection to offer a comprehensive view of development patterns over time. The findings highlight significant land conversion in peri-urban areas, correlating with socio-economic factors and infrastructure developments. These insights can aid urban planners in designing policies that foster sustainable growth, in alignment with Sustainable Development Goal (SDG) 11 for building inclusive, resilient cities.

Keywords: Urban Sprawl, Vijayawada, Google Earth Engine, Support Vector Machine (SVM), Change Detection, Land Use Classification, Sustainable Urban Planning, SDG 11, Satellite Imagery, Socio-Economic Factors

154. Advancing Water Quality Prediction: Integrating Ensemble Learning and Explainable AI for Actionable Insights

Paper Id 334

Kavya Preksha¹, Kuldeep Kumar Tiwari¹
¹Chandigarh University, Mohali, Punjab, India
kaavya23p@gmail.com, kuldeep.smvd@gmail.com

Abstract: Water quality is critical to public health and environmental sustainability, making it essential to maintain effective monitoring systems to prevent contamination risks. Timely assessment of water quality is vital for reducing environmental degradation and ensuring safe drinking water. This study explores the capability of machine learning models, particularly ensemble methods like Random Forest and Gradient Boosting, in water quality assessment. These models have demonstrated superior performance compared to traditional classifiers like Naive Bayes and SVM. The approach integrates various Explainable AI (XAI) techniques to provide transparency in model decision-making, emphasizing feature importance. Through this analysis, pH emerges as the most significant factor in water quality prediction. The findings highlight the predictive power of ensemble methods, achieving up to 100% accuracy, and the importance of pH monitoring for effective water quality management. By incorporating XAI tools, this research advocates for transparent, interpretable models that support environmental monitoring and provide actionable insights for more effective, prioritized interventions in water quality management.

Keywords: Water quality, machine learning, ensemble methods, Random Forest, Gradient Boosting, Explainable AI (XAI), SHAP, LIME, feature importance, pH monitoring

155. Approximate Equalities Based on Rough Neutrosophic Set with Their Analysis

Paper Id 335

Seema Singh¹, Kuldeep Kumar Tiwari², Navjot Kaur²

¹Department of Mathematics, Starex University, Gurugram, Haryana, India

²Department of Mathematics, Chandigarh University, Mohali, Punjab, India

seemamotsara2@gmail.com, kuldeep.smvd@gmail.com, navjotkaurkajjal@gmail.com

Abstract: The concept of determining equalities in sets is not always mathematically equal for all users. Based on this idea, Novotny and Pawlak [6, 7, 8] introduced three kinds of approximate rough equalities. Tripathy, Mitra, and Ojha [15] later generalized these notions to approximate rough equivalences. Unlike rough equalities, rough equivalences capture a higher level of equality between sets. The properties of these equivalences were further investigated by Tripathy, Mitra, and Ojha [16]. Initially, rough set theory was used to analyze approximate equalities [12], but B.K. Tripathy later expanded the approach to rough fuzzy sets, proposing four types of approximate equalities. Tripathy and Panda [13] extended this by introducing approximate equalities based on rough intuitionistic fuzzy sets, providing a comprehensive analysis. This paper introduces approximate equalities and their analysis within the framework of rough neutrosophic set theory. Specifically, it explores the approximate equalities of rough neutrosophic sets and investigates their properties.

Keywords: Approximate Rough Equalities, Approximate Rough Equivalence, Rough Set, Rough Intuitionistic Fuzzy Set, Neutrosophic Set, Rough Neutrosophic Set, Analysis

156. Ignition Time Prediction of Live Shrubs using Machine Learning

Paper Id 336

Deepak Sharma¹, Ajay Singh¹, David L. Blunck¹

¹School of Mechanical, Industrial and Manufacturing Engineering, Oregon State University,
Corvallis, OR, USA 97331

sharmade@oregonstate.edu, ajay.singh@oregonstate.edu,
david.blunck@oregonstate.edu

Abstract: Living fine foliage plays a significant role in wildland fire spread. However, understanding the burning behavior of live fuels remains a challenge, particularly for shrub species, which eventually limits wildfire prediction capabilities. In this study, we predict ignition time using machine learning (ML) models for three evergreen shrub species in Northwest United States, salal (*Gaultheria shallon*), Oregon grape (*Mahonia aquifolium*) and manzanita (*Arctostaphylos*). Laboratory experiments are conducted across 1121 kW/m² of heat fluxes, and 12-129% of moisture contents. Individual shrub leaves are burned over a flat-flame-burner operated with stoichiometric mixture of methane and air. A high-speed (1000 frames per second) monochromatic camera is used to assess ignition time. Ignition time increased with higher moisture content and lower heat fluxes. We evaluate five supervised ML models – Support Vector Machine, Linear Regression, Multi-Layer Perceptron, Random Forest, and XGBoost Regressor. Predicted ignition times are in good agreement with experiments for all tested ML models with maximum root mean square error of 3.3%. High prediction accuracies of ML models clearly outline potential of ML tools for the predictions of complex wildfire processes.

Keywords: Wildfires; live foliage; ignition time; machine learning.

157. ToMEto: A Fusion Cuisine Platform for Recipe Innovation and Ingredient Substitution

Paper Id 337

Dishant Tandel

tandel.dishant00@gmail.com

Abstract: This paper presents ToMEto, a web-based platform designed to foster culinary creativity through the fusion of global cuisines. Unlike traditional recipe applications, which focus on meal planning or dietary preferences, ToMEto enables users to explore and create innovative fusion dishes by substituting ingredients from one cuisine for recipes from another. The platform leverages data collected from major recipe sources, employing graph-based models to analyze the relationships between ingredients and identify potential substitutions. The initial phase of development focused on familiarizing the team with necessary tools and environments, including exploring APIs, reviewing existing literature on recipe recommendations, and acquiring data through web scraping techniques. By integrating

front-end user interfaces with back-end algorithms, ToMEto aims to revolutionize recipe exploration and provide a personalized, dynamic experience for chefs and home cooks alike. This paper outlines the project's goals, progress, and technical challenges, highlighting its potential impact on culinary innovation and recipe development.

Keywords: Fusion Cuisine, Ingredient Substitution, Graph-Based Models, Recipe Exploration, Web Scraping, API Integration, Recipe Innovation

158. Effect of Variable Thickness on the Thermal Buckling Behavior of Functionally Graded Circular Plates

Paper Id 338

Aastha Tanwar, Rashmi Rani

Abstract: This paper investigates the axisymmetric buckling behavior of functionally graded thick circular plates with quadratic varying thickness subjected to a uniform temperature rise. The material properties vary continuously through the thickness of the plate according to a power law distribution. The equilibrium equations of the plate are derived based on first-order shear deformation theory (FSDT) and von-Kármán type geometrical nonlinearity, employing Hamilton's principle. The resulting equations are solved using the differential quadrature method (DQM) to evaluate the critical buckling temperature difference and the critical buckling load of the plate. A parametric analysis is conducted to investigate the effect of taper parameters on the critical buckling load for the clamped boundary condition. A comparison of the results for some special cases with published results obtained by other approximate methods is presented which shows an excellent agreement.

Keywords: Thermal buckling, Circular plates, Functionally graded material, Differential quadrature method, Quadratically varying thickness

159. Predicting Cryptocurrency Prices with Sentiment Analysis and Deep Learning Models

Paper Id 339

Shreya Krishna¹, Nitesh Kumar Sah¹, Umamageswaran J¹

¹Department of Computer Science, Amrita Vishwa Vidyapeetham, Chennai, India
ch.sc.u4cse23146@ch.student.amrita.edu, ch.sc.u4cse23166@ch.student.amrita.edu,
j.umamageswaran@ch.amrita.edu

Abstract: Predicting cryptocurrency prices remains a challenging task due to the inherent volatility and diverse influencing factors such as social media sentiment, market trends, and technical indicators. This paper presents a new multi-phased framework that combines long-term and short-term market dynamics with advanced natural language processing and

deep learning techniques. During the feature preparation phase, FinBERT, which is a pre-trained financial text language model capable of capturing nuanced sentiment signals from social media platforms like Twitter and Telegram, extracts market data and sentiment features. Hybrid deep learning architectures that utilize transformer-based models are applied for modeling sequential dependencies and market fluctuations efficiently. In the fusion phase, an attention-based dynamic weighting mechanism is introduced in order to adaptively prioritize features according to the changing market conditions. This approach enables accurate forecasting of both short-term price fluctuations and long-term market trends, providing a comprehensive understanding of cryptocurrency market behavior. Experimental evaluations demonstrate significant improvements in prediction accuracy compared to baseline models, highlighting the effectiveness of combining sentiment-driven features with transformer-based architectures. The proposed framework aims to improve the reliability of cryptocurrency price forecasts by leveraging state-of-the-art NLP and deep learning methods, providing valuable insights for traders and investors.

Keywords: Cryptocurrency Price Prediction, Social Media Sentiment Analysis, FinBERT, Transformer-Based Models, Deep Learning Architectures, Financial Text Analysis, Market Data Integration

160. Evaluating YOLO Algorithms for Efficient Crowd Counting: A Comparative Study

Paper Id 340

Silky Goel¹, Deepika Koundal^{1,2}, Ambika Aggarwal¹

¹Department of Computer Science and Engineering, UPES, India

²A.I. Virtanen Institute of Molecular Sciences, University of Eastern Finland, Finland

`silkygoel90@gmail.com`, `dkoundal@ddn.upes.ac.in`, `dkoundal@uef.fi`,
`drambika.cse@gmail.com`

Abstract: Computer Vision has primarily focused its research efforts on two key areas, i.e., object detection and crowd counting. The practical applications of this research involve identifying objects through deep learning techniques. The YOLO (You Only Look Once) series is one of the most recognized frameworks in this domain, focusing primarily on object detection rather than their precise localization in real-time scenarios. In this study, the effectiveness of crowd counting is computed using the YOLOv6, YOLOv7, YOLOv8, and YOLOv9 models and shown on the three well-known datasets, i.e., ShanghaiTech, UCF-QNRF, and UCF-CC-50. The comparison is based on two critical measures, i.e., Mean Absolute Error and Mean Squared Error. The findings show that YOLOv9 is the most advanced version by offering improved performance with lower Mean Absolute Error and Mean Squared Error across all datasets, particularly in dense environments. This study highlights the evolution of the YOLO architecture in object detection and crowd counting for precise and effective crowd counting.

Keywords: Crowd Counting, Object Detection, Deep Learning, Dense Environment, YOLO series, Convolution Neural Network, Deep Learning

161. Alzheimer Disease Classification using Transfer Learning of Pre-trained Model

Paper Id 341

Chiraag U¹, Soumyalatha Naveen²

¹Chethana College, Bengaluru, India

²Department of Computer Science and Engineering, Manipal Institute of Technology
Bengaluru, Manipal Academy of Higher Education, Manipal, India

u.chiraag@gmail.com, soumyalatha.naveen@manipal.edu

Abstract: Alzheimer's disease (AD) is a progressive and irreversible neurological illness that impairs thinking and memory, making it challenging to identify in its early stages. Deep learning models are extensively employed for early detection of AD, enabling reduced progression of the brain disorder. While many detection methods exist, it is crucial to achieve high performance in classifying the stages of AD. Therefore, an AD detection and classification system with improved accuracy is needed. This study uses 51,864 images from an AD dataset, which were preprocessed to remove skull brains in the axial view. Transfer learning of two pre-trained models, SqueezeNet and ResNet, was utilized for feature extraction and classification. In our experiments, 8,600 images were used for testing and 43,264 images for training. We achieved 99.1% accuracy using SqueezeNet and 99.8% accuracy using ResNet on the augmented dataset.

Keywords: Alzheimer's disease, Detection, SqueezeNet, ResNet

162. RNN and Logistic Regression-Based Ensemble Model for Distinguishing AI-Generated Text

Paper Id 343

Nidhi Umashankar¹, Chandu Siddartha Reddy Gooty²

¹Department of AI & ML, BMS Institute of Technology and Management, Bangalore, India

²Founder, InverstorMate, Bangalore, India

nidhiumashankar03@gmail.com

Abstract: Generative AI models change quickly, highlighting crucial concerns such as the difficulty of distinguishing between human-written and AI-generated texts. This research proposes a unique ensemble model that combines a Recurrent Neural Network and Logistic Regression to efficiently address the differentiation difficulty. The RNN is used to sequence-model complicated patterns in text input, whereas Logistic Regression is used for classification via dense feature representations. The model was trained and evaluated using a publicly available dataset that contained both AI-generated and human-written material. Key performance indicators such as accuracy, precision-recall, and ROC-AUC demonstrate the ensemble model's ability to accurately classify text. In order to validate the findings, this study also includes intricate visualizations like precision-recall curves and confusion matrices. Future developments in related content authentication and regulatory frameworks will

be made possible by this combined version of deep learning with the conventional machine learning end, which strengthens the scalable and reliable process to recognize AI-generated text.

Keywords: AI-generated text, Human-written text, Recurrent Neural Network (RNN), Logistic Regression, Ensemble model, Text classification, Deep learning, Generative AI detection, Content authentication, Binary classification, Text authentication, Machine learning, Natural Language Processing (NLP), Tokenization, Sequence modelling, Model interpretability, AI-generated content regulation, Text sequence padding, Feature engineering, AI and human text distinction, Computational linguistics, Transformer models, Generative AI validation

163. Human-Centric Medical Summarization with Hybrid Generative AI

Paper Id 346

M Pavithra¹, Varunkrishna B¹, Umamageswaran J¹, Nithish Kannaa S¹

¹Department of Computer Science and Engineering, Amrita Vishwa Vidyapeetham, Chennai, India

pavi261105@gmail.com, bvk1412@gmail.com, j_umamageswaran@ch.amrita.edu, nithishkannaa2k05@gmail.com

Abstract: With the proliferation of digital healthcare data, there is a substantial challenge in summarizing the volumes effectively and making such summaries available to non-specialist audiences. The work under way makes an attempt towards a hybrid approach for medical text summarization based upon the generative AI model that integrates both the rules-based approach and the transformer-based generative model hence enhancing the clarity and relevance of information in healthcare. While in contrast to fully NLP models, this hybrid combines the imperative of medical accuracy with that of accessibility through the exploitation of domain-specific heuristics along with generative language models, we tested this considerably using real-world clinical texts against readability, factual consistency, and summarization, and examined the appropriateness of the model's ability to make complex medical terminology accessible while being highly clinical, based on feedback from both clinical and lay audiences. The results show that the proposed framework indeed remarkably improves the interpretability of medical data, thus providing an effective solution for patient-centered digital health applications, and establishes a reference standard for responsible and trustworthy AI-driven medical summarization. It demonstrates the capability of hybrid generative AI to revolutionize patient engagement and access to healthcare insights.

Keywords: Hybrid Generative AI, Medical Summarization, Natural Language Processing, Healthcare Data, Readability, Factual Consistency, Patient Engagement, Clinical Terminology, Digital Health, Ethical AI

164. Predictive Analysis of Drug Impact Using GNN

Paper Id 347

Aneesha M H¹, Maya Mohan¹

¹Department of Computer Science Engineering, NSS College of Engineering, Palakkad,
India

aneeshamh05@gmail.com, mayamohan@nssce.ac.in

Abstract: The prediction of drug side effects is critical in drug discovery and development to guarantee patient safety and therapeutic effectiveness. Traditional drug targeting methods emphasize potential side effects, but do not consider affected tissues and organs or body parts. In this study, we are proposing a new approach utilizing a graph neural network (GNN)-based model that predicts not just the side effects of drugs but also the organs and tissues affected by them. Our model constructs an interactive graph for drug interplay by enriching the data obtained from diversified sources such as SIDER, PubChem, DrugBank, and BioMart data. The findings give hope for progress in more effective drug safety evaluations and the potential to improve personalized medicines through the prediction of tissue and organ responses to medications.

Keywords: Graph Neural Networks, Drug Side Effects Prediction, Tissue and Organ Prediction, Pharmacovigilance, Healthcare, Therapeutics.

165. Recent Five Years' Comprehensive Review for Green Supplier Selection with Advanced Decision Techniques

Paper Id 348

Deepanshu Nayak^{1,3}, Millie Pant^{1,2}

¹Department of Applied Mathematics and Scientific Computing, IIT Roorkee, Roorkee,
India

²Mehta Family School of Data Science and Artificial Intelligence, IIT Roorkee, Roorkee,
India

³Rail Coach Factory, Indian Railways, Kapurthala, India
deepanshu_n@as.iitr.ac.in, pant.milli@as.iitr.ac.in

Abstract: Green supplier selection (GSS) is a crucial process for making the decisions for the Sustainable Supply Chain management (SSCM). The researchers from the Supply Chain (SC) field, performed different studies to overcome the present issues for the GSS. The present study focuses on the literature review for a comprehensive GSS analysis with the social, economic, technological, environmental and other aspects simultaneously. In this paper, the author used recent five years (2020-2024) research papers related to the GSS. During study, the author selected 36 papers out of 690 papers based on different filters. This study identifies the latest & advanced Multi Criteria Decision Making (MCDM) techniques including the new era of Artificial Intelligence (AI). Author analysed that researchers had

used mainly hybridization methods for the Sustainable Supplier Selection (SSS) and most of the studies for GSS are concerned for real-world applications. The paper also identifies key trends, challenges, and future research directions in this field, highlighting the potential for integrating emerging technologies like block chain and Internet of Things (IoT) to enhance sustainable supplier selection decisions. This review aims to serve as a valuable resource for researchers, practitioners, and policymakers seeking to advance sustainable supply chain management practices.

166. Assessing the Impact of FGSM Adversarial Attack on Convolutional Neural Networks in X-ray Images

Paper Id 349

Harshita¹, Kuldeep Kumar¹, Sushil Kumar¹

¹Department of Computer Engineering, National Institute of Technology Kurukshetra, Haryana, India

Abstract: In recent years machine learning has gained applications in various fields but it has its own limitations as well, these limitations can be in the form of the computational power of the machine in use, vulnerabilities against attacks, etc. With the onset of adversarial attacks, the deployment of machine learning/deep learning models has started facing a serious threat of becoming unreliable. Deep learning models have found their way into healthcare in the fields of prognosis to diagnosis but because of carefully crafted images to cheat these systems, there is a lot of concern about the practical implementation of these models due to the very sensitive nature of the field of medical science. In this paper, we study the consequence of an adversarial attack, the Fast Gradient Sign Method (FGSM), on the Covid-19 X-Ray image dataset, and its effect on the classification accuracy. Different Convolutional Neural Networks (CNNs) including Simple CNN, InceptionV3, InceptionResNetV2, and MobileNet have been used to determine the performance degradation that is caused by the FGSM. The accuracies drop from a range of 86%–92% to 33%–39% which is very a significant amount and discourages the use of machine learning without the deployment of some defense mechanisms like adding adversarial examples during the training of models which would make the whole system robust or help mitigate these attacks.

Keywords: Machine Learning, Adversarial Attacks, Convolutional Neural Networks, Medical Imaging.

167. Evaluation of Side Effects Associated with COVID-19 Vaccines in India

Paper Id 352

Divyansh Singhal¹, Karuna Panwar², Kusum Deep², Millie Pant³

¹Department of Mathematics, National Institute of Technology Agartala, Tripura, India

²Department of Mathematics, Indian Institute of Technology Roorkee, Roorkee,
Uttarakhand, India

³Department of Applied Mathematics and Scientific Computing, Indian Institute of
Technology Roorkee, Roorkee, Uttarakhand, India

deepanshu_n@as.iitr.ac.in, pant.milli@as.iitr.ac.in

Abstract: This study investigates adverse effects and newly diagnosed illnesses following COVID-19 vaccination with Covishield and Covaxin in 267 participants across India. Conducted via an online survey from June 1 to July 5, 2024, the study includes participants of all ages and genders who received at least one dose. Adults aged 20-30 reported the most side effects, which decreased after the second dose. Common short-term side effects were pain, redness, and allergic reactions, while long-term effects included pain, breath shortness, and memory loss, particularly in older adults. Covaxin was linked to more pain and allergies, whereas Covishield was associated with gastrointestinal, liver, and blood-related illnesses. Newly diagnosed illnesses like heart, respiratory, neurological, and kidney-related issues were more common with Covaxin. The study underscores the importance of continuous monitoring and tailored care to manage adverse effects, enhancing public confidence in vaccination programs.

Keywords: COVID-19, Covaxin, Covishield, Side Effects, Vaccine.

Poster Presentation/ Extended Abstracts

HAMMF: A Hybrid Adaptive Modified Median Filter for Denoising Mammogram

Poster Id: 1

Dipti Deb¹, Ratnakar Dash¹, Durga Prasad Mohapatra¹

¹National Institute of Technology Rourkela.

ddiptideb5@gmail.com, ratnakar@nitrkl.ac.in, durga@nitrkl.ac.in

Abstract: Mammography is crucial for detecting breast cancer, but noise can hinder accurate interpretation. This paper proposes a two-stage hybrid de-noising algorithm for digital mammograms. First, the Adaptive Modified Median Filter (AMMF) removes noise, and then Guided Filter (GF) is applied to preserve edges and details. Experiments on the Mammographic Image Analysis Society (MIAS) dataset show the filter effectively removes salt-and-pepper noise. Performance is evaluated using metrics like Mean Square Error (MSE), Peak Signal-to-Noise Ratio (PSNR), and Structural Similarity Index Measure (SSIM), comparing it to other filters like Median, Adaptive Median, Hybrid Median, Bilateral, and GF. The proposed method effectively suppresses noise, preserves edges, and improves visual quality and PSNR.

Keywords: Image denoising, mammogram, denoising filter, guided filter, hybrid median filter.

Hybrid Deep Learning Approach for Gait Classification

Poster Id: 2

Nehal Chhalotre¹, Sivakumar Rajagopal¹

¹Vellore Institute of Technology Vellore

Nehal.chhalotre2022@vitstudent.ac.in, rsivakumar@vit.ac.in

Abstract: Gait analysis is fundamental in the estimation of neuromuscular problems, the rehabilitation treatment, and the optimization of sports activities. Other systems such as motion capture or force platforms can achieve high accuracy; however, they are costly and sophisticated. Electromyography (EMG) is a cheaper method to estimate muscle electric activity, but is problematic as it is very high dimensional and very noisy. This work focuses on the classification of gait phases with the use of Myo electric signals processed through a specialized architecture which implements multiple modules of Convolutional Neural Networks (CNNs) and Long Short-Term Memory (LSTM) networks. With these particular networks, it is possible to design a powerful classification framework because the CNN part learns how to extract spatial features while the LSTM part learns how to model temporal dependencies. The effectiveness of the CNN-LSTM model is compared with baseline results provided by a Feedforward Neural Network (FNN), checking the models against accuracy, precision, recall, and F1 score.

Keywords: Electromyography (EMG), Deep learning, CNN-LSTM model, Neural networks, Hybrid architecture.

AI and Soft Computing for Regenerative Architecture: Designing for Long-Term Sustainability

Poster Id: 3

Ar. Deepika Shukla¹, Ar. Srajati Tiwari², Bhavjal Singh Bagga³

¹Post Graduate Diploma in Vastu Shastra, IGNOU, New Delhi

²Post Graduate in Urban and Regional Planning, School of Planning, Vijayawada

³3rd Year Student in Bachelor of Architecture, School of Planning, Vijayawada

deepika.da.shukla@gmail.com, srajatitiwari4022@gmail.com,

bhavjalsingh028@gmail.com

Abstract: The architecture industry accounts for 40% of the energy used globally and has been subjected to immense pressure for sustainability as cities grow and global warming persists. Regenerative architecture, focused on ecosystem restoration and biodiversity, offers a route toward long-term sustainability. Adaptive systems are very complex, though, and resilience calls for innovation in design. Emergent transformations for architects today involve artificial intelligence (AI) and soft computing techniques, among them machine learning, generative design, neural networks, and fuzzy logic, allowing architects to optimize building performance with efficient resource management and real-time environmental adjustments. This long abstract looks at how AI and soft computing may help improve regenerative architecture concerning the use of energy-inefficient, adaptive building systems, and responsive designs for the climate. By integrating knowledge across disciplines, these technologies facilitate sustainable, human-centric, and ecologically restorative buildings, advancing the more universal goals of fighting climate change and achieving long-term urban sustainability.

Keywords: AI_Soft Computing_Regenerative Architecture_Machine Learning_Sustainable Design

A Multi-Objective Chaotic Walrus Optimization Algorithm

Poster Id: 4

Kanchan Kushwaha¹, Ranjan Kumar Jana¹

¹SVNIT Surat.

knchnkushwaha52@gmail.com, rkjana2003@yahoo.com

Abstract: The study extends the single-objective Walrus Optimization Algorithm into a multi-objective framework. The approach incorporates sorting, diversity preservation, constraint handling, and elitism to address multi-objective constrained optimization problems. The proposed method is validated and compared against some well-known algorithms using four performance metrics across five benchmark test problems. Finally, the obtained results are analyzed using Pareto fronts.

Keywords: Multi-Objective Walrus Optimization, chaos, benchmark problems, Pareto solutions

Enhancing Portfolio Optimization using a Hybrid Multi-level Prediction Approach with Deep Reinforcement Learning in Multi-period Framework

Poster Id: 5

Himanshu Choudhary¹, Arishi Orra¹, Manoj Thakur¹

¹Indian Institute of Technology Mandi, Mandi, HP, 175005.

ch.himanshu1199@gmail.com, d21022@students.iitmandi.ac.in,
manoj@iitmandi.ac.in

Abstract: Portfolio Optimization is an extensively studied topic in finance, and its effectiveness is primarily determined by the expected performance of the stock markets. Recent developments in machine learning have demonstrated promising capabilities to improve the portfolio optimization process by integrating it with predictive models. This study suggests a hybrid multi-level approach that employs four predictive models—random forest (RF), support vector regressor (SVR), extreme gradient boosting (XGBoost), and long short-term memory (LSTM)—to model the returns of stocks. A ranking is provided to all the stocks using a score function, and the eligible stocks form a portfolio using Deep Reinforcement Learning in a multi-period framework. The effectiveness of our proposed method is confirmed using stocks from the Nifty 100 Index listed on the National Stock Exchange (NSE), India. The experimental findings illustrated the efficacy of the proposed method compared to benchmarks, as evidenced by various performance metrics.

Keywords: Portfolio Optimization, Deep Reinforcement Learning, Multi-period, Machine Learning, Quantitative Finance.

Optimal PMU Placement using Hybrid vs. Individual TLBO-PSO Techniques: A Comparative Analysis

Poster Id: 6

Santosh Kumari Meena¹, Dr. Akhil Ranjan Garg¹

¹MBM University, Jodhpur

santosh.ee@mbm.ac.in, agarg@jnvu.edu.in

Abstract: This Paper presents a comparative analysis of three optimization techniques: Teaching-Learning-Based Optimization (TLBO), Particle Swarm Optimization (PSO), and a hybrid TLBO-PSO approach, focusing on their efficiency in determining the best PMU placements. Individual methods, such as TLBO and PSO, are often limited by longer computation times and the requirement for a higher number of PMUs to achieve full observability. In contrast, the hybrid TLBO-PSO method demonstrates significant improvements, consistently delivering solutions with fewer PMUs, faster computation times, and higher placement accuracy. By evaluating performance of these techniques on IEEE 14bus, 30bus and 57 bus systems through simulations conducted over 100 iterations for each method in every test case. The results highlight the hybrid approach's superior efficiency compared to individual methods. Furthermore, comparisons with prior research confirm that the hybrid TLBO-PSO approach is a robust and reliable solution for minimizing PMU installations while ensuring

complete system observability.

Keywords: Optimal PMU placement(OPP), Particle Swarm Optimization (PSO), Teaching-Learning Based Optimization (TLBO), Complete Observability, Hybrid TLBO-PSO Approach, system observability redundancy index(SORI).

Intelligent Supply Chain Optimization in Mechanical Engineering: A Fuzzy-SWARA IoT Approach

Poster Id: 7

Dixita Barua^{1,2}, Khushi Sharma², Ojasvi Chaudhary², Shiwani Sharma^{1,3}

¹Department of Operational Research, University of Delhi, New Delhi.

²Dronacharya College of Engineering, Farukhnagar, Gurugram.

³Dronacharya Group Of Institutions, Greater Noida.

dixitabarua10@gmail.com, khushisharmaq385@gmail.com,

ojasvi.27716@ggnindia.dronacharya.info, shiwani.sharma.8668@gmail.com

Abstract: Supply chain management has been demanding due to the fluctuations in the market, supply disruptions, and considerations of sustainability while managing mechanical engineering supply chains. This paper suggests an innovative framework that integrates SWARA-Fuzzy logic with IoT-enabled supply chains for making optimal decisions in the paradigm of Lean, Agile, Resilient, and Sustainable (LARS). The study proposes an adaptive model for supplier selection, risk assessment, and sustainability optimization by leveraging fuzzy logic for uncertainty handling and SWARA for dynamic weight assessment. Real-time IoT data enhances the accuracy of decision-making by continuously updating weight parameters in response to changing supply chain conditions. The framework is checked using case studies and simulation models, showing effectiveness in reducing the risks, achieving efficiency, and sustainability in supply chains of mechanical engineering.

Keywords: SWARA, Fuzzy Logic, Internet of Things, Supply Chain Management, Mechanical Engineering, LARS.

Surface Area of Material Prediction Using Multiple Linear Regression

Poster Id: 8

Dinesh Kumar¹, Poonam Kumari¹

¹Department of Mathematics, Singhania University, Jhunjhunu.

dineshkumarmathdips@gmail.com, poonamsk700@gmail.com

Abstract: This study presents a novel application of the Multiple Linear Regression Algorithm (MLRA) implemented in a Python-based Jupyter Notebook for predicting the surface area of MnO_2 . Experimental data were collated from 11 reputed research articles, focusing on synthesis parameters—temperature, reaction time, and the quantity of $KMnO_4$ —to forecast the material's surface area. The dataset was partitioned into 72% for training and 28% for testing. The developed regression model achieved an accuracy of 94.95%, demonstrating a strong correlation particularly between temperature and surface area. Notably, tuning the

hydrothermal synthesis parameters enabled the enhancement of the surface area from 92 to $196.67 \text{ m}^2/\text{g}$. This work underscores the potential of MLRA as an effective predictive tool in materials science.

Keywords: Multiple Linear Regression Algorithm (MLRA), Machine Learning, Python, Heatmap, Surface Area Prediction, MnO_2 , Hydrothermal Synthesis.

SugarScope: Diabetes Detection

Poster Id: 9

R. Girija¹, N. Deepa¹, Narapureddy Durga Prasad Reddy¹, Dogga Pavan Sekhar¹

¹Centre for Health Innovations Manav Rachna International Institute of Research and Studies, Manav Rachna University.

girija.srikanth09@gmail.com, gn.deepu822017@gmail.com,
narapureddydurgaprasad818@gmail.com, doggapavansekhar@gmail.com

Abstract: Diabetes is a growing global health concern, necessitating early and accurate detection for timely intervention. This study presents a machine learning-based predictive model for diabetes classification using a dataset of 100,000 patient records. The dataset includes key health indicators such as age, BMI, blood glucose levels, hypertension, heart disease, and smoking history. We evaluated two machine learning models—Gradient Boosting and Logistic Regression—with Gradient Boosting achieving the highest accuracy of 97.25%, while Logistic Regression yielded an accuracy of 95.87%. To enhance accessibility, the proposed methodology developed a Streamlit web application integrating the Gradient Boosting model, providing an efficient and user-friendly tool for diabetes detection. This work demonstrates the potential of machine learning in early diagnosis and personalized healthcare.

Keywords: Diabetes Prediction, Machine Learning, Gradient Boosting, Decision Tree, Streamlit.

EBA: A Novel Enhanced Bat Algorithm for Improved Convergence and Global Search in Optimization

Poster Id: 10

Gurmeet Saini¹, Shimpi Singh Jadon¹

¹Rajkiya Engineering College Kannauj U.P.

gurmeetsaini3397@gmail.com, shimpisingh2k6@gmail.com

Abstract: Nature-inspired algorithms have gained prominence for solving complex optimization problems, with the Bat Algorithm (BA) standing out due to its simplicity and adaptability. This paper introduces the Enhanced Bat Algorithm (EBA), a novel advancement designed to achieve enhanced convergence speed and solution quality. EBA improves BA's performance through two critical enhancements: revised velocity update equations and an optimized mechanism for updating positions. These modifications strategically balance exploration and exploitation, enabling agents to converge more efficiently toward global optima while avoiding stagnation in local optima. The proposed algorithm's effectiveness is rigorously evaluated using a suite of well-known 23 benchmark functions and 2 well-known

engineering applications (including pressure vessel and compression spring/tension) where it consistently outperforms the standard BAT algorithm, its variant Modified BAT algorithm (MBA), and other established metaheuristic algorithms such as Particle Swarm Optimization (PSO), Whale Optimization Algorithm (WOA), and Gravitational Search Algorithm (GSA). Results demonstrate significant improvements in convergence speed, accuracy, and robustness, establishing EBA as a potent tool for tackling diverse and challenging optimization problems.

Keywords: BAT Algorithm, Swarm Intelligence, Metaheuristic, Benchmark Functions, Global Optimization.

Optimizing Food Supply Chain Logistics: A Blockchain and Genetic Algorithm-Based Approach

Poster Id: 11

Dixita Barua¹, Kartik¹, Dilip Yadav¹, Shiwani Sharma²

¹Dronacharya College of Engineering, Farukhnagar

²Gurugram Dronacharya Group of Institutions, Greater Noida

dixitabarua10@gmail.com, dilip.27502@ggnindia.dronacharya.info,
kartik.27519@ggnindia.dronacharya.info, shiwani.sharma.8668@gmail.com

Abstract: The global food supply chain is a dynamic and complex system that ensures the seamless movement of agricultural and perishable goods across regions. However, inefficiencies in route optimization, food spoilage during transportation, and inadequate real-time tracking mechanisms continue to hinder supply chain performance. Traditional centralized logistics systems often lack transparency and responsiveness, leading to increased waste and economic losses. This study proposes a hybrid model integrating Blockchain Technology and Genetic Algorithms (GA) to optimize delivery routes and enhance supply chain efficiency. Blockchain, as a decentralized and tamper-proof ledger, ensures transparent and secure record-keeping, while GA dynamically optimizes transportation routes based on real-time conditions. The model incorporates IoT sensors for real-time data collection on temperature, vehicle location, and traffic conditions, ensuring adaptive logistics management. Additionally, smart contracts automate route adjustments and alert stakeholders to unexpected disruptions, enhancing supply chain resilience. Expected results of this integration include reduced transportation time, improved transparency, real-time monitoring, lower operational costs, and enhanced food safety. This research contributes to developing a sustainable, cost-effective, and efficient food supply chain by leveraging emerging technologies to minimize food wastage and optimize logistics operations. Future work may explore AI-driven predictive analytics, blockchain scalability, and further automation in supply chain management.

Keywords: Blockchain, Genetic Algorithms, Food Supply Chain, Route Optimization, Automated Logistics IoT, Smart Contracts, Real-Time Tracking, Logistics Efficiency.

Custom Implemented Machine Learning Algorithms for Skin Cancer Diagnosis: A Comparative Study with Open-Source Library

Poster Id: 12

N. Divya¹, S. Athithan¹

¹SRM Institute of Science and Technology Kattankulathur Tamil Nadu.

dn9668@srmist.edu.in, athithas@srmist.edu.in

Abstract: This study compares scikit-learn-based and custom-implemented machine learning models for skin lesion classification to assess their advantages and behavior on imbalanced datasets. Deep features are extracted using Xception and a custom CNN, followed by classification using Logistic Regression and Random Forest. Results show hybrid ML-DL models outperform standalone approaches, but class imbalance and overfitting affect performance. Future work aims to explore resampling, augmentation, and optimization techniques to improve model reliability.

Keywords: Machine Learning, Deep Learning, Custom- Implemented, Comparative study.

A Deep Learning Based Detection of Cardiovascular Health through Flowmetry Data

Poster Id: 13

Anandha Jothi K G¹, Vignesh T A¹, R Rishab¹, Sivakumar Rajagopal¹

¹Vellore Institute of Technology, Vellore, Tamilnadu-632014, India.

anandhajothi.kg2022@vitsudent.ac.in, rishab.r2022@vitstudent.ac.in,

vignesh.ta2022@vitstudent.ac.in, rsivakumar@vit.ac.in

Abstract: Cardiovascular diseases (CVD) are increasingly impacting global health, with many individuals experiencing severe complications before a diagnosis is made. Early detection is crucial for effective treatment, yet traditional diagnostic methods can be slow and inaccessible, especially in resource-limited settings. This study proposes a novel approach that leverages a deep learning approach to provide an automated and efficient diagnosis of cardiovascular health. By analyzing critical parameters such as blood flow rate, blood pressure, heartrate, and vascular resistance, the model is able to classify individuals as healthy or at risk of CVD with high accuracy. The custom dataset for training, generated in the absence of available clinical flowmetry data, reflects realistic cardiovascular metrics and captures the physiological variability of these parameters. The MLP model interprets these data points to offer reliable predictions, providing clinicians with a decision-support system that enhances diagnostic speed and accuracy. This machine learning-based solution represents a scalable and accessible tool for early CVD detection, with potential applications in telemedicine and other remote healthcare environments.

Keywords: Machine Learning, Skin Cancer, CNN, Custom-Implemented, Feature Extraction, Classification.

Optimizing Modern Logistics with AI-Driven Swarm Intelligence and IoT

Poster Id: 14

Dixita Barua¹, Ugal Sharma¹, Juhi Jha¹, Shiwani Sharma²

¹Dronacharya College of Engineering, Farukhnagar, Gurugram.

²Dronacharya Group of Institutions, Greater Noida.

Dixitabarua10@gmail.com, ugalsharma57@gmail.com, jha.juhii@gmail.com,
shiwani.sharma.8688@gmail.com

Abstract: The rapid growth of urban populations and the rise of e-commerce have placed a heavy strain on logistics and supply chain networks, requiring more efficient, scalable, and sustainable solutions. Traditional logistics models often fail to address issues such as high last mile delivery costs, limited scalability, and poor adaptability. The integration of Artificial Intelligence (AI), Internet of Things (IoT), and Ant Colony Optimization (ACO) offers a transformative solution: AI and IoT provide a connected logistics network where IoT devices collect real-time data from vehicles, inventory, and environmental factors to Build it. AI then analyzes this data to optimize routes, forecast demand, and improve decision-making. Meanwhile, ACO, an optimization algorithm inspired by nature, enhances delivery by continuously recalculating optimal routes based on real-time conditions, much as ants find the most efficient route to food. This research explores the integration of Artificial Intelligence (AI), Internet of Things (IoT), and Ant Colony Optimization (ACO) to enhance logistics operations. This research focuses on addressing the key challenges of scalability, real-time responsiveness, and sustainability in the logistics industry. By leveraging AI for data-driven decision making, IoT for real-time monitoring, and ACO for route and resource allocation optimization, the proposed system aims to reduce operational costs, improve delivery efficiency, and minimize environmental impact. The findings demonstrate that this combined approach significantly improves the performance of the logistics system and provides a scalable, responsive, and sustainable solution to modern supply chain challenges. This integration will make the logistics system more adaptable, responsive to real-time challenges, and sustainable, ultimately improving efficiency and reducing operational complexity.

Keywords: Supply Chain, AI, Ant Colony Optimization, IoT, Optimization, Quantum Computing.

AI-Driven Solutions for Optimizing Product Returns: Reducing Waste and Maximizing Material Recovery

Poster Id: 15

Shiwani Sharma^{1,2}, Jyoti Dhingra Darbari³, P. C. Jha¹

¹Department of Operational Research, Faculty of Mathematical Sciences, University of Delhi, Delhi, India .

²Dronacharya Group of Institutions, Greater Noida, Uttar Pradesh.

³Department of Mathematics, Lady Shri Ram College, University of Delhi, Delhi, India.
shiwani.sharma.8668@gmail.com, jydr@hotmail.com, pcjhadu@gmail.com

Abstract: The rapid growth of e-commerce and global supply chains has led to a significant increase in product returns, resulting in financial losses, environmental waste, and inefficiencies in Reverse Logistics (RL). AI-driven solutions offer a transformative approach to optimizing product returns by leveraging machine learning, predictive analytics, and automation to enhance decision making processes. This study explores how artificial intelligence can reduce waste and maximize material recovery through intelligent return forecasting, automated sorting, and adaptive resale or recycling strategies. On the basis of such considerations, the current study lists key decision-making criteria such as, cost savings, environmental consideration, rate of recovery, and process efficiency to examine AI solutions for managing e-waste. Adopting the Fuzzy Elimination And Choice Translating Reality (ELECTRE) methodology, this study offers a methodological template to select suitable AI technologies, improving material recovery, minimizing waste, and addressing sustainability agendas for the electronics industry. The integration of AI in RL not only enhances sustainability but also improves profitability by reducing operational costs and enhancing supply chain efficiency. This research highlights key AI-driven methodologies, challenges, and future directions in sustainable product returns management, emphasizing the role of technology in fostering a circular economy. Through AI-enabled optimization, businesses can create a more sustainable, cost-effective, and customer-centric approach to handling returns while mitigating the environmental impact of waste.

Keywords: AI-Driven Optimization, Reverse Logistics, Sustainability, Material Recovery, Waste reduction strategies.

Stress Testing Agricultural Food Supply Chain Viability using Triangular Fuzzy Numbers

Poster Id: 16

Dixita Barua¹, Rashi Sharma², P.C.Jha¹

¹Department of Operational Research, University of Delhi.

²Lal Bahadur Shastri Institute of Management, Dwarka.

dixitabarua10@gmail.com, rashilakhanpal9@gmail.com, pcjhadu@gmail.com

Abstract: Agricultural food supply chains (AFSCs) are highly vulnerable to disruptions such as natural disasters, pandemics, and market fluctuations. Traditional risk assessment methods often fail to address these uncertainties. This study introduces a fuzzy logic-based approach using Triangular Fuzzy Numbers (TFNs) to stress test AFSCs and evaluate their resilience under various disruption scenarios. By applying a fuzzy inference system (FIS), key performance indicators like demand variability, supply reliability, and lead time are modelled to assess supply chain robustness. The methodology involves defining membership functions for input variables, formulating fuzzy rules, and simulating different stress conditions. A case study of a perishable goods supply chain showed that high demand variability and extended lead times significantly reduce resilience, while stable supply and reduced lead times improve robustness. These results validate the effectiveness of TFNs in capturing uncertainties and enhancing resilience assessments. The study concludes that fuzzy logic-based modelling, particularly TFNs, is a powerful tool for improving AFSC resilience. Future research could incorporate additional risk factors like climate variability and geopolitical disruptions or

explore alternative fuzzy number representations. This approach helps stakeholders make data-driven decisions to strengthen supply chain stability, ensuring food security and sustainability in an uncertain global economy.

Keywords: AI-driven optimization, reverse logistics, waste reduction, material recovery, sustainability.

Precision Agriculture: Tailored Crop Solution through Soil and Climatic Assessment

Poster Id: 17

Harsh Raj¹, Sakshi¹, Kumar Harsh¹, Dr. Upender Patri¹

¹Vellore Institute of Technology, Chennai.

Harshraj9601@gmail.com, sakshi724639@gmail.com, k.r.harsh3007@gmail.com,
upender.p@vit.ac.in

Abstract: Precision Agriculture (PA) is transforming contemporary farming practices by utilizing data-driven methodologies to enhance resource efficiency, increase crop yields, and foster sustainability. This research explores the creation of customized crop solutions through detailed assessments of soil and climate conditions, which are critical for understanding the factors that affect crop growth. By employing cutting-edge technologies such as remote sensing, Geographic Information Systems (GIS), and soil sensors, the study provides a thorough analysis of essential environmental parameters, including soil health, moisture content, and nutrient availability. The methodology integrates various machine learning algorithms, notably Random Forest and Support Vector Machine, to analyse data and recommend optimal crops tailored to specific environmental conditions. Data collection is achieved through advanced sensors, including NPK sensors that measure vital soil nutrients, while an Arduino microcontroller streamlines data processing and transmission. The results underscore the influence of phosphorus and other soil nutrients on crop selection, highlighting the necessity for precise fertilizer application. By utilizing the Random Forest model, this research illustrates the potential of PA to improve food security and ecological sustainability, effectively addressing challenges such as resource scarcity and climate change. This study emphasizes the pivotal role of precision agriculture in promoting resilient and sustainable farming practices for the future.

Keywords: Precision Agriculture, Soil Assessment, Crop Solutions, Remote Sensing, Machine Learning, Nutrient Availability, Sustainable Farming, Food Security.

Renewable Fuel Solutions for Freight Transport in India: A Fuzzy Multi-Criteria Approach

Poster Id: 18

Shiwani Sharma¹, Diwakar Kumar¹, Dixita Barua²

¹Dronacharya Group of Institutions Greater Noida Uttar Pradesh.

²Dronacharya College of Engineering Farukhnagar Gurugram Haryana.

shiwani.sharma.8668@gmail.com, diwakarkumar25may@gmail.com,
dixitabarua10@gmail.com

Abstract: This research examines the contribution of alternative fuels towards the revolution of the transport and logistics industries of supply chains with the potential to decrease their ecological footprint while maintaining operational efficiency. The study employs the Analytic Hierarchy Process (AHP) coupled with triangular fuzzy logic to assess and prioritize major criteria that affect fuel choice, such as Environmental Impact, Renewability, Transportation, Cost, and Availability. These standards are applied in the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) to measure and prioritize different alternative fuels. The TOPSIS approach permits comparison among alternative fuels according to their proximity to an ideal solution, taking into consideration both sustainability and feasibility requirements. Through the synthesis of these methods, the research presents an in-depth framework for the choice of sustainable fuel substitutes that can assist in reducing the environmental footprint of transportation while preserving the operational efficacy of supply chains. The results from this paper will be a vital takeaway for future energy.

Keywords: Renewable fuels, Alternative fuel, Fuzzy, MCDM, Freight Transportation.

Quality 4.0 in Apparel Manufacturing: Key Enablers for Implementation

Poster Id: 19

Amna Obaid¹, Pankaj¹, Sameer Anand¹

¹Department of Operational Research, University of Delhi, Delhi, India.

amnaobaid009@gmail.com, pankaj.du.or.17@gmail.com, sanand@or.du.ac.in

Abstract: With increasing market competition, manufacturers must produce high-quality products at minimal cost and time to enhance customer satisfaction and drive continuous improvement. Achieving this requires an efficient quality management system. Quality 4.0, the latest advancement in quality management, integrates Industry 4.0 technologies with traditional quality tools and methods to improve efficiency and precision. However, transitioning from Total Quality Management (TQM) to Quality 4.0 requires a systematic study to identify the key enablers for successful adoption. This paper explores these enablers in apparel manufacturing and proposes a framework for their evaluation. A Fuzzy Delphi and Stepwise Weight Assessment Ratio Analysis (SWARA) methodology is used to identify and rank the enablers. First, an extensive literature review identifies potential enablers. Then, expert opinions refine the list using Fuzzy Delphi. Finally, SWARA ranks the enablers to highlight their importance in Quality 4.0 adoption.

Keywords: Quality 4.0, Apparel Manufacturing, MCDM.

Evaluation of Adoption of Artificial Intelligence Technologies for the Apparel Supply Chain Industry

Poster Id: 20

Vaishnavi Singh¹, Pankaj¹, Shilpi Verma¹

¹Department of Operational Research, Faculty of Mathematical Sciences, University of Delhi.

Abstract: The apparel supply chain plays a vital role in the economy. Artificial Intelligence Technology (AIT) enables organizations to achieve economic and competitive benefits. AIT offers several benefits for the apparel industry, such as identifying trends, having virtual sample try-ons, managing inventory, producing efficiently and reducing fast fashion's environmental and social impact. The aim of this paper is to analyse the determinants that affect the adoption of AIT in the apparel supply chain. The determinants to evaluate the implementation of AIT are based on the integrated conceptual model, including features of the Technology Adoption Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Technology-Organization-Environment (TOE) and Theory of Planned Behaviour (TPB) frameworks. Fourteen major determinants were selected with the help of a survey floated among industry experts and an extensive literature review. The current paper utilizes the Multi-criteria Decision Making (MCDM) method and the Fuzzy-Analytical Hierarchy Process (F-AHP) to rank these determinants. Based on the analysis of F-AHP, the determinants such as enhancement of productivity and readiness of consumers, are crucial factors that significantly influence the successful adoption of AIT in the apparel SC.

Keywords: AIT, SC, MCDM, F-AHP.

Barriers to Implementing Autonomous Collection and AI-Enabled Industrial Sorting Pipelines for Advanced Textile Waste Recycling within a Circular Economy Framework

Poster Id: 21

Rabiya Faheem¹, Akansha Jain², Rubina Mittal³

¹Department of Operational Research, University of Delhi.

²Department of Operations Management and Business Analytics, Fortune Institute of International Business, New Delhi.

³Keshav Mahavidyalaya, University of Delhi, Delhi.

rabiyaafaheem95@gmail.com, akansha.jain@fiib.edu.in, drmittal@keshav.du.ac.in

Abstract: Textile waste is a growing issue, with inefficient recycling causing material losses. A circular economy (CE) approach promotes reuse and recycling, but AI-enabled sorting and autonomous collection face adoption barriers. Key challenges include textile complexity, lack of standardized AI datasets, high costs, regulatory gaps, and social resistance. Solutions include improving AI algorithms, multispectral imaging, and data standardization. Financial incentives, subsidies, and partnerships can lower costs, while clear regulations and workforce training ease adoption. Despite challenges, AI integration can enhance material recovery and sustainability. Addressing these barriers through innovation, policy support, and education will accelerate the transition to a more efficient, circular textile industry.

Keywords: Textile Industry, Circular Economy (CE), Textile Waste, Collection, Sorting, Recycling, Artificial Intelligence (AI)-Driven Technologies, Fuzzy-Step-wise Weight Assessment Ratio Analysis (SWARA).

Risk Mitigation Framework for Enhancing Resilience in Smart Manufacturing for Electric Vehicle Supply Chain: A Case Study of an Indian MSME

Poster Id: 22

Pankaj¹, Rashi Sharma², Rubina Mittal³, PC Jha⁴

¹Department of Operational Research, University of Delhi, New Delhi, India

²Lal Bahadur Shastri Institute of Management, Delhi, India.

³Keshav Mahavidyalaya, University of Delhi, New Delhi, India.

pankaj.du.or.17@gmail.com, rashisharma@lbsim.ac.in,

drmittal@keshav.du.ac.in, pcjhadu@gmail.com

Abstract: Smart manufacturing is the integration of Industry 4.0 and Circular Economy concepts in the manufacturing process to minimize waste and enhance its productivity, flexibility, and responsiveness. It focuses on sustainable practices and energy efficiency to align with Environment, Social, and Governance goals. In the present study, risks faced by smart manufacturing Micro Small and Medium Enterprises (MSMEs) in the electric vehicle supply Chain (EVSC) are determined and their corresponding risk coping mechanisms are suggested. Initially, 21 risks within the electric vehicle industry are identified based on the integrated opinion of literature review, EVSC entrepreneurs, and supply chain experts. Further, an integrated Multi-Criteria Decision-Making approach is utilized to determine the importance of risks, taking into consideration their criticality. Firstly, Best-Worst-Method is utilized to prioritize the identified key potential risks according to their severity. Appropriate coping mechanisms are determined through literature review, and expert opinion to develop a framework which can be adopted by MSMEs to mitigate the risk. Finally, the Weighted Aggregated Sum Product Assessment method is employed to determine the importance of risk coping strategies. A real-life case study of plug-in electric scooter manufacturing MSME located in India is utilized to illustrate the application of the proposed framework. This study is one of the earliest attempts in identifying risks associated with smart manufacturing MSMEs in the electric vehicle supply chain and their corresponding coping mechanism. The finding of this study could be advantageous for electric scooter manufacturers and other stakeholders in the EVSC, since they can use them to establish strategies, policies, and plans to mitigate risks in their supply chain.

Keywords: Electric Vehicle Supply Chain, Smart Manufacturing, MSMEs, Supply Chain Risks, Risk coping mechanisms.

A Machine Learning Model for Pulmonary Medication Recommendation Based on Patient Data

Poster Id: 23

Saanvi Chaudhary¹, Sivakumar Rajagopal¹

¹School of Electronics Engineering, Vellore Institute of Technology, Vellore, India

saanvi.chaudhary2023@vitstudent.ac.in, rsivakumar@vit.ac.in

Abstract: Incorporation of artificial intelligence (AI) and machine learning (ML) in medicine

has helped us to create a more personalised experience when it comes to healthcare facilities, such advancements enable us to develop patient- specific treatment which are more precise than the traditional treatment methods. This research involves creating a machine learning model that analyses patient demographics with smoking status, asthma diagnosis and peak flow measurements to predict accurate pulmonary medications. Through Random Forest classifier the model evaluates these inputs to predict appropriate medications for patients, thus improving the patient treatment experience. Evaluation of the model is done using key metrics like accuracy, precision, recall and F1- score which make sure that the model is reliable and effective, additionally an exploratory data analysis (EDA) is also done which uncovers some critical patterns and relations with the dataset providing an insight into how personalized the medication response is, with respect to the patient characteristics. The study also highlights the potential of such ML-driven approaches in assisting healthcare professionals in making evidence-based treatment decisions, ultimately contributing to improved pulmonary healthcare. Model underscores the growing importance of AI in personalised medication and demonstrates its potential to optimise therapeutic recommendations and enhance the patient care.

Keywords: Machine Learning, Personalized Pulmonary Medication, Random Forest, Healthcare.

Towards Viksit Bharat: MCDM-AI-Based Scrutiny of Mental Status in Indian States

Poster Id: 24

Princy Verma¹, Millie Pant^{1,2}, Mukesh Kumar Barua³

¹Department of Applied Mathematics and Scientific Computing, IIT Roorkee.

^{1,2}Mehta Family School for Data Science and Artificial Intelligence, IIT Roorkee.

³Department of Management Studies, IIT Roorkee.

princy_v@amsc.iitr.ac.in, pant.milli@as.iitr.ac.in,

Mukesh.barua@ms.iitr.ac.in

Abstract: The progress of any country depends not only on its economic advancement but also on the overall well-being of its citizens. According to WHO, 14.3% of India's people suffer from mental disorders, and the treatment gap is approximately 83%. The objective of this study is to estimate the prevalence and burden of mental health disorders, identify the current treatment gap, and assess mental healthcare facilities, resources, and systems in Indian states in terms of mental health care and socio-economic factors. The dataset for this study is collected from NMHS surveys 1 and 2. This study is conducted in three parts. Firstly, some advanced data exploration tools are applied to data visualization to find insights from the data based on various factors. Secondly, AI models are to be utilized for important feature selection for the model. Third, hybrid MCDM methods are to be integrated to evaluate the efficiency of the Indian states. The findings aim to create the framework for policymakers to bridge the treatment gap and strengthen mental healthcare systems to ensure equitable access and improved outcomes for all citizens.

Keywords: Mental Health, NMHS, Artificial Intelligence, MCDM, Data-driven.

Water Impurities Detection Robot

Poster Id: 25

Gaurav Shukla¹, Kalyani Jha¹, Riway karki¹, Rishanshu Tripathi¹

¹Tulas Institute, Dehradun, India

gaurav.202304204@tulas.edu.in, gauravshukla7060@gmail.com,

riwazkarki03@gmail.com, rishanshutripathi21@gmail.com

Abstract: Water pollution affects 2.2 billion people globally, causing severe health and environmental crises. Traditional monitoring methods are costly and time-consuming, limiting large-scale implementation. This research introduces an Water Impurities Detection Robot(IoT-driven RC boat) that autonomously navigates and collects real-time water quality data, measuring pH, turbidity, TDS, temperature, and dissolved oxygen using advanced sensors. The system integrates Raspberry Pi, GPS, and MQTT communication for seamless data transmission and cloud visualization. Unlike manual sampling, this cost-efficient and scalable solution provides continuous, automated, and location-specific monitoring, benefiting government agencies, environmental bodies, and researchers. The innovation aligns with SDG 6 (Clean Water and Sanitation) and offers a proactive approach to mitigating water pollution, ensuring a sustainable and healthier future.

Keywords: Water Pollution, IoT, Smart Sensing, Real-Time Monitoring, Sustainable Development

Factors affecting adoption of Blockchain, Artificial Intelligence & Machine Learning in Manufacturing Industry

Poster Id: 26

Mananya Gupta¹, Gunjan Sood¹

¹FIIB, New Delhi

26-mananya.gupta@fiib.edu.in, gunjan.sood@fiib.edu.in

Abstract: The integration of Blockchain, Artificial Intelligence (AI), and Machine Learning (ML) is revolutionizing the manufacturing industry by enhancing security, efficiency, and decision-making. Blockchain ensures transparency, traceability, and data integrity, mitigating unauthorized transactions and fostering trust in manufacturing supply chains. AI and ML contribute to process of automation, predictive maintenance, and quality control, enabling smart manufacturing environments. The study employs Interpretive Structural Modelling (ISM) and Fuzzy MICMAC methodologies to analyze the key enablers influencing the adoption of these technologies and create a hierarchical model of enablers . By structuring the interdependencies among 19 critical factors, including data security, risk management, and digital manufacturing, the study identifies the driving and dependent variables in the adoption process. Findings suggest that foundational enablers such as regulatory support, technological readiness, and investment play a crucial role in shaping adoption strategies. The research highlights the need for structured adoption frameworks to optimize digital transformation in manufacturing. By prioritizing key drivers, businesses can streamline implementation, reduce risks, and enhance sustainability. These insights

contribute to the growing discourse on Industry 4.0, providing a roadmap for integrating emerging technologies for a competitive, efficient, and resilient manufacturing sector.

Keywords: Artificial Intelligence, Enablers, FUZZY MCDM, ISM, Manufacturing, Structural Model, Blockchain, Machine Learning

Bridging Knowledge, Attitude, and Behavior Gaps in Fashion Sustainability: The Role of AI in Advancing Viksit Bharat

Poster Id: 27

Anushka¹, Akansha Jain¹

¹FIIB, New Delhi

26-anushka@fiib.edu.in, akansha.jain@fiib.edu.in

Abstract: The global fashion industry, while a cornerstone of economic growth and creative expression, remains a major contributor to environmental degradation and social inequalities. Despite rising awareness, a persistent Knowledge-Attitude-Behavior (KAB) gap among consumers and industry stakeholders undermines sustainability efforts. This study explores the critical role of artificial intelligence (AI) in addressing this gap, particularly within India's vision of Viksit Bharat (Developed India) 2047. Utilizing the Fuzzy House of Risk (FHoR) model, we identify and prioritize key unsustainable practices in the fashion sector and assess the factors perpetuating the KAB gap. AI-driven solutions, including blockchain for supply chain transparency, predictive analytics for demand forecasting, and personalized sustainability education tools, are proposed as transformative interventions. By integrating AI with strategic policy shifts and consumer engagement initiatives, this research provides a roadmap for aligning fashion industry practices with sustainability goals. The findings contribute to bridging the KAB gap, fostering responsible consumption, and enhancing industry resilience, thereby advancing India's sustainable development agenda. This study underscores the potential of AI in shaping a circular and ethical fashion ecosystem, supporting economic inclusivity, and reinforcing India's commitment to global sustainability frameworks such as the United Nations Sustainable Development Goals (SDGs).

Keywords: Sustainability, Fashion, Knowledge, Attitude, Behaviour, fuzzy-MCDM.



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APPLIED MATHEMATICS
AND SCIENTIFIC COMPUTING**

Indian Institute of Technology Roorkee,
Saharanpur Campus, Saharanpur (U.P.)

Webpage : <https://ase.iitr.ac.in>

E-mail : head-office@amsc.iitr.ac.in

Phone : +91-0132-2714367