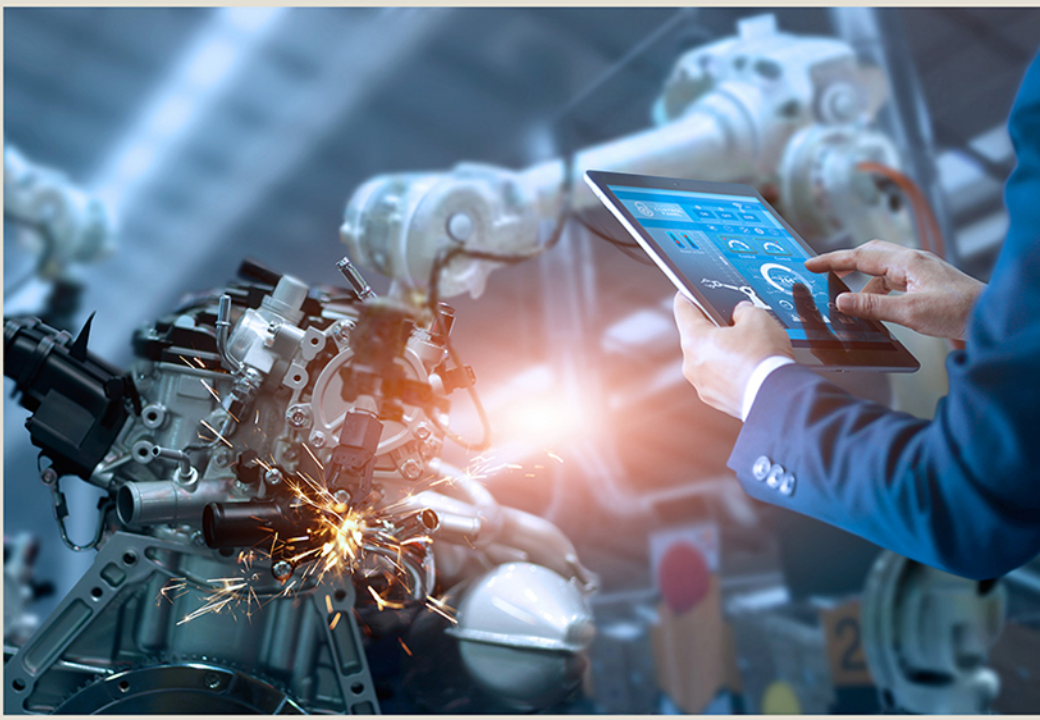
INTELLIGENT MANUFACTURING AND INDUSTRIAL ENGINEERING

CRC Press
Taylor & Francis Group

Integration of AI-Based Manufacturing and Industrial Engineering Systems with the Internet of Things



Edited by
Pankaj Bhambri, Sita Rani, Valentina E. Balas, and Ahmed A. Elngar

Integration of AI-Based Manufacturing and Industrial Engineering Systems with the Internet of Things

Integration of AI-Based Manufacturing and Industrial Engineering Systems with the Internet of Things describes how AI techniques, such as deep learning, cognitive computing, and Machine Learning, can be used to analyze massive volumes of data produced by IoT devices in manufacturing environments.

The potential benefits and challenges associated with the integration of AI and IoT in industrial environments are explored throughout the book as the authors delve into various aspects of the integration process. The role of IoT-enabled sensors, actuators, and smart devices in capturing real-time data from manufacturing processes, supply chains, and equipment is discussed along with how data can be processed and analyzed using AI algorithms to derive actionable insights, optimize production, improve quality control, and enhance overall operational efficiency.

A valuable resource for researchers, practitioners, and professionals involved in the fields of AI, IoT, manufacturing systems, and industrial engineering, and combines theoretical foundations, practical applications, and case studies.

Intelligent Manufacturing and Industrial Engineering
Series Editor: Ahmed A. Elngar, Beni-Suef Uni.
Mohamed Elhoseny, Mansoura University, Egypt

Machine Learning Adoption in Blockchain-Based Intelligent Manufacturing
Edited by Om Prakash Jena, Sabyasachi Pramanik, Ahmed A. Elngar

Integration of AI-Based Manufacturing and Industrial Engineering Systems with the Internet of Things
Edited by Pankaj Bhambri, Sita Rani, Valentina E. Balas, Ahmed A. Elngar

For more information about this series, please visit: https://www.routledge.com/Mathematical-Engineering-Manufacturing-and-Management-Sciences/book-series/CRCIMIE

Integration of AI-Based Manufacturing and Industrial Engineering Systems with the Internet of Things

Edited by
Pankaj Bhambri
Sita Rani
Valentina E. Balas
Ahmed A. Elngar

CRC Press
Taylor & Francis Group
Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

Designed cover image: © Shutterstock

First edition published 2024
by CRC Press
2385 NW Executive Center Drive, Suite 320, Boca Raton FL 33431

and by CRC Press
4 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

CRC Press is an imprint of Taylor & Francis Group, LLC

ISBN: 978-1-032-46601-9 (hbk)
ISBN: 978-1-032-46831-0 (pbk)
ISBN: 978-1-003-38350-5 (ebk)

DOI: 10.1201/9781003383505

Typeset in Times LT Std
by SPi Technologies India Pvt Ltd (Straive)

Contents

About the Editors

Dr. Pankaj Bhambri is affiliated with the Department of Information Technology at Guru Nanak Dev Engineering College in Ludhiana. Additionally, he fulfills the role of the Institute's Coordinator for the Skill Enhancement Cell and acts as the Convener for his Departmental Board of Studies. He possesses nearly two decades of teaching experience. Dr. Bhambri acquired a Master of Technology degree in Computer Science and Engineering and a Bachelor of Engineering degree in Information Technology with Honours from I.K.G. Punjab Technical University in Jalandhar, India, and Dr. B.R. Ambedkar University in Agra, India, respectively. Dr. Bhambri obtained a Doctorate in Computer Science and Engineering from I.K.G. Punjab Technical University, located in Jalandhar, India. Over an extended period, he fulfilled many responsibilities including those of an Assistant Registrar (Academics), Member (Academic Council/BoS/DAB/RAC), Hostel Warden, APIO, and NSS Coordinator within his institution. His research work has been published in esteemed worldwide and national journals, as well as conference proceedings. Dr. Bhambri has made significant contributions to the academic field through his role as both an editor and author of various textbooks. Additionally, he has demonstrated his innovative thinking by filing several patents. Dr. Bhambri has received numerous prestigious awards from esteemed organizations in recognition of his exceptional achievements in both social and academic/research domains. These accolades include the ISTE Best Teacher Award in 2022, the I2OR National Award in 2020, the Green ThinkerZ Top 100 International Distinguished Educators award in 2020, the I2OR Outstanding Educator Award in 2019, the SAA Distinguished Alumni Award in 2012, the CIPS Rashtriya Rattan Award in 2008, the LCHC Best Teacher Award in 2007, and several other commendations from various government and non-profit entities. He has provided guidance and oversight for numerous research projects and dissertations at the undergraduate, postgraduate, and Ph.D. levels. He successfully organized a diverse range of educational programmes, securing financial backing from esteemed institutions such as the All India Council for Technical Education (AICTE), the Technical Education Quality Improvement Programme (TEQIP), among others. Dr. Bhambri's areas of interest encompass machine learning, bioinformatics, wireless sensor networks, and network security. Dr. Bhambri possesses a wide array of professional responsibilities, encompassing the duties of an educator, editor, author, reviewer, expert speaker, motivator, and technical committee member for esteemed national and worldwide organizations.

Dr. Sita Rani works in the Department of Computer Science and Engineering at Guru Nanak Dev Engineering College, Ludhiana. Earlier, she served as Deputy Dean (Research) at the Gulzar Group of Institutions, Khanna (Punjab). She completed her B. Tech. and M. Tech. degrees in Computer Science and Engineering from Guru Nanak Dev Engineering College, Ludhiana. She earned her Ph. D. in Computer Science and Engineering from I.K. Gujral Punjab Technical University, Kapurthala, Punjab in 2018.She completed her Post Graduate Certificate Program in Data Science and Machine Learning from the Indian Institute of Technology, Roorkee in 2023. She is also a Post Doctoral Research Fellow at South Ural State University, Russia since May 2022. She has more than two decades of teaching experience. She is an active member of ISTE, IEEE and IAEngg and is the recipient of the ISTE Section Best Teacher Award– 2020, and the International Young Scientist Award–2021. She has contributed to the various research activities while publishing articles in renowned journals and conference proceedings. She has also published seven international patents. Dr. Rani has delivered many expert talks in AICTE-sponsored Faculty Development Programs and organized many international conferences over the course of her 20 years of teaching experience. She is a member of editorial boards and also a reviewer for many international journals of repute. Her areas of research interest include parallel and distributed computing, data science, Machine Learning, Blockchain, the Internet of Things (IoT), and healthcare.

Prof. Valentina E. Balas is currently Full Professor in the Department of Automatics and Applied Software at the Faculty of Engineering, "Aurel Vlaicu" University of Arad, Romania. She holds a PhD in Applied Electronics and Telecommunications from the Polytechnic University of Timisoara. Dr. Balas is the author of more than 300 research papers in refereed journals and international conferences. Her research interests include intelligent systems, fuzzy control, soft computing, smart sensors, information fusion, modeling and simulation. She is the editor-in chief for the *International Journal of Advanced Intelligence Paradigms* (*IJAIP*) and the *International Journal of Computational Systems Engineering* (*IJCSysE*), an editorial board member of several national and international journals and an evaluating expert for national, international projects and PhD theses. Dr. Balas is the director of the Intelligent Systems Research Centre in Aurel Vlaicu University of Arad and the director of the Department of International Relations, Programs and Projects in the same university. She served as general chair of the International Workshop on Soft Computing and Applications (SOFA),which was held in Romania and Hungary on eight occasions between 2005 and 2018. Dr. Balas has participated in many international conferences in a variety of different roles, including organizer, honorary chair,

session chair and has also been a member of Steering, Advisory or International Program Committees. She is a member of the EUSFLAT and the SIAM and a Senior Member of the IEEE, and a member of the TC – Fuzzy Systems (IEEE CIS), the TC – Emergent Technologies (IEEE CIS), and the TC – Soft Computing (IEEE SMCS). Dr. Balas was also past vice-president (Awards) of IFSA International Fuzzy Systems Association Council (2013–2015) and is a Joint Secretary of the Governing Council of Forum for Interdisciplinary Mathematics (FIM), a multidisciplinary academic body in India. She is also director of the Department of International Relations, Programs and Projects and head of the Intelligent Systems Research Centre in Aurel Vlaicu University of Arad, Romania.

Dr. Ahmed A. Elngar is an Associate Professor and Head of the Computer Science Department at the Faculty of Computers and Artificial Intelligence, Beni-Suef University, Egypt. Dr. Elngar is also an Associate Professor of Computer Science at the College of Computer Information Technology, and the American University in the Emirates, United Arab Emirates. Dr. Elngar is also Adjunct Professor at the School of Technology, Woxsen University, India. He is the Founder and Head of the Scientific Innovation Research Group (SIRG) and a Director of the Technological and Informatics Studies Center (TISC), Faculty of Computers and Artificial Intelligence, Beni-Suef University. Dr. Elngar has more than 106 scientific research papers published in prestigious international journals and over 25 books covering such diverse topics as data mining, intelligent systems, social networks, and the smart environment. Dr. Elngar is a collaborative researcher and a member of the Egyptian Mathematical Society (EMS) and the International Rough Set Society (IRSS). His other research areas include the Internet of Things (IoT), network security, intrusion detection, Machine Learning, data mining, and Artificial Intelligence, Big Data, authentication, cryptology, healthcare systems, and automation systems. He is an editor and reviewer of many international journals around the world. He has won several awards, including the "Young Researcher in Computer Science Engineering", from Global Outreach Education Summit and Awards 2019, on 31 January 2019 in Delhi, India. He has also been awarded the "Best Young Researcher Award (Male) (Below 40 years)", Global Education and Corporate Leadership Awards (GECL–2018).

Contributors

Saaema Akhtar
National Institute of Technology,
Warangal, Telangana, India

Hutashan Vishal Bhagat
Sant Longowal Institute of Engineering and Technology,
Sangrur, Punjab, India

Pankaj Bhambri
Guru Nanak Dev Engineering College,
Ludhiana, Punjab, India

Vidyadevi G. Biradar
NITTE Meenakshi Institute of Technology,
Bangalore, Karnataka, India

Yogesh Chhabra
CT University,
Ludhiana, Punjab, India

Dharmavaram Asha Devi
Sreenidhi Institute of Science and Technology,
Hyderabad, Telangana, India

M. Dharmananda
NITTE Meenakshi Institute of Technology,
Bangalore, Karnataka, India

M. R. Dileep
NITTE Meenakshi Institute of Technology,
Bangalore, Karnataka, India

Aayushi Gautam
Chandigarh Group of Colleges,
SAS Nagar, Punjab, India

Polishetty Gayatri
Sreenidhi Institute of Science and Technology,
Hyderabad, Telangana, India

P. Geetha
Sri Venkateswara College of Engineering,
Sriperumbudur, Tamil Nadu, India

Madhwaraj Kango Gopal
Mangalore Institute of Technology and Engineering,
Moodbidri, Karnataka, India

M. Gopala Krishna
SRM Institute of Science and Technology,
Ramapuram Campus, Chennai, Tamil Nadu, India

B. S. Harisha
NITTE Meenakshi Institute of Technology,
Bangalore, Karnataka, India

D. Sai Surya Harsha
SRM Institute of Science and Technology,
Ramapuram Campus, Chennai, Tamil Nadu, India

Kusumlata Jain
Manipal University,
Jaipur, Rajasthan, India

T. Kalaichelvi
Pondicherry University,
Pondicherry, Puducherry, India

R. K. Kapila Vani
Sri Venkateswara College of Engineering,
Sriperumbudur, Tamil Nadu, India

S. Keerthana Sri
Sri Venkateswara College of Engineering,
Sriperumbudur, Tamil Nadu, India

Charu Krishna
Motilal Nehru National Institute of Technology Allahabad,
Prayagraj, Uttar Pradesh, India

Divya Kumar
Motilal Nehru National Institute of Technology Allahabad,
Prayagraj, Uttar Pradesh, India

Naveen Kumar
National Institute of Technology,
Kurukshetra, Haryana, India

Santosh Kumar
Chandigarh Group of Colleges,
SAS Nagar, Punjab, India

Dharmender Singh Kushwaha
Motilal Nehru National Institute of Technology Allahabad,
Prayagraj, Uttar Pradesh, India

H. Lakshmi
NITTE Meenakshi Institute of Technology,
Bangalore, Karnataka, India

S. Lakshmi Gayathri
Sri Venkateswara College of Engineering,
Sriperumbudur, Tamil Nadu, India

Zahid Amin Malik
Kumaun University,
Nainital, Uttarakhand, India

Archana Naik
NITTE Meenakshi Institute of Technology,
Bangalore, Karnataka, India

A. V. Navaneeth
NITTE Meenakshi Institute of Technology,
Bangalore, Karnataka, India

Gampa Nikhitha
Sreenidhi Institute of Science and Technology,
Hyderabad, Telangana, India

Anshuman Priyadarshini
NITTE Meenakshi Institute of Technology,
Bangalore, Karnataka, India

Rachna Rana
Ludhiana Group of Colleges,
Ludhiana, Punjab, India

Manju Rani
Gurugram University,
Gurugram, Haryana, India

Sita Rani
Guru Nanak Dev Engineering College,
Ludhiana, Punjab, India

S. Ravi
Pondicherry University,
Pondicherry, Puducherry, India

G. Pavan Sundar Reddy
SRM Institute of Science and Technology,
Ramapuram Campus, Chennai, Tamil Nadu, India

Hemant Kumar Saini
Chandigarh University,
SAS Nagar, Punjab, India

R. Sathya
SRM Institute of Science and Technology,
Ramapuram Campus, Chennai, Tamil Nadu, India

Gurjeet Singh
Guru Kashi University,
Bathinda, Punjab, India

Jagdeep Singh
Guru Nanak Dev Engineering College,
Ludhiana, Punjab, India

Manminder Singh
Sant Longowal Institute of Engineering and Technology,
Sangrur, Punjab, India

Prem Singh
Guru Nanak Dev Engineering College,
Ludhiana, Punjab, India

Swaran Singh
Chandigarh Group of Colleges,
SAS Nagar, Punjab, India

P. Ushashree
Geethanjali College of Engineering and Technology,
Hyderabad, Telangana, India

Anurag Verma
NITTE Meenakshi Institute of Technology,
Bangalore, Karnataka, India

Pusa Vineela
Sreenidhi Institute of Science and Technology,
Hyderabad, Telangana, India

Preface

Welcome to *Integration of AI-Based Manufacturing and Industrial Engineering Systems with the Internet of Things*. In today's rapidly evolving technological landscape, the convergence of artificial intelligence (AI), manufacturing, industrial engineering, and the Internet of Things (IoT) has brought about a paradigm shift in the way we design, produce, and optimize industrial systems. This book serves as a comprehensive guide that explores the integration of these transformative technologies and their applications in the realm of manufacturing and industrial engineering.

The Fourth Industrial Revolution, often referred to as Industry 4.0, has propelled us into an era where intelligent systems, interconnected devices, and data-driven decision-making are revolutionizing the industrial sector. The marriage of AI-based approaches, such as machine learning, deep learning, and data analytics, with the vast network of IoT devices has opened up a world of possibilities for optimizing production processes, enhancing quality control, improving resource management, and enabling predictive maintenance, among many other applications.

This book aims to provide a holistic understanding of the integration of AI-based manufacturing and industrial engineering systems with the IoT. It delves into the underlying principles, methodologies, and technologies that drive this integration and explores real-world case studies, practical implementations, and emerging trends. Whether you are a researcher, practitioner, student, or an industry professional seeking to stay at the forefront of this rapidly evolving field, this book offers valuable insights and knowledge. Each chapter is authored by experts in their respective domains, ensuring that the content is both comprehensive and up-to-date. Additionally, practical examples, illustrations, and references are provided to facilitate a deeper understanding of the topics covered.

We hope that this book serves as a valuable resource for researchers, educators, students, and professionals interested in exploring the integration of AI-based manufacturing and industrial engineering systems with the Internet of Things. We believe that the knowledge and insights shared within these pages will inspire further advancements and innovations in this exciting field.

We would like to express our gratitude to all the contributors who have dedicated their time and expertise to make this book possible. We also extend our appreciation to the readers for their interest in this subject matter. Together, let us embark on this journey into the integration of AI, manufacturing, industrial engineering, and the Internet of Things.

1 Challenges, Opportunities, and the Future of Industrial Engineering with IoT and AI

Pankaj Bhambri and Sita Rani
Guru Nanak Dev Engineering College, Ludhiana, India

1.1 INTRODUCTION

Industrial engineering is a field that has long been concerned with designing, optimizing, and managing complex systems and processes. However, with the emergence of the Internet of Things (IoT) and Artificial Intelligence (AI), the challenges and opportunities faced by industrial engineers have evolved (Kothandaraman et al, 2022). IoT is a collection of physical objects that are interconnected with the internet, allowing them to exchange information (Kaur et al., 2015). Conversely, AI pertains to machines endowed with the capacity to carry out tasks typically necessitating human intelligence, including learning, decision-making, and problem-solving (Tao et al., 2019).

The integration of IoT and AI into industrial engineering has the potential to revolutionize the field, but it also presents significant challenges. The sheer amount of data generated by IoT devices can overwhelm traditional data management systems, while the vulnerability of IoT devices to cyber-attacks presents a significant security risk. On the other hand, the benefits of IoT and AI are many, including real-time monitoring, predictive maintenance, and predictive quality control (McAfee and Brynjolfsson, 2017).

This chapter will explore the challenges, opportunities, and future of industrial engineering with IoT and AI. We will begin by discussing the challenges that industrial engineers face in the age of IoT and AI, including data management and cybersecurity. We will then examine the opportunities that these technologies offer, including real-time monitoring, predictive maintenance, and predictive quality control. Finally, we will discuss the future of industrial engineering with IoT and AI, including the changes in the nature of work and the skills required for success in this evolving field (Paika and Bhambri, 2013).

DOI: 10.1201/9781003383505-1

1.1.1 Industrial Engineering Role, Processes, and Developments in Brief

Industrial engineering involves the optimization of intricate systems and processes. It involves the application of engineering principles, mathematics, and statistics to improve efficiency, productivity, and quality in a variety of industries (Qureshi and Khan 2019).

The role of an industrial engineer is to analyze existing processes, identify problems and inefficiencies, and develop solutions to optimize the process. They work closely with other professionals, including engineers, managers, and technicians, to identify opportunities for improvement and implement changes (Wang and Liu, 2019). The processes involved in industrial engineering can vary depending on the industry, but some common processes include:

- Process design and improvement: Industrial engineers analyze existing processes and develop new processes that are more efficient, cost-effective, and productive.
- Quality control: Industrial engineers design quality control systems that ensure that products and services meet customer requirements and industry standards.
- Supply chain management: Industrial engineers manage the flow of goods and services from suppliers to customers, optimizing logistics, inventory management, and transportation.
- Human factors: Industrial engineers consider the human factors involved in industrial processes, such as ergonomics, safety, and worker productivity.
- Project management: Industrial engineers are often involved in managing projects, including planning, budgeting, and scheduling.

There have been several significant developments in industrial engineering in recent years. Among the noteworthy advancements, the IoT and AI have emerged as prominent ones. In industrial environments, the prevalence of IoT devices has grown substantially, enabling the collection of real-time data (Rani et al. 2023b). This data serves the purpose of optimizing processes, enhancing quality control, and minimizing wastage. AI algorithms can analyze this data to predict equipment failures, identify quality issues, and optimize supply chain management (Rauschecker and Devaraj, 2019).

Another development in industrial engineering is the increasing use of automation and robotics. Industrial robots are becoming more affordable and capable, allowing them to perform tasks that were previously done by humans. This has the potential to increase efficiency, reduce labor costs, and improve worker safety.

Finally, there is a growing emphasis on sustainability and environmental impact in industrial engineering. Industrial engineers are increasingly concerned with reducing waste, minimizing energy consumption, and developing more environmentally friendly processes. In various industries, ranging from manufacturing to healthcare, industrial engineering assumes a vital role. Its focus on efficiency, productivity, and quality makes it a key driver of economic growth and development. With the continued development of IoT, AI, automation, and sustainability initiatives, industrial engineering is poised to become even more important in the years to come.

1.2 INDUSTRIAL ENGINEERING APPLICATIONS

Industrial engineering is a field that has a wide range of applications across many industries. Its focus on optimizing processes and systems can improve efficiency, productivity, quality, and safety. Here are some of the key applications of industrial engineering:

- **Manufacturing**: The application of industrial engineering in manufacturing is commonly utilized to enhance production processes, minimize waste, and enhance quality control. This can involve the design of manufacturing systems, the optimization of supply chain management, and the development of quality control systems.
- **Healthcare**: In healthcare, industrial engineering can be applied to improve patient flow, reduce wait times, and optimize resource utilization. This can involve the design of hospital layouts, the development of scheduling systems, and the analysis of patient data to identify areas for improvement (Liu and Wang 2018).
- **Transportation**: Industrial engineering is used in transportation to optimize logistics, reduce fuel consumption, and improve safety. This can involve the optimization of transportation networks, the design of routing systems, and the development of safety systems.
- **Service industries**: Industrial engineering can be applied in service industries such as banking, hospitality, and retail to improve customer service, reduce wait times, and optimize resource utilization. This can involve the design of service systems, the development of scheduling systems, and the optimization of supply chain management.
- **Energy**: In the energy industry, industrial engineering is used to optimize energy production processes, reduce waste, and improve safety. This can involve the optimization of energy production systems, the development of safety systems, and the analysis of data to identify areas for improvement (Sundmaeker et al., 2010).
- **Construction**: Industrial engineering is applied in construction to optimize construction processes, reduce waste, and improve safety. This can involve the design of construction processes, the optimization of resource utilization, and the development of safety systems.
- **Agriculture**: In agriculture, industrial engineering can be used to optimize farming processes, reduce waste, and improve resource utilization. This can involve the design of farming systems, the optimization of supply chain management, and the development of safety systems.

Overall, industrial engineering has a wide range of applications across many industries. Its focus on optimizing processes and systems can improve efficiency, productivity, quality, and safety, making it an essential field for driving economic growth and development.

1.3 ARTIFICIAL INTELLIGENCE

AI can be used to optimize production processes, detect quality issues before they become serious, and predict supply chain disruptions. AI has significant implications for society as a whole.

One of the challenges of AI is the development of explainable AI, which refers to the ability to understand how AI algorithms make decisions. This is important for ensuring that AI is transparent and accountable, and for identifying and mitigating any biases or errors in the algorithms. Explainable AI demands the development of techniques and algorithms that can provide explanations for AI decisions, such as decision trees, rule-based systems, and feature importance analysis (Manyika et al., 2011).

Ethical AI involves developing algorithms and techniques that are designed to minimize bias, ensure privacy and security, and prevent harm to individuals and society. AI is also rapidly transforming the nature of work and employment.

It is important to develop techniques for identifying and mitigating bias in AI algorithms, such as ensuring diverse representation in the data used for training, and regularly auditing AI systems for bias. Another challenge of AI is the development of secure AI, which refers to the ability to protect AI systems from cyber-attacks and other security threats. AI systems are vulnerable to various types of attacks, such as adversarial attacks, where malicious actors intentionally manipulate the input data to deceive the AI algorithm, and data poisoning attacks, where malicious actors intentionally inject biased or malicious data into the training data to manipulate the AI algorithm. It is important to develop techniques for securing AI systems and ensuring that they are resilient to cyber-attacks. Despite these challenges, the future of AI is promising, with significant potential for further advancements and applications.

Integration of AI with other emerging technologies, such as the IoT, blockchain, and 5G could lead to new applications and benefits, such as more efficient and automated supply chains, more personalized healthcare, and smarter cities. AI is a rapidly evolving field with significant applications and implications for society. It is important to develop appropriate policies and regulations to ensure that AI is used responsibly and ethically, and to continue to invest in research and development to advance the field and realize its full potential.

However, the deployment of AI also raises concerns around energy consumption and the environmental impact of AI hardware, as well as the potential for unintended consequences and unforeseen environmental impacts. AI is a transformative technology with significant implications for society, the economy, and the environment (Zeng et al., 2019).

Machine Learning (ML) is a highly significant application of AI that entails the creation of algorithms which are capable of learning from data without the need for explicit programming (Bhambri, 2020). The field of machine learning can be broadly classified into three main categories, namely reinforcement learning, supervised learning and unsupervised learning. Supervised learning involves the training of a model on labeled data, wherein the right result is already established. Conversely, unsupervised learning pertains to the process of instructing a model

with un-annotated data, wherein the accurate output is unknown. Reinforcement learning is a machine learning technique that entails instructing an instance to make decisions by utilizing a reward and punishment system.

The field of AI encompasses various applications, among which Natural Language Processing (NLP) holds a prominent position. NLP involves the development of algorithms that are capable of comprehending and processing human language. NLP encompasses a wide array of practical implementations, such as language translation, speech recognition, sentiment analysis, and chatbot development (Sumathi et al., 2021). AI has noteworthy implications in diverse sectors, such as finance, healthcare, transportation, & manufacturing. AI has the potential to enhance patient outcomes, decrease expenses, and boost efficiency in the healthcare sector (Bali et al. 2023). AI has the potential to be utilized in the analysis of medical images, resulting in more precise diagnoses. Additionally, AI can be employed in the monitoring of patient health, enabling the detection of potential health concerns before they escalate into critical conditions (Kumar et al., 2022). AI has the potential to enhance fraud detection, risk management, and customer service within the finance industry. AI has the potential to be utilized in the analysis of financial data to identify fraudulent transactions. Additionally, it can offer tailored financial guidance to customers according to their unique requirements and objectives. AI has the potential to enhance efficiency, safety, and sustainability in the field of transportation. AI has the potential to enhance transportation networks by optimizing them, mitigating traffic congestion, and enhancing fuel efficiency (Rani et al., 2022). AI has the potential to enhance quality control, productivity, and supply chain management in the manufacturing industry (Kataria et al. 2022). AI has the potential to enhance production processes, identify quality concerns in advance, and anticipate potential disruptions in the supply chain. AI carries substantial ramifications for the broader society (Rana et al., 2020). The phenomenon under consideration possesses the capacity to generate noteworthy economic and societal advantages, yet it simultaneously engenders ethical and societal apprehensions, including but not limited to issues of privacy, bias, and displacement of employment. Given the increasing sophistication and ubiquity of AI, it is imperative to contemplate these apprehensions and formulate suitable protocols and guidelines to guarantee the responsible and ethical utilization of AI (Sangwan et al., 2021).

A significant hurdle in the field of AI pertains to the advancement of explainable AI. This concept pertains to the capacity to comprehend the decision-making process of AI algorithms. Ensuring the transparency and accountability of AI is crucial, as it enables identification and mitigation of any biases or lapses present in the algorithms. The concept of Explainable AI pertains to the creation of algorithms and methodologies that are capable of furnishing justifications for the decisions made by AI. This may include the utilization of rule-based systems, decision trees, and feature importance analysis.

The development of ethical AI poses a significant challenge in the field of Artificial Intelligence. This pertains to the utilization of AI in a manner that aligns with ethical principles, including but not limited to fairness, transparency, accountability, and the upholding of human rights (Babu et al., 2021). The concept of ethical Artificial Intelligence pertains to the creation of algorithms and methodologies that aim to

reduce partiality, guarantee confidentiality and protection, and forestall any detrimental effects on both individuals and the community. The impact of Artificial Intelligence on the field of work and employment is undergoing rapid transformation (Li et al., 2015). AI possesses the capacity to generate novel employment prospects, however, it also harbors the potential to mechanize numerous jobs, thereby resulting in displacement of employment and unemployment. As AI continues to progress and become more integrated into various industries, it is crucial to contemplate the potential consequences for the labor force and establish suitable policies and initiatives to guarantee that employees are adequately equipped to adapt to the evolving work landscape (Bhambri and Gupta, 2012).

The likelihood for discrimination prejudice in AI algorithms is considered to be one of the biggest effects of AI on society. The level of impartiality exhibited by AI algorithms is contingent upon the impartiality of the data utilized in their training. In the event that the data is partial, the algorithm will additionally be partial (Bakshi et al., 2021). The phenomenon under consideration has the potential to engender discriminatory practices in various domains, including but not limited to employment, financial transactions, and the criminal justice system, thereby reinforcing preexisting disparities in society. The development of techniques for recognizing and minimizing discrimination in AI algorithms is crucial. This can be achieved by ensuring different representations in the information used in training and conducting regular audits of AI systems to detect any bias (Kothandaraman et al., 2022). An additional obstacle in the field of Artificial Intelligence pertains to the advancement of secure AI, denoting the capacity to safeguard AI systems against cyber-assaults and other forms of security hazards (Hossain et al., 2017). AI systems are susceptible to different forms of attacks, including adversarial attacks and data poisoning attacks. Adversarial attacks involve the deliberate manipulation of input data by malicious actors to mislead the AI algorithm, while data poisoning attacks involve the intentional injection of biased or fraudulent information into the training info to alter the AI algorithm (Kothandaraman et al., 2022). The development of techniques aimed at securing AI systems while improving their resilience to cyber-attacks is of paramount importance. Notwithstanding these obstacles, the outlook for Artificial Intelligence is encouraging, as there exists substantial potential for additional progress and utilization. The advancement of Artificial General Intelligence (AGI) is a subject of significant interest, as it pertains to the creation of Artificial Intelligence that can perform any cognitive task that a human is capable of. The development of AGI would constitute a noteworthy advancement in the field of AI and has the potential to generate numerous novel applications and advantages for the community Gupta et al., 2011).

An additional field of inquiry pertains to the amalgamation of AI with other nascent technologies, including the IoT, blockchain, and 5G. The integration of various technologies has the potential to result in novel applications and advantages, including streamlined and automatic supply chains, customized healthcare services, and intelligent urban environments. The field of Artificial Intelligence is characterized by a swift pace of development and holds substantial potential for societal applications and ramifications. AI possesses the capacity to generate substantial advantages; however, it simultaneously elicits ethical and societal

apprehensions that necessitate resolution. The formulation of suitable policies and regulations is crucial in ensuring the responsible and ethical utilization of AI. Additionally, sustained investment in development & research is necessary to further the progress of the field and fully actualize its capabilities. Moreover, it is anticipated that AI will have a substantial influence on the labor market and the characteristics of employment (Anand and Bhambri, 2018). AI possesses the capability to generate novel employment prospects; however, it also harbors the potential to mechanize numerous extant jobs, particularly ones that entail monotonous duties. The aforementioned scenario has the potential to result in the displacement of jobs, necessitating the acquisition of novel skills and expertise by workers in order to maintain their competitiveness in the labor market (Gubbi et al., 2013). It is imperative for policymakers as well as business entities to acknowledge and tackle the potential ramifications of the advent of Artificial Intelligence and formulate effective measures to facilitate the welfare of employees and ensure a fair and equitable transition to an economy driven by AI (Ritu and Bhambri, 2022). Furthermore, it is anticipated that Artificial Intelligence will have noteworthy ramifications for the healthcare industry. AI possesses the capability to enhance healthcare results through the facilitation of precise diagnoses, customized treatment plans, and streamlined healthcare administration (Rachna et al., 2022). AI algorithms have the potential to be trained using medical images as well as patient data, which can lead to precise disease diagnosis and identification of optimal treatment options. AI has the potential to facilitate the creation of customized treatment plans that take into account an individual's distinct genetic profile and medical background. The implementation of AI in the healthcare sector has given rise to apprehensions regarding ethical considerations, privacy, and security. One of the major concerns is the possibility of AI exacerbating the existing healthcare disparities (Bhambri and Gupta, 2014).

AI possesses the capability to considerably influence the environment and environmental sustainability (Kaur and Bhambri, 2020). AI has the potential to enhance the efficiency and sustainability of manufacturing processes, optimize consumption of energy in buildings and travel, and monitor and mitigate the effects of climate change (Huang et al., 2017). AI has the potential to enhance the efficiency of systems that generate electricity from renewable sources, for example windmills & solar panels, through optimization of their placement and operation (Kaur et al., 2019). The implementation of AI technology gives rise to apprehensions regarding its consumption of energy and the ecological implications of AI hardware. Additionally, there exists a possibility of inadvertent outcomes and unanticipated environmental effects. AI is a technology that has the potential to bring about significant transformations with far-reaching implications for various aspects of the economy, society, and the environment. AI possesses the capacity to generate substantial advantages; however, it also elicits noteworthy societal, ethical, and environmental apprehensions that necessitate attention. Continuous communication and cooperation among policymakers, corporations, and individuals are crucial to guarantee the ethical, responsible, and sustainable development and implementation of AI. This approach should priorities the advancement of the common good and the enhancement of the overall welfare of all members of society.

1.4 INTERNET OF THINGS

The IoT refers to a system of interconnected devices that are capable of communicating with one another and sharing data via the internet, without the need for human intervention. The IoT is swiftly revolutionizing diverse sectors such as manufacturing, healthcare, transportation, and agriculture, by facilitating instantaneous data analysis and informed decision-making. This section aims to present a thorough exposition of the IoT, encompassing its conceptualization, structural framework, practical implementations, and associated obstacles.

1.4.1 IoT Definition and Architecture

The term IoT refers to the interconnection of tangible entities such as structures, automobiles, and devices, which are equipped with software, network connectivity, and sensors. The interconnectivity of these devices facilitates the acquisition and transmission of data. The IoT is structured into three distinct layers, namely the network layer, the perception layer, and the application layer. The stratum of perception encompasses a range of technological apparatus, including RFID tags, sensors, and analogous devices, which are responsible for gathering data from the surrounding milieu. The network layer provides connectivity among the devices, and the application layer comprises software applications that analyze the data and provide insights.

1.4.2 IoT Applications

IoT is revolutionizing multiple sectors, such as manufacturing, healthcare, transportation, and agriculture. The healthcare sector leverages IoT devices to monitor the patients' well-being and vital signs, thereby facilitating remote medical treatment and diagnosis by physicians. IoT devices find various applications in different industries. In manufacturing, these devices are utilized for monitoring equipment performance, identifying faults, and optimizing maintenance schedules. In transportation, they are employed for tracking the location of vehicles, monitoring fuel efficiency, and enhancing safety. In agriculture, IoT devices are utilized for monitoring environmental factors such as soil moisture, temperature, etc., to optimize crop yield (Rani et al., 2022).

1.5 OTHER TECHNOLOGIES IN INDUSTRIAL PROCESSES

The use of technology has transformed industrial processes by increasing efficiency, reducing costs, and improving product quality. From automation to Artificial Intelligence, there are many technologies that businesses can leverage to streamline their operations and stay ahead of the competition. This section explores some of the most significant technologies used in industrial processes and their impact on the industry (Bhambri and Gupta, 2014).

- Automation: The term "automation" pertains to the utilization of computers, machines, and robots in executing tasks that were previously accomplished by human beings. Automation has been widely adopted in industrial

processes to reduce labor costs and improve productivity. For example, in manufacturing, robots are used to assemble products, paint, and weld. This allows companies to produce goods more quickly, efficiently, and with fewer errors. The benefits of automation in industrial processes are many. Firstly, automation reduces the likelihood of human error, which can lead to product defects and quality issues. Secondly, automation improves production speed and output, as machines can work 24/7 without breaks or fatigue. Thirdly, automation can reduce the need for manual labor, which can save companies money on wages and benefits (Singh et al., 2020).

- Artificial Intelligence: AI has revolutionized industrial processes. AI pertains to the replication of human intellect in machines which are designed to emulate human thinking and learning processes (Bandyopadhyay and Sen, 2011). AI is used in many industrial processes, such as predictive maintenance, quality control, and logistics. One of the primary benefits of AI in industrial processes is its ability to improve predictive maintenance. With AI, machines can analyze data from sensors and other sources to predict when equipment is likely to fail. This allows companies to schedule maintenance in advance, reducing downtime and repair costs. AI is also used in quality control, where it can identify defects and anomalies in products more quickly and accurately than humans (Vijayalakshmi et al., 2021).
- Internet of Things: IoT pertains to a system of interconnected devices that are capable of sharing data amongst themselves. In industrial processes, IoT is used to monitor equipment, track inventory, and optimize energy consumption. IoT devices can be connected to sensors and other devices, allowing companies to collect data and analyze it to improve efficiency and reduce waste. One of the primary benefits of IoT in industrial processes is its ability to provide real-time data. With IoT, companies can monitor equipment and processes in real time, allowing them to make adjustments on the fly to improve efficiency and reduce waste. IoT can also be used to track inventory, ensuring that companies have the right amount of supplies on hand at all times (Bhambri et al., 2023).
- Augmented Reality: Augmented Reality (AR) is a technological innovation that overlays computer-generated visual content onto the physical environment. In industrial processes, AR is used to provide workers with information and instructions while they are performing tasks. AR can be used to overlay instructions onto machines, allowing workers to see exactly what they need to do in real-time. One of the primary benefits of AR in industrial processes is its ability to improve worker productivity and safety. With AR, workers can receive instructions and information without having to consult manuals or other materials. This can reduce the likelihood of errors and accidents, improving worker safety and reducing downtime (Bhambri et al., 2022).
- Cloud Computing: Cloud computing pertains to the utilization of off-site servers for the purpose of storing, organizing, and manipulating data. In industrial processes, cloud computing is used to store and analyze data from sensors and other devices. Cloud computing can provide companies

with real-time insights into their operations, allowing them to make better decisions and improve efficiency (Atzori et al., 2010). One of the primary benefits of cloud computing in industrial processes is its ability to provide real-time data analysis. With cloud computing, companies can analyze data from sensors and other devices in real-time, allowing them to make decisions quickly and effectively. Cloud computing can also reduce the need for on-premise hardware, reducing costs and improving scalability (Bhambri et al., 2021).

- Blockchain: The blockchain technology offers a decentralized and secure method for the storage and dissemination of information. In industrial processes, blockchain can be used to create a tamper-proof record of transactions, improving transparency and reducing the likelihood of fraud.
- 3D Printing: Additive manufacturing, commonly referred to as 3D printing, is a cutting-edge technology that enables the creation of three-dimensional objects by depositing successive layers of material on top of one another. The utilization of 3D printing technology in industrial processes has the potential to produce prototypes and finalized products, thereby decreasing production costs and lead times (Bose et al., 2021).
- Virtual Reality: The technology of Virtual Reality (VR) generates a computer-generated environment that enables users to engage in interactive experiences. In industrial processes, VR can be used to train workers on new processes and equipment, allowing them to gain experience in a safe and controlled environment (Singh et al., 2021).

Technology has transformed industrial processes in many ways. Various technological advancements, such as automation, AI, IoT, AR, and cloud computing, have the potential to enhance operational efficiency, minimize expenses, and elevate product standards for enterprises. By adopting these technologies, companies can stay ahead of the competition and remain relevant in an increasingly competitive marketplace. However, it is important to note that the adoption of technology in industrial processes is not without challenges. For example, there may be resistance to change from workers who fear job loss due to automation. Additionally, there may be concerns around cyber-security and data privacy when using cloud computing and internet of things technologies (Kuzhaloli et al., 2020). To overcome these challenges, it is important for businesses to involve their workers in the adoption of technology and provide training and support to help them adapt to new processes. Additionally, businesses should prioritize cyber-security and data privacy when implementing new technologies, ensuring that proper measures are in place to protect sensitive information (Rani et al., 2023a). On the whole, the advantages of incorporating technology into industrial operations surpass the obstacles. The adoption of novel technologies by enterprises can enhance operational effectiveness, curtail expenses, and elevate the caliber of their merchandise, thereby enabling them to attain prosperity in a constantly changing commercial sphere (Jabeen et al., 2021).

Overall, the use of technology in industrial processes will continue to evolve and transform the industry. As new technologies emerge, businesses will need to stay up to date and be willing to adapt to remain competitive. By utilizing cutting-edge

technologies, enterprises can enhance operational effectiveness, curtail expenses, and elevate product standards, thereby positioning themselves for triumph in an intensifying competitive landscape (Al-Fuqaha et al., 2015).

1.6 APPLICATIONS OF AI AND IoT IN IE

AI and IoT are two technologies that have gained a lot of attention in recent years, and for good reason. These technologies are revolutionizing industrial engineering and enabling businesses to improve their processes, reduce costs, and increase efficiency. In this section, we will explore the applications of AI and IoT in industrial engineering and discuss their potential impact.

1.6.1 Applications of AI in Industrial Engineering

Following are the applications of Artificial Intelligence in industrial engineering:

- Predictive Maintenance: Artificial Intelligence has the capability to forecast equipment malfunction in advance, thereby allowing enterprises to execute maintenance procedures prior to the occurrence of a potential breakdown. This approach has the potential to decrease the amount of time that equipment is out of service and result in cost savings associated with maintenance and repairs.
- Quality Control: Artificial Intelligence has the capability to monitor manufacturing processes and identify any defects in real time. This can both improve product quality and reduce waste.
- Production Planning: AI has the potential to enhance production scheduling and minimize wastage. Through the examination of data such as consumer demand and stock levels, Artificial Intelligence has the ability to generate production strategies that are characterized by enhanced efficiency and cost-effectiveness.
- Supply Chain Management: The implementation of AI has the potential to enhance supply chain management through its ability to forecast demand, minimize inventory, and detect potential disruptions. This can improve efficiency and reduce costs (Chui et al., 2016).
- Autonomous Vehicles: AI can be used to enable autonomous vehicles, such as drones and self-driving trucks, to navigate industrial environments. This can improve safety and efficiency in logistics operations.

1.6.2 Applications of IoT in Industrial Engineering

Following are the applications of Artificial Intelligence in industrial engineering:

- Remote Monitoring: The utilization of IoT sensors enables remote monitoring of equipment and processes, thereby facilitating the identification of potential issues prior to their escalation into significant problems, thereby benefiting businesses. The implementation of this measure has the potential

to decrease operational downtime and result in cost savings for maintenance expenses.

- Predictive Maintenance: The utilization of IoT sensors has the potential to facilitate the monitoring of equipment and identification of indications of deterioration, thereby allowing enterprises to conduct maintenance activities proactively and prevent unexpected equipment failures. The implementation of this measure has the potential to decrease periods of inactivity and result in cost savings associated with maintenance (Bhambri & Gupta, 2013).
- Asset Tracking: The utilization of IoT sensors enables the monitoring of the current location and condition of equipment as well as inventory in a timely manner. The implementation of this approach has the potential to enhance the management of supply chain operations and mitigate the occurrence of theft and loss.
- Energy Management: The implementation of IoT sensors in manufacturing facilities and distribution centres can facilitate the monitoring of energy consumption, thereby allowing businesses to pinpoint areas that require optimization and ultimately curtail expenses.
- Condition Monitoring: The utilization of IoT sensors has the potential to facilitate the monitoring of equipment status and the early detection of potential issues, thereby mitigating the likelihood of significant problems. This can improve equipment reliability and reduce maintenance costs (Davenport and Ronanki, 2018).

1.6.3 Potential Impact of AI and IoT on Industrial Engineering

The potential ramifications of the integration of AI and IoT in the field of industrial engineering are considerable (Chen et al., 2019). Through the utilization of these technologies, enterprises can enhance operational effectiveness, curtail expenses, and augment output. For example, predictive maintenance can reduce downtime and save money on repairs, while quality control can improve product quality and reduce waste (Sharma and Bhambri, 2020). Autonomous vehicles can improve safety and efficiency in logistics operations, while remote monitoring and asset tracking can improve supply chain management. Additionally, the use of AI and IoT can enable businesses to make more informed decisions by providing real-time data and analytics. This can lead to better resource allocation, improved production planning, and more efficient supply chain management.

The applications of AI and IoT in industrial engineering are vast and diverse (Rani & Kaur, 2012). The implementation of these technologies harbors the possibility of transforming the industry through the enhancement of operational efficiency, the reduction of expenses, and the augmentation of output. Businesses that embrace these technologies will be better positioned for success in an increasingly competitive marketplace. Nevertheless, it is crucial to acknowledge that the implementation of AI and IoT in the field of manufacturing is not devoid of obstacles. Cyber security poses a significant challenge. The susceptibility of IoT devices to cyber-attacks necessitates that enterprises implement security protocols to

safeguard their networks and devices. Likewise, the efficacy of AI systems is contingent upon the quality of the data on which they are trained. Therefore, it is incumbent upon businesses to guarantee the precision and impartiality of their data (Devadutta et al., 2020). Another challenge is the fear of job loss. AI and IoT hold the potential to automate several tasks that were previously carried out by humans, which has raised concerns regarding job displacement. Effective communication of technological advantages and the provision of support and instruction to employees who may be affected by automation are crucial for businesses. Notwithstanding these obstacles, the prospective advantages of AI and IoT in the field of industrial engineering are noteworthy. As businesses continue to adopt these technologies, we can expect to see increased efficiency, reduced costs, and improved productivity in the industry (Bhambri et al., 2022).

To give a real-world example of the impact of AI and IoT in industrial engineering, let us consider the case of a manufacturer that produces automotive parts. By using IoT sensors to monitor its production lines, the manufacturer can detect defects in real time and make adjustments to its processes to improve quality. This can lead to a reduction in scrap and rework, as well as an improvement in customer satisfaction. Additionally, the manufacturer can use AI to optimize its production schedules, reducing lead times and improving efficiency. This can lead to a reduction in inventory and a decrease in production costs. By embracing these technologies, the manufacturer can stay ahead of the competition and remain relevant in an ever-evolving marketplace. The applications of AI and IoT in industrial engineering are numerous and diverse. The implementation of these technologies holds the promise of transforming the industry through enhancements in operational efficiency, cost reduction, and productivity amplification. Businesses that adopt these technologies will be better positioned for success in an increasingly competitive marketplace. It is imperative to acknowledge and tackle obstacles such as computer security and employment displacement in order to effectively actualize the advantages presented by these technologies.

With the ongoing advancements in AI and IoT, it is anticipated that industrial engineering will witness further sophisticated applications. For example, AI algorithms can be used to optimize complex manufacturing processes, such as chemical reactions, to reduce costs and improve efficiency. The utilization of IoT sensors for the purpose of monitoring environmental parameters, such as humidity and temperature, is a viable approach to guarantee the appropriate storage and transportation of goods under ideal circumstances. Furthermore, the use of AI and IoT can enable businesses to achieve sustainability goals by reducing waste and energy consumption. Another area where AI and IoT can make a significant impact is in the field of predictive maintenance. Through the utilization of sensors for equipment monitoring and the application of AI algorithms for data analysis, enterprises can anticipate equipment failure and undertake maintenance procedures in advance of any potential breakdown. The implementation of this approach has the potential to decrease the amount of time that a system is non-operational and result in cost savings with regards to maintenance. For example, in the oil and gas industry, predictive maintenance can help prevent equipment failures that could result in oil spills or other environmental disasters. The use of AI and IoT in industrial engineering also has

implications for the workforce. As automation becomes more prevalent, there will be a need for workers with new skills, such as data analytics and programming. This scenario provides a prospect for enterprises to allocate resources towards employee training and development, in order to ensure that their workforce possesses the necessary competencies required for the contemporary digital era. The ongoing advancements in AI and IoT are anticipated to yield more sophisticated industrial engineering applications. Enterprises that adopt these technologies are likely to be better situated for success in a dynamic marketplace.

1.7 CHALLENGES AND FUTURE RESEARCH DIRECTIONS

1.7.1 Challenges

The amalgamation of IoT and AI within the domain of industrial engineering poses a number of challenges that require resolution. Data management poses a significant challenge. IoT generates a massive amount of data, which must be collected, processed, analyzed, and stored. Industrial engineers must develop new data management strategies and tools that can handle this large amount of data efficiently.

Cyber security poses an additional challenge. The susceptibility of IoT devices to cyber-attacks poses a significant threat, as it may result in the compromise of confidential information or the interference with industrial operations. Industrial engineers must develop secure systems and protocols that can protect against cyber threats.

1.7.2 Opportunities

Despite the challenges, IoT and AI also offer significant opportunities for industrial engineering. The IoT offers a significant advantage by facilitating the instantaneous monitoring and management of industrial operations. This allows industrial engineers to identify and address problems as they arise, which can lead to increased efficiency and productivity.

AI offers a range of benefits, including predictive maintenance, predictive quality control, and predictive supply chain management. Through the analysis of data obtained from IoT devices, Artificial Intelligence has the capability to anticipate the occurrence of equipment failure, defects, and low inventory levels. This allows industrial engineers to take proactive measures to prevent problems from occurring, which can save time and money.

1.7.3 Future of Industrial Engineering with IoT and AI

The future of industrial engineering is closely tied to the development and implementation of IoT and AI. In the coming years, industrial engineers are likely to use these technologies to develop more efficient and effective processes, improve supply chain management, reduce waste and environmental impact, and improve worker safety.

IoT and AI are also likely to change the nature of work for industrial engineers. As machines become more intelligent and autonomous, industrial engineers may spend more time designing and optimizing processes, and less time on manual tasks. This

will require new skills and knowledge, as well as a shift in the way industrial engineers approach their work.

1.8 CONCLUSIONS

In conclusion, IoT and AI present both challenges and opportunities for industrial engineering. Industrial engineers must develop new data management strategies and cyber-security protocols to address the challenges posed by these technologies. At the same time, IoT and AI offer significant benefits, including real-time monitoring, predictive maintenance, and predictive quality control. The integration and implementation of these technologies are expected to shape the future of the industrial engineering field as they continue to advance.

REFERENCES

Al-Fuqaha, A., Guizani, M., Mohammadi, M., Aledhari, M., & Ayyash, M. (2015). Internet of things: A survey on enabling technologies, protocols, and applications. *IEEE Communication Surveys and Tutorials*, 17(4), 2347–2376.

Anand, A., & Bhambri, P. (2018). Character recognition system using radial features. *International Journal on Future Revolution in Computer Science & Communication Engineering*, 4(4), 599–602.

Atzori, L., Iera, A., & Morabito, G. (2010). The internet of things: A survey. *Computer Networks*, 54(15), 2787–2805.

Babu, G. C. N., Gupta, S., Bhambri, P., Leo, L. M., Rao, B. H., & Kumar, S. (2021). A semantic health observation system development based on the IoT sensors. *Turkish Journal of Physiotherapy and Rehabilitation*, 32(3), 1721–1729.

Bakshi, P., Bhambri, P., & Thapar, V. (2021). A review paper on wireless sensor network techniques in internet of things (IoT). *Wesleyan Journal of Research*, 14(7), 147–160.

Bali, V., Bali, S., Gaur, D., Rani, S., & Kumar, R. (2023). Commercial-off-the shelf vendor selection: A multi-criteria decision-making approach using intuitionistic fuzzy sets and TOPSIS. *Operational Research in Engineering Sciences: Theory and Applications*, 12(4), 100–113.

Bandyopadhyay, D., & Sen, J. (2011). Internet of things: Applications and challenges in technology and standardization. *Wireless Personal Communications*, 58(1), 49–69.

Bhambri, P. (2020). Green compliance. In S. Agarwal (Ed.), *Introduction to Green Computing* (pp. 95–125). AGAR Saliha Publication. ISBN: 978-81-948141-5-3.

Bhambri, P., & Gupta, O. P. (2012). A novel method for the design of phylogenetic tree. *International Journal of IT, Engineering and Applied Sciences Research*, 1(1), 24–28.

Bhambri, P., & Gupta, O. P. (2013). Design of distributed prefetching protocol in push-to-peer video-on-demand system. *International Journal of Research in Advent Technology*, 1(3), 95–103.

Bhambri, P., & Gupta, O. P. (2014). Dynamic frequency allocation scheme of mobile networks using priority assignment technique. *International Journal of Engineering and Technology Innovation*, 1(1), 9–12.

Bhambri, P., Singh, M., Dhanoa, I. S., & Kumar, M. (2022). Deployment of ROBOT for HVAC duct and disaster management. *Oriental Journal of Computer Science and Technology*, 15, 1–8.

Bhambri, P., Singh, M., Jain, A., Dhanoa, I. S., Sinha, V. K., & Lal, S. (2021). Classification of gene expression data with the aid of optimized feature selection. *Turkish Journal of Physiotherapy and Rehabilitation*, 32, 3.

Bhambri, P., Singh, S., Sangwan, S., Devi, J., & Jain, S. (2023). Plants recognition using leaf image pattern analysis. *Journal of Survey in Fisheries Sciences*, 10(2S), 3863–3871.

Bose, M. M., Yadav, D., Bhambri, P., & Shankar, R. (2021). Electronic customer relationship management: Benefits and pre-implementation considerations. *Journal of Maharaja Sayajirao University of Baroda*, 55(01(VI)), 1343–1350.

Chen, C., Li, X., & Li, X. (2019). A survey of industrial internet of things: A focus on architecture, applications, technologies, and security. *Journal of Industrial Information Integration*, 15, 100–120.

Chui, M., Manyika, J., & Bughin, J. (2016). The rise of the machines: Prospects and challenges for the internet of things. *McKinsey Global Institute*, 7, 1–11.

Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world: Don't start with moon shots. *Harvard Business Review*, 96(1), 108–116.

Devadutta, K., Bhambri, P., Gountia, D., Mehta, V., Mangla, M., Patan, R., Kumar, A., Agarwal, P.K., Sharma, A., Singh, M., & Gadicha, A.B. (2020). Method for Cyber Security in Email Communication among Networked Computing Devices [Patent application number 202031002649]. India.

Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2013). Internet of things (IoT): A vision, architectural elements, and future directions. *Future Generation Computer Systems*, 29(7), 1645–1660.

Gupta, O., Rani, S., & Pant, D. C. (2011). Impact of parallel computing on bioinformatics algorithms. In *Proceedings 5th IEEE International Conference on Advanced Computing and Communication Technologies* (pp. 206–209).

Hossain, M. S., Muhammad, G., & Muhammad, R. (2017). Industrial internet of things (IIoT): Challenges, opportunities, and directions. *Future Generation Computer Systems*, 82, 354–365.

Huang, J., Xu, W., & Li, L. (2017). Industrial big data analytics: Understanding, modeling and predicting maintenance problems. *Engineering Applications of Artificial Intelligence*, 60, 197–210.

Jabeen, A., Pallathadka, H., Pallathadka, L. K., & Bhambri, P. (2021). E-CRM successful factors for business enterprises case studies. *Journal of Maharaja Sayajirao University of Baroda*, 55(01(VI)), 1332–1342.

Kataria, A., Agrawal, D., Rani, S., Karar, V., & Chauhan, M. (2022). Prediction of blood screening parameters for preliminary analysis using neural networks. In *Predictive Modeling in Biomedical Data Mining and Analysis* (pp. 157–169). Academic Press.

Kaur, G., Kaur, R., & Rani, S. (2015). Cloud computing-a new trend in it era. *International Journal of Science, Technology and Management*, 4(6), 1–6.

Kaur, J., & Bhambri, P. (2020). *Hybrid classification model for the reverse code generation in software engineering*. I.K. Gujral Punjab Technical University.

Kaur, J., Bhambri, P., & Sharma, K. (2019). Wheat production analysis based on Naïve Bayes classifier. *International Journal of Analytical and Experimental Model Analysis*, 11(9), 705–709.

Kothandaraman, D., Manickam, M., Balasundaram, A., Pradeep, D., Arulmurugan, A., Sivaraman, A. K., … & Balakrishna, R. (2022). Decentralized link failure prevention routing (DLFPR) algorithm for efficient internet of things. *Intelligent Automation & Soft Computing*, 34(1), 655–666.

Kumar, P., Banerjee, K., Singhal, N., Kumar, A., Rani, S., Kumar, R., & Lavinia, C. A. (2022). Verifiable, secure mobile agent migration in healthcare systems using a polynomial-based threshold secret sharing scheme with a blowfish algorithm. *Sensors*, 22(22), 8620.

Kuzhaloli, S., Devaneyan, P., Sitaraman, N., Periyathanbi, P., Gurusamy, M., & Bhambri, P. (2020). IoT based Smart Kitchen Application for Gas Leakage Monitoring [Patent application number 202041049866A]. India.

Li, S., Xu, L. D., & Zhao, S. (2015). The internet of things: A survey of topics and trends. *Information Systems Frontiers*, 17(2), 261–274.

Liu, Y., & Wang, Z. (2018). Big data analytics with applications. *Journal of Computer Science and Technology*, 33(1), 223–224.

Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., & Byers, A. H. (2011). Big data: The next frontier for innovation, competition, and productivity. *McKinsey Global Institute*, 1, 1–149.

McAfee, A., & Brynjolfsson, E. (2017). *Machine, Platform, Crowd: Harnessing Our Digital Future*. WW Norton & Company.

Paika, E. V., & Bhambri, E. P. (2013). Edge detection-fuzzy inference system. *International Journal of Management & Information Technology*, 4(1), 148–155.

Qureshi, K. N., & Khan, M. A. (2019). Internet of things (IoT) for industrial applications: Challenges and solutions. *Wireless Networks*, 25(3), 1117–1136.

Rachna, R., Bhambri, P., & Chhabra, Y. (2022). Deployment of distributed clustering approach in WSNs and IoTs. In Pankaj Bhambri, Sita Rani, Gaurav Gupta, & Alex Khang (Eds.), *Cloud and Fog Computing Platforms for Internet of Things* (pp. 85–98). Chapman and Hall/CRC. https://www.routledge.com/Cloud-and-Fog-Computing-Platforms-for-Internet-of-Things/Bhambri-Rani-Gupta-Khang/p/book/9781032101507

Rana, R., Chabbra, Y., & Bhambri, P. (2020). Comparison of clustering approaches for enhancing sustainability performance in WSNs: A Study. In *Proceedings of the International Congress on Sustainable Development through Engineering Innovations* (pp. 62–71). ISBN 978-93-89947-14-4.

Rani, S., Bhambri, P., & Gupta, O. P. (2022). Green smart farming techniques and sustainable agriculture: Research roadmap towards organic farming for imperishable agricultural products. In Vikram Bali, Rajni Mohana, Ahmed A. Elngar, Sunil Kumar Chawla, & Gurpreet Singh (Eds.), *Handbook of Sustainable Development through Green Engineering and Technology* (pp. 49–67). CRC Press. https://www.routledge.com/Handbook-of-Sustainable-Development-Through-Green-Engineering-and-Technology/Bali-Mohana-Elngar-Chawla-Singh/p/book/9780367650926

Rani, S., Bhambri, P., Kataria, A., & Khang, A. (2023a). Smart city ecosystem: Concept, sustainability, design principles, and technologies. In Alex Khang, Sita Rani & Arun Kumar Sivaraman (Eds.), *AI-Centric Smart City Ecosystems* (pp. 1–20). CRC Press. https://www.taylorfrancis.com/books/edit/10.1201/9781003252542/ai-centric-smart-city-ecosystems-alex-khang-sita-rani-arun-kumar-sivaraman

Rani, S., Kataria, A., Kumar, S., & Tiwari, P. (2023b). Federated learning for secure IoMT-applications in smart healthcare systems: A comprehensive review. *Knowledge-Based Systems*, 110658, 1–15.

Rani, S., & Kaur, S. (2012). Cluster analysis method for multiple sequence alignment. *International Journal of Computer Applications*, 43(14), 19–25.

Rauschecker, U., & Devaraj, S. (2019). Artificial intelligence and the future of work. *MIS Quarterly Executive*, 18(3), 49–60.

Ritu, & Bhambri, P. (2022). A CAD System for Software Effort Estimation. *Paper presented at the International Conference on Technological Advancements in Computational Sciences* (pp. 140–146). IEEE. DOI: 10.1109/ICTACS56270.2022.9988123.

Sangwan, Y. S., Lal, S., Bhambri, P., Kumar, A., & Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. *NVEO-Natural Volatiles & Essential Oils Journal NVEO*, 8(4), 15353–15362.

Sharma, R., & Bhambri, P. (2020). *Energy aware bio inspired routing technique for mobile Adhoc networks*. I.K. Gujral Punjab Technical University.

Singh, G., Singh, M., & Bhambri, P. (2020). Artificial intelligence based flying car. In *Proceedings of the International Congress on Sustainable Development through Engineering Innovations* (pp. 216–227). ISBN 978-93-89947-14-4.

Singh, M., Bhambri, P., Lal, S., Singh, Y., Kaur, M., & Singh, J. (2021). Design of the effective technique to improve memory and time constraints for sequence alignment. *International Journal of Applied Engineering Research (Netherlands)*, 6(02), 127–142.

Sumathi, N., Thirumagal, J., Jagannathan, S., Bhambri, P., & Ahamed, I. N. (2021). A comprehensive review on bionanotechnology for the 21st century. *Journal of the Maharaja Sayajirao University of Baroda*, 55(1), 114–131.

Sundmaeker, H., Guillemin, P., Friess, P., & Woelfflé, S. (2010). Vision and challenges for realising the internet of things. *European Commission Information Society and Media*, 10(2), 1–1.

Tao, F., Zhang, M., & Venkatesh, V. C. (2019). Industrial internet of things and digital innovation: A convergence review. *International Journal of Production Research*, 57(7), 2117–2135.

Vijayalakshmi, P., Shankar, R., Karthik, S., & Bhambri, P. (2021). Impact of work from home policies on workplace productivity and employee sentiments during the Covid-19 pandemic. *Journal of Maharaja Sayajirao University of Baroda*, 55(01(VI)), 1314–1331.

Wang, X., & Liu, J. (2019). An overview of industrial internet of things. *Engineering*, 5(1), 28–40.

Zeng, X., Chen, H., Liao, J., & Wu, Z. (2019). Artificial intelligence-based smart manufacturing: A review. *Engineering*, 5(4), 676–687.

Challenges, Opportunities, and the Future of Industrial Engineering with IoT and AI

Al-Fuqaha, A. , Guizani, M. , Mohammadi, M. , Aledhari, M. , & Ayyash, M. (2015). Internet of things: A survey on enabling technologies, protocols, and applications. IEEE Communication Surveys and Tutorials, 17(4), 2347–2376.

Anand, A. , & Bhambri, P. (2018). Character recognition system using radial features. International Journal on Future Revolution in Computer Science & Communication Engineering, 4(4), 599–602.

Atzori, L. , Iera, A. , & Morabito, G. (2010). The internet of things: A survey. Computer Networks, 54(15), 2787–2805.

Babu, G. C. N. , Gupta, S. , Bhambri, P. , Leo, L. M. , Rao, B. H. , & Kumar, S. (2021). A semantic health observation system development based on the IoT sensors. Turkish Journal of Physiotherapy and Rehabilitation, 32(3), 1721–1729.

Bakshi, P. , Bhambri, P. , & Thapar, V. (2021). A review paper on wireless sensor network techniques in internet of things (IoT). Wesleyan Journal of Research, 14(7), 147–160.

Bali, V. , Bali, S. , Gaur, D. , Rani, S. , & Kumar, R. (2023). Commercial-off-the shelf vendor selection: A multi-criteria decision-making approach using intuitionistic fuzzy sets and TOPSIS. Operational Research in Engineering Sciences: Theory and Applications, 12(4), 100–113.

Bandyopadhyay, D. , & Sen, J. (2011). Internet of things: Applications and challenges in technology and standardization. Wireless Personal Communications, 58(1), 49–69.

Bhambri, P. (2020). Green compliance. In S. Agarwal (Ed.), Introduction to Green Computing (pp. 95–125). AGAR Saliha Publication. ISBN: 978-81-948141-5-3.

Bhambri, P. , & Gupta, O. P. (2012). A novel method for the design of phylogenetic tree. International Journal of IT, Engineering and Applied Sciences Research, 1(1), 24–28.

Bhambri, P. , & Gupta, O. P. (2013). Design of distributed prefetching protocol in push-to-peer video-on-demand system. International Journal of Research in Advent Technology, 1(3), 95–103.

Bhambri, P. , & Gupta, O. P. (2014). Dynamic frequency allocation scheme of mobile networks using priority assignment technique. International Journal of Engineering and Technology Innovation, 1(1), 9–12.

Bhambri, P. , Singh, M. , Dhanoa, I. S. , & Kumar, M. (2022). Deployment of ROBOT for HVAC duct and disaster management. Oriental Journal of Computer Science and Technology, 15, 1–8.

Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of gene expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, 32, 3.

Bhambri, P. , Singh, S. , Sangwan, S. , Devi, J. , & Jain, S. (2023). Plants recognition using leaf image pattern analysis. Journal of Survey in Fisheries Sciences, 10(2S), 3863–3871.

Bose, M. M. , Yadav, D. , Bhambri, P. , & Shankar, R. (2021). Electronic customer relationship management: Benefits and pre-implementation considerations. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1343–1350.

Chen, C. , Li, X. , & Li, X. (2019). A survey of industrial internet of things: A focus on architecture, applications, technologies, and security. Journal of Industrial Information Integration, 15, 100–120.

Chui, M. , Manyika, J. , & Bughin, J. (2016). The rise of the machines: Prospects and challenges for the internet of things. McKinsey Global Institute, 7, 1–11.

Davenport, T. H. , & Ronanki, R. (2018). Artificial intelligence for the real world: Don’t start with moon shots. Harvard Business Review, 96(1), 108–116.

Devadutta, K. , Bhambri, P. , Gountia, D. , Mehta, V. , Mangla, M. , Patan, R. , Kumar, A. , Agarwal, P.K. , Sharma, A. , Singh, M. , & Gadicha, A.B. (2020). Method for Cyber Security in Email Communication among Networked Computing Devices [Patent application number 202031002649]. India.

Gubbi, J. , Buyya, R. , Marusic, S. , & Palaniswami, M. (2013). Internet of things (IoT): A vision, architectural elements, and future directions. Future Generation Computer Systems, 29(7), 1645–1660.

Gupta, O. , Rani, S. , & Pant, D. C. (2011). Impact of parallel computing on bioinformatics algorithms. In Proceedings 5th IEEE International Conference on Advanced Computing and Communication Technologies (pp. 206–209).

Hossain, M. S. , Muhammad, G. , & Muhammad, R. (2017). Industrial internet of things (IIoT): Challenges, opportunities, and directions. Future Generation Computer Systems, 82, 354–365.

Huang, J. , Xu, W. , & Li, L. (2017). Industrial big data analytics: Understanding, modeling and predicting maintenance problems. Engineering Applications of Artificial Intelligence, 60, 197–210.

Jabeen, A. , Pallathadka, H. , Pallathadka, L. K. , & Bhambri, P. (2021). E-CRM successful factors for business enterprises case studies. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1332–1342.

Kataria, A. , Agrawal, D. , Rani, S. , Karar, V. , & Chauhan, M. (2022). Prediction of blood screening parameters for preliminary analysis using neural networks. In Predictive Modeling in Biomedical Data Mining and Analysis (pp. 157–169). Academic Press.

Kaur, G. , Kaur, R. , & Rani, S. (2015). Cloud computing-a new trend in it era. International Journal of Science, Technology and Management, 4(6), 1–6.

Kaur, J. , & Bhambri, P. (2020). Hybrid classification model for the reverse code generation in software engineering. I.K. Gujral Punjab Technical University.

Kaur, J. , Bhambri, P. , & Sharma, K. (2019). Wheat production analysis based on Naïve Bayes classifier. International Journal of Analytical and Experimental Model Analysis, 11(9), 705–709.

Kothandaraman, D. , Manickam, M. , Balasundaram, A. , Pradeep, D. , Arulmurugan, A. , Sivaraman, A. K. , … & Balakrishna, R. (2022). Decentralized link failure prevention routing (DLFPR) algorithm for efficient internet of things. Intelligent Automation & Soft Computing, 34(1), 655–666.

Kumar, P. , Banerjee, K. , Singhal, N. , Kumar, A. , Rani, S. , Kumar, R. , & Lavinia, C. A. (2022). Verifiable, secure mobile agent migration in healthcare systems using a polynomial-based threshold secret sharing scheme with a blowfish algorithm. Sensors, 22(22), 8620.

Kuzhaloli, S. , Devaneyan, P. , Sitaraman, N. , Periyathanbi, P. , Gurusamy, M. , & Bhambri, P. (2020). IoT based Smart Kitchen Application for Gas Leakage Monitoring [Patent application number 202041049866A]. India.

Li, S. , Xu, L. D. , & Zhao, S. (2015). The internet of things: A survey of topics and trends. Information Systems Frontiers, 17(2), 261–274.

Liu, Y. , & Wang, Z. (2018). Big data analytics with applications. Journal of Computer Science and Technology, 33(1), 223–224.

Manyika, J. , Chui, M. , Brown, B. , Bughin, J. , Dobbs, R. , Roxburgh, C. , & Byers, A. H. (2011). Big data: The next frontier for innovation, competition, and productivity. McKinsey Global Institute, 1, 1–149.

McAfee, A. , & Brynjolfsson, E. (2017). Machine, Platform, Crowd: Harnessing Our Digital Future. WW Norton & Company.

Paika, E. V. , & Bhambri, E. P. (2013). Edge detection-fuzzy inference system. International Journal of Management & Information Technology, 4(1), 148–155.

Qureshi, K. N. , & Khan, M. A. (2019). Internet of things (IoT) for industrial applications: Challenges and solutions. Wireless Networks, 25(3), 1117–1136.

Rachna, R. , Bhambri, P. , & Chhabra, Y. (2022). Deployment of distributed clustering approach in WSNs and IoTs. In Pankaj Bhambri , Sita Rani , Gaurav Gupta , & Alex Khang (Eds.), Cloud and Fog Computing Platforms for Internet of Things (pp. 85–98). Chapman and Hall/CRC. https://www.routledge.com/Cloud-and-Fog-Computing-Platforms-for-Internet-of-Things/Bhambri-Rani-Gupta-Khang/p/book/9781032101507

Rana, R. , Chabbra, Y. , & Bhambri, P. (2020). Comparison of clustering approaches for enhancing sustainability performance in WSNs: A Study. In Proceedings of the International Congress on Sustainable Development through Engineering Innovations (pp. 62–71). ISBN 978-93-89947-14-4.

Rani, S. , Bhambri, P. , & Gupta, O. P. (2022). Green smart farming techniques and sustainable agriculture: Research roadmap towards organic farming for imperishable agricultural products. In Vikram Bali , Rajni Mohana , Ahmed A. Elngar , Sunil Kumar Chawla , & Gurpreet Singh (Eds.), Handbook of Sustainable Development through Green Engineering and Technology (pp. 49–67). CRC Press. https://www.routledge.com/Handbook-of-Sustainable-Development-Through-Green-Engineering-and-Technology/Bali-Mohana-Elngar-Chawla-Singh/p/book/9780367650926

Rani, S. , Bhambri, P. , Kataria, A. , & Khang, A. (2023a). Smart city ecosystem: Concept, sustainability, design principles, and technologies. In Alex Khang , Sita Rani & Arun Kumar Sivaraman (Eds.), AI-Centric Smart City Ecosystems (pp. 1–20). CRC Press.

https://www.taylorfrancis.com/books/edit/10.1201/9781003252542/ai-centric-smart-city-ecosystems-alex-khang-sita-rani-arun-kumar-sivaraman
Rani, S. , Kataria, A. , Kumar, S. , & Tiwari, P. (2023b). Federated learning for secure IoMT-applications in smart healthcare systems: A comprehensive review. Knowledge-Based Systems, 110658, 1–15.
Rani, S. , & Kaur, S. (2012). Cluster analysis method for multiple sequence alignment. International Journal of Computer Applications, 43(14), 19–25.
Rauschecker, U. , & Devaraj, S. (2019). Artificial intelligence and the future of work. MIS Quarterly Executive, 18(3), 49–60.
Ritu , & Bhambri, P. (2022). A CAD System for Software Effort Estimation. *Paper presented at the* International Conference on Technological Advancements in Computational Sciences (pp. 140–146). IEEE. DOI: 10.1109/ICTACS56270.2022.9988123.
Sangwan, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. , & Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. NVEO-Natural Volatiles & Essential Oils Journal NVEO, 8(4), 15353–15362.
Sharma, R. , & Bhambri, P. (2020). Energy aware bio inspired routing technique for mobile Adhoc networks. I.K. Gujral Punjab Technical University.
Singh, G. , Singh, M. , & Bhambri, P. (2020). Artificial intelligence based flying car. In Proceedings of the International Congress on Sustainable Development through Engineering Innovations (pp. 216–227). ISBN 978-93-89947-14-4.
Singh, M. , Bhambri, P. , Lal, S. , Singh, Y. , Kaur, M. , & Singh, J. (2021). Design of the effective technique to improve memory and time constraints for sequence alignment. International Journal of Applied Engineering Research (Netherlands), 6(02), 127–142.
Sumathi, N. , Thirumagal, J. , Jagannathan, S. , Bhambri, P. , & Ahamed, I. N. (2021). A comprehensive review on bionanotechnology for the 21st century. Journal of the Maharaja Sayajirao University of Baroda, 55(1), 114–131.
Sundmaeker, H. , Guillemin, P. , Friess, P. , & Woelfflé, S. (2010). Vision and challenges for realising the internet of things. European Commission Information Society and Media, 10(2), 1–1.
Tao, F. , Zhang, M. , & Venkatesh, V. C. (2019). Industrial internet of things and digital innovation: A convergence review. International Journal of Production Research, 57(7), 2117–2135.
Vijayalakshmi, P. , Shankar, R. , Karthik, S. , & Bhambri, P. (2021). Impact of work from home policies on workplace productivity and employee sentiments during the Covid-19 pandemic. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1314–1331.
Wang, X. , & Liu, J. (2019). An overview of industrial internet of things. Engineering, 5(1), 28–40.
Zeng, X. , Chen, H. , Liao, J. , & Wu, Z. (2019). Artificial intelligence-based smart manufacturing: A review. Engineering, 5(4), 676–687.

Evolution and the Future of Industrial Engineering with the IoT and AI

Adhikari, M. , & Munusamy, A. (2021). ICovidCare: Intelligent health monitoring framework for COVID-19 using ensemble random forest in edge networks. Internet of Things, 14, 100385. https://doi.org/10.1016/j.iot.2021.100385
Anand, A. , & Bhambri, P. (2018). Character recognition system using radial features. International Journal on Future Revolution in Computer Science & Communication Engineering, 4(4), 599–602.
Arya, V. , Rani, S. , & Choudhary, N. (2022). Enhanced bio-inspired trust and reputation model for wireless sensor networks. In Proceedings of Second Doctoral Symposium on Computational Intelligence: DoSCI 2021 (pp. 569–579). Springer Singapore.
Babu, G. C. N. , Gupta, S. , Bhambri, P. , Leo, L. M. , Rao, B. H. , & Kumar, S. (2021). A semantic health observation system development based on the IoT sensors. Turkish Journal of Physiotherapy and Rehabilitation, 32(3), 1721–1729.
Bakshi, P. , & Bhambri, P. (2021, March). A Review Paper on Wireless Sensor Network Techniques in Internet of Things (IOT). Wesleyan Journal of Research, 14(07), 147–160, ISSN:

0975-1386.
Bali, V. , Bali, S. , Gaur, D. , Rani, S. , & Kumar, R. (2023). Commercial-off-the shelf vendor selection: A multi-criteria decision-making approach using intuitionistic fuzzy sets and TOPSIS. Operational Research in Engineering Sciences: Theory and Applications, 12(4), 100–113.
Bhambri, P. , Aggarwal, M. , Singh, H. , Singh, A. P. , & Rani, S. (2022). Uprising of EVs: Charging the future with demystified analytics and sustainable development. In Decision Analytics for Sustainable Development in Smart Society 5.0: Issues, Challenges and Opportunities (pp. 37–53). Singapore: Springer Nature Singapore.
Bhambri, P. , Dhanoa, I. S. , Sinha, V. K. , & Kaur, J. (2020). Paddy crop production analysis based on SVM and KNN classifier. International Journal of Recent Technology and Engineering, 8(5), 2791–2793.
Bhambri, P. , & Gupta, O. P. (2012). A novel method for the design of phylogenetic tree. Int J IT Eng Appl Sci Res, 1(1), 24–28.
Bhambri, P. , & Gupta, O. P. (2013). Design of distributed prefetching protocol in push-to-peer video-on-demand system. Int J Res Advent Technol, 1(3), 95–103.
Bhambri, P. , & Gupta, O. P. (2014). Dynamic frequency allocation scheme of mobile networks using priority assignment technique. Int J Eng Technol Innov, 1(1), 9–12.
Bhambri, P. , & Gupta, O. P. (2016). Phylogenetic tree construction with optimum multiple sequence alignment. Biological Forum-An International Journal, 8(2), 330–339.
Bhambri, P. , & Gupta, O. P. (2017). Applying distributed processing for different distance based methods during phylogenetic tree construction. Asian Journal of Computer Science and Information Technology, 7(3), 57–67.
Bhambri, P. , & Gupta, O. P. (2018). Implementing Machine Learning Algorithms for Distance based Phylogenetic Trees. I.K. Gujral Punjab Technical University, Jalandhar.
Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of gene expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, 32, 3.
Bhambri, P. , Singh, S. , Sangwan, S. , Devi, J. , & Jain, S. (2023). Plants recognition using leaf image pattern analysis. Journal of Survey in Fisheries Sciences, 10(2S), 3863–3871.
Bhambri, P. , Sinha, V. K. , & Jaiswal, M. (2019). Change in iris dimensions as a potential human consciousness level indicator. International Journal of Innovative Technology and Exploring Engineering, 8(9S), 517–525.
Bose, M. M. , Yadav, D. , Bhambri, P. , & Shankar, R. (2021). Electronic customer relationship management: Benefits and pre-implementation considerations. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1343–1350.
Bousdekis, A. , Apostolou, D. , & Mentzas, G. (2020). A human cyber physical system framework for operator 4.0 – Artificial intelligence symbiosis. Manufacturing Letters, 25, 10–15. https://doi.org/10.1016/j.mfglet.2020.06.001
Chauhan, M. , & Rani, S. (2021). COVID-19: A revolution in the field of education in India. Learning How to Learn Using Multimedia, 1, 23–42.
Cioffi, R. , Travaglioni, M. , Piscitelli, G. , Petrillo, A. , & De Felice, F. (2020). Artificial intelligence and machine learning applications in smart production: Progress, trends, and directions. Sustainability, 12(2), 492. https://doi.org/10.3390/su12020492
Dal Mas, F. , Bagnoli, C. , Massaro, M. , & Biazzo, S. (2021). Smart technologies and new business models: Insights from artificial intelligence and blockchain. SIDREA Series in Accounting and Business Administration, 271–285. https://doi.org/10.1007/978-3-030-80737-5_21
Devadutta, K. , Bhambri, P. , Gountia, D. , Mehta, V. , Mangla, M. , Patan, R. , Kumar, A. , Agarwal, P. K. , Sharma, A. , Singh, M. , & Gadicha, A.B. (2020). Method for Cyber Security in Email Communication among Networked Computing Devices [Patent application number 202031002649]. India.
Dhanalakshmi, R. , Anand, J. , Sivaraman, A. K. , & Rani, S. (2022). IoT-based water quality monitoring system using cloud for agriculture use. In Cloud and fog computing platforms for internet of things (pp. 183–196). Chapman and Hall/CRC.
Dhanoa, I.S. , & Bhambri, P. (2020). Traffic-aware energy efficient VM migrations. Journal of Critical Reviews, 7(19), 177–183.
Gordon, N. , & Moore, K. W. (2022). The effects of artificial intelligence (AI) enabled personality assessments during team formation on team cohesion. Information Systems and Neuroscience,

311–318. https://doi.org/10.1007/978-3-031-13064-9_31
Gupta, B. B. , Tewari, A. , Cvitić, I. , Peraković, D. , & Chang, X. (2021). Artificial intelligence empowered emails classifier for Internet of things based systems in industry 4.0. Wireless Networks, 28(1), 493–503. https://doi.org/10.1007/s11276-021-02619-w
Gupta, O. , Rani, S. , & Pant, D. C. (2011). Impact of parallel computing on bioinformatics algorithms. In Proceedings 5th IEEE International Conference on Advanced Computing and Communication Technologies (pp. 206–209).
Haleem, A. , Javaid, M. , Singh, R. P. , & Suman, R. (2021). Applications of artificial intelligence (AI) for cardiology during COVID-19 pandemic. Sustainable Operations and Computers, 2, 71–78. https://doi.org/10.1016/j.susoc.2021.04.003
Hansen, E. B. , & Bøgh, S. (2021). Artificial intelligence and Internet of things in small and medium-sized enterprises: A survey. Journal of Manufacturing Systems, 58, 362–372. https://doi.org/10.1016/j.jmsy.2020.08.009
Hofmann, E. , Sternberg, H. , Chen, H. , Pflaum, A. , & Prockl, G. (2019). Supply chain management and industry 4.0: Conducting research in the digital age. International Journal of Physical Distribution & Logistics Management, 49(10), 945–955. https://doi.org/10.1108/ijpdlm-11-2019-399
Jabeen, A. , Pallathadka, H. , Pallathadka, L. K. , & Bhambri, P. (2021). E-CRM successful factors for business enterprises case studies. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1332–1342.
Jain, A. , Singh, M. , & Bhambri, P. (2021a). Performance evaluation of IPv4-IPv6 tunneling procedure using IoT. Journal of Physics: Conference Series, 1950(1), 012010. https://doi.org/10.1088/1742-6596/1950/1/012010
Jain, A. , Singh, M. , & Bhambri, P. (2021b, August). Performance Evaluation of IPv4-IPv6 Tunneling Procedure Using IoT. In Journal of Physics: Conference Series (Vol. 1950, No. 1, p. 012010). IOP Publishing.
Javaid, M. , & Haleem, A. (2019). Industry 4.0 applications in medical field: A brief review. Current Medicine Research and Practice, 9(3), 102–109. https://doi.org/10.1016/j.cmrp.2019.04.001
Karaca, K. N. , & Cetin, A. (2021). Botnet attack detection using convolutional neural networks in the IoT environment. 2021 International Conference on Innovations in Intelligent Systems and Applications (INISTA). https://doi.org/10.1109/inista52262.2021.9548445
Kaur, H. , & Bhambri, P. (2016). A prediction technique in data mining for the diabetes mellitus. Apeejay Journal of Management Sciences and Technology, 4(1), 1–12.
Kaur, J. , & Bhambri, P. (2019). Various DNA sequencing techniques and related applications. International Journal of Analytical and Experimental Model Analysis, 11(9), 3104–3111.
Kaur, J. , & Bhambri, P. (2020). Hybrid Classification Model for the Reverse Code Generation in Software Engineering. Jalandhar: I.K. Gujral Punjab Technical University.
Kaur, J. , Bhambri, P. , & Sharma, K. (2019). Wheat production analysis based on NaÃve Bayes classifier. International Journal of Analytical and Experimental Model Analysis, *11* (9), 705–709.
Kaur, K. , Dhanoa, I. S. , & Bhambri, P. (2020, December). Optimized PSO-EFA Algorithm for Energy Efficient Virtual Machine Migrations. In 2020 5th IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE) (pp. 1–5). IEEE.
Kaur, R. , & Bhambri, P. (2015). Information retrieval system for hospital management. International Journal of Multidisciplinary Consortium, 2(4), 16–21.
Koh, L. , Orzes, G. , & Jia, F. (2019). The fourth industrial revolution (Industry 4.0): Technologies disruption on operations and supply chain management. International Journal of Operations & Production Management, 39(6/7/8), 817–828. https://doi.org/10.1108/ijopm-08-2019-788
Kothandaraman, D. , Manickam, M. , Balasundaram, A. , Pradeep, D. , Arulmurugan, A. , Sivaraman, A. K. , … & Balakrishna, R. (2022). Decentralized link failure prevention routing (DLFPR) algorithm for efficient internet of things. Intelligent Automation & Soft Computing, 34(1), 1–23.
Kshirsagar, P. R. , Jagannadham, D. B. V. , Ananth, M. B. , Mohan, A. , Kumar, G. , & Bhambri, P. (2022, May). Machine learning algorithm for leaf disease detection. In AIP Conference Proceedings (Vol. 2393, No. 1, p. 020087). AIP Publishing LLC.
Kumar, P. , Banerjee, K. , Singhal, N. , Kumar, A. , Rani, S. , Kumar, R. , & Lavinia, C. A. (2022). Verifiable, secure mobile agent migration in healthcare systems using a polynomial-

based threshold secret sharing scheme with a blowfish algorithm. Sensors, 22(22), 8620.
Kuzhaloli, S. , Devaneyan, P. , Sitaraman, N. , Periyathanbi, P. , Gurusamy, M. , & Bhambri, P. (2020). IoT based Smart Kitchen Application for Gas Leakage Monitoring [Patent application number 202041049866A]. India.
Oswal, N. , Ateeq, K. , & Mathew, S. (2021). Trends in recruitment information and communication system using artificial intelligence in industry 4.0. Proceedings of the 3rd International Conference on Finance, Economics, Management and IT Business. https://doi.org/10.5220/0010503201110118
Paika, E. V. , & Bhambri, E. P. (2013). Edge detection-fuzzy inference system. International journal of management & Information Technology, 4(1), 148–155.
Panda, S. K. , Reddy, G. S. M. , Goyal, S. B. , Thirunavukkarasu, K. , Bhambri, P. , Rao, M. V. , Singh, A. S. , Fakih, A. H. , Shukla, P. K. , Shukla, P. K. , Gadicha, A. B. , & Shelke, C. J. (2019). Method for Management of Scholarship of Large Number of Students based on Blockchain (Patent No. IN201911034937A).
Pereira, A. G. , Lima, T. M. , & Charrua-Santos, F. (2020). Industry 4.0 and society 5.0: Opportunities and threats. International Journal of Recent Technology and Engineering (IJRTE), 8(5), 3305–3308. https://doi.org/10.35940/ijrte.d8764.018520
Peres, R. S. , Jia, X. , Lee, J. , Sun, K. , Colombo, A. W. , & Barata, J. (2020). Industrial artificial intelligence in industry 4.0 – Systematic review, challenges and outlook. IEEE Access, *8* , 220121–220139. https://doi.org/10.1109/access.2020.3042874
Potluri, S. , Tiwari, P. K. , Bhambri, P. , Obulesu, O. , Naidu, P. A. , Lakshmi, L. , Kallam, S. , Gupta, S. , & Gupta, B. (2019). Method of Load Distribution Balancing for Fog Cloud Computing in IoT Environment [Patent number IN201941044511].
Rachna, R. , Bhambri, P. , & Chhabra, Y. (2022). Deployment of distributed clustering approach in WSNs and IoTs. Cloud and Fog Computing Platforms for Internet of Things, 85–98. https://doi.org/10.1201/9781003213888-7
Rachna, R. , Chhabra, Y. , & Bhambri, P. (2020). Comparison of Clustering Approaches for Enhancing Sustainability Performance in WSNSL a Study. TEQIP-III Sponsored International Conference on Sustainable Development Through Engineering Innovations (pp. 62–71), ISBN: 978-93-89947-14-4.
Rachna, R. , Chhabra, Y. , & Bhambri, P. (2021). Various approaches and algorithms for monitoring energy efficiency of wireless sensor networks. Lecture Notes in Civil Engineering, 761–770. https://doi.org/10.1007/978-981-15-9554-7_68
Radanliev, P. , De Roure, D. , Nicolescu, R. , Huth, M. , & Santos, O. (2021a). Artificial intelligence and the Internet of things in industry 4.0. CCF Transactions on Pervasive Computing and Interaction, 3(3), 329–338. https://doi.org/10.1007/s42486-021-00057-3
Radanliev, P. , De Roure, D. , Nicolescu, R. , Huth, M. , & Santos, O. (2021b). Digital twins: Artificial intelligence and the IoT cyber-physical systems in industry 4.0. International Journal of Intelligent Robotics and Applications, 6(1), 171–185. https://doi.org/10.1007/s41315-021-00180-5
Rana, R. (2018, March). A review on evolution of wireless sensor network. International Journal of Advanced Research Trends in Engineering and Technology (IJARTET), 5. Available at www.ijartet.com
Rana, R. , Chhabra, Y. , & Bhambri, P. (2019). A Review on Development and Challenges in Wireless Sensor Network. International Multidisciplinary Academic Research Conference (IMARC, 2019), (pp. 184–188), ISBN: 978-81-942282-0-2.
Rana, R. , Chhabra, Y. , & Bhambri, P. (2021a). Comparison and evaluation of various QoS parameters in WSNs with the implementation of enhanced low energy adaptive efficient distributed clustering approach, Webology, 18(1), (ISSN: 1735-188X).
Rana, R. , Chhabra, Y. , & Bhambri, P. (2021b). Design and development of distributed clustering approach in wireless sensor network. Webology, 18(1), (ISSN: 1735-188X).
Rani, S. , Arya, V. , & Kataria, A. (2022c). Dynamic pricing-based E-commerce model for the produce of organic farming in India: A research roadmap with main advertence to vegetables. In Proceedings of Data Analytics and Management: ICDAM 2021, Volume 2 (pp. 327–336). Springer Singapore.
Rani, S. , Bhambri, P. , & Gupta, O. P. (2022b). Green smart farming techniques and sustainable agriculture: Research roadmap towards organic farming for imperishable agricultural products. In Handbook of Sustainable Development through Green Engineering and Technology (pp. 49–67). CRC Press.

Rani, S. , & Gupta, O. P. (2016). Empirical analysis and performance evaluation of various GPU implementations of protein BLAST. International Journal of Computer Applications, *151* (7), 22–27.

Rani, S. , Kataria, A. , & Chauhan, M. (2022a). Cyber security techniques, architectures, and design. In Holistic approach to quantum cryptography in cyber security (pp. 41–66). CRC Press.

Rani, S. , Mishra, K. R. , Usman, M. , Kataria, A. , Kumar, P. , Bhambri, P. , & Mishra, K. A. (2021). Amalgamation of advanced technologies for sustainable development of smart city environment: A review. IEEE Access, 9, 150060–150087.

Ribeiro, J. , Lima, R. , Eckhardt, T. , & Paiva, S. (2021). Robotic process automation and artificial intelligence in industry 4.0 – A literature review. Procedia Computer Science, 181, 51–58. https://doi.org/10.1016/j.procs.2021.01.104

Riley, C , J Vrbka & Z Rowland (2021). Internet of things-enabled sustainability, big data-driven decision-making processes, and digitized mass production in industry 4.0-based manufacturing systems. Journal of Self-Governance and Management Economics, 6(1), 42. https://doi.org/10.22381/jsme9120214

Ritu, P. , & Bhambri, P. (2023, February 17). Software effort estimation with machine learning – A systematic literature review. In Agile Software Development: Trends, Challenges and Applications (pp. 291–308). John Wiley & Sons, Inc.

Sanchez, M. , Exposito, E. , & Aguilar, J. (2020). Autonomic computing in manufacturing process coordination in industry 4.0 context. Journal of Industrial Information Integration, 19, 100159. https://doi.org/10.1016/j.jii.2020.100159

Sangwan, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. , & Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. NVEO-Natural Volatiles & Essential Oils Journal|NVEO, 8(4), 15353–15362.

Sharma, R. , & Bhambri, P. (2020). Energy Aware Bio Inspired Routing Technique for Mobile Adhoc Networks. Jalandhar: I.K. Gujral Punjab Technical University.

Sharma, R. , Bhambri, P. , & Sohal, K. A. (2020a, February). Mobile adhoc networks. JAC: A Journal of Composition Theory, XIII(2), 982–985, ISSN: 0731-6755.

Sharma, R. , Bhambri, P. , & Sohal, K. A. (2020b, March). Energy bio-inspired for MANET. International Journal of Recent Technology and Engineering (IJRTE), 8(6), 5581–5585. https://doi.org/10.35940/ijrte.F8522.038620

Singh, A. P. , Aggarwal, M. , Singh, H. , & Bhambri, P. (2021b). Sketching of EV network: A complete roadmap. Lecture Notes in Civil Engineering, 431–442. https://doi.org/10.1007/978-981-15-9554-7_37

Singh, G. , Singh, M. , & Bhambri, P. (2020). Artificial Intelligence Based Flying Car. In Proceedings of the International Congress on Sustainable Development through Engineering Innovations (pp. 216–227), ISBN 978-93-89947-14-4.

Singh, M. , Bhambri, P. , Singh, I. , Jain, A. , & Kaur, E. K. (2021a). Data mining classifier for predicting diabetics. Annals of the Romanian Society for Cell Biology, 25(4), 6702–6712.

Sinha, V. K. , Jeet 2D, R. , Bhambri, P. , & Mahajan, M. (2020). Empowering intrusion detection in iris recognition system: A review. Journal of Natural Remedies, 21(2), 131–153.

Soni, K. , Kumar, N. , Nair, A. S. , Chourey, P. , Singh, N. J. , & Agarwal, R. (2022). Artificial intelligence. Handbook of Metrology and Applications, 1–23. https://doi.org/10.1007/978-981-19-1550-5_54-2

Sumathi, N. , Thirumagal, J. , Jagannathan, S. , Bhambri, P. , & Ahamed, I. N. (2021). A comprehensive review on bionanotechnology for the 21st century. Journal of the Maharaja Sayajirao University of Baroda, 55(1), 114–131.

Tondon, N. , & Bhambri, P. (2017). Technique for drug discovery in medical image processing. International Journal of Advance Research in Science & Engineering, 6(8), 1712–1718.

Vijayalakshmi, P. , Shankar, R. , Karthik, S. , & Bhambri, P. (2021). Impact of work from home policies on workplace productivity and employee sentiments during the covid-19 pandemic. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1314–1331.

Wang, Z. , Shou, M. , Wang, S. , Dai, R. , & Wang, K. (2019). An empirical study on the key factors of intelligent upgrade of small and medium-sized enterprises in China. Sustainability, *11* (3), 619. https://doi.org/10.3390/su11030619

Applications of Artificial Intelligence and Internet of Things IoT in Marketing

Adobe Sensei Team . Adobe. AI: Your behind-the-scenes marketing companion. https://www.adobe.com/insights/sensei-ai-for-marketers.html (Accessed 7 June 2019).

Adobe . Artificial intelligence unlocks the true power of analytics. https://www.adobe.com/au/insights/ai-unlocks-the-true-power-of-analytics.html (Accessed 4 June 2019).

Agrawal, A. (2020). How the IoT helps transform the field in different impactful ways – From machine efficiency to worker safety, CustomerThink, February 21. Retrieved from http://customerthink.com/how-the-iothelps-transform-the-field-in-different-impactful-ways-from-machine-efficiency-to-worker-safety/?

Anand, A. and Bhambri, P. (2018). Character recognition system using radial features. International Journal on Future Revolution in Computer Science & Communication Engineering, 4(4), 599–602.

Bali, V. , Bali, S. , Gaur, D. , Rani, S. and Kumar, R. (2023). Commercial-off-the shelf vendor selection: A multi-criteria decision-making approach using intuitionistic fuzzy sets and TOPSIS. Operational Research in Engineering Sciences: Theory and Applications, 12(4), 100–113.

Bhambri, P. and Chhabra, Y. (2022). Deployment of distributed clustering approach in WSNs and IoTs. In Pankaj Bhambri , Sita Rani , Gaurav Gupta , Alex Khang (Eds.), Cloud and Fog Computing Platforms for Internet of Things (pp. 85–98). Chapman and Hall/CRC.

Bhambri, P. , Dhanoa, I. S. , Sinha, V. K. and Kaur, J. (2020). Paddy crop production analysis based on SVM and KNN classifier. International Journal of Recent Technology and Engineering, 8(5), 2791–2793.

Bughin, J. , Catlin, T. and LaBerge, L. (2019). A Winning Operating Model for Digital Strategy, Digital McKinsey, McKinsey & Company, January. Retrieved from https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/a-winning-operating-model-for-digital-strategy

Chaffey, D. (2019a). 15 applications of artificial intelligence in marketing, Smart Insights, 31 January. Retrieved from https://www.smartinsights.com/managing-digital-marketing/marketing-innovation/15-applications-artificialintelligence-marketing/

Chaffey, D. (2019b). 15 marketing applications of artificial intelligence across the RACE marketing model, Dr Dave Chaffey – Personal site, Digital Insights, 14 October. Retrieved from https://www.davechaffey.com/digital-marketingglossary/artificial-intelligence-for-marketing/

Chhabra, Y. and Bhambri, P. (2021). Various approaches and algorithms for monitoring energy efficiency of wireless sensor networks. In Sustainable Development Through Engineering Innovations: Select Proceedings of SDEI 2020 (pp. 761–770). Springer Singapore.

Clifford, Catherin . (2018). Google CEO: A.I. is more important than fire or electricity, CNBC.com. February 1, 2018. Retrieved from https://www.cnbc.com/2018/02/01/google-ceo-sundar-pichai-ai-is-more-important-than-fire-electricity.html (Accessed 6 June 2019).

Deakin, J. , LaBerge, L. and O'Beirne, B. (2019). Five Moves to Make During a Digital Transformation, McKinsey &Company, April. Retrieved from https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/five-moves-to-make-during-a-digital-transformation

Dhanalakshmi, R. , Vijayaraghavan, N. , Sivaraman, A. K. and Rani, S. (2020). Epidemic awareness spreading in smart cities using the artificial neural network. In Alex Khang , Sita Rani , Arun Kumar Sivaraman (Eds.), AI-Centric Smart City Ecosystems (pp. 187–207). CRC Press. https://www.taylorfrancis.com/books/edit/10.1201/9781003252542/ai-centric-smart-city-ecosystems-alex-khang-sita-rani-arun-kumar-sivaraman?refId=4f506ea6-341a-422c-b932-e03649e8f883&context=ubx

Derek, Thompson . (2018). The Atlantic. Where did all the advertising jobs go? February 7, 2018. Retrieved from https://www.theatlantic.com/business/archive/2018/02/advertising-jobs-programmatic-tech/552629/ (Accessed 1 June 2019).

Dooley, J. (2020). UX is the top brand differentiator among marketers in 2020, ClickZ, February 25. Retrieved from https://www.clickz.com/ux-is-the-top-brand-differentiator-among-marketers-

in-2020/
Enterprise Content Team . The magic of AI in a content-driven world. Using AI to create content faster. Retrieved from https://www.adobe.com/insights/the-magic-of-AI-in-a-content-driven-world.html (Accessed 5 June 2019).
https://appinventiv.com/blog/ai-and-iot-will-transform-your-business/
https://martechvibe.com/martech/top-10-applications-of-ai-in-marketing/
https://www.automationworld.com/process/iiot/article/21723170/iot-applied-to-marketing
https://www.clariontech.com/blog/ai-and-iot-blended-what-it-is-and-why-it-matters
https://www.i-scoop.eu/internet-of-things-iot/internet-things-marketing/
https://www.linkedin.com/pulse/15-applications-artificial-intelligence-marketing-robert-allen/
https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world
https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world
https://www.smartinsights.com/managing-digital-marketing/marketing-innovation/15-applications-artificial-intelligence-marketing/
https://www.techtarget.com/iotagenda/definition/Artificial-Intelligence-of-Things-AIoT#:~:text=AI%2Dintegrated%20IoT%20devices%20can,Data%20analytics%20done%20by%20AI
https://www.tutorialspoint.com/internet_of_things/internet_of_things_media_marketing_and_advertising.htm
IBM . How to get started with cognitive computing. https://www.ibm.com/watson/advantage-reports/getting-started-cognitivetechnology.html (Accessed 6 June 2019).
Jain, A. , Singh, M. and Bhambri, P. (2021, August). Performance evaluation of IPv4-IPv6 tunneling procedure using IoT. Journal of Physics: Conference Series, 1950(1), 012010.
Kaur, J. and Bhambri, P. (2019). Various DNA sequencing techniques and related applications. International Journal of Analytical and Experimental Model Analysis, 11(9), 3104–3111.
Kaur, J. , Bhambri, P. and Sharma, K. (2019). Wheat production analysis based on Naïve Bayes classifier. International Journal of Analytical and Experimental Model Analysis, 11(9), 705–709.
Kaur, K. , Dhanoa, I. S. and Bhambri, P. (2020, December). Optimized PSO-EFA algorithm for energy efficient virtual machine migrations. In 2020 5th IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE) (pp. 1–5). IEEE.
Levine, Barry . (2018). Marketingland.com. Adobe adds new features to its data management platform, December 3, 2018. Retrieved from https://marketingland.com/adobe-adds-new-features-to-its-data-management-platform-252944 (Accessed 2 June 2019).
Maruti Tech . 14 powerful chatbot platforms. Retrieved from https://www.marutitech.com/14-powerful-chatbot-platforms/ (Accessed 8 June 2019).
Puri, V. , Kataria, A. , Solanki, V. K. and Rani, S. (2022, December). AI-based botnet attack classification and detection in IoT devices. In 2022 IEEE International Conference on Machine Learning and Applied Network Technologies (ICMLANT) (pp. 1–5). IEEE.
Rani, S. , Kataria, A. , Sharma, V. , Ghosh, S. , Karar, V. , Lee, K. and Choi, C. (2021). Threats and corrective measures for IoT security with observance of cybercrime: A survey. Wireless Communications and Mobile Computing, *2021* , 1–30.
Rani, S. , Pareek, P. K. , Kaur, J. , Chauhan, M. and Bhambri, P. (2023, February). Quantum machine learning in healthcare: Developments and challenges. In 2023 IEEE International Conference on Integrated Circuits and Communication Systems (ICICACS) (pp. 1–7). IEEE.
Rachna, R. , Bhambri, P. and Chhabra, Y. (2022). Deployment of distributed clustering approach in WSNs and IoTs. In Pankaj Bhambri , Sita Rani , Gaurav Gupta , Alex Khang (Eds.), Cloud and Fog Computing Platforms for Internet of Things (pp. 85–98). Chapman and Hall/CRC.
Ritu, P. , and Bhambri, P. (2022). A CAD system for software effort estimation. *Paper presented at the* International Conference on Technological Advancements in Computational Sciences (pp. 140–146). IEEE. DOI: 10.1109/ICTACS56270.2022.9988123.
Ritu, P. and Bhambri, P. (2023, February 17). Software effort estimation with machine learning – A systematic literature review. In Susheela Hooda , Vandana Mohindru Sood , Yashwant Singh , Sandeep Dalal , Manu Sood (Eds.), Agile software development: Trends, challenges and applications (pp. 291–308). John Wiley & Sons, Inc.

Sangwan, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. and Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. NVEO-Natural Volatiles & Essential Oils Journal|NVEO, 8(4). 15353–15362.
Singh, A. P. , Aggarwal, M. , Singh, H. , and Bhambri, P. (2021a). Sketching of EV network: a Complete Roadmap. In Sustainable Development Through Engineering Innovations: Select Proceedings of SDEI 2020 (pp. 431–442). Springer Singapore.
https://www.statista.com/?kw=statista&crmtag=adwords&gclid=Cj0KCQjwxuCnBhDLARIsABcq1qE3kNDwfV7dZ8Hl3AgcZ2ntiUcvbehp3VwIl8b6FgRoLX8UUHHMwEaAiH_EALw_wcB (accessed on dated 04.04.2023)
Sinha, V. K. , Jeet 2D, R. , Bhambri, P. and Mahajan, M. (2020). Empowering intrusion detection in iris recognition system: A review. Journal of Natural Remedies, 21(2), 131–153.
Singh, M. , Bhambri, P. , Singh, I. , Jain, A. and Kaur, E. K. (2021b). Data mining classifier for predicting diabetics. Annals of the Romanian Society for Cell Biology, 25(4), 6702–6712.
Suthar, S. (2020). 6 proven ways to revamp your digital customer experience, CustomerThink, February 21. Retrieved from http://customerthink.com/6-proven-ways-to-revamp-your-digital-customer-experience/?
Sweeny, T. (2020). Best practices for support web site design, CustomerThink, February 20. Retrieved from http://customerthink.com/best-practices-for-support-web-site-design/?
Vecteezy.com Licence Attribution : Home Appliances Vectors by Vecteezy. https://www.vecteezy.com/free-vector/home-appliances
Vicioso, Sara . (2019). Seer interactive. Programmatic advertising 101: How it works, August 27, 2015. https://www.seerinteractive.com/blog/programmatic-advertising-101-works/ (Accessed 6 June 2019).
Zambito, T. (2014). The future of modern marketing is human-centered, Business 2 Community, May 17. Retrieved from https://www.business2community.com/marketing/future-modern-marketing-human-centered-

An Introduction to Multi-Objective Decision Programming with Fuzzy Parameters

Bellman, R. E. , & Zadeh, L. A. (1970). Decision-making in a fuzzy environment. Management Science, *17* (4), b-141–b-164. http://www.scopus.com/inward/record.url?eid=2-s2.0-0346636333&partnerID=40&md5=b5ef518469231f711aac4c2243d1e8ff
Biswas, A. , & Modak, N. (2012). A fuzzy goal programming approach for fuzzy multiobjective stochastic programming through expectation model. Communications in Computer and Information Science, *283 CCIS* (1), 124–135. https://doi.org/10.1007/978-3-642-28926-2_14
Biswas, A. , & Pal, B. B. (2005). Application of fuzzy goal programming technique to land use planning in agricultural system. Omega, *33* (5), 391–398. https://doi.org/10.1016/j.omega.2004.07.003
Chalam, G. (1994). Fuzzy goal programming (FGP) approach to a stochastic transportation problem under budgetary constraint. Fuzzy Sets and Systems, *66* (3), 293–299. https://doi.org/10.1016/0165-0114(94)90096-5
Chanas, S. , & Kuchta, D. (2002). Fuzzy goal programming – One notion, many meanings. Control and Cybernetics, *31* (4), 871–890.
Charnes, A. , & Cooper, W. W. (1977). Goal programming and Multi-objective optimization. European Journal of Operational Research, *1* , 39–54.
Chhabra, Y. , & Bhambri, P. (2021). Various Approaches and Algorithms for Monitoring Energy Efficiency of Wireless Sensor Networks. In Sustainable Development Through Engineering Innovations: Select Proceedings of SDEI 2020 (pp. 761–770). Springer Singapore.
Dangwal, R. , Sharma, M. K. , & Singh, P. (2013). A goal programming procedure for fuzzy multi-objective linear fractional problem in vague environment using tolerance. International Journal of Physics and Mathematical Sciences, *3* , 17–24.
Díaz-Madroñero, M. , Mula, J. , & Jiménez, M. (2014). Fuzzy goal programming for material requirements planning under uncertainty and integrity conditions. International Journal of Production Research, *52* (23), 6971–6988. https://doi.org/10.1080/00207543.2014.920115

Fazlollahtabar, H. , Akbari, F. , & Mahdavi, I. (2013). A fuzzy goal programming for optimizing service industry market using virtual intelligent agent. Journal of Industrial and Production Engineering, *30* (1), 20–29. https://doi.org/10.1080/10170669.2012.760493

Flavell, R. (1976). A new goal programming formulation. Omega, *4* (6), 731–732. https://doi.org/10.1016/0305-0483(76)90099-2

Ghiani, G. , Grieco, A. , Guerriero, E. , & Musmanno, R. (2003). Allocating production batches to subcontractors by fuzzy goal programming. International Transactions in Operational Research, *10* (3), 295–306. https://doi.org/10.1111/1475-3995.00408

Golany, B. , Yadin, M. , & Learner, O. (1991). A goal programming inventory control model applied at a large chemical plant. Production & Inventory Management Journal, *32* (1), 16–24. http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=7862877&amp%0Alang=es&site=ehost-live

Hajikarimi, A. , Rahmani, K. , & Farahmand, N. F. (2015). Designing a new model to improve productivity factors implementing the fuzzy goal programming method. Indian Journal of Science and Technology, *8* (S9), 9–15. https://doi.org/10.17485/ijst/2015/v8iS9/68545

Ignizio, J. P. (1976). Goal Programming and Extensions. Lexington Books, Lexington, MA. https://doi.org/10.2307/3009003

Ignizio, J. P. (1985). Multiobjective mathematical programming via the multiplex model and algorithm. European Journal of Operational Research, *22* (3), 338–346. https://doi.org/10.1016/0377-2217(85)90253-X

Ijiri, Y. (1965). Management Goals and Accounting for Control. Rand-McNally, Chicago, IL. https://doi.org/10.2307/3007458

Isermann, H. (1982). Linear lexicographic optimization. OR Spektrum, *4* (4), 223–228. https://doi.org/10.1007/BF01782758

Iskander, M. G. (2006). Exponential membership function in stochastic fuzzy goal programming. Applied Mathematics and Computation, *173* (2), 782–791. https://doi.org/10.1016/j.amc.2005.04.014

Iskander, M. G. (2015). Exponential membership functions in fuzzy goal programming: A computational application to a production problem in the textile industry. American Journal of Computational and Applied Mathematics, *5* (1), 1–6.

Jyoti , & Mannan, H. (2016). Goal programming: an application to financial estimation of and organization/institution. ELK Asia Pacific Journal of Finance, and Risk Management, *7* (1), 1–11.

Kaur, J. , & Bhambri, P. (2019). Various DNA sequencing techniques and related applications. International Journal of Analytical and Experimental Model Analysis, 11(9), 3104–3111.

Kaur, J. , Bhambri, P. , & Sharma, K. (2019). Wheat production analysis based on NaÃve Bayes classifier. International Journal of Analytical and Experimental Model Analysis, *11* (9), 705–709.

Kaur, K. , Dhanoa, I. S. , & Bhambri, P. (2020, December). Optimized PSO-EFA Algorithm for Energy Efficient Virtual Machine Migrations. In 2020 5th IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE) (pp. 1–5). IEEE.

Kumar, M. , Vrat, P. , & Shankar, R. (2004). A fuzzy goal programming approach for vendor selection problem in a supply chain. Computers and Industrial Engineering, *46* (1), 69–85. https://doi.org/10.1016/j.cie.2003.09.010

Lee, S. M. (1972). Goal Programming for Decision Analysis. Auerbach, Publishers Philadelphia, Pennsylvania (Vol. 14, Issue 2).

Malik, Z. A. , Kumar, R. , Roy, H. , & Pathak, G. (2019a). Multi-objective mathematical programming technique in the paper production. Glimpses, *9* (1), 380–394.

Malik, Z. A. , Kumar, R. , Singh, N. K. , Roy, H. , & Pathak, G. (2019b). Weighted goal programming approach in the bakery production planning problems. International Journal of Management, IT & Engineering, *7* (1), 548–556.

Mekidiche, M. , Belmokaddem, M. , & Djemmaa, Z. (2013). Weighted additive fuzzy goal programming approach to aggregate production planning. International Journal of Intelligent Systems and Applications, *5* (4), 20–29. https://doi.org/10.5815/ijisa.2013.04.02

Mohamed, R. H. (1997). The relationship between goal programming and fuzzy programming. Fuzzy Sets and Systems, *89* (2), 215–222. https://doi.org/10.1016/S0165-0114(96)00100-5

Naithani, V. , Dangwal, R. , & Kumar, A. (2016). A fuzzy goal programming approach for achieving sustainability in construction industry. Arya Bhatta Journal of Mathematics and Informatics, *8* (2), 253–260.

Orumie, U. C. , & Ebong, D. (2014). A glorious literature on linear goal programming algorithms. American Journal of Operations Research, *04* (02), 59–71. https://doi.org/10.4236/ajor.2014.42007

Pal, B. B. , & Moitra, B. N. (2003). Fuzzy Goal Programming Approach to Long Term Land Allocation Planning Problem in Agricultural System: A Case Study. Proceedings of the Fifth International Conference on Advances in Pattern Recognition (pp. 441–447), Allied Publishers Pvt. Ltd.

Pal, B. B. , Moitra, B. N. , & Maulik, U. (2003). A goal programming procedure for fuzzy multiobjective linear fractional programming problem. Fuzzy Sets and Systems, *139* (2), 395–405. https://doi.org/10.1016/S0165-0114(02)00374-3

Patel, N. , Thaker, M. , & Chaudhary, C. (2016). Study of some agricultural crop production planning condition through fuzzy multi-objective linear programming mathematical model. International Journal of Science and Research (IJSR), *5* (4), 1329–1332. https://doi.org/10.21275/v5i4.nov162766

Petrovic, D. , & Aköz, O. (2008). A fuzzy goal programming approach to integrated loading and scheduling of a batch processing machine. Journal of the Operational Research Society, *59* (9), 1211–1219. https://doi.org/10.1057/palgrave.jors.2602467

Ritu, P. , & Bhambri, P. (2023, February 17). Software Effort Estimation with Machine Learning – A Systematic Literature Review. In Susheela Hooda , Vandana Mohindru Sood , Yashwant Singh , Sandeep Dalal , Manu Sood (Eds.), Agile Software Development: Trends, Challenges and Applications (pp. 291–308). John Wiley & Sons, Inc.

Rivaz, S. , Nasseri, S. H. , & Ziaseraji, M. (2020). A fuzzy goal programming approach to multi-objective transportation problems. Fuzzy Information and Engineering, *12* (2), 139–149. https://doi.org/10.1080/16168658.2020.1794498

Romero, C. (2004). A general structure of achievement function for a goal programming model. European Journal of Operational Research, *153* (3), 675–686. https://doi.org/10.1016/S0377-2217(02)00793-2

Sherali, H. D. (1982). Equivalent weights for lexicographic multi-objective programs: Characterizations and computations. European Journal of Operational Research, *11* (4), 367–379. https://doi.org/10.1016/0377-2217(82)90202-8

Sherali, H. D. , & Soyster, A. L. (1983). Preemptive and nonpreemptive multi-objective programming: Relationship and counterexamples. Journal of Optimization Theory and Applications, *39* (2), 173–186. https://doi.org/10.1007/BF00934527

Singh, A. P. , Aggarwal, M. , Singh, H. , & Bhambri, P. (2021). Sketching of EV Network: A Complete Roadmap. In Sustainable Development Through Engineering Innovations: Select Proceedings of SDEI 2020 (pp. 431–442). Springer Singapore.

Toksarı, M. (2008). Taylor series approach to fuzzy multiobjective linear fractional programming. Information Sciences, *178* (4), 1189–1204. http://www.sciencedirect.com/science/article/pii/S0020025507002940

Tsai, K. M. , You, S. Y. , Lin, Y. H. , & Tsai, C. H. (2008). A fuzzy goal programming approach with priority for channel allocation problem in steel industry. Expert Systems with Applications, *34* (3), 1870–1876. https://doi.org/10.1016/j.eswa.2007.02.034

Yimmee, R. , & Phruksaphanrat, B. (2011). Fuzzy Goal Programming for Aggregate Production and Logistics Planning. IMECS 2011 – International MultiConference of Engineers and Computer Scientists 2011, *2* , 1082–1087.

Yu, G. F. , Li, D. F. , Liang, D. C. , & Li, G. X. (2021). An intuitionistic fuzzy multi-objective goal programming approach to portfolio selection. International Journal of Information Technology and Decision Making, *20* (5), 1477–1497. https://doi.org/10.1142/S0219622021500395

Zimmermann, H. J. (1976). Description and optimization of fuzzy systems. International Journal of General Systems, *2* (1), 209–215. https://doi.org/10.1080/03081077508960870

Zimmermann, H. J. (1978). Fuzzy programming and linear programming with several objective functions. Fuzzy Sets and Systems, *1* (1), 45–55. https://doi.org/10.1016/0165-0114(78)90031-3

Data Analytics

Anand, A. , & Bhambri, P. (2018). Character recognition system using radial features. International Journal on Future Revolution in Computer Science & Communication Engineering, *4* (4), 599–602.

Angrave, D. , Charlwood, A. , Kirkpatrick, I. , Lawrence, M. , & Stuart, M. (2016). HR and analytics: Why HR is set to fail the big data challenge. Human Resource Management Journal, *26* (1), 1–11. https://doi.org/10.1111/1748-8583.12090

Berk, L. , Bertsimas, D. , Weinstein, A. M. , & Yan, J. (2019). Prescriptive analytics for human resource planning in the professional services industry. European Journal of Operational Research, *272* (2), 636–641. https://doi.org/10.1016/j.ejor.2018.06.035

Bhambri, P. , Dhanoa, I. S. , Sinha, V. K. , & Kaur, J. (2020). Paddy crop production analysis based on SVM and KNN classifier. International Journal of Recent Technology and Engineering, *8* (5), 2791–2793.

Chhabra, Y. , & Bhambri, P. (2021). Various approaches and algorithms for monitoring energy efficiency of wireless sensor networks. In Sustainable Development through Engineering Innovations: Select Proceedings of SDEI 2020 (pp. 761–770). Springer Singapore.

Davenport, T. H. , Harris, J. , & Shapiro, J. (2010). Competing on Talent Analytics. www.hbr.org

Dhanalakshmi, R. , Vijayaraghavan, N. , Sivaraman, A. K. , & Rani, S. (2022). Epidemic awareness spreading in smart cities using the artificial neural network. In Alex Khang, Sita Rani , Arun Kumar Sivaraman (Eds.), AI-Centric Smart City Ecosystems (pp. 187–207). CRC Press.

Fitz-Enz, J. (2022). Advance Praise for the New HR Analytics. http://u.camdemy.com/sysdata/doc/f/fb30e8a98c5d9a85/pdf.pdf

Kalvakolanu, S. , & Madhavaiah, C. (2019). HR Analytics: The Emergence and Growth Higher Education View Project Management Issues View Project. https://doi.org/10.6084/m9.figshare.13601357

Kaur, J. , Bhambri, P. , & Sharma, K. (2019). Wheat production analysis based on Naïve Bayes classifier. International Journal of Analytical and Experimental Model Analysis, *11* (9), 705–709.

Kumar, P. , Banerjee, K. , Singhal, N. , Kumar, A. , Rani, S. , Kumar, R. , & Lavinia, C. A. (2022). Verifiable, secure mobile agent migration in healthcare systems using a polynomial-based threshold secret sharing scheme with a blowfish algorithm. Sensors, *22* (22), 8620.

Margherita, A. (2022). Human resources analytics: A systematization of research topics and directions for future research. Human Resource Management Review, *32* (2). https://doi.org/10.1016/j.hrmr.2020.100795

Mirski, P. , Bernsteiner, R. , & Radi, D. (2017). Analytics in human resource management: the OpenSKIMR approach. Procedia Computer Science, *122* , 727–734. https://doi.org/10.1016/j.procs.2017.11.430

Rani, S. , Kataria, A. , Kumar, S. , & Tiwari, P. (2023a). Federated learning for secure IoMT-applications in smart healthcare systems: A comprehensive review. Knowledge-Based Systems, *2* (3), 110658.

Rani, S. , Pareek, P. K. , Kaur, J. , Chauhan, M. , & Bhambri, P. (2023b, February). Quantum machine learning in healthcare: Developments and challenges. In 2023 IEEE International Conference on Integrated Circuits and Communication Systems (ICICACS) (pp. 1–7). IEEE.

Ritu, P. , & Bhambri, P. (2023, February 17). Software effort estimation with machine learning – A systematic literature review. In Susheela Hooda , Vandana Mohindru Sood , Yashwant Singh , Sandeep Dalal , Manu Sood (Eds.), Agile Software Development: Trends, Challenges and Applications (pp. 291–308). John Wiley & Sons, Inc.

Shet, S. V. , Poddar, T. , Wamba Samuel, F. , & Dwivedi, Y. K. (2021). Examining the determinants of successful adoption of data analytics in human resource management – A framework for implications. Journal of Business Research, *131* , 311–326. https://doi.org/10.1016/j.jbusres.2021.03.054

Singh, A. P. , Aggarwal, M. , Singh, H. , & Bhambri, P. (2021). Sketching of EV network: A complete roadmap. In Sustainable Development through Engineering Innovations: Select Proceedings of SDEI 2020 (pp. 431–442). Springer Singapore.

Wirges, F. , & Neyer, A. K. (2022). Towards a process-oriented understanding of HR analytics: Implementation and application. Review of Managerial Science. https://doi.org/10.1007/s11846-022-00574-0

Recent Advances on Deep Learning Based Thermal Infrared Object Tracking in Videos

Asha, C. S. , & Narasimhadhan, A. V. (2017). Robust infrared target tracking using discriminative and generative approaches. Infrared Physics & Technology, *85* , 114–127. https://doi.org/10.1016/j.infrared.2017.05.022

Berg, A. , Ahlberg, J. , & Felsberg, M. (2015). A thermal object tracking benchmark. 2015 12th IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS), 1–6. https://doi.org/10.1109/AVSS.2015.7301772

Bhambri, P. , Aggarwal, M. , Singh, H. , Singh, A. P. , & Rani, S. (2022). Uprising of EVs: Charging the future with demystified analytics and sustainable development. In Vikram Bali , Vishal Bhatnagar , Joan Lu , Kakoli Banerjee (Eds.), Decision Analytics for Sustainable Development in Smart Society 5.0: Issues, Challenges and Opportunities, 37–53. Springer Nature Singapore.

Bhambri, P. , Dhanoa, I. S. , Sinha, V. K. , & Kaur, J. (2020). Paddy crop production analysis based on SVM and KNN classifier. International Journal of Recent Technology and Engineering, *8* (5), 2791–2793.

Bondi, E. , Jain, R. , Aggrawal, P. , Anand, S. , Hannaford, R. , Kapoor, A. , Piavis, J. , Shah, S. , Joppa, L. , Dilkina, B. , & Tambe, M. (2020). BIRDSAI: A Dataset for Detection and Tracking in Aerial Thermal Infrared Videos. 1747–1756. https://openaccess.thecvf.com/content_WACV_2020/html/Bondi_BIRDSAI_A_Dataset_for_Detection_and_Tracking_in_Aerial_Thermal_WACV_2020_paper.html

Bourlai, T. , & Cukic, B. (2012). Multi-spectral face recognition: Identification of people in difficult environments. 2012 IEEE International Conference on Intelligence and Security Informatics, 196–201. https://doi.org/10.1109/ISI.2012.6284307

Chhabra, Y. , & Bhambri, P. (2021). Various approaches and algorithms for monitoring energy efficiency of wireless sensor networks. In Sustainable Development Through Engineering Innovations: Select Proceedings of SDEI 2020, 761–770. Springer Singapore.

Chugh, H. , Gupta, S. , & Garg, M. (2021). Image retrieval system – An integrated approach. IOP Conference Series: Materials Science and Engineering, *1022* (1), 012040. https://doi.org/10.1088/1757-899X/1022/1/012040

Ciaparrone, G. , Luque Sánchez, F. , Tabik, S. , Troiano, L. , Tagliaferri, R. , & Herrera, F. (2020). Deep learning in video multi-object tracking: A survey. Neurocomputing, *381* , 61–88. https://doi.org/10.1016/j.neucom.2019.11.023

Dhanalakshmi, R. , Anand, J. , Sivaraman, A. K. , & Rani, S. (2022). IoT-based water quality monitoring system using cloud for agriculture use. In Pankaj Bhambri , Sita Rani , Gaurav Gupta , Alex Khang (Ed.), Cloud and Fog Computing Platforms for Internet of Things, 183–196. Chapman and Hall/CRC.

El Ahmar, W. A. , Kolhatkar, D. , Nowruzi, F. E. , AlGhamdi, H. , Hou, J. , & Laganiere, R. (2022). Multiple object detection and tracking in the thermal spectrum. 2022 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), 276–284. https://doi.org/10.1109/CVPRW56347.2022.00042

Felsberg, M. , Berg, A. , Hager, G. , Ahlberg, J. , Kristan, M. , Matas, J. , Leonardis, A. , Cehovin, L. , Fernandez, G. , Vojir, T. , Nebehay, G. , & Pflugfelder, R. (2015). The Thermal Infrared Visual Object Tracking VOT-TIR2015 Challenge Results, 76–88. https://www.cv-foundation.org/openaccess/content_iccv_2015_workshops/w14/html/Felsberg_The_Thermal_Infrared_ICCV_2015_paper.html

Gautam, A. , & Singh, S. (2022). Neural style transfer combined with EfficientDet for thermal surveillance. The Visual Computer, *38* (12), 4111–4127. https://doi.org/10.1007/s00371-021-02284-2

Gebhardt, E. , & Wolf, M. (2018). CAMEL dataset for visual and thermal infrared multiple object detection and tracking. 2018 15th IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS), 1–6. https://doi.org/10.1109/AVSS.2018.8639094

Huang, Y. , He, Y. , Lu, R. , Li, X. , & Yang, X. (2022). Thermal infrared object tracking via unsupervised deep correlation filters. Digital Signal Processing, *123* , 103432. https://doi.org/10.1016/j.dsp.2022.103432

Jia, X. , Zhu, C. , Li, M. , Tang, W. , & Zhou, W. (2021). LLVIP: A visible-infrared paired dataset for low-light vision, 3496–3504. https://openaccess.thecvf.com/content/ICCV2021W/RLQ/html/Jia_LLVIP_A_Visible-

Infrared_Paired_Dataset_for_Low-Light_Vision_ICCVW_2021_paper.html
Kadim, Z. , Zulkifley, M. A. , & Hamzah, N. (2020). Deep-learning based single object tracker for night surveillance. International Journal of Electrical and Computer Engineering (IJECE), *10* (4), 3576. https://doi.org/10.11591/ijece.v10i4.pp3576-3587
Kim, W. , Cho, Y. B. , & Lee, S. (2017). Thermal sensor-based multiple object tracking for intelligent livestock breeding. IEEE Access, *5* , 27453–27463. https://doi.org/10.1109/ACCESS.2017.2775040
Krišto, M. , Ivasic-Kos, M. , & Pobar, M. (2020). Thermal object detection in difficult weather conditions using YOLO. IEEE Access, *8* , 125459–125476. https://doi.org/10.1109/ACCESS.2020.3007481
Kumar, P. , Banerjee, K. , Singhal, N. , Kumar, A. , Rani, S. , Kumar, R. , & Lavinia, C. A. (2022). Verifiable, secure mobile agent migration in healthcare systems using a polynomial-based threshold secret sharing scheme with a blowfish algorithm. Sensors, *22* (22), 8620.
Kumar, S. (2022). Influence of processing conditions on the mechanical, tribological and fatigue performance of cold spray coating: A review. Surface Engineering, *38* (4), 324–365. https://doi.org/10.1080/02670844.2022.2073424
Kumar, S. , Handa, A. , Chawla, V. , Grover, N. K. , & Kumar, R. (2021). Performance of thermal-sprayed coatings to combat hot corrosion of coal-fired boiler tube and effect of process parameters and post-coating heat treatment on coating performance: A review. Surface Engineering, *37* (7), 833–860. https://doi.org/10.1080/02670844.2021.1924506
Leira, F. S. , Helgesen, H. H. , Johansen, T. A. , & Fossen, T. I. (2021). Object detection, recognition, and tracking from UAVs using a thermal camera. Journal of Field Robotics, *38* (2), 242–267. https://doi.org/10.1002/rob.21985
Leykin, A. , Ran, Y. , & Hammoud, R. (2007). Thermal-visible video fusion for moving target tracking and pedestrian classification. 2007 IEEE Conference on Computer Vision and Pattern Recognition, 1–8. https://doi.org/10.1109/CVPR.2007.383444
Li, X. , Liu, Q. , Fan, N. , He, Z. , & Wang, H. (2019). Hierarchical spatial-aware Siamese network for thermal infrared object tracking. Knowledge-Based Systems, *166* , 71–81. https://doi.org/10.1016/j.knosys.2018.12.011
Liu, Q. , He, Z. , Li, X. , & Zheng, Y. (2020). PTB-TIR: A thermal infrared pedestrian tracking benchmark. IEEE Transactions on Multimedia, *22* (3), 666–675. https://doi.org/10.1109/TMM.2019.2932615
Liu, Q. , Li, X. , He, Z. , Fan, N. , Yuan, D. , & Wang, H. (2021). Learning deep multi-level similarity for thermal infrared object tracking. IEEE Transactions on Multimedia, *23* , 2114–2126. https://doi.org/10.1109/TMM.2020.3008028
Liu, Q. , Lu, X. , He, Z. , Zhang, C. , & Chen, W.-S. (2017). Deep convolutional neural networks for thermal infrared object tracking. Knowledge-Based Systems, *134* , 189–198. https://doi.org/10.1016/j.knosys.2017.07.032
Luo, W. , Xing, J. , Milan, A. , Zhang, X. , Liu, W. , & Kim, T.-K. (2021). Multiple object tracking: A literature review. Artificial Intelligence, *293* , 103448. https://doi.org/10.1016/j.artint.2020.103448
Oksuz, K. , Cam, B. C. , Akbas, E. , & Kalkan, S. (2018). Localization Recall Precision (LRP): A New Performance Metric for Object Detection, 504–519. https://openaccess.thecvf.com/content_ECCV_2018/html/Kemal_Oksuz_Localization_Recall_Precision_ECCV_2018_paper.html
Padilla, R. , Netto, S. L. , & da Silva, E. A. B. (2020). A survey on performance metrics for object-detection algorithms. 2020 International Conference on Systems, Signals and Image Processing (IWSSIP), 237–242. https://doi.org/10.1109/IWSSIP48289.2020.9145130
Rani, S. , Kataria, A. , Kumar, S. , & Tiwari, P. (2023). Federated learning for secure IoMT-applications in smart healthcare systems: A comprehensive review. *Knowledge-Based Systems* , 110658.
Ritu, P. , & Bhambri, P. (2023, February 17). Software effort estimation with machine learning – A systematic literature review. In Susheela Hooda , Vandana Mohindru Sood , Yashwant Singh , Sandeep Dalal , Manu Sood (Eds.), Agile Software Development: Trends, Challenges and Applications, 291–308. John Wiley & Sons, Inc.
Singh, A. P. , Aggarwal, M. , Singh, H. , & Bhambri, P. (2021). Sketching of EV network: A complete roadmap. In Sustainable Development Through Engineering Innovations: Select Proceedings of SDEI 2020, 431–442. Springer Singapore.

Singh, S. , Sharma, M. , Khosla, D. , Palta, P. , Gupta, A. K. , Sharma, T. , & Goyal, S. (2019). A novel approach for deblurring colored images using blind deconvolution algorithm. 2019 5th International Conference on Signal Processing, Computing and Control (ISPCC), 108–113. https://doi.org/10.1109/ISPCC48220.2019.8988325

Wang, Y. , Wei, X. , Tang, X. , Shen, H. , & Zhang, H. (2021). Adaptive fusion CNN features for RGBT object tracking. IEEE Transactions on Intelligent Transportation Systems, 1–10. https://doi.org/10.1109/TITS.2021.3073046

Weng, X. , Wang, J. , Held, D. , & Kitani, K. (2020). 3D multi-object tracking: A baseline and new evaluation metrics. 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 10359–10366. https://doi.org/10.1109/IROS45743.2020.9341164

Xu, J. , Ikram-Ul-Haq , Chen, J. , Dou, L. , & Liu, Z. (2010). Moving target detection and tracking in FLIR image sequences based on thermal target modeling. 2010 International Conference on Measuring Technology and Mechatronics Automation, 715–720. https://doi.org/10.1109/ICMTMA.2010.459

Yan, Y. , Ren, J. , Zhao, H. , Sun, G. , Wang, Z. , Zheng, J. , Marshall, S. , & Soraghan, J. (2018). Cognitive fusion of thermal and visible imagery for effective detection and tracking of pedestrians in videos. Cognitive Computation, *10* (1), 94–104. https://doi.org/10.1007/s12559-017-9529-6

Yu, T. , Mo, B. , Liu, F. , Qi, H. , & Liu, Y. (2019). Robust thermal infrared object tracking with continuous correlation filters and adaptive feature fusion. Infrared Physics & Technology, *98* , 69–81. https://doi.org/10.1016/j.infrared.2019.02.012

Yu, X. , Yu, Q. , Shang, Y. , & Zhang, H. (2017). Dense structural learning for infrared object tracking at 200+ frames per second. Pattern Recognition Letters, *100* , 152–159. https://doi.org/10.1016/j.patrec.2017.10.026

Zhang, L. , Gonzalez-Garcia, A. , van de Weijer, J. , Danelljan, M. , & Khan, F. S. (2019). Synthetic data generation for end-to-end thermal infrared tracking. IEEE Transactions on Image Processing, *28* (4), 1837–1850. https://doi.org/10.1109/TIP.2018.2879249

Zulkifley, M. A. (2019). Two streams multiple-model object tracker for thermal infrared video. IEEE Access, *7* , 32383–32392. https://doi.org/10.1109/ACCESS.2019.2903829

Zulkifley, M. A. , & Trigoni, N. (2018). Multiple-model fully convolutional neural networks for single object tracking on thermal infrared video. IEEE Access, *6* , 42790–42799. https://doi.org/10.1109/ACCESS.2018.2859595

Heuristics to Secure IoT-based Edge Driven UAV

Ali Z , Hossain MS , Muhammad G , Ullah I , Abachi H , Alamri A (2018).Edge-centric multimodal authentication system using encrypted biometric templates, Future Generation Computer Systems, 85: 76–80.

Anand A , Bhambri P (2018). Character recognition system using radial features, International Journal on Future Revolution in Computer Science & Communication Engineering, 4(4), 599–602.

Ansari N , Sun X (2016). Edge IoT: Mobile edge computing for the internet of things, IEEE Commun. Mag. 2016, 54: 22–29.

Ara A. , Al-Rodhaan M. , Tian Y. , Al-Rodhaan A (2017). A secure privacy-preserving data aggregation scheme based on bilinear ElGamal cryptosystem for remote health monitoring systems, IEEE Access, 5: 12601–12617.

Bhambri P , Dhanoa IS , Sinha VK , Kaur J (2020). Paddy crop production analysis based on SVM and KNN classifier, International Journal of Recent Technology and Engineering, 8(5): 2791–2793.

Bhambri P , Singh M , Dhanoa IS , Kumar M (2022). Deployment of ROBOT for HVAC duct and disaster management, Oriental Journal of Computer Science and Technology, 15, 1–8.

Bhambri P , Singh M , Jain A , Dhanoa IS , Sinha VK , Lal S (2021). Classification of gene expression data with the aid of optimized feature selection, Turkish Journal of Physiotherapy and Rehabilitation, 32: 3.

Bhambri P , Singh S , Sangwan S , Devi J , Jain S (2023). Plants recognition using leaf image pattern analysis, Journal of Survey in Fisheries Sciences, 10(2S): 3863–3871.

Bithas PS , Michailidis ET , Nomikos N , Vouyioukas D , Kanatas AG (2019). A survey on machine-learning techniques for UAV-based communications, Sensors, 19(23): 5170.
Du M , et al (2018). Big data privacy preserving in multi-access edge computing for heterogeneous internet of things, IEEE Communications Magazine, 56(8): 62–67.
Echeverría S et al. (2020). Kal Ki: A software-defined IoT security platform, IEEE 6th World Forum on Internet of Things (WF-IoT), New Orleans, LA, USA, 2020, pp. 1–6. DOI: 10.1109/WF-IoT48130.2020.9221050.
Fan CI , Huang SY , Lai YL (2013). Privacy-enhanced data aggregation scheme against internal attackers in smart grid, IEEE Transactions on Industrial Informatics, 10: 666–675.
Fotouhi M , Bayat M , Das AK , Far HAN , Pournaghi SM , Doostari MA (2020). A lightweight and secure two-factor authentication scheme for wireless body area networks in health-care IoT, Computer Networks, 177: 107333.
Gao JF , Cui YH , Luo SL , Jiao LL (2019). Reasearch on information system controllability evaluation, Netinfo Security, 8: 67–75.
Granjal EM , Silva JS (2020). End-to-end transport-layer security for internet-integrated sensing applications with mutual and delegated ECC public-key authentication, IEEE Ifip Networking Conference, pp. 1–9.
Gubbi J , et al (2013). Internet of things (Iot): A vision, architectural elements, and future directions future gener, Computer System, 29(7): 1645–1660.
He D. , Chan S. , Guizani M. (2018). Security in the Internet of Things supported by mobile edge computing, IEEE Communications Magazine, 56(8): 56–61.
Kewei Sha T Yang A , Wei W , Davari S (2020). A survey of edge computing-based designs for IoT security, Digital Communications and Networks, 6(2): 195–202.
Kothandaraman D , Manickam M , Balasundaram A , Pradeep D , Arulmurugan A , Sivaraman AK , … & Balakrishna R (2022). Decentralized link failure prevention routing (DLFPR) algorithm for efficient Internet of Things, Intelligent Automation & Soft Computing, 34(1), 132–156.
Kumar R , Rani S , Awadh MA (2022). Exploring the application sphere of the internet of things in industry 4.0: A review, bibliometric and content analysis, Sensors, *22* (11): 4276.
Lehong H (2019). Hype Cycle for the Internet of Things, Stamford: Gartner Inc.
Lu R , Heung K , Lashkari A , Ghorbani AA (2017). A lightweight privacy-preserving data aggregation scheme for fog computing-enhanced iot, IEEE Access, 5: 3302–3312.
McSherry F , Talwar K (2007). Mechanism design via differential privacy, Proceedings of 48th Annual IEEE Symposium on Foundations of Computer Science (FOCS'07).
Mehta P , Gupta R , Tanwar S (2020). Blockchain envisioned UAV networks: Challenges, solutions, and comparisons, Computer Communications, 151: 518–538.
Michailidis ET , Vouyioukas D (2022). A review on software-based and hardware-based authentication mechanisms for the internet of drones, Drones, 6(2): 41.
Nia AM , Jha NK (2016). A comprehensive study of security of internet-of-things. IEEE Transactions on Emerging Topics in Computing, 5(4): 586–602.
Rachna R , Bhambri P , Chhabra Y (2022). Deployment of distributed clustering approach in WSNs and IoTs. In Cloud and Fog Computing Platforms for Internet of Things (pp. 85–98). Boca Raton, FL: Chapman and Hall/CRC.
Ranaweera P , Jurcut AD , Liyanage M (2021). Survey on multiaccess edge computing security and privacy, IEEE Communications Surveys and Tutorials, 23(2): 1078–1124.
Rani S , Kataria A , Kumar S , Tiwari P (2023). Federated learning for secure IoMT-applications in smart healthcare systems: A comprehensive review, Knowledge-Based Systems, 65(6), 110658.
Rani S , Kataria A , Sharma V , Ghosh S , Karar V , Lee K , Choi C (2021). Threats and corrective measures for IoT security with observance of cybercrime: A survey, Wireless Communications and Mobile Computing, 2021: 1–30.
Ritu K , Bhambri P (2022). A CAD System for Software Effort Estimation, Paper presented at the International Conference on Technological Advancements in Computational Sciences, pp. 140–146. IEEE. DOI: 10.1109/ICTACS56270.2022.9988123.
Roman R , Lopez J , Mambo M , (2018b). Mobile edge computing Fog et al: A survey and analysis of security threats and challenges, Future Generation Computer Systems, 78: 680–698.
Roman R , Rios R , Onieva J (2018a). Lopez immune system for the internet of things using edge technologies, IEEE Internet of Things Journal, 178, 1–8.

Sangwan YS , Lal S , Bhambri P , Kumar A , Dhanoa IS (2021). Advancements in social data security and encryption: A review, NVEO-Natural Volatiles & Essential Oils Journal| NVEO, 8(4), 15353–15362.
Sharma N , Sultana HP , Singh R , Patil S (2019). Secure hash authentication in IoT based applications, Procedia Computer Science, 165: 328–335.
Sodanapalli S , et al. (2021). Recent advances in edge computing paradigms: Taxonomy benchmarks and standards for unconventional computing, IJFC, 4(1): 37–51.
Sun X , Ng DWK , Ding Z , Xu Y , Zhong Z (2019). Physical layer security in UAV systems: Challenges and opportunities, IEEE Wireless Communications, 26(5): 40–47.
Yuchang L , Bhagya NS , Kijun H (2021). Algorithmic implementation of deep learning layer assignment in edge computing based smart city environment, Computers & Electrical Engineering, 89: 106909.

Phased.js

Amazon Web Services (AWS) (2023). https://aws.amazon.com/
Babu, G. C. N. , Gupta, S. , Bhambri, P. , Leo, L. M. , Rao, B. H. , & Kumar, S. (2021). A semantic health observation system development based on the IoT sensors. Turkish Journal of Physiotherapy and Rehabilitation, 32(3), 1721–1729.
Benson, J. O. , Prevost, J. J. , & Rad, P. (2016, April). Survey of automated software deployment for computational and engineering research. In 2016 Annual IEEE Systems Conference (SysCon) (pp. 1–6). IEEE.
Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of the gene expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, 32(3), 1158–1167.
Bose, M. M. , Yadav, D. , Bhambri, P. , & Shankar, R. (2021). Electronic customer relationship management: Benefits and pre-implementation considerations. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1343–1350.
Canali, C. , & Lancellotti, R. (2012, September). Automated clustering of VMs for scalable cloud monitoring and management. In SoftCOM 2012, 20th International Conference on Software, Telecommunications and Computer Networks (pp. 1–5). IEEE.
Chen, H. S. , Wu, C. H. , Pan, Y. L. , Yu, H. E. , Chen, C. M. , & Cheng, K. Y. (2013, December). Towards the automated fast deployment and clone of private cloud service: the Ezilla toolkit. In 2013 IEEE 5th International Conference on Cloud Computing Technology and Science (Vol. 1, pp. 136–141). IEEE.
Danielsson, P. , Postema, T. , & Munir, H. (2021). Heroku-based innovative platform for web-based deployment in product development at axis. IEEE Access, 9, 10805–10819.
Deshmukh, S. N. , & Khandagale, H. P. (2017, April). A system for application deployment automation in a cloud environment. In 2017 Innovations in Power and Advanced Computing Technologies (i-PACT) (pp. 1–4). IEEE.
Durairajan, S. , & Sundararajan, P. (2013, October). Portable service management deployment over cloud platforms to support production workloads. In 2013 IEEE International Conference on Cloud Computing in Emerging Markets (CCEM) (pp. 1–7). IEEE.
Giannakopoulos, I. , Papailiou, N. , Mantas, C. , Konstantinou, I. , Tsoumakos, D. , & Koziris, N. (2014, October). Celar: Automated application elasticity platform. In 2014 IEEE International Conference on Big Data (Big Data) (pp. 23–25). IEEE.
Huang, F. , Li, H. , Yuan, Z. , & Li, X. (2017, May). An application deployment approach based on hybrid cloud. In 2017 IEEE 3rd International Conference on Big Data Security on Cloud (Big Data Security), IEEE International Conference on High Performance and Smart Computing (HPSC), and IEEE International Conference on Intelligent Data and Security (IDS) (pp. 74–79). IEEE.
Jabeen, A. , Pallathadka, H. , Pallathadka, L. K. , & Bhambri, P. (2021). E-CRM successful factors for business enterprises case studies. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1332–1342.
Juve, G. , & Deelman, E. (2011, November). Automating application deployment in infrastructure clouds. In 2011 IEEE Third International Conference on Cloud Computing

Technology and Science (pp. 658–665). IEEE.
Karakostas, B. (2014, September). Towards autonomic cloud configuration and deployment environments. In 2014 International Conference on Cloud and Autonomic Computing (pp. 93–96). IEEE.
Kikuchi, S. (2015, December). Prediction of workloads in incident management based on incident ticket updating history. In 2015 IEEE/ACM 8th International Conference on Utility and Cloud Computing (UCC) (pp. 333–340). IEEE.
Kumar, P. , Banerjee, K. , Singhal, N. , Kumar, A. , Rani, S. , Kumar, R. , & Lavinia, C. A. (2022). Verifiable, secure mobile agent migration in healthcare systems using a polynomial-based threshold secret sharing scheme with a blowfish algorithm. Sensors, 22(22), 8620.
Lu, H. , Shtern, M. , Simmons, B. , Smit, M. , & Litoiu, M. (2013, June). Pattern-based deployment service for next generation clouds. In 2013 IEEE Ninth World Congress on Services (pp. 464–471). IEEE.
Microsoft Azure (2023). https://azure.microsoft.com/en-in/
Ocone, L. , Rak, M. , & Villano, U. (2019, June). Benchmark-based cost analysis of auto scaling web applications in the cloud. In 2019 IEEE 28th International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE) (pp. 98–103). IEEE.
Quinton, C. , Romero, D. , & Duchien, L. (2014). Automated selection and configuration of cloud environments using software product lines principles. 2014 IEEE 7th International Conference on Cloud Computing (pp. 144–151). DOI: 10.1109/CLOUD.2014.29.
Rachna, R. , Chhabra, Y. , & Bhambri, P. (2021). Various approaches and algorithms for monitoring energy efficiency of wireless sensor networks. In Harvinder Singh , Puneet Pal Singh Cheema , Prashant Garg (Eds.), Lecture Notes in Civil Engineering (Vol. 113, pp. 761–770). Springer, Singapore.
Rani, S. , Pareek, P. K. , Kaur, J. , Chauhan, M. , & Bhambri, P. (2023, February). Quantum machine learning in healthcare: Developments and challenges. In 2023 IEEE International Conference on Integrated Circuits and Communication Systems (ICICACS) (pp. 1–7). IEEE.
Shah, I. , Al Toaimy, L. , & Jawed, M. (2008). RWELS: A remote web event logging system. Journal of King Saud University-Computer and Information Sciences, 20, 1–11.
Shaik, B. , Vallarapu, A. , Shaik, B. , & Vallarapu, A. (2018). Google Cloud. Beginning PostgreSQL on the Cloud: Simplifying Database as a Service on Cloud Platforms, 133–167. https://doi.org/10.1007/978-1-4842-3447-1 https://link.springer.com/book/10.1007/978-1-4842-3447-1
Shekhar, S. S. (2019). Artificial intelligence in automation. Artificial Intelligence, 3085(06), 14–17.
Singh, M. , Bhambri, P. , Lal, S. , Singh, Y. , Kaur, M. , & Singh, J. (2021). Design of the effective technique to improve memory and time constraints for sequence alignment. International Journal of Applied Engineering Research (Netherlands), 6(02), 127–142.
Tanwar, R. , Chhabra, Y. , Rattan, P. , & Rani, S. (2022, September). Blockchain in IoT networks for precision agriculture. In International Conference on Innovative Computing and Communications: Proceedings of ICICC 2022 (Vol 2, pp. 137–147). Springer Nature Singapore.
Toffetti, G. , Brunner, S. , Blöchlinger, M. , Spillner, J. , & Bohnert, T. M. (2017). Self-managing cloud-native applications: Design, implementation, and experience. Future Generation Computer Systems, 72, 165–179.
Vijayalakshmi, P. , Shankar, R. , Karthik, S. , & Bhambri, P. (2021). Impact of work from home policies on workplace productivity and employee sentiments during the Covid-19 pandemic. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1314–1331.
Xu, J. , Chen, P. , Yang, L. , Meng, F. , & Wang, P. (2017, November). Logdc: Problem diagnosis for declaratively-deployed cloud applications with log. In 2017 IEEE 14th International Conference on e-Business Engineering (ICEBE) (pp. 282–287). IEEE.
Yokoyama, S. , & Yoshioka, N. (2012, June). Dodai-deploy: Fast cluster deployment tool. In 2012 IEEE 19th International Conference on Web Services (pp. 681–682). IEEE.
Yu, H. E. , Pan, Y. L. , Wu, C. H. , Chen, H. S. , Chen, C. M. , & Cheng, K. Y. (2013, December). On-demand automated fast deployment and coordinated cloud services. In 2013 IEEE 5th International Conference on Cloud Computing Technology and Science (Vol. 2, pp. 252–255). IEEE.

Robust Image Enhancement Technique to Automatically Enrich the Visibility of Satellite Captured Snaps

Ayoobkhan, M. U. A. , Chikkannan, E. , Ramakrishnan, K. , & Balasubramanian, S. B. (2019). Prediction-based lossless image compression. In International Conference on ISMAC in Computational Vision and Bio-Engineering (pp. 1749–1761). Springer, Cham.

Bakshi, P. , Bhambri, P. , & Thapar, V. (2021a). A review paper on wireless sensor network techniques in Internet of Things (IoT). Wesleyan Journal of Research, *14* (7), 147–160.

Bakshi, P. , Bhambri, P. , & Thapar, V. (2021b). A review paper on wireless sensor network techniques in Internet of Things (IoT). In Proceedings of the International Conference on Contemporary Issues in Engineering & Technology.

Bhambri, P. (2020). Green compliance. In S. Agarwal (Ed.), Introduction to Green Computing (pp. 95–125). AGAR Saliha Publication. ISBN: 978-81-948141-5-3.

Bhambri, P. (2021). Electronic evidence. In Kamal Gulati , Narinder Kumar Bhasin (Eds.), Textbook of Cyber Heal (pp. 86–120). AGAR Saliha Publication. ISBN: 978-81-948141-7-7.

Chauhan, M. , & Rani, S. (2021). COVID-19: A revolution in the field of education in India. Learning How to Learn Using Multimedia, 23–42.

Dileep, M. R. , & Danti, A. (2018). Human age and gender prediction based on neural networks and three sigma control limits. Applied Artificial Intelligence, *32* (3), 281–292.

Fan, L. , Zhang, F. , Fan, H. , & Zhang, C. (2019). Brief review of image denoising techniques. Visual Computing for Industry, Biomedicine, and Art, *2* (1), 1–12.

Ghamisi, P. , Maggiori, E. , Li, S. , Souza, R. , Tarablaka, Y. , Moser, G. , … & Benediktsson, J. A. (2018). New frontiers in spectral-spatial hyperspectral image classification: The latest advances based on mathematical morphology, Markov random fields, segmentation, sparse representation, and deep learning. IEEE Geoscience and Remote Sensing Magazine, *6* (3), 10–43.

Higaki, T. , Nakamura, Y. , Tatsugami, F. , Nakaura, T. , & Awai, K. (2019). Improvement of image quality at CT and MRI using deep learning. Japanese Journal of Radiology, *37* (1), 73–80.

Hussain, A. J. , Al-Fayadh, A. , & Radi, N. (2018). Image compression techniques: A survey in lossless and lossy algorithms. Neurocomputing, *300* , 44–69.

Jin, L. , Zhang, W. , Ma, G. , & Song, E. (2019). Learning deep CNNs for impulse noise removal in images. Journal of Visual Communication and Image Representation, *62* , 193–205.

Johnston, N. , Vincent, D. , Minnen, D. , Covell, M. , Singh, S. , Chinen, T. , … & Toderici, G. (2018). Improved lossy image compression with priming and spatially adaptive bit rates for recurrent networks. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (pp. 4385–4393).

Kandala, R. N. , Dhuli, R. , Pławiak, P. , Naik, G. R. , Moeinzadeh, H. , Gargiulo, G. D. , & Gunnam, S. (2019). Towards real-time heartbeat classification: evaluation of nonlinear morphological features and voting method. Sensors, *19* (23), 5079.

Kataria, A. , Agrawal, D. , Rani, S. , Karar, V. , & Chauhan, M. (2022). Prediction of blood screening parameters for preliminary analysis using neural networks. In Predictive Modeling in Biomedical Data Mining and Analysis (pp. 157–169). Academic Press.

Kuzhaloli, S. , Devaneyan, P. , Sitaraman, N. , Periyathanbi, P. , Gurusamy, M. , & Bhambri, P. (2020). IoT based Smart Kitchen Application for Gas Leakage Monitoring [Patent application number 202041049866A]. India.

Li, Y. , Zhang, H. , Xue, X. , Jiang, Y. , & Shen, Q. (2018). Deep learning for remote sensing image classification: A survey. Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, *8* (6), e1264.

Mercedes, L. , Gil, L. , & Bernat-Maso, E. (2018). Mechanical performance of vegetal fabric reinforced cementitious matrix (FRCM) composites. Construction and Building Materials, *175* , 161–173. https://doi.org/10.1016/j.conbuildmat.2018.04.171

Minnen, D. , Ballé, J. , & Toderici, G. D. (2018). Joint autoregressive and hierarchical priors for learned image compression. Advances in neural information processing systems, *31* , 1–13.

Mishra, P. , Karami, A. , Nordon, A. , Rutledge, D. N. , & Roger, J. M. (2019). Automatic de-noising of close-range hyperspectral images with a wavelength-specific shearlet-based image noise reduction method. Sensors and Actuators B: Chemical, *281* , 1034–1044.

Owotogbe, J. S. , Ibiyemi, T. S. , & Adu, B. A. (2019). Edge detection techniques on digital images – A review. International Journal of Innovative Science and Research Technology, *4* ,

329–332.
Paoletti, M. E. , Haut, J. M. , Plaza, J. , & Plaza, A. (2018). A new deep convolutional neural network for fast hyperspectral image classification. ISPRS Journal of Photogrammetry and Remote Sensing, *145* , 120–147.
Puri, V. , Kataria, A. , Solanki, V. K. , & Rani, S. (2022, December). AI-based botnet attack classification and detection in IoT devices. In 2022 IEEE International Conference on Machine Learning and Applied Network Technologies (ICMLANT) (pp. 1–5). IEEE.
Rahman, M. A. , & Hamada, M. (2019). Lossless image compression techniques: A state-of-the-art survey. Symmetry, *11* (10), 1274.
Rana, R. , Chhabra, Y. , & Bhambri, P. (2021). Design and development of distributed clustering approach in wireless sensor network. Webology, *18* (1), 696–712.
Rani, S. , Pareek, P. K. , Kaur, J. , Chauhan, M. , & Bhambri, P. (2023, February). Quantum machine learning in healthcare: Developments and challenges. In 2023 IEEE International Conference on Integrated Circuits and Communication Systems (ICICACS) (pp. 1–7). IEEE.
Samadi, F. , Akbarizadeh, G. , & Kaabi, H. (2019). Change detection in SAR images using deep belief network: a new training approach based on morphological images. IET Image Processing, *13* (12), 2255–2264.
Sibaruddin, H. I. , Shafri, H. Z. M. , Pradhan, B. , & Haron, N. A. (2018, June). Comparison of pixel-based and object-based image classification techniques in extracting information from UAV imagery data. In O. O. Elutade , I. A. Obisesan , O. E. Omotayo , O. A. Ajayi-Odoko , T. A. Olaogun (Eds.), IOP Conference Series: Earth and Environmental Science (Vol. 169, No. 1, p. 012098). IOP Publishing.
Singh, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. , & Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. Natural Volatiles & Essential Oils, *8* (4), 15353–15362.
Sumathi, N. , Thirumagal, J. , Jagannathan, S. , Bhambri, P. , & Ahamed, I. N. (2021). A comprehensive review on bionanotechnology for the 21st century. Journal of the Maharaja Sayajirao University of Baroda, *55* (1), 114–131.
Wang, B. , Chen, L. L. , & Zhang, Z. Y. (2019a). A novel method on the edge detection of infrared image. Optik, *180* , 610–614.
Wang, Y. , Shi, F. , Cao, L. , Dey, N. , Wu, Q. , Ashour, A. S. & Wu, L. (2019b). Morphological segmentation analysis and texture-based support vector machines classification on mice liver fibrosis microscopic images. Current Bioinformatics, *14* (4), 282–294.
Westreich, J. , Khorasani, M. , Jones, B. , Demidov, V. , Nofech-Mozes, S. , & Vitkin, A. (2019). Novel methodology to image stromal tissue and assess its morphological features with polarized light: Towards a tumour microenvironment prognostic signature. Biomedical Optics Express, *10* (8), 3963–3973.

Implementation of FIR Filter and the Creation of Custom IP Blocks

Balakumaran, R. , & Prabhu, E. (2016). Design of high-speed multiplier using modified Booth algorithm with hybrid carry look-ahead adder. 2016 International Conference on Circuit, Power and Computing Technologies (ICCPCT). doi:10.1109/iccpct.2016.7530164.
Bali, V. , Bali, S. , Gaur, D. , Rani, S. , & Kumar, R. (2023). Commercial-off-the shelf vendor selection: A multi-criteria decision-making approach using intuitionistic fuzzy sets and TOPSIS. Operational Research in Engineering Sciences: Theory and Applications, 12(4), 100–113.
Bhambri, P. , Kaur, H. , Gupta, A. , & Singh, J. (2020a). Human activity recognition system. Oriental Journal of Computer Science and Technology, 13(2–3), 91–96.
Bhambri, P. , Sinha, V. K. , & Dhanoa, I. S. (2020b). Diabetes prediction with WEKA tool. Journal of Critical Reviews, *7* (9), 2366–2371.
Bhatt, T. M. , & McCain, D. (2005). “MATLAB as a development environment for FGPA design”. Proceedings of the 42nd Annual Conference on Design Automation-DAC’05. doi:10.1145/1065579.1065737.
Deepika , & Goel, N. (2016). Design of FIR filter using reconfigurable MAC unit. 20163rd International Conference on Signal Processing and Integrated Networks (SPIN). doi:10.1109/spin.2016.7566710.

Devadutta, K. , Bhambri, P. , Gountia, D. , Mehta, V. , Mangla, M. , Patan, R. , Kumar, A. , Agarwal, P. K. , Sharma, A. , Singh, M. , & Gadicha, A. B. (2020). Method for Cyber Security in Email Communication among Networked Computing Devices [Patent application number 202031002649]. India.

Devi, D. A. , & Rani, N. S. (2019). Design and implementation of custom IP for real time clock on reconfigurable device. 2019 Third International Conference on Inventive Systems and Control (ICISC) (pp. 414–418). doi:10.1109/ICISC44355.2019.9036428.

Devi, D. A. , & Sugun, L. S. (2018). Design, implementation and verification of 32-Bit ALU with VIO. 2018 2nd International Conference on Inventive Systems and Control (ICISC) (pp. 495–499). doi:10.1109/ICISC.2018.8399122.

Devi, P. , & Vlcek, M. (2012). Perfect decomposition narrow-band FIR filter banks. IEEE Transactions on Circuits and Systems II: Express Briefs, 59(11), 805–809. doi:10.1109/tcsii.2012.2218453.

Fan, K.Y. et al. (2014). Optimization of FIR filter design scheme based on FPGA. Research and Exploration in Laboratory, *33* (5), 91–95. doi:10.3969/j.issn.1006-7167.2014.05.023

Govekar, D. , & Amonkar, A. (2017). “Design and implementation of high speed modified Booth Multiplier using hybrid adder”. 2017 International Conference on Computing Methodologies and Communication (ICCMC). doi:10.1109/iccmc.2017.8282661.

Kaur, J. , & Bhambri, P. (2020). Hybrid Classification Model for the Reverse Code Generation in Software Engineering. Jalandhar: I.K. Gujral Punjab Technical University.

Kaur, K. , Dhanoa, I. S. , Bhambri, P. , & Singh, G. (2020). Energy saving VM migration techniques. Journal of Critical Reviews, *7* (9), 2359–2365.

Kaur, S. , Kumar, R. , Kaur, R. , Singh, S. , Rani, S. , & Kaur, A. (2022). Piezoelectric materials in sensors: Bibliometric and visualization analysis. Materials Today: Proceedings, 4(4), 10–20.

Kolawole, Emmanuel S. , Ali, Warsame H. , Cfie, Penrose , Fuller¸ John , Tolliver, C. , & Obiomon, Pamela (2015). Design and implementation of low-pass, high-pass and band- pass finite impulse response (FIR) filters using FPGA. Circuits and Systems, 6, 30–48.

Lamba, B. , & Sharma, A. (2018). A review paper on different multipliers based on their different performance parameters. 2018 2nd International Conference on Inventive Systems and Control (ICISC). doi:10.1109/icisc.2018.8399088.

Maddipati, U. , Ahemedali, S. , Ramya, M. S. S. , Reddy, M. D. P. , & Priya, K. N. J. (2020). “Comparative analysis of 16-tap FIR filter design using different adders”. 2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT). doi:10.1109/ICCCNT49239.2020.9225691.

Nagaria, S. , Singh, A. , & Niranjan, V. (2018). “Efficient FIR Filter Design using Booth Multiplier for VLSI Applications”. 2018 International Conference on Computing, Power and Communication Technologies (GUCON). doi:10.1109/gucon.2018.8674998

Patel, D. K. , Chouksey, R. , & Saxena, M. (2016). Design of fast FIR filter using compressor and carry select adder. 2016 3rd International Conference on Signal Processing and Integrated Networks (SPIN). doi:10.1109/spin.2016.7566739.

Prabhu, A. S. , & Elakya, V. (2012). Design of modified low power Booth Multiplier. 2012 International Conference on Computing, Communication and Applications. doi:10.1109/iccca.2012.6179166.

Rai, N. S. , Shree, P. , Meghana, Y. P. , Chavan, A. P. , & Aradhya, H. R. (2018).“Design and implementation of 16 tap FIR filter for DSP Applications”. 2018 Second International Conference on Advances in Electronics, Computers and Communications (ICAECC). doi:10.1109/icaecc.2018.8479480.

Rana, R. , Chabbra, Y. , & Bhambri, P. (2020). Comparison of clustering approaches for enhancing sustainability performance in WSNs: A study. In Proceedings of the International Congress on Sustainable Development through Engineering Innovations (pp. 62–71). ISBN 978-93-89947-14-4.

Rani, S. , Kataria, A. , Sharma, V. , Ghosh, S. , Karar, V. , Lee, K. , & Choi, C. (2021). Threats and corrective measures for IoT security with observance of cybercrime: A survey. Wireless Communications and Mobile Computing, *2021* , 1–30.

Rani, S. , Pareek, P. K. , Kaur, J. , Chauhan, M. , & Bhambri, P. (2023, February). Quantum machine learning in healthcare: Developments and challenges. 2023 IEEE International Conference on Integrated Circuits and Communication Systems (ICICACS) (pp. 1–7). IEEE.

Ruan, A. W. , Liao, Y. B. , & Li, J. X. (2009) An ALU-based universal architecture for FIR filters. IEEE Proceedings of International Conference on Communications, Circuits and Systems,

Milpitas (pp. 1070–1071). July 2009.
Sangram, Patil , Prithviraj, Patil , Indrajit, Patil , Prof. Jadhav, Sachin (October 2017). Implementation of FIR filter using VLSI. *AESS Journal*. ISSN: 0975–6779.
Sarkar, S. , Sarkar, S. , & Mehedi, J. (2018). Comparison of various adders and their VLSI implementation. 2018 International Conference on Computer Communication and Informatics (ICCCI). doi:10.1109/iccci.2018.8441253.
Sayed, J. F. , Hasan, B. H. , Muntasir, B. , Hasan, M. , & Arifin, F. (2021). “Design and evaluation of a FIR filter using hybrid adders and Vedic multipliers”. 2022 International Conference on Robotics, Electrical and Signal Processing Techniques (ICREST). doi:10.1109/ICREST51555.2021.9331063.
Schafer, Ronald W. , & Oppenheim, Alan V. (1975). Digital Signal Processing, Second Edition. USA: Pearson Publishers.
Sharma, R. , & Bhambri, P. (2020). Energy Aware Bio Inspired Routing Technique for Mobile Adhoc Networks. Jalandhar: I.K. Gujral Punjab Technical University.
Singh, G. , Singh, M. , & Bhambri, P. (2020). Artificial intelligence based flying car. In Proceedings of the International Congress on Sustainable Development through Engineering Innovations (pp. 216–227). ISBN 978-93-89947-14-4.
Thakur, A. S. , & Tiwari, V. (2018). Design high speed FIR filter based on complex vedic multiplier using CBL adder. 2018 International Conference on Recent Innovations in Electrical, Electronics & Communication Engineering (ICRIEECE). doi:10.1109/icrieece44171.2018.9.
Zheng, J. , & Wei, Z. (2018). “FIR Filter Design Based on FPGA”. 2018 10th International Conference on Measuring Technology and Mechatronics Automation (ICMTMA). doi:10.1109/icmtma.2018.00016.

Use Cases of Blockchain in Post-Covid Healthcare

Amponsah, A. A. , Adekoya, A. F. , & Weyori, B. A. (2022). Improving the financial security of national health insurance using cloud-based blockchain technology application. International Journal of Information Management Data Insights, *2* (1), 100081.
Anand, A. , & Bhambri, P. (2018). Character recognition system using radial features. International Journal on Future Revolution in Computer Science & Communication Engineering, 4(4), 599–602.
Babu, G. C. N. , Gupta, S. , Bhambri, P. , Leo, L. M. , Rao, B. H. , & Kumar, S. (2021). A semantic health observation system development based on the IoT sensors. Turkish Journal of Physiotherapy and Rehabilitation, 32(3), 1721–1729.
Bhambri, P. , Dhanoa, I. S. , Sinha, V. K. , & Kaur, J. (2020). Paddy crop production analysis based on SVM and KNN classifier. International Journal of Recent Technology and Engineering, 8(5), 2791–2793.
Bhambri, P. , Singh, M. , Dhanoa, I. S. , & Kumar, M. (2022). Deployment of ROBOT for HVAC duct and disaster management. oriental Journal of Computer Science and Technology, 15, 1–18.
Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of gene expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, 32, 3.
Bhambri, P. , Singh, S. , Sangwan, S. , Devi, J. , & Jain, S. (2023). Plants recognition using leaf image pattern analysis. Journal of Survey in Fisheries Sciences, 10(2S), 3863–3871.
Bose, M. M. , Yadav, D. , Bhambri, P. , & Shankar, R. (2021). Electronic customer relationship management: Benefits and pre-implementation considerations. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1343–1350.
Chhabra, Y. , & Bhambri, P. (2021). Various approaches and algorithms for monitoring energy efficiency of wireless sensor networks. In Sustainable Development Through Engineering Innovations: Select Proceedings of SDEI 2020 (pp. 761–770). Springer Singapore.
Clauson, K. A. , Breeden, E. A. , Davidson, C. , & Mackey, T. K. (2018). Leveraging blockchain technology to enhance supply chain management in healthcare: An exploration of challenges and opportunities in the health supply chain. Blockchain in Healthcare Today, *5* (8), 132–142.

Dagher, G. G. , Mohler, J. , Milojkovic, M. , & Marella, P. B. (2018). Ancile: Privacy-preserving framework for access control and interoperability of electronic health records using blockchain technology. Sustainable Cities and Society, *39* , 283–297.

Dhanalakshmi, R. , Vijayaraghavan, N. , Sivaraman, A. K. , & Rani, S. (2022). Epidemic awareness spreading in smart cities using the artificial neural network. In Sita Rani Khang , Arun Kumar Sivaraman (Eds.), AI-Centric Smart City Ecosystems (pp. 187–207). CRC Press.

Dubovitskaya, A. , Xu, Z. , Ryu, S. , Schumacher, M. , & Wang, F. (2017). Secure and trustable electronic medical records sharing using blockchain. In AMIA Annual Symposium Proceedings (Vol. 2017, p. 650). American Medical Informatics Association.

Ekblaw, A. , Azaria, A. , Halamka, J. D. , & Lippman, A. (2016, August). A case study for blockchain in healthcare: “MedRec” prototype for electronic health records and medical research data. In Proceedings of IEEE Open & Big Data Conference (Vol. 13, p. 13).

Hathaliya, J. , Sharma, P. , Tanwar, S. , & Gupta, R. (2019, December). Blockchain-based remote patient monitoring in healthcare 4.0. In 2019 IEEE 9th International Conference on Advanced Computing (IACC) (pp. 87–91). IEEE.

Ismail, L. , & Zeadally, S. (2021). Healthcare insurance frauds: Taxonomy and blockchain-based detection framework (Block-HI). IT Professional, *23* (4), 36–43.

Jabeen, A. , Pallathadka, H. , Pallathadka, L. K. , & Bhambri, P. (2021). E-CRM successful factors for business enterprises case studies. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1332–1342.

Joshi, M. (2020). PHBC announces blockchain monitor to track virus-free zones. Cryptopolitan, 19 March 2020. https://www.cryptopolitan.com/phbc-blockchain-monitor-for-virus-free-zones/. Accessed 27 May 2023 .

Kumar, P. , Banerjee, K. , Singhal, N. , Kumar, A. , Rani, S. , Kumar, R. , & Lavinia, C. A. (2022). Verifiable, secure mobile agent migration in healthcare systems using a polynomial-based threshold secret sharing scheme with a blowfish algorithm. Sensors, *22* (22), 8620.

Kurni, M. , & Mrunalini, M. (2021). Managing health insurance using blockchain technology. In Blockchain in digital healthcare (pp. 169–194). Chapman and Hall/CRC.

Marbouh, D. , Abbasi, T. , Maasmi, F. , Omar, I. A. , Debe, M. S. , Salah, K. , … & Ellahham, S. (2020). Blockchain for COVID-19: Review, opportunities, and a trusted tracking system. Arabian Journal for Science and Engineering, *45* , 9895–9911.

McGhin, T. , Choo, K. K. R. , Liu, C. Z. , & He, D. (2019). Blockchain in healthcare applications: Research challenges and opportunities. Journal of Network and Computer Applications, *135* , 62–75.

Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. Decentralized Business Review, 21260, 34–35.

Rachna , Bhambri, P. , & Chhabra, Y. (2022). Deployment of distributed clustering approach in WSNs and IoTs. In Pankaj Bhambri , Sita Rani , Gaurav Gupta , Alex Khang (Eds.), Cloud and Fog Computing Platforms for Internet of Things (pp. 85–98). Chapman and Hall/CRC.

Rani, S. , Bhambri, P. , & Gupta, O. P. (2022). Green smart farming techniques and sustainable agriculture: Research roadmap towards organic farming for imperishable agricultural products. In Vikram Bali , Rajni Mohana , Ahmed A. Elngar , Sunil Kumar Chawla , Gurpreet Singh (Eds.), Handbook of Sustainable Development through Green Engineering and Technology (pp. 49–67). CRC Press.

Rani, S. , Pareek, P. K. , Kaur, J. , Chauhan, M. , & Bhambri, P. (2023, February). Quantum machine learning in healthcare: Developments and challenges. In 2023 IEEE International Conference on Integrated Circuits and Communication Systems (ICICACS) (pp. 1–7). IEEE.

Ritu , & Bhambri, P. (2022). A CAD system for software effort estimation. *Paper presented at the* International Conference on Technological Advancements in Computational Sciences (pp. 140–146). IEEE. https://doi.org/10.1109/ICTACS56270.2022.9988123

Ritu, P. , & Bhambri, P. (2023, February 17). Software effort estimation with machine learning – A systematic literature Review. In Susheela Hooda , Vandana Mohindru Sood , Yashwant Singh , Sandeep Dalal , Manu Sood (Eds.), Agile Software Development: Trends, Challenges and Applications (pp. 291–308). John Wiley & Sons, Inc.

Sangwan, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. , & Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. NVEO-Natural Volatiles & Essential Oils Journal| NVEO, 8(4), 15353–15362.

Singh, A. P. , Aggarwal, M. , Singh, H. , & Bhambri, P. (2021a). Sketching of EV network: A complete roadmap. In Sustainable Development Through Engineering Innovations: Select

Proceedings of SDEI 2020 (pp. 431–442). Springer Singapore.
Singh, G. , & Levi, J. (2020). MiPasa project and IBM Blockchain team on open data platform to support Covid-19 response. IBM, Armonk, NY.
Singh, M. , Bhambri, P. , Lal, S. , Singh, Y. , Kaur, M. , & Singh, J. (2021b). Design of the effective technique to improve memory and time constraints for sequence alignment. International Journal of Applied Engineering Research (Netherlands), 6(02), 127–142.
Tang, F. , Ma, S. , Xiang, Y. , & Lin, C. (2019). An efficient authentication scheme for blockchain-based electronic health records. IEEE Access, *7* , 41678–41689.
Tanwar, R. , Chhabra, Y. , Rattan, P. , & Rani, S. (2022, September). Blockchain in IoT networks for precision agriculture. In International Conference on Innovative Computing and Communications: Proceedings of ICICC 2022, Volume 2 (pp. 137–147). Singapore: Springer Nature Singapore.
Tanwar, S. , Parekh, K. , & Evans, R. (2020). Blockchain-based electronic healthcare record system for healthcare 4.0 applications. Journal of Information Security and Applications, *50* , 102407.
Uddin, M. A. , Stranieri, A. , Gondal, I. , & Balasubramanian, V. (2018). Continuous patient monitoring with a patient centric agent: A block architecture. IEEE Access, *6* , 32700–32726.
Vijayalakshmi, P. , Shankar, R. , Karthik, S. , & Bhambri, P. (2021). Impact of work from home policies on workplace productivity and employee sentiments during the Covid-19 pandemic. Journal of Maharaja Sayajirao University of Baroda, 55(01(VI)), 1314–1331.
Xu, H. , Zhang, L. , Onireti, O. , Fang, Y. , Buchanan, W. J. , & Imran, M. A. (2020). Beep Trace: Blockchain-enabled privacy-preserving contact tracing for COVID-19 pandemic and beyond. IEEE Internet of Things Journal, *8* (5), 3915–3929.
Zhang, J. (2020). Chinese startup launches blockchain platform to improve donation efficiency. Tech in Asia, 14.
Zheng, Z. , Xie, S. , Dai, H. N. , Chen, X. , & Wang, H. (2018). Blockchain challenges and opportunities: A survey. International Journal of Web and Grid Services, *14* (4), 352–375.

A Prediction of Telecom Customer Churn Analysis Using the I-GBDT Algorithm

Azeem, M. , Usman, M. , & Fong, A. C. M. (2017). A churn prediction model for prepaid customers in telecom using fuzzy classifiers. Telecommunication Systems, 66(4), 603–614.
Bakshi, P. , Bhambri, P. , & Thapar, V. (2021). A review paper on wireless sensor network techniques in Internet of Things (IoT). Wesleyan Journal of Research, 14(7), 147–160.
Bhambri, P. (2020). Green compliance. In S. Agarwal (Ed.), Introduction to green computing (pp. 95–125). AGAR Saliha Publication. ISBN: 978-81-948141-5-3.
Bhambri, P. , Kaur, H. , Gupta, A. , & Singh, J. (2020). Human activity recognition system. Oriental Journal of Computer Science and Technology, 13(2–3), 91–96.
Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of the GENE expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, 32(3), 1158–1167.
Caigny, A. D. , Coussement, K. , & Koen, W. (2018). A new hybrid classification algorithm for customer churn prediction based on logistic regression and decision trees. European Journal of Operational Research, 269(2), 760–772.
Chauhan, M. , & Rani, S. (2021). COVID-19: A revolution in the field of education in India. *Learning How to Learn Using Multimedia*, 23–42.
Chen, K. , Hu, Y. H. , & Hsien, Y. C. (2015). Predicting customer churn from valuable B2B customers in the logistics industry: A case study. Information Systems and E-Business Management, 13(3), 475–494.
Devadutta, K. , Bhambri, P. , Gountia, D. , Mehta, V. , Mangla, M. , Patan, R. , Kumar, A. , Agarwal, P. K. , Sharma, A. , Singh, M. , & Gadicha, A. B. (2020). Method for Cyber Security in Email Communication among Networked Computing Devices [Patent application number 202031002649]. India.
Gucci, D. O. D. R. , & Mardiansyah, Y. (2020). IMPLEMENTASI LEMBAR PENILAIAN POTENSI BAHAYA BERDASARKAN FRAMEWORK PENILAIAN POTENSI BAHAYA IDEACM

DI INDUSTRI MENGGUNAKAN PENDEKATAN ERGONOMI MAKRO (STUDI KASUS: PT XYZ). Journal Rekayasa Sistem Industri, 6(1), 45–50.

Guo, C. , Pleiss, G. , Sun, Y. & Weinberger, K.Q. (2017). On Calibration of Modern Neural Networks. Proceedings of the 34th International Conference on Machine Learning. Proceedings of Machine Learning Research, 70, 1321–1330. Available from https://proceedings.mlr.press/v70/guo17a.html

Hossain, M. A. , Quaresma, R. , & Rahman, M. H. (2019). Investigating factors influencing the physicians' adoption of electronic health record (EHR) in healthcare system of Bangladesh: An empirical study. International Journal of Information Management, 44, 76–87. https://doi.org/10.1016/j.ijinfomgt.2018.09.016

Hughes, A. M. (2005). Strategic database marketing. McGraw-Hill Pub. Co.

Jayaswal, P. , Tomar, D. , Agarwal, S. , & Prasad, B. R. (2016). An ensemble approach for efficient churn prediction in telecom industry. International Journal of Database Theory and Application, 9(8), 211–232.

Kataria, A. , Agrawal, D. , Rani, S. , Karar, V. , & Chauhan, M. (2022). Prediction of blood screening parameters for preliminary analysis using neural networks. In Sudipta Roy , Lalit Mohan Goyal , Valentina Emilia Balas , Basant Agarwal , Mamta Mittal (Eds.), Predictive modeling in biomedical data mining and analysis (pp. 157–169). Academic Press.

Khan, M. R. , & Blumenstock, J. E. (2016). Machine learning across cultures: Modeling the adoption of financial services for the poor. In 2016 ICML Workshop on #Data4Good: Machine Learning in Social Good Applications, New York, NY, USA.

Kincaid, J. (2003). Customer relationship management: Getting it right. NJ: Prentice-Hall.

Kisioglu, P. , & Topcu, Y. I. (2011). Applying Bayesian Belief Network approach to customer churn analysis: A case study on the telecom industry of Turkey. Expert Systems with Applications, 38(6), 7151–7157. https://doi.org/10.1016/j.eswa.2010.12.045

Kuzhaloli, S. , Devaneyan, P. , Sitaraman, N. , Periyathanbi, P. , Gurusamy, M. , & Bhambri, P. (2020). IoT based Smart Kitchen Application for Gas Leakage Monitoring [Patent application number 202041049866A]. India.

Li, Qing , Huaige Zhang , & Xianpei Hong (2020). Knowledge structure of technology licensing based on co-keywords network: A review and future directions. International Review of Economics & Finance, 75, 267–268. https://doi.org/10.1016/j.iref.2021.03.018

Liu, Rencheng , Ali, Saqib , Bilal, Syed Fakhar , Sakhawat, Zareen , Imran, Azha , Almuhaimeed, Abdullah , Alzahrani, Abdulkareem , & Sun, Guangmin , (2022). An intelligent hybrid scheme for customer churn prediction integrating clustering and classification algorithms. MDPI Applied Sciences, *12* , 9355.

Mahalekshmi, A. , & Chellam, G. H. (2022). Analysis of customer churn prediction using machine learning and deep learning algorithms. International Journal of Health Sciences, 6(S1), 11684–11693.

Olafsson, S. , Li, X. , & Wu, S. (2008). Operations research and data mining. European Journal of Operational Research, 187, 1429–1448.

Perez, M. J. , & Flannery, W. T. , (2009). A study of the relationships between service failures and customer churn in a telecommunications environment. In PICMET '09 - 2009 Portland International Conference on Management of Engineering Technology, 2009, pp. 3334–3342.

Rachna , Chhabra, Y. , & Bhambri, P. (2021). Various approaches and algorithms for monitoring energy efficiency of wireless sensor networks. In Lecture notes in civil engineering, Vol. 113, pp. 761–770. Springer Singapore.

Rana, R. , Chhabra, Y. , & Bhambri, P. (2021). Design and development of distributed clustering approach in wireless sensor network. Webology, 18(1), 696–712.

Rani, S. , & Gupta, O. P. (2016). Empirical analysis and performance evaluation of various GPU implementations of Protein BLAST. International Journal of Computer Applications, 151(7), 22–27.

Rani, S. , Kataria, A. , & Chauhan, M. (2022). Cyber security techniques, architectures, and design. In Holistic approach to quantum cryptography in cyber security (pp. 41–66). CRC Press.

Reinartz, W. , Thomas, J. , & Kumar, V. (2005). Balancing acquisition and retention resources to maximize profitability. Journal of Marketing, 69(1), 63–79.

Rygielski, C. , Wang, J. , & Yen, D. (2002). Data mining techniques for customer relationship management. Technology in Society, 24(4), 483–502.

Singh, G. , Singh, M. , & Bhambri, P. (2020). Artificial intelligence based flying car. In Proceedings of the International Congress on Sustainable Development through Engineering Innovations, pp. 216–227. ISBN 978-93-89947-14-4.
Singh, M. , Bhambri, P. , Dhanoa, I. S. , Jain, A. , & Kaur, K. (2021). Data mining model for predicting diabetes. Annals of the Romanian Society for Cell Biology, 25(4), 6702–6712.
Sumathi, N. , Thirumagal, J. , Jagannathan, S. , Bhambri, P. , & Ahamed, I. N. (2021). A comprehensive review on bionanotechnology for the 21st century. Journal of the Maharaja Sayajirao University of Baroda, 55(1), 114–131.
Toderean , & Beleiu, H. (2016). Methods for churn prediction in the prepaid mobile telecommunications industry. In 2016 International Conference on Communications (COMM), 2016, pp. 97–100.
Yabas, U. , & Cankaya, H. C. , (2013). Churn prediction in subscriber management for mobile and wireless communications services. In *2013 IEEE Globecom Workshops* (GC Wkshps), 2013, pp. 991–995.
Zacharis, K. , Messini, C. I. , Anifandis, G. , Koukoulis, G. , Satra, M. , & Daponte, A. (2018). Human Papilloma Virus (HPV) and fertilization: A mini review. Medicina (Kaunas), 54(4), 50. https://doi.org/10.3390/medicina54040050
Zeineb, A. , & Rania, H. K. (2019). Forecast bankruptcy using a blend of clustering and MARS model: Case of US banks. Annals of Operations Research, 281(1–2), 27–64.
Zengyuan, Wu , Lizheng, Jing , Wu, Bei , & Jin, Lingmin (2022). A PCA-AdaBoostmodel for E-commerce customer churn prediction. Annals of operations research. Springer Nature.
Zhang, H. , Demirer, R. , & Pierdzioch, C. (2017). On the short-term predictability of stock returns: A quantile boosting approach. Finance Research Letters, 22(3), 35–41.
Zhang, X. , Gao, T. , Fang, L. , Fackler, S. , Borchers, J. A. , Kirby, B. J. , … Takeuchi, I. (2021, November 17). Chiral Spin Bobbers in Exchange-Coupled Hard-Soft Magnetic Bilayers. arXiv preprint, arXiv:2111.09183.

Deployment of Machine Learning and Deep Learning Algorithms in Industrial Engineering

Alsawafy, O. G. , & Selim, S. Z. (2022). Analysis of a discrete production workstation. Computers & Operations Research, *137* , 105532. https://doi.org/10.1016/j.cor.2021.105532
Arunachalam, P. , Janakiraman, N. , Sivaraman, A. K. , Balasundaram, A. , Vincent, R. , Rani, S. , … & Rajesh, M. (2022). Synovial sarcoma classification technique using support vector machine and structure features. Intelligent Automation & Soft Computing, *32* (2), 34–43.
Banerjee, K. , Bali, V. , Nawaz, N. , Bali, S. , Mathur, S. , Mishra, R. K. , & Rani, S. (2022). A machine-learning approach for prediction of water contamination using latitude, longitude, and elevation. Water, *14* (5), 728.
Bauza, M. B. , Tenboer, J. , Li, M. , Lisovich, A. , Zhou, J. , Pratt, D. , & Knebel, R. (2018). Realization of industry 4.0 with high speed CT in high volume production. CIRP Journal of Manufacturing Science and Technology, *22* , 121–125. https://doi.org/10.1016/j.cirpj.2018.04.001
Bhagwan, N. , & Evans, M. (2023). A review of industry 4.0 technologies used in the production of energy in China, Germany, and South Africa. Renewable and Sustainable Energy Reviews, *173* , 113075. https://doi.org/10.1016/j.rser.2022.113075
Bhambri, P. , Sinha, V. K. , & Dhanoa, I. S. (2020). Diabetes prediction with WEKA tool. Journal of Critical Reviews, *7* (9), 2366–2371.
Bolu, A. , & Korçak, Ö. (2021). Adaptive task planning for multi-robot smart warehouse. IEEE Access, *9* , 27346–27358. https://doi.org/10.1109/ACCESS.2021.3058190
Can, B. , & Heavey, C. (2016, December). A demonstration of machine learning for explicit functions for cycle time prediction using MES data. In 2016 Winter Simulation Conference (WSC) (pp. 2500–2511). IEEE. https://doi.org/10.1109/WSC.2016.7822289
Chang, P. C. , Lin, Y. K. , & Chiang, Y. M. (2019). System reliability estimation and sensitivity analysis for multi-state manufacturing network with joint buffers–A simulation approach. Reliability Engineering & System Safety, *188* , 103–109. https://doi.org/10.1016/j.ress.2019.03.024

Dhanoa, I. S. , & Bhambri, P. (2020). Traffic-aware energy efficient VM migrations. Journal of Critical Reviews, *7* (19), 177–183.
Duarte, S. , & Cruz-Machado, V. (2017, July). Exploring linkages between lean and green supply chain and the industry 4.0. In International Conference on Management Science and Engineering Management (pp. 1242–1252). Springer, Cham. https://doi.org/10.1007/978-3-319-59280-0_103
Fan, Y. , Yang, J. , Chen, J. , Hu, P. , Wang, X. , Xu, J. , & Zhou, B. (2021). A digital-twin visualized architecture for flexible manufacturing system. Journal of Manufacturing Systems, *60* , 176–201. https://doi.org/10.1016/j.jmsy.2021.05.010
Fritzsche, R. , Richter, A. , & Putz, M. (2017). Automatic adjustment of car body fixtures using artificial intelligence. Procedia Cirp, *62* , 600–605. https://doi.org/10.1016/j.procir.2016.06.075
Golkarnarenji, G. , Naebe, M. , Badii, K. , Milani, A. S. , Jazar, R. N. , & Khayyam, H. (2019). A machine learning case study with limited data for prediction of carbon fiber mechanical properties. Computers in Industry, *105* , 123–132. https://doi.org/10.1016/j.compind.2018.11.004
Jalayer, M. , Orsenigo, C. , & Vercellis, C. (2021). Fault detection and diagnosis for rotating machinery: A model based on convolutional LSTM, Fast Fourier and continuous wavelet transforms. Computers in Industry, *125* , 103378. https://doi.org/10.1016/j.compind.2020.103378
Jelsch, M. , Roggo, Y. , Mohamad, A. , Kleinebudde, P. , & Krumme, M. (2022). Automatic system dynamics characterization of a pharmaceutical continuous production line. European Journal of Pharmaceutics and Biopharmaceutics, *180* , 137–148. https://doi.org/10.1016/j.ejpb.2022.09.010
Kang, Z. , Catal, C. , & Tekinerdogan, B. (2020). Machine learning applications in production lines: A systematic literature review. Computers & Industrial Engineering, *149* , 106773. https://doi.org/10.1016/j.cie.2020.106773
Kaur, J. , & Bhambri, P. (2020). Hybrid classification model for the reverse code generation in software engineering. I.K. Gujral Punjab Technical University.
Kaur, K. , Dhanoa, I. S. , Bhambri, P. , & Singh, G. (2020). Energy saving VM migration techniques. Journal of Critical Reviews, *7* (9), 2359–2365.
Khan, M. , Wu, X. , Xu, X. , & Dou, W. (2017, May). Big data challenges and opportunities in the hype of Industry 4.0. In 2017 IEEE International Conference on Communications (ICC) (pp. 1–6). IEEE. https://doi.org/10.1109/ICC.2017.7996801
Lemstra, M. A. M. S. , & de Mesquita, M. A. (2023). Industry 4.0: A tertiary literature review. Technological Forecasting and Social Change, *186* , 122204. https://doi.org/10.1016/j.techfore.2022.122204
Lihao, W. , & Yanni, D. (2018, November). A fault diagnosis method of tread production line based on convolutional neural network. In 2018 IEEE 9th International Conference on Software Engineering and Service Science (ICSESS) (pp. 987–990). IEEE. https://doi.org/10.1109/ICSESS.2018.8663824
Ling, S. , Li, M. , Guo, D. , Rong, Y. , & Huang, G. Q. (2022). Assembly Workstation 4.0: Concept, framework and research perspectives for assembly systems implementation in the Industry 4.0 era. IFAC-PapersOnLine, *55* (2), 420–426. https://doi.org/10.1016/j.ifacol.2022.04.230
Liu, X. , Jin, J. , Wu, W. , & Herz, F. (2020). A novel support vector machine ensemble model for estimation of free lime content in cement clinkers. ISA Transactions, *99* , 479–487. https://doi.org/10.1016/j.isatra.2019.09.003
Liu, Y. , Zhou, H. , Tsung, F. , & Zhang, S. (2019). Real-time quality monitoring and diagnosis for manufacturing process profiles based on deep belief networks. Computers & Industrial Engineering, *136* , 494–503. https://doi.org/10.1016/j.cie.2019.07.042
Luo, R. C. , & Wang, H. (2018, August). Diagnostic and prediction of machines health status as exemplary best practice for vehicle production system. In 2018 IEEE 88th Vehicular Technology Conference (VTC-Fall) (pp. 1–5). IEEE. https://doi.org/10.1109/VTCFall.2018.8690710
Müller, J. , Dotzauer, V. , & Voigt, K. I. (2017). Industry 4.0 and its impact on reshoring decisions of German manufacturing enterprises. In Christoph Bode , Ronald Bogaschewsky , Michael Eßig , Rainer Lasch , Wolfgang Stölzle (Ed.), Supply management research (pp. 165–179). Springer Gabler, Wiesbaden. https://doi.org/10.1007/978-3-658-18632-6_8
Mulrennan, K. , Donovan, J. , Creedon, L. , Rogers, I. , Lyons, J. G. , & McAfee, M. (2018). A soft sensor for prediction of mechanical properties of extruded PLA sheet using an instrumented

slit die and machine learning algorithms. Polymer Testing, *69* , 462–469. https://doi.org/10.1016/j.polymertesting.2018.06.002

Nicoletti, B. (2018). The future: Procurement 4.0. In Agile procurement (pp. 189–230). Palgrave Macmillan. https://doi.org/10.1007/978-3-319-61085-6_8

Pfohl, H. C. , Yahsi, B. , & Kurnaz, T. (2017). Concept and diffusion-factors of industry 4.0 in the supply chain. In Michael Freitag , Herbert Kotzab , Jürgen Pannek (Eds.), Dynamics in logistics (pp. 381–390). Springer. https://doi.org/10.1007/978-3-319-45117-6_33

Potluri, S. , Tiwari, P. K. , Bhambri, P. , Obulesu, O. , Naidu, P. A. , Lakshmi, L. , Kallam, S. , Gupta, S. , & Gupta, B. (2019). Method of Load Distribution Balancing for Fog Cloud Computing in IoT Environment [Patent number IN201941044511].

Principi, E. , Rossetti, D. , Squartini, S. , & Piazza, F. (2019). Unsupervised electric motor fault detection by using deep autoencoders. IEEE/CAA Journal of Automatica Sinica, *6* (2), 441–451. https://doi.org/10.1109/JAS.2019.1911393

Rani, S. , Arya, V. , & Kataria, A. (2022). Dynamic pricing-based E-commerce model for the produce of organic farming in India: A research roadmap with main advertence to vegetables. In Proceedings of Data Analytics and Management: ICDAM 2021, Volume 2 (pp. 327–336). Springer Singapore.

Rani, S. , Bhambri, P. , & Chauhan, M. (2021, October). A machine learning model for kids' behavior analysis from facial emotions using principal component analysis. In 2021 5th Asian Conference on Artificial Intelligence Technology (ACAIT) (pp. 522–525). IEEE.

Santos, M. Y. , Oliveira e Sá, J. , Costa, C. , Galvão, J. , Andrade, C. , Martinho, B. , … & Costa, E. (2017, April). A big data analytics architecture for industry 4.0. In World Conference on Information Systems and Technologies (pp. 175–184). Springer. https://doi.org/10.1007/978-3-319-56538-5_19

Sharma, R. , & Bhambri, P. (2020). Energy aware bio inspired routing technique for mobile adhoc networks. I.K. Gujral Punjab Technical University.

Sharma, R. , Bhambri, P. , & Sohal, A. K. (2020). Mobile adhoc networks. Journal of Composition Theory, *13* (2), 982–985.

Usuga Cadavid, J. P. , Lamouri, S. , Grabot, B. , Pellerin, R. , & Fortin, A. (2020). Machine learning applied in production planning and control: A state-of-the-art in the era of industry 4.0. Journal of Intelligent Manufacturing, *31* (6), 1531–1558. https://doi.org/10.1007/s10845-019-01531-7

Wang, P. , Gao, R. X. , & Yan, R. (2017). A deep learning-based approach to material removal rate prediction in polishing. Cirp Annals, *66* (1), 429–432. https://doi.org/10.1016/j.cirp.2017.04.013

Wang, Y. , & Yang, R. (2017, October). Fault diagnosis system of emulsifier based on neural network theory. In 2017 Chinese Automation Congress (CAC) (pp. 3087–3091). IEEE. https://doi.org/10.1109/CAC.2017.8243305

Wang, Z. H. , Liu, Y. M. , Gong, D. Y. , & Zhang, D. H. (2018). A new predictive model for strip crown in hot rolling by using the hybrid AMPSO-SVR-based approach. Steel Research International, *89* (7), 1800003. https://doi.org/10.1002/srin.201800003

Xiao, D. , Huang, Y. , Zhang, X. , Shi, H. , Liu, C. , & Li, Y. (2018, October). Fault diagnosis of asynchronous motors based on LSTM neural network. In 2018 Prognostics and System Health Management Conference (PHM-Chongqing) (pp. 540–545). IEEE. https://doi.org/10.1109/PHM-Chongqing.2018.00098

Simulation Analysis of AODV and DSDV Routing Protocols for Secure and Reliable Service in Mobile Adhoc Networks (MANETs)

Alhaidari, F. , Almotiri, S. H. , Ghamdi, M. A. , Khan, M. A. , Rehman, A. , Abbas, S. , Khan, K. M. , & Rahman, A. (2021). Intelligent software-defined network for cognitive routing optimization using deep extreme learning machine approach. Computers, Materials & Continua, vol. 67, no. 1, 1269–1285.

Anchugam, C.V. , & Thangadurai, K. (July 2015). Detection of black hole attack in mobile adhoc networks using ant colony optimization – Simulation analysis. Indian Journal of Science and Technology, vol. 8(13).

Babu, G. C. N. , Gupta, S. , Bhambri, P. , Leo, L. M. , Rao, B. H. , & Kumar, S. (2021). A semantic health observation system development based on the IoT sensors. Turkish Journal of Physiotherapy and Rehabilitation, vol. 32, no. 3, 1721–1729.

Bhambri, P. , Singh, M. , Dhanoa, I. S. , & Kumar, M. (2022). Deployment of ROBOT for HVAC duct and disaster management. Oriental Journal of Computer Science and Technology, vol. 15, 1–18.

Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of gene expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, vol. 32, 3.

Bhambri, P. , Singh, S. , Sangwan, S. , Devi, J. , & Jain, S. (2023). Plants recognition using leaf image pattern analysis. Journal of Survey in Fisheries Sciences, vol. 10, no. 2S, 3863–3871.

Bose, M. M. , Yadav, D. , Bhambri, P. , & Shankar, R (2021). Electronic customer relationship management: Benefits and pre-implementation considerations. Journal of Maharaja Sayajirao University of Baroda, vol. 55, no. 01(VI), 1343–1350.

Ibrahim, N. M. , Gabr, D. G. I. , Rahman, A. , Dash, S. , & Nayyar, A. (2022). A deep learning approach to intelligent fruit identification and family classification. Multimedia Tools and Applications, vol. 6, no. 7, 76–87.

Jabeen, A. , Pallathadka, H. , Pallathadka, L. K. , & Bhambri, P. (2021). E-CRM successful factors for business enterprises case studies. Journal of Maharaja Sayajirao University of Baroda, vol. 55, no. 01(VI), 1332–1342.

Jamal, M. , Zafar, N. A. , Rahman, A. , Musleh, D. , Gollapalli, M. , & Chabani, S. (2022). Modeling and verification of aircraft takeoff through novel quantum nets. Computers, Materials and Continua, vol. 72, no. 2, 3331–3348.

Mahmoud, T. M. , Aly, A. , & Makram, O. (January 2015). A modified AODV routing protocol to avoid black hole attack in MANETs. International Journal of Computer Applications, vol. 109, no. 6, 876–888.

Quy, V. K. , Ban, N. T. , & Han, N. D. (2018). An advanced energy efficient and high performance routing protocol for MANET in 5G. Journal of Communications, vol. 13, no. 12, 743–749.

Quy, V. K. , Ban, N. T. , & Han, N. D. (2019a). A high performance routing protocol for multimedia applications in MANETs. Journal of Communications, vol. 14, no. 4, 267–274.

Quy, V. K. , Hung, L. N. , & Han, N. D. (2019b). CEPRM: A cloud-assisted energy-saving and performance-improving routing mechanism for MANETs. Journal of Communications, vol. 14, no. 12, 1211–1217.

Quy, V. K. , Nam, V. H. , Linh, D. M. , et al. (2022). Communication solutions for vehicle ad-hoc network in smart cities environment: A comprehensive survey. Wireless Personal Communications, vol. 122, 2791–2815.

Rachna , Bhambri, P. , & Chhabra, Y. (2022). Deployment of Distributed Clustering Approach in WSNs and IoTs. In Pankaj Bhambri , Sita Rani , Gaurav Gupta , Alex Khang (Eds.), Cloud and Fog Computing Platforms for Internet of Things (pp. 85–98). Chapman and Hall/CRC.

Ritu , & Bhambri, P. (2022). A CAD System for Software Effort Estimation. *Paper presented at the* International Conference on Technological Advancements in Computational Sciences (pp. 140–146). IEEE. DOI: 10.1109/ICTACS56270.2022.9988123.

Ritu, P. , & Bhambri, P. (2023, February 17). Software Effort Estimation with Machine Learning – A Systematic Literature Review. In Susheela Hooda , Vandana Mohindru Sood , Yashwant Singh , Sandeep Dalal , Manu Sood (Eds.), Agile Software Development: Trends, Challenges and Applications (pp. 291–308). John Wiley & Sons, Inc.

Sangwan, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. , & Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. NVEO-Natural Volatiles & Essential Oils Journal|NVEO, vol. 8, no. 4, 15353–15362.

Sharma, S. , & Patheja, P. S. (2012). Improving AODV routing protocol with priority and power efficiency in mobile ad hoc WiMAX network. International Journal of Computer Technology and Electronics Engineering (IJCTEE), vol. 2, no. 1, 67–89. ISSN 2249-6343.

Singh, M. , Bhambri, P. , Lal, S. , Singh, Y. , Kaur, M. , & Singh, J. (2021). Design of the effective technique to improve memory and time constraints for sequence alignment. International Journal of Applied Engineering Research (Netherlands), vol. 6, no. 02, 127–142.

Vijayalakshmi, P. , Shankar, R. , Karthik, S. , & Bhambri, P. (2021). Impact of work from home policies on workplace productivity and employee sentiments during the Covid-19 pandemic. Journal of Maharaja Sayajirao University of Baroda, vol. 55, no. 01(VI), 1314–1331.

Landmine Detection and Classification Based on Machine Learning Algorithms

Abraham, R. S. A. (2013). Comparison of supervised and unsupervised learning algorithms for pattern classification. International Journal of Advanced Research in Artificial Intelligence, *2* (2), 34–38.

Andrew Karem, H. F. (2011). A multiple instance learning approach for landmine detection using ground penetrating radar. 2011 IEEE International Geoscience and Remote Sensing Symposium, Vancouver, BC, Canada. (pp. 878–881).

Anis Hamdi, H. F. (2015). Ensemble hidden Markov models with application to landmine detection. EURASIP Journal on Advances in Signal Processing. https://doi.org/10.1186/s13634-015-0260-8

Ayon Dey . (2016). Machine learning algorithms: A review. International Journal of Computer Science and Information Technologies, *7* (3), 1174–1179. https://doi.org/10.21275/ART20203995

Bakshi, P. , Bhambri, P. , & Thapar, V. (2021). A review paper on wireless sensor network techniques in Internet of Things (IoT). Wesleyan Journal of Research, *14* (7), 147–160.

Banerjee, K. , Bali, V. , Nawaz, N. , Bali, S. , Mathur, S. , Mishra, R. K. , & Rani, S. (2022). A machine-learning approach for prediction of water contamination using latitude, longitude, and elevation. Water, *14* (5), 728.

Bhambri, P. (2020). Green compliance. In S. Agarwal (Ed.), Introduction to Green Computing (pp. 95–125). AGAR Saliha Publication. ISBN: 978-81-948141-5-3.

Bhambri, P. (2021). Electronic evidence. In Kamal Gulati , Narinder Kumar Bhasin (Eds.), Textbook of Cyber Heal (pp. 86–120). AGAR Saliha Publication. ISBN: 978-81-948141-7-7.

Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of the GENE expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, *32* (3), 1158–1167.

Camilo, J. A. , Malof, J. M. , & Collins, L. M. (2016). A feature learning approach for classifying buried threats in forward looking ground penetrating radar data. Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XXI, *9823* , 98231I. https://doi.org/10.1117/12.2223117

Conyers, L. B. (2018). Ground penetrating radar. In The Encyclopedia of Archaeological Sciences. John Wiley & Sons, Inc. https://doi.org/10.1002/9781119188230.saseas0272

“Facts About Landmines - Minesweepers,” (n.d.). Minesweepers, 2019. https://landminefree.org/facts-about-landmines/

Florez-Lozano, J. , Caraffini, F. , Parra, C. , & Gongora, M. (2020). Cooperative and distributed decision-making in a multi-agent perception system for improvised land mines detection. Information Fusion, *64* (September 2019), 32–49. https://doi.org/10.1016/j.inffus.2020.06.009

Frigui, H. , & Gader, P. (2009). Detection and discrimination of land mines in ground-penetrating radar based on edge histogram descriptors and a possibilistic K-nearest neighbor classifier. IEEE Transactions on Fuzzy Systems, *17* (1), 185–199. https://doi.org/10.1109/TFUZZ.2008.2005249

Ghareeb, M. , Bazzi, A. , Raad, M. and Abdulnabi, S. (2017). Wireless Robo-Pi for landmine detection. 2017 First International Conference on Landmine: Detection, Clearance and Legislations (LDCL) (pp. 1–5). https://doi.org/10.1109/LDCL.2017.7976932

Giovanneschi, F. , Gonzalez-Huici, M. A. , & Uschkerat, U. (2013). A parametric analysis of time and frequency domain GPR scattering signatures from buried landmine-like targets. Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XVIII, 8709 (November 2014, p. 870914). https://doi.org/10.1117/12.2015804

Gupta, O. , Rani, S. , & Pant, D. C. (2011). Impact of parallel computing on bioinformatics algorithms. In Proceedings 5th IEEE International Conference on Advanced Computing and Communication Technologies (pp. 206–209).

Gutierrez, S. , Vega, F. , Gonzalez, F. A. , Baer, C. , & Sachs, J. (2019). Application of polarimetric features and support vector machines for classification of improvised explosive devices. IEEE Antennas and Wireless Propagation Letters, *18* (11), 2282–2286. https://doi.org/10.1109/LAWP.2019.2934691

Harkat, H. , Ruano, A. E. , Ruano, M. G. , & Bennani, S. D. (2019). GPR target detection using a neural network classifier designed by a multi-objective genetic algorithm. Applied Soft Computing Journal, *79* , 310–325. https://doi.org/10.1016/j.asoc.2019.03.030

Hussein, E. M. A. , & Waller, E. J. (2000). Landmine detection: The problem and the challenge. Applied Radiation and Isotopes, *53* (4–5), 557–563. https://doi.org/10.1016/S0969-8043(00)00218-9

Jin, T. , & Zhou, Z. (2010). Ultrawideband synthetic aperture radar unexploded ordnance detection. IEEE Transactions on Aerospace and Electronic Systems, *46* (3), 1201–1213. https://doi.org/10.1109/TAES.2010.5545183

Kasban, H. , Zahran, O. , Elaraby, S. M. , El-Kordy, M. , & Abd El-Samie, F. E. (2010). A comparative study of landmine detection techniques. Sensing and Imaging, *11* (3), 89–112. https://doi.org/10.1007/s11220-010-0054-x

Khalaf, M. W. , Elsherbeni, A. Z. , El-Hefnawi, F. M. , Harb, H. M. , & Bannis, M. H. (2018). Feature extraction and classification of buried landmine signals. 2018 IEEE Antennas and Propagation Society International Symposium and USNC/URSI National Radio Science Meeting, APSURSI 2018 - Proceedings (vol. 2, 1175–1176). https://doi.org/10.1109/APUSNCURSINRSM.2018.8609023

K-Nearest Neighbor(KNN) Algorithm for Machine Learning - Javatpoint. (n.d.). Retrieved November 11, 2022 , from https://www.javatpoint.com/k-nearest-neighbor-algorithm-for-machine-learning

Kuzhaloli, S. , Devaneyan, P. , Sitaraman, N. , Periyathanbi, P. , Gurusamy, M. , & Bhambri, P. (2020). IoT Based Smart Kitchen Application for Gas Leakage Monitoring [Patent application number 202041049866A]. India.

Manandhar, A. , Torrione, P. A. , Collins, L. M. , & Morton, K. D. (2015). Multiple-instance hidden markov model for GPR-based landmine detection. IEEE Transactions on Geoscience and Remote Sensing, *53* (4), 1737–1745. https://doi.org/10.1109/TGRS.2014.2346954

Missaoui, O. , Frigui, H. , & Gader, P. (2011). Landmine detection with ground-penetrating radar using multistream discrete hidden Markov models. IEEE Transactions on Geoscience and Remote Sensing, *49* (6 PART 1), 2080–2099. https://doi.org/10.1109/TGRS.2010.2090886

Mohammed, Mohssen , Khan, Muhammad Badruddin , Bashier, E. (n.d.). Machine learning algorithms and applications. CRC Press. https://doi.org/10.1201/9781315371658

Nguyen, L. (2016). Tutorial on hidden Markov model. Special Issue “Some Novel Algorithms for Global Optimization and Relevant Subjects”, Applied and Computational Mathematics (ACM), *6* (4–1), 16–38. https://doi.org/10.11648/j.acm.s.2017060401.12

Osisanwo, F. Y. , Akinsola, J. E. T. , Awodele, O. , Hinmikaiye, J. O. , Olakanmi, O. , & Akinjobi, J. (2017). Supervised machine learning algorithms: Classification and comparison. International Journal of Computer Trends and Technology, *48* (3), 128–138. https://doi.org/10.14445/22312803/ijctt-v48p126

Oualid Missaoui, H. F. , Frigui, H , & Gader, P. (2013). Multi-stream continuous hidden Markov models with application to landmine detection. EURASIP Journal on Advances in Signal Processing, *6* (3), 43–56.

Rachna , Chhabra, Y. , & Bhambri, P. (2021). Various approaches and algorithms for monitoring energy efficiency of wireless sensor networks. In Lecture Notes in Civil Engineering (Vol. 113, pp. 761–770). Springer.

Rana, R. , Chhabra, Y. , & Bhambri, P. (2021). Design and development of distributed clustering approach in wireless sensor network. Webology, *18* (1), 696–712.

Rani, S. , Bhambri, P. , & Chauhan, M. (2021, October). A machine learning model for kids’ behavior analysis from facial emotions using principal component analysis. In 2021 5th Asian Conference on Artificial Intelligence Technology (ACAIT) (pp. 522–525). IEEE.

Rani, S. , & Gupta, O. P. (2016). Empirical analysis and performance evaluation of various GPU implementations of protein BLAST. International Journal of Computer Applications, *151* (7), 22–27.

Reichman, D. , Collins, L. M. , & Malof, J. M. (2018). On choosing training and testing data for supervised algorithms in ground-penetrating radar data for buried threat detection. IEEE Transactions on Geoscience and Remote Sensing, *56* (1), 497–507. https://doi.org/10.1109/TGRS.2017.2750920

Safatly, L. , Baydoun, M. , Alipour, M. , Al-Takach, A. , Atab, K. , Al-Husseini, M. , El-Hajj, A. , & Ghaziri, H. (2021). Detection and classification of landmines using machine learning applied to metal detector data. Journal of Experimental and Theoretical Artificial Intelligence, *33* (2), 203–226. https://doi.org/10.1080/0952813X.2020.1735529

Sato, M. , Hamada, Y. , Feng, X. , Kong, F.-N. , Zeng, Z. , & Fang, G. (2004). GPR using an array antenna for landmine detection. Near Surface Geophysics, *2* (1), 7–13.

https://doi.org/10.3997/1873-0604.2003011
Shi, X. , Song, Z. , & Wang, C. (2018). A Real-time Method For Landmine Detection Using Vehicle Array GPR. Water. https://www.mdpi.com/2073-4441/14/5/728
Silva, J. S. , Guerra, I. F. L. , Bioucas-Dias, J. , & Gasche, T. (2019). Landmine detection using multispectral images. IEEE Sensors Journal, *19* (20), 9341–9351. https://doi.org/10.1109/JSEN.2019.2925203
Singh, M. , Bhambri, P. , Dhanoa, I. S. , Jain, A. , & Kaur, K. (2021a). Data mining model for predicting diabetes. Annals of the Romanian Society for Cell Biology, *25* (4), 6702–6712.
Singh, N. S. V. (2019). Decluttering using wavelet based higher order statistics and target detection of GPR images. Sensing and Imaging. https://doi.org/10.1007/s11220-018-0223-x
Singh, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. , & Dhanoa, I. S. (2021b). Advancements in social data security and encryption: A review. Natural Volatiles & Essential Oils, *8* (4), 15353–15362.
Sumathi, N. , Thirumagal, J. , Jagannathan, S. , Bhambri, P. , & Ahamed, I. N. (2021). A comprehensive review on bionanotechnology for the 21st century. Journal of the Maharaja Sayajirao University of Baroda, *55* (1), 114–131.
Support Vector Machine (SVM) Algorithm - Javatpoint. (n.d.). Retrieved November 10, 2022 , from https://www.javatpoint.com/machine-learning-support-vector-machine-algorithm
Takahashi, K. , Preetz, H. , & Igel, J. (2011). Soil properties and performance of landmine detection by metal detector and ground-penetrating radar – Soil characterisation and its verification by a field test. Journal of Applied Geophysics, *73* (4), 368–377. https://doi.org/10.1016/j.jappgeo.2011.02.008
Tbarki, K. , Ben Said, S. , Ksantini, R. , & Lachiri, Z. (2017). Landmine detection improvement using one-class SVM for unbalanced data. Proceedings – 3rd International Conference on Advanced Technologies for Signal and Image Processing, ATSIP 2017 (pp. 1–6). https://doi.org/10.1109/ATSIP.2017.8075597
Todkar, S. S. , Baltazart, V. , Ihamouten, A. , Dérobert, X. , & Guilbert, D. (2021). One-class SVM based outlier detection strategy to detect thin interlayer debondings within pavement structures using ground penetrating radar data. Journal of Applied Geophysics, *192* . https://doi.org/10.1016/j.jappgeo.2021.104392
Yuan, D. , An, Z. , & Zhao, F. (2019). Gray-statistics-based twin feature extraction for hyperbola classification in ground penetrating radar images. Procedia Computer Science, *147* , 567–573. https://doi.org/10.1016/j.procs.2019.01.215
Yuksel, Seniha E. , & Gader, P. D. (2016). Context-based classification via mixture of hidden Markov model experts with applications in landmine detection. IET Computer Vision, 873–883. https://doi.org/10.1049/iet-cvi.2016.0138

Application of Queuing Technique in an Educational Institute Canteen

Abolnikova L. , Agarwal R. P. and Dshalalow J. H. (2007). Random walk analysis of parallel queuing stations, Mathematical and Computer Modelling, 27, 452–468.
Akbari E. , Cung F. , Patel H. and Razaque A. (2016). Incorporation of Weighted Linear Prediction Technique and M/M/1 Queuing Theory for Improving Energy Efficiency of Cloud Computing Datacenters, IEEE Long Island Systems, Applications and Technology Conference (LISAT), 12, 55–60.
Chawla V.K. (2005). Operation Research, Kalayani publications, New Delhi.
Hira D. S. (2007). Operations Research, S. Chand publications, New Delhi.
Malipatil N. , Avati S. I. , Vinay H. N. and Sunil S. (2017). Application of queuing theory to a Toll Plaza-A case study, Conference of Transportation Research Group of India (CTRG-2019), 45, 343–354.
Nobel R. and Moreno P. (2008). A discrete-time retrial queuing model with one server, European Journal of Operational Research, 189, 1088–1103.
Oluwadare S. A. , Agbonifo O. C. and Babatunde A. T. (2019). Network Traffic analysis using queuing model and regression technique, Journal of Information, 5, 16–26.
Pazgala A. I. and Radas S. (2008). Comparison of customer balking and reneging behavior to queuing theory predictions: An experimental study, Computers & Operations Research, 35,

2537–2548.
Rao S. S. (1978). Optimization-Theory and Practice, Wiley Eastern Ltd., New Delhi.
Taha H. A. (2001). Operation Research: an Introduction (sixth ed.), Macmillan publishing co., New York.

IoT-Based Driver Drowsiness Detection and Alerting System Using Haar Cascade and Eye Aspect Ratio Algorithms

Majumder, S. , Guragain, B. , Wang, C. , & Wilson, N. (2019). On-board Drowsiness Detection using EEG: Current Status and Future Prospects. In 2019 IEEE International Conference on Electro Information Technology (EIT). doi:10.1109/eit.2019.8833866.
Nikolskaia, K. , Bessonov, V. , Starkov, A. , & Minbaleev, A. (2019). Prototype of Driver Fatigue Detection System Using Convolutional Neural Network. In 2019 International Conference “Quality Management, Transport and Information Security, Information Technologies” (IT & QM & IS). doi:10.1109/itqmis.2019.8928341.
Mehreen, A. , Anwar, S.M. , Haseeb, M. , Majid, M. , & Ullah, M.O. (2019). A hybrid scheme for drowsiness detection using wearable sensors. IEEE Sensors Journal, 1–1. doi:10.1109/jsen.2019.2904222.
Dhanalakshmi, R. , Anand, J. , Sivaraman, A. K. , & Rani, S. (2022). IoT-based water quality monitoring system using cloud for agriculture use. In Cloud and fog computing platforms for internet of things (pp. 183–196). Chapman and Hall/CRC.
Hong, Tianyi , & Qin, Huabiao . (2007). Drivers’ Drowsiness Detection in Embedded System. In 2007 IEEE International Conference on Vehicular Electronics and Safety. doi:10.1109/icves.2007.4456381.
Ritu, P. , & Bhambri, P. (2023, February 17). Software effort estimation with machine learning – A Systematic literature review. In Susheela Hooda , Vandana Mohindru Sood , Yashwant Singh , Sandeep Dalal , Manu Sood (Eds.), Agile Software Development: Trends, Challenges and Applications (pp. 291–308). John Wiley & Sons, Inc.
Sangwan, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. , & Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. NVEO-Natural Volatiles & Essential Oils Journal|NVEO, 8(4), 15353–15362.
Katyal, Y. , Alur, S. , & Dwivedi, S. (2014). Safe Driving by Detecting Lane Discipline and Driver Drowsiness. In 2014 IEEE International Conference on Advanced Communications, Control and Computing Technologies. doi:10.1109/icaccct.2014.7019248.
Anilkumar, C. V. , Ahmed, M. , Sahana, R. , Thejashwini, R. , & Anisha, P. S. (2016). Design of Drowsiness, Heart Beat Detection System and Alertness Indicator for Driver Safety. In 2016 IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT). doi:10.1109/rteict.2016.7807966.
Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of gene expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, 32, 3.
Jafari Yazdi, M. Z. , & Soryani, M. (2019). Driver Drowsiness Detection by Yawn Identification Based on Depth Information and Active Contour Model. In 2019 2nd International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT). doi:10.1109/icicict46008.2019.899.
Girish, I. , Kumar, A. , Kumar, A. , & Anuradha, M. (2020). Driver Fatigue Detection. In 2020 IEEE 17th India Council International Conference (INDICON). doi:10.1109/indicon49873.2020.934.
Bhambri, P. , Singh, S. , Sangwan, S. , Devi, J. , & Jain, S. (2023). Plants recognition using leaf image pattern analysis. Journal of Survey in Fisheries Sciences, 10(2S), 3863–3871.
Babaeian, M. , and Mozumdar, M. (2019). Driver Drowsiness Detection Algorithms Using Electrocardiogram Data Analysis. In 2019 IEEE 9th Annual Computing and Communication Workshop and Conference (CCWC). doi:10.1109/ccwc.2019.8666467.
Budak, U. , Bajaj, V. , Akbulut, Y. , Atilla, O. , and Sengur, A. (2019). An effective hybrid model for EEG-based drowsiness detection. IEEE Sensors Journal, *1–1* . doi: 10.1109/jsen.2019.2917850.

Arya, V. , Rani, S. , & Choudhary, N. (2022). Enhanced Bio-Inspired Trust and Reputation Model for Wireless Sensor Networks. In Proceedings of Second Doctoral Symposium on Computational Intelligence: DoSCI 2021 (pp. 569–579). Springer Singapore.

Bhambri, P. , Singh, M. , Dhanoa, I. S. , & Kumar, M. (2022). Deployment of ROBOT for HVAC duct and disaster management. Oriental Journal of Computer Science and Technology, 15, 1–8.

Rachna , Bhambri, P. , & Chhabra, Y. (2022). Deployment of distributed clustering approach in WSNs and IoTs. In Pankaj Bhambri , Sita Rani , Gaurav Gupta , Alex Khang (Eds.), Cloud and Fog Computing Platforms for Internet of Things (pp. 85–98). Chapman and Hall/CRC.

Rajevenceltha, J. , Gaidhane, V. H. , & Anjana, V. (2019). A Novel Approach for Drowsiness Detection Using Local Binary Patterns and Histogram of Gradients. In 2019 International Conference on Electrical and Computing Technologies and Applications (ICECTA). doi:10.1109/icecta48151.2019.8959669.

Tanveer, M. A. , Khan, M. J. , Qureshi, M. J. , Naseer, N. , and Hong, K.-S. (2019). Enhanced drowsiness detection using deep learning: An fNIRS study. IEEE Access, *1–1* . doi:10.1109/access.2019.2942838.

Tipprasert, W. , Charoenpong, T. , Chianrabutra, C. , & Sukjamsri, C. (2019). A Method of Driver's Eyes Closure and Yawning Detection for Drowsiness Analysis by Infrared Camera. In 2019 First International Symposium on Instrumentation, Control, Artificial Intelligence, and Robotics (ICA-SYMP). doi:10.1109/ica-symp.2019.8646001.

Ritu , & Bhambri, P. (2022). A CAD System for Software Effort Estimation. In *Paper presented at the* International Conference on Technological Advancements in Computational Sciences, 140–146. IEEE. doi:10.1109/ICTACS56270.2022.9988123.

Singh, M. , Bhambri, P. , Lal, S. , Singh, Y. , Kaur, M. , & Singh, J. (2021). Design of the effective technique to improve memory and time constraints for sequence alignment. International Journal of Applied Engineering Research (Netherlands), 6(02), 127–142.

Babu, G. C. N. , Gupta, S. , Bhambri, P. , Leo, L. M. , Rao, B. H. , & Kumar, S. (2021). A semantic health observation system development based on the IoT sensors. Turkish Journal of Physiotherapy and Rehabilitation, 32(3), 1721–1729.

Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of the GENE expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, 32(3), 1158–1167.

Singh, M. , Bhambri, P. , Dhanoa, I. S. , Jain, A. , & Kaur, K. (2021). Data mining model for predicting diabetes. Annals of the Romanian Society for Cell Biology, 25(4), 6702–6712.

You, F. , Li, X. , Gong, Y. , Wang, H. , & Li, H. (2019). A real-time driving drowsiness detection algorithm with individual differences consideration. IEEE Access, 1–1. doi:10.1109/access.2019.2958667.

Zhang, C. , Wu, X. , Zheng, X. , & Yu, S. (2019). Driver drowsiness detection using multi-channel second order blind identifications. IEEE Access, 1–1. doi:10.1109/access.2019.2891971.

Rachna , Chhabra, Y. , & Bhambri, P. (2021). Various approaches and algorithms for monitoring energy efficiency of wireless sensor networks. In Lecture Notes in Civil Engineering (Vol. 113, pp. 761–770). Springer, Singapore.

Bakshi, P. , Bhambri, P. , & Thapar, V. (2021). A review paper on wireless sensor network techniques in Internet of Things (IoT). Wesleyan Journal of Research, 14(7), 147–160.

Rana, R. , Chhabra, Y. , & Bhambri, P. (2021). Design and development of distributed clustering approach in wireless sensor network. Webology, 18(1), 696–712.

Guede-Fernandez, F. , Fernandez-Chimeno, M. , Ramos-Castro, J. , & Garcia-Gonzalez, M. A. (2019). Driver drowsiness detection based on respiratory signal analysis. IEEE Access, 1–1. doi:10.1109/access.2019.2924481.

Lashkov, I. , Kashevnik, A. , Shilov, N. , Parfenov, V. , & Shabaev, A. (2019).Driver Dangerous State Detection Based on Open CV & Dlib Libraries Using Mobile Video Processing. In 2019 IEEE International Conference on Computational Science and Engineering (CSE) and IEEE International Conference on Embedded and Ubiquitous Computing (EUC). doi:10.1109/cse/euc.2019.00024.

Rana, R. , Chhabra, Y. , & Bhambri, P. (2021). Comparison and evaluation of various QoS parameters in WSNs with the implementation of enhanced low energy adaptive efficient distributed clustering approach. Webology, 18(1), 677–695.

Singh, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. , & Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. Natural Volatiles & Essential Oils, 8(4), 15353–15362.
Bhambri, P. (2021). Electronic evidence. In Kamal Gulati , Narinder Kumar Bhasin (Eds.), Textbook of Cyber Heal (pp. 86–120). AGAR Saliha Publication. ISBN: 978-81-948141-7-7.
Bakshi, P. , Bhambri, P. , & Thapar, V. (2021). A Review Paper on Wireless Sensor Network Techniques in Internet of Things (IoT). In Proceedings of the International Conference on Contemporary Issues in Engineering & Technology.
Bhambri, P. (2020). Green compliance. In S. Agarwal (Ed.), Introduction to Green Computing (pp. 95–125). AGAR Saliha Publication. ISBN: 978-81-948141-5-3.
Bhambri, P. , Kaur, H. , Gupta, A. , & Singh, J. (2020). Human activity recognition system. Oriental Journal of Computer Science and Technology, 13(2–3), 91–96.
Singh, G. , Singh, M. , & Bhambri, P. (2020). Artificial Intelligence Based Flying Car. In Proceedings of the International Congress on Sustainable Development through Engineering Innovations, pp. 216–227. ISBN 978-93-89947-14-4.
Rigane, O. , Abbes, K. , Abdelmoula, C. , & Masmoudi, M. (2017). A Fuzzy Based Method for Driver Drowsiness Detection. In 2017 IEEE/ACS 14th International Conference on Computer Systems and Applications (AICCSA). doi:10.1109/aiccsa.2017.131
Wathiq, O. , & Ambudkar, B. D. (2017). Optimized Driver Safety Through Driver Fatigue Detection Methods. In 2017 International Conference on Trends in Electronics and Informatics (ICEI). doi:10.1109/icoei.2017.8300787.
Artanto, D. , Sulistyanto, M. P. , Pranowo, I. D. , & Pramesta, E. E. (2017). Drowsiness Detection System Based on Eye-Closure Using a Low-Cost EMG and ESP8266. In 2017 2nd International Conferences on Information Technology, Information Systems and Electrical Engineering (ICITISEE). doi:10.1109/icitisee.2017.8285502.
Gupta, I. , Garg, N. , Aggarwal, A. , Nepalia, N. , & Verma, B. (2018). Real-Time Driver's Drowsiness Monitoring Based on Dynamically Varying Threshold. In 2018 Eleventh International Conference on Contemporary Computing (IC3). doi:10.1109/ic3.2018.8530651.
Rani, S. , Kataria, A. , Kumar, S. , & Tiwari, P. (2023). Federated learning for secure IoMT-applications in smart healthcare systems: A comprehensive review. Knowledge-Based Systems, *5* (7), 110658.
Vasudevan, S. K. , Kowshik, G. , & Anudeep, J. (2019). Driver Feedback System with White Line Fever Detection. In 2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN). doi:10.1109/vitecon.2019.8899665.
Oliveira, L. , Cardoso, J. S. , Lourenco, A. , & Ahlstrom, C. (2018). Driver Drowsiness Detection: A Comparison Between Intrusive and Non-Intrusive Signal Acquisition Methods. In 2018 7th European Workshop on Visual Information Processing (EUVIP). doi:10.1109/euvip.2018.8611704.
Pratama, B. G. , Ardiyanto, I. , & Adji, T. B. (2017). A Review on Driver Drowsiness Based on Image, Bio-Signal, and Driver Behavior. In 2017 3rd International Conference on Science and Technology-Computer (ICST). doi:10.1109/icstc.2017.8011855.
Sathya, R. & Reddy, T & Reddy, S & Raghavendra, K. (2020). An IoT based driver drowsiness detection system and deterrent system for safety and driving. International Journal of Future Generation Communication and Networking, 13(3), 413–421.
Rani, S. , Bhambri, P. , & Gupta, O. P. (2022). Green smart farming techniques and sustainable agriculture: Research roadmap towards organic farming for imperishable agricultural products. In Handbook of Sustainable Development through Green Engineering and Technology (pp. 49–67). CRC Press.

Force/Position Control of Constrained Reconfigurable Manipulators Using Hybrid Backstepping Neural Networks Based Control Approach

Ahmad, S. , Zhang, H. , & Liu, G. (2013). Distributed fault detection for modular and reconfigurable robots with joint torque sensing: A prediction error based approach. Mechatronics, *23* (6), 607–616.
Bali, V. , Bali, S. , Gaur, D. , Rani, S. , & Kumar, R. (2023). Commercial-off-the shelf vendor selection: A multi-criteria decision-making approach using intuitionistic fuzzy sets and TOPSIS.

Operational Research in Engineering Sciences: Theory and Applications, *12* (4), 100–113.
Bhambri, P. , Singh, M. , Dhanoa, I. S. , & Kumar, M. (2022). Deployment of ROBOT for HVAC duct and disaster management. Oriental Journal of Computer Science and Technology, 15, 1–8.
Bhambri, P. , Singh, M. , Jain, A. , Dhanoa, I. S. , Sinha, V. K. , & Lal, S. (2021). Classification of gene expression data with the aid of optimized feature selection. Turkish Journal of Physiotherapy and Rehabilitation, 32, 3.
Bhambri, P. , Singh, S. , Sangwan, S. , Devi, J. , & Jain, S. (2023). Plants recognition using leaf image pattern analysis. Journal of Survey in Fisheries Sciences, *10* (2S), 3863–3871.
Cao, C. , Wang, F. , Cao, Q. , Sun, H. , Xu, W. , & Cui, M. (2018). Neural network–based terminal sliding mode applied to position/force adaptive control for constrained robotic manipulators. Advances in Mechanical Engineering, *10* (6), https://doi.org/10.1177/1687814018781288
Dajer, M. , Ma, Z. , Piazzi, L. , Prasad, N. , Qi, X. F. , Sheen, B. , & Yue, G. (2022). Reconfigurable intelligent surface: Design the channel–A new opportunity for future wireless networks. Digital Communications and Networks, *8* (2), 87–104.
Dong, B. , Li, Y. , & Liu, K. (2017a). Decentralized control for harmonic drive–based modular and reconfigurable robots with uncertain environment contact. Advances in Mechanical Engineering, *9* (4), 43–56.
Dong, B. , Li, Y. , Liu, K. , & Li, Y. (2017b, July). Decentralized adaptive super-twisting control for modular and reconfigurable robots with uncertain environment contact. In 2017 36th Chinese Control Conference (CCC) (pp. 6644–6651). IEEE.
Dong, B. , Liu, K. , & Li, Y. (2017c). Decentralized control of harmonic drive based modular robot manipulator using only position measurements: Theory and experimental verification. Journal of Intelligent & Robotic Systems, *88* , 3–18.
Dong, B. , Zhou, F. , Liu, K. , & Li, Y. (2018). Torque sensorless decentralized neuro-optimal control for modular and reconfigurable robots with uncertain environments. Neurocomputing, *282* , 60–73.
Du, Y. , & Zhu, Q. (2018). Decentralized adaptive force/position control of reconfigurable manipulator based on soft sensors. Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering, *232* (9), 1260–1271.
Ghajar, M. H. , Keshmiri, M. , & Bahrami, J. (2018). Neural-network-based robust hybrid force/position controller for a constrained robot manipulator with uncertainties. Transactions of the Institute of Measurement and Control, *40* (5), 1625–1636.
Gierlak, P. , & Szuster, M. (2017). Adaptive position/force control for robot manipulator in contact with a flexible environment. Robotics and Autonomous Systems, *95* , 80–101.
Heck, D. , Saccon, A. , Van de Wouw, N. , & Nijmeijer, H. (2016). Guaranteeing stable tracking of hybrid position–force trajectories for a robot manipulator interacting with a stiff environment. Automatica, *63* , 235–247.
Holcomb, T. , & Morari, M. (1991, June). Local training for radial basis function networks: towards solving the hidden unit problem. In 1991 American Control Conference (pp. 2331–2336). IEEE.
Kumar, N. , & Rani, M. (2021). Neural network-based hybrid force/position control of constrained reconfigurable manipulators. Neurocomputing, *420* , 1–14.
Kumar, P. , Banerjee, K. , Singhal, N. , Kumar, A. , Rani, S. , Kumar, R. , & Lavinia, C. A. (2022). Verifiable, secure mobile agent migration in healthcare systems using a polynomial-based threshold secret sharing scheme with a blowfish algorithm. Sensors, *22* (22), 8620.
Li, Y. , Ding, G. , Zhao, B. , Dong, B. , & Liu, G. (2016b, July). Decentralized adaptive neural network sliding mode control for reconfigurable manipulators with data-based modeling. In 2016 International Joint Conference on Neural Networks (IJCNN) (pp. 595–602). IEEE.
Li, Y. , Lu, Z. , Zhou, F. , Dong, B. , Liu, K. , & Li, Y. (2019). Decentralized trajectory tracking control for modular and reconfigurable robots with torque sensor: Adaptive terminal sliding control-based approach. Journal of Dynamic Systems, Measurement, and Control, *141* (6).
Li, Y. C. , Ding, G. B. , & Zhao, B. (2016a). Decentralized adaptive neural network sliding mode position/force control of constrained reconfigurable manipulators. Journal of Central South University, *23* (11), 2917–2925.
Li, Z. , Ge, S. S. , Adams, M. , & Wijesoma, W. S. (2008). Robust adaptive control of uncertain force/motion constrained nonholonomic mobile manipulators. Automatica, *44* (3), 776–784.

Liu, C. , Liu, X. , Wang, H. , Zhou, Y. , & Lu, S. (2019). Observer-based adaptive fuzzy funnel control for strict-feedback nonlinear systems with unknown control coefficients. Neurocomputing, *358* , 467–478.

Liu, Y. , Zhao, B. , & Li, Y. (2014, December). Adaptive neural network position/force hybrid control for constrained reconfigurable manipulators. In 2014 IEEE 17th International Conference on Computational Science and Engineering (pp. 38–43). IEEE.

Naderi, B. , & Azab, A. (2021). Production scheduling for reconfigurable assembly systems: Mathematical modeling and algorithms. Computers & Industrial Engineering, *162* , 107741.

Park, J. , & Sandberg, I. W. (1991). Universal approximation using radial-basis-function networks. Neural Computation, *3* (2), 246–257.

Rachna , Bhambri, P. , & Chhabra, Y. (2022). Deployment of distributed clustering approach in WSNs and IoTs. In Pankaj Bhambri , Sita Rani , Gaurav Gupta , Alex Khang (Eds.), Cloud and Fog Computing Platforms for Internet of Things (pp. 85–98). Chapman and Hall/CRC.

Rani, S. , Bhambri, P. , & Kataria, A. (2023). Integration of IoT, Big data, and cloud computing technologies. Big Data, Cloud Computing and IoT: Tools and Applications.

Ren, Y. , Chen, Z. , Liu, Y. , Gu, Y. , Jin, M. , & Liu, H. (2017). Adaptive hybrid position/force control of dual-arm cooperative manipulators with uncertain dynamics and closed-chain kinematics. Journal of the Franklin Institute, *354* (17), 7767–7793.

Ritu , & Bhambri, P. (2022). A CAD system for software effort estimation. *Paper presented at the* International Conference on Technological Advancements in Computational Sciences (pp. 140–146). IEEE. https://doi.org/10.1109/ICTACS56270.2022.9988123

Ritu, P. , & Bhambri, P. (2023, February 17). Software effort estimation with machine learning – A systematic literature review. In Susheela Hooda , Vandana Mohindru Sood , Yashwant Singh , Sandeep Dalal , Manu Sood (Eds.), Agile software development: Trends, challenges and applications (pp. 291–308). John Wiley & Sons, Inc.

Sangwan, Y. S. , Lal, S. , Bhambri, P. , Kumar, A. , & Dhanoa, I. S. (2021). Advancements in social data security and encryption: A review. NVEO-Natural Volatiles & Essential Oils Journal|NVEO, 8(4), 15353–15362.

Singh, M. , Bhambri, P. , Lal, S. , Singh, Y. , Kaur, M. , & Singh, J. (2021). Design of the effective technique to improve memory and time constraints for sequence alignment. International Journal of Applied Engineering Research (Netherlands), 6(02), 127–142.

Slotine, J. J. E. , & Li, W. (1991). Applied nonlinear control (Vol. 199, No. 1, p. 705). Englewood Cliffs, NJ: Prentice Hall.

Sofi, A. , Ding, Y. , Weng, F. , Jiang, X. , & Tang, M. (2016). Vibration-attenuation controller design for uncertain mechanical systems with input time delay. Shock and Vibration, 2016, 9686358. https://doi.org/10.1155/2016/9686358

Wang, G. , Dong, B. , Wu, S. , & Li, Y. (2015, October). Sliding mode position/force control for constrained reconfigurable manipulator based on adaptive neural network. In 2015 International Conference on Control, Automation and Information Sciences (ICCAIS) (pp. 96–101). IEEE.

Zhang, G. , Zhuang, Z. , & Guo, X. (2015). Bloch surface plasmon enhanced blue emission from InGaN/GaN light-emitting diode structures with Al-coated GaN nanorods. Nanotechnology, 26(12), 125201. https://doi.org/10.1088/0957-4484/26/12/125201

Zhao, B. , & Li, Y. (2014). Local joint information based active fault tolerant control for reconfigurable manipulator. Nonlinear Dynamics, *77* , 859–876.

Zhou, F. , Li, Y. , & Liu, G. (2017). Robust decentralized force/position fault-tolerant control for constrained reconfigurable manipulators without torque sensing. Nonlinear Dynamics, *89* , 955–969.

Zhu, L. , & Li, Y. (2010a). Decentralized adaptive neural network control for reconfigurable manipulators. In 2010 Chinese Control and Decision Conference (pp. 1760–1765). https://doi.org/10.1109/CCDC.2010.5498523

Zhu, M. , & Li, Y. (2009). Decentralized adaptive fuzzy sliding mode control for reconfigurable modular manipulators. International Journal of Robust and Nonlinear Control. Advance online publication. https://doi.org/10.1002/rnc.1444

Zhu, Q. , Zhang, W. , Zhang, J. , & Sun, B. (2019). U-neural network-enhanced control of nonlinear dynamic systems. Neurocomputing, *352* , 12–21.