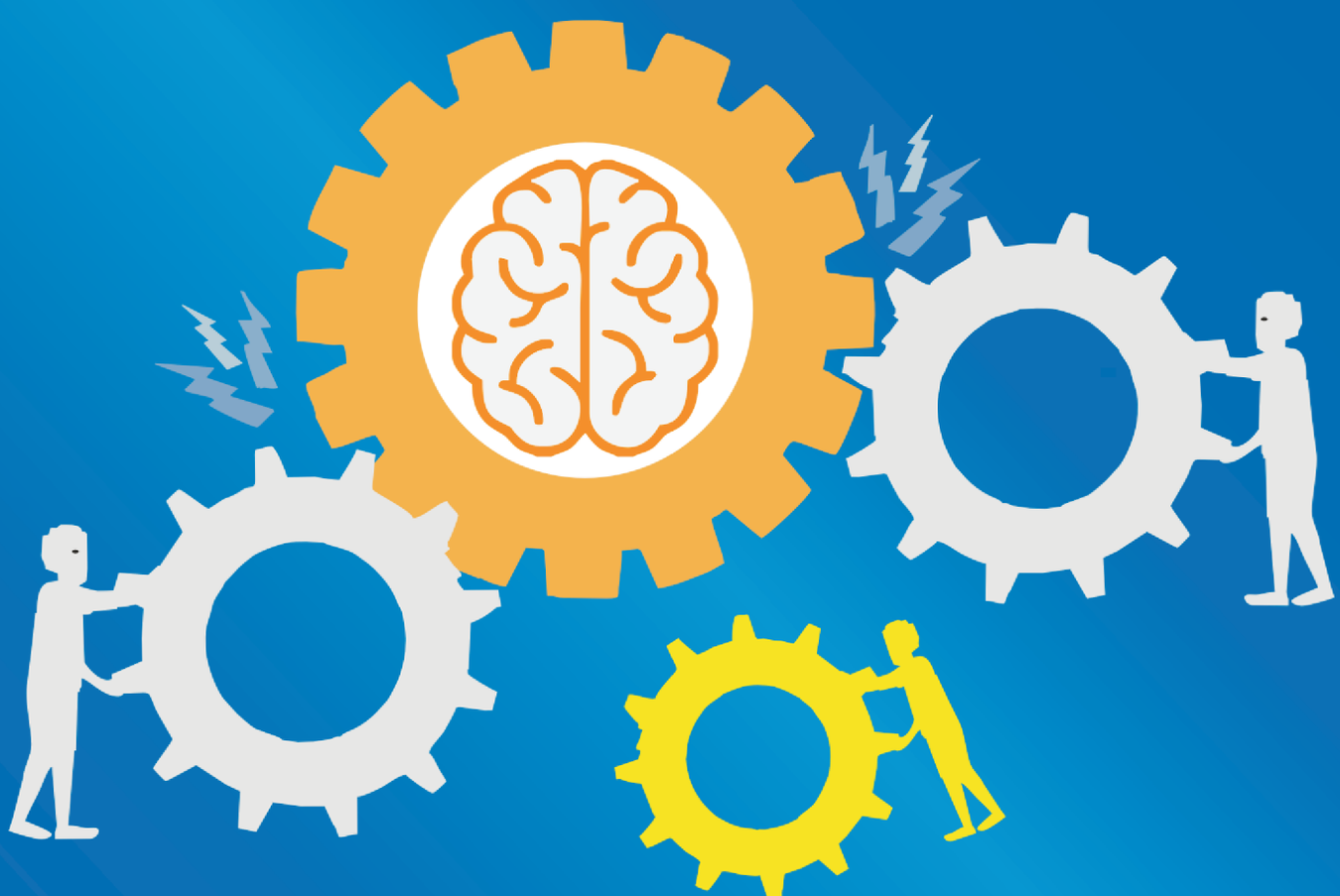
COGNITION

Quarterly Research Newsletter of NIT Raipur
VOLUME 2, ISSUE 1, APRIL 2022



NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
GE ROAD, RAIPUR - 492010

CONTENTS

CONTENTS

COGNITION

Editorial Note : COGNITION
Volume 2, Issue 1

Dear readers and contributors of Cognition,

It gives us great pleasure to introduce you to the 1st Issue (Volume 2) of Cognition, a digital research newsletter of NIT Raipur that is published four times in a year. After making a tremendous start to 2022 with the release of the 4th Issue (Volume 1) of Cognition in January, the current Issue further highlights the zeal with which NIT Raipur's fraternity is working towards the Institute's goals. Accordingly, the 1st Issue (Volume 2) of the research newsletter shares the extraordinary efforts and contributions that have been made in research and related activities during the quarter January-March 2022. The significant progress made in research in different fields in the Institute has been possible because of the relentless and admirable guidance of Honorable Director NIT Raipur, Dr. A.M. Rawani. We shall always be grateful to him.

The 1st Issue (Volume 2) of Cognition features the research papers and chapters that have been published by the faculty and research scholars of the Institute in prominent national and international journals and with reputed publishers. It also shares the details of various research projects that have either been undertaken or approved by the concerned agencies within the quarter

January-March 2022. This Issue also highlights other research-oriented activities undertaken at NIT Raipur, such as the patents awarded, books published, conferences and seminars organized etc.

With this Issue, we provide you with all the details of the efforts that have been made in research and related activities at NIT Raipur. We are hopeful that this Issue will have something useful to offer to you.

Team Cognition would again like to thank Dr. A.M. Rawani, Director NIT Raipur, for his consistent and vigorous support. We are also grateful to our respected Deans, Heads of all the departments, faculty, researchers, scholars, administrative and non-teaching staff for their support.

We would appreciate if you let us know your queries, inputs or concerns. We can be contacted at: cognition@nitrr.ac.in.

Team Cognition would like to thank you for your support and appreciations.

Warm regards!

Editorial Team

Cognition

HEAD

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Dr. Deepak Singh
Assistant Professor
Department of CSE

Graphic Support by :

X-PERT GRAPHICS, Raipur (C.G.)

PATENTS GRANTED TO NIT RAIPUR

1. **Title :** Development of piezo-wheel for electric vehicle

   Names of inventor(s) : Dr. Swapnajit Pattnaik, Department of Electrical Engg., NIT Raipur and Dr. M. V. Aware, Department of Electrical Engg., VNIT Nagpur

   Patent granting authority : Intellectual Property India

   Status : Granted

   Month and year of granting : February, 2022

   Summary of the invention: The present invention relates to development of a complete energy system for an electric vehicle with the help of piezoelectric wheel. Over the rim of wheel lead zirconatetitanates (PZTs) are placed at regular angle intervals of 10^0 between two adjacent strips. On the rim a proper frame is formed as per to the size of the PZTs, so that it is not displaced from its position while the vehicle is running. The strip placed at the centre produces high voltage as compared to the adjacent strips. The output of adjacent strips is connected in series so that maximum voltage can be produced by the pressure of the vehicle on the strips. With this configuration at each 10^0 interval impulse voltage is generated under mechanical pressure. The magnitude of voltage produced depends on the weight of the vehicle and the size of PZT strip. The charges generated across the PZT strip are stored in a common ultracapacitor before it dies out. The charged capacitor now acts as a source for the electro-mechanical system to operate the motor. In between PZT system and ultracapacitor, diodes are connected to avoid any reverse current flow from the charged capacitor to PZTs.

2. **Title :** Composition and process for preparation of sub-base material for Mine Haul Road Construction

   Names of inventor(s) : Dr. Traun Rajak and Dr. Laxmikant Yadu, Department of Civil Engg, NIT Raipur

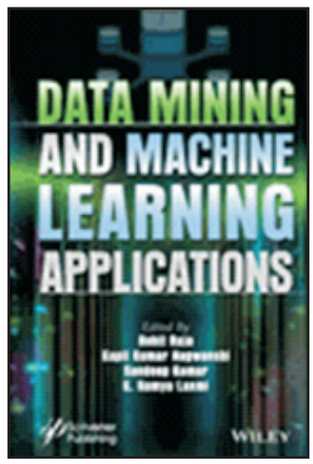
   Patent granting authority: Patent Office, Government of India

   Status : Awarded

   Month and year of award : March, 2022

   Summary of invention: The present invention focuses on the production of GGBS stabilized pond ash-overburden (OB) mix material that can be used in the sub-base layer of mine haul road. The objective of this invention is to use GGBS and pond ash with mine OB material as they improve the compaction and strength characteristics i.e., unconfined compressive strength and California bearing ratio. The mix proportion comprising of 68% OB material, 20% pond ash, and 12% GGBS by volume achieves the maximum strength and which is highly suitable as a sub-base material for the construction of mine haul road.

PUBLISHED BOOKS & BOOK CHAPTERS

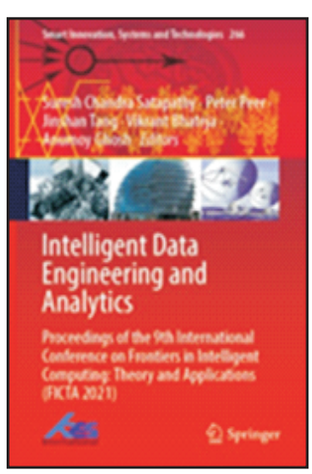


Title of the book : Data Mining and Machine Learning Applications
Title of the chapter : A Comparative Overview of Hybrid Recommender Systems: Review, Challenges, and Prospects
Publisher : Wiley
ISBN : 9781119791782
Month and year of publication : January 2022
Authors : Rakhi Seth and Aakanksha Sharaff

About the book

The book features:

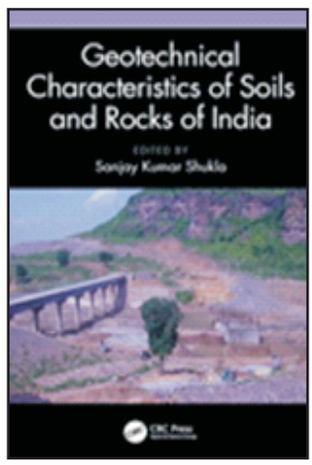
- A review of the state-of-the-art in data mining and machine learning.
- A review and description of the learning methods in human-computer interaction.
- Implementation strategies and future research directions used in meeting the design and application requirements of several modern and real-time applications for a long time.
- The scope and implementation of a majority of data mining and machine learning strategies.
- A discussion of real-time problems.



Title of the book : Intelligent Data Engineering and Analytics
Title of the chapter : Remodeling Rainfall Prediction Using Artificial Neural Network and Machine Learning Algorithms
Publisher : Springer
ISBN : 978-981-16-6624-7
Month and year of publication : January, 2022
Authors : Aakanksha Sharaff, Kshitij Ukey, Rajkumar Choure, Vinay Ujee and Gyananjaya Tripathy

About the book

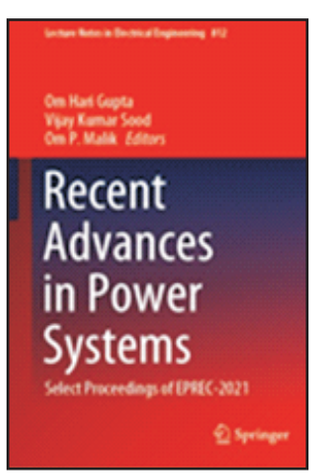
This book presents the proceedings of the 9th International Conference on Frontiers of Intelligent Computing: Theory and Applications (FICTA 2021), held at NIT Mizoram, Aizwal, Mizoram, India, from June 25 – 26, 2021. FICTA conference aimed at bringing together researchers, scientists, engineers, and practitioners for exchange of their new ideas and experiences in the domain of intelligent computing theories with prospective applications to various engineering disciplines.



Title of the book : Geotechnical Characteristics of Soils and Rocks of India
Title of the chapter: Chhattisgarh
Publisher : CRC Press, Taylor & Francis Group
ISBN : 978-1-032-01098-4 (hbk)
Month and year of publication : January, 2022
Authors : Dr. Laxmikant Yadu, Dr. Sunny Deol Guzzarlapudi, Dr. Mahasakti Mahamaya and Mr. Arun Bhave

About the book

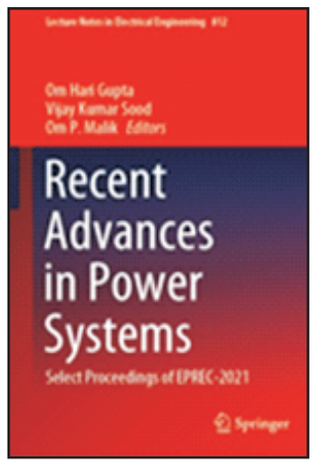
This book mainly presents the geotechnical details of geomaterials (soils and rocks) found in all the 36 states and union territories of India. There are 37 chapters in this book. Each chapter is contributed by a team of authors. Chapter 8 i:e Chhattisgarh is contributed by Dr. Laxmikant Yadu, Dr. Sunny Deol Guzzarlapudi, Dr. Mahasakti Mahamaya and Mr. Arun Bhave. Each chapter covers highly practical information and technical data for application in ground infrastructure projects, including foundations of structures (buildings, towers, tanks, machines and so on), highway, railway and airport pavements, embankments, retaining structures/walls, dams, reservoirs, canals and ponds, and landfills and tunnels. These details are also highly useful for professionals dealing with mining, oil and gas projects as well as agricultural and aquacultural engineering projects.



Title of the book : Recent Advances in Power Systems
Title of the chapter : Fault Analysis in Integrated Power System Network Under Wind Intermittency
Publisher : Springer
ISBN : 978-981-16-6969-9
Month and year of publication : January, 2022
Authors : Vijay Kumar and Monalisa Biswal

About the book

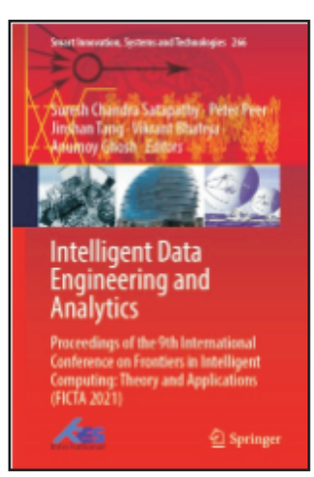
The nonlinear fluctuations in the generated power is because of the unforeseeable variation in the wind speed and which affects the distance relaying-based protection of the sub-transmission and transmission line. So due to their intermittent nature of generation because of varying wind speed, it escorts along with it several challenges for operation and control. This intermittency also upsurges the challenges for the distance relay protection of the transmission line. This research work examines the performance of the conventional distance relay algorithms during the large intermittency in the power system network that arises due to the integration of the wind farm.



Title of the book : Recent Advances in Power Systems
Title of the chapter : Detection and Identification of Faulty Phase in a Thyristor Compensated Transmission Network Integrated with DFIG-Based Wind Farm
Publisher : Springer
ISBN : 978-981-16-6969-9
Month and year of publication : January, 2022
Authors : Ramsarovar Kumar, Ch Prasad and Monalisa Biswal

About the book

In this chapter, an advanced signal decomposition approach is applied to a thyristor-controlled series compensated (TCSC) network integrated with large wind farm to detect and classify the different types of faults irrespective of wind intermittency. Fault analysis in conventional variable series compensated network is difficult since the operation of series capacitor and metal oxide varistor (MOV) are nonlinear. With the inclusion of wind farm, the signals are more varying with respect to wind speed. Under such a condition, phasor estimation is challenging. So, fault analysis using time-domain signal can give better output. Hence, ensemble empirical mode decomposition (EEMD) technique is applied to both the sending and receiving end current signal and the differential quantity is estimated to detect and identify the correct faulty phase.



Title of the book : Intelligent Data Engineering and Analytics
Title of the chapter : Efficient Fault-Tolerant Cluster-Based Approach for Wireless Sensor Networks
Publisher : Springer
ISBN : 978-981-16-6624-7
Month and year of publication : January, 2022
Authors : Kavita Jaiswal and Veena Anand

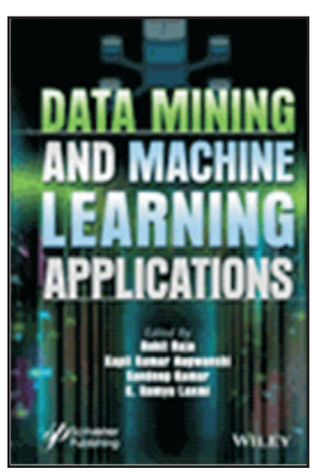
About the chapter

This chapter presents research work in intelligent data engineering and analytics. It provides results of FICTA 2021 held at NIT Mizoram, India. It also serves as a reference for researchers and practitioners in academia and industry.

Title of the book : ISEA Asia Security and Privacy (ISEASP)
Title of the chapter : Peer-to-Peer Trade Registration Process with Blockchain in Small and Medium Enterprises (SMEs) in E-Governance
Publisher : IEEE
ISBN : 978-1-6654-2017-4
Month and year of publication : January, 2022
Authors : Narendra Kumar Dewangan and Preeti Chandrakar

About the chapter

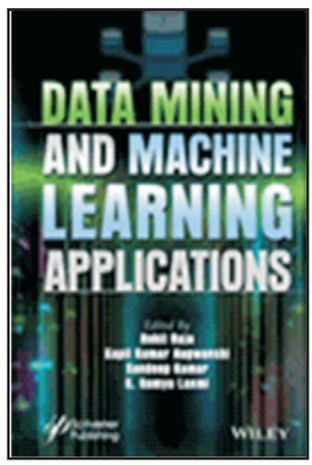
In the traditional trade registration system, challenges like corruption, delay in time, non-availability of authorities and critical registration process exist. Blockchain is a transparent, distributed, decentralized and reliable technology for the fast and trusted working process. Using blockchain in the trade registration process can solve the problems mentioned above can be solved in the industrial set up. The consensus algorithm in blockchain provides the decentralized authority approval process. In this chapter, proof-of-authentication for transaction approval and a novel miner selection algorithm are used to reduce the biasing and centralization of authorization in e-governance.



Title of the book : Data Mining and Machine Learning Applications
Title of the chapter : MSDTrA: A Boosting Based-Transfer Learning Approach for Class Imbalanced Skin Lesion Dataset for Melanoma Detection
Publisher : Wiley
ISBN : 9781119791782
Month and year of publication : January, 2022
Authors : Lokesh Singh, Rekh Ram Janghel and Satya Prakash Sahu

About the chapter

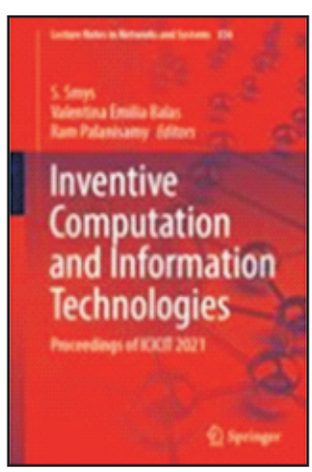
Pigmented skin lesion datasets comprise a higher percentage of benign lesion than the malignant lesions which lead to the class skewness issue in the dataset. Transfer learning permits to leverage the knowledge from the source domain to train a classifier towards the target domain when the data is rare. Importing knowledge from multiple or several sources towards increasing the chance of searching a source closer to a target may alleviate the negative transfer. A framework is proposed in this work to transfer knowledge from multiple sources utilizing AdaBoost, TrAdaBoost and MultiSource Dynamic TrAdaBoost (MSDTrA), for melanoma detection.



Title of the book : Data Mining and Machine Learning Applications
Title of the chapter : Classification of EEG Signals for Detection of Epileptic Seizure using Restricted Boltzmann Machine Classifier
Publisher : Wiley
ISBN : 9781119791782
Month and year of publication : January, 2022
Authors : Sudesh Kumar, Rekh Ram Janghel and Satya Prakash Sahu

About the chapter

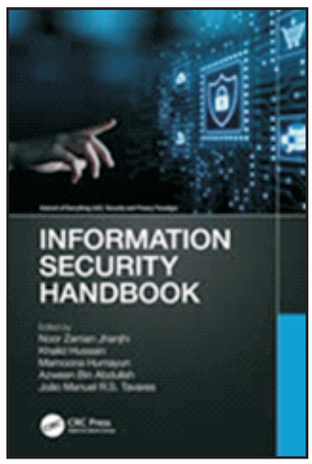
Epilepsy is a disease that is an electrophysiological disorder related to the brain and is characterized by various types of recurrent seizures. Electroencephalogram (EEG) is a test that is developed by various neurologists to capture the electrical signals that occur in the brain and is widely used for the Analysis and detection of epileptic seizures. We handled the EEG dataset of CHB-MIT (scalp EEG) to discover if our model could outflank the best in class proposed models. We have proposed a methodology based on the Restricted Boltzmann Machine (RBM) neural network model, which is used to perform classification over the EEG signals among binary classes, namely a healthy (non-seizure) and non-healthy (seizure) classes.



Title of the book : Inventive Computation and Information Technologies
Title of the chapter : Message Forwarding Scheme with Max-Delivery and Min-Delay for Delay Tolerant Network
Publisher : Springer
ISBN : 978-981166722-0
Month and year of publication : January, 2022
Authors : Sudhakar Pandey, Nidhi Sonkar, Sanjay Kumar, Danda Pravija and S. Mahto

About the chapter

Delay tolerant networks are most reliable in the state of emergency such as during earthquakes as these enable communication without end-to-end connectivity. For creating communication, store-carry-forward technique is used, that means, if connectivity does not exist between nodes, they store the message till connectivity does not exist and then transfer to other nodes. In this study, we proposed a protocol that tried to deliver the message to the destination node by selecting the best intermediate node based on three features: speed of the node, residual energy of the node, and distance between the neighbor nodes.



Title of the book : Information Security Handbook

Title of the chapter : Ransomware Attack: Threats & Different Detection Technique

Publisher : CRC Press

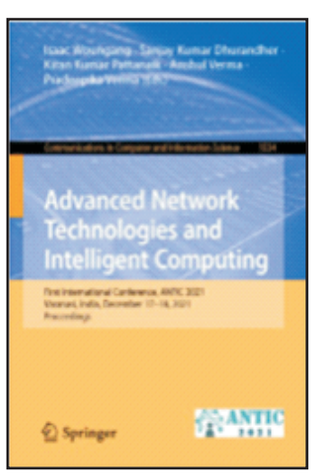
ISBN : 9780367808228

Month and year of publication : February, 2022

Author : Rakhi Seth, Aakanksha Sharaff, Jyotir Moy Chatterjee and N Z Jhanjhi

About the book

This handbook provides a comprehensive collection of knowledge for emerging multidisciplinary research areas such as cybersecurity, IoT, Blockchain, Machine Learning, Data Science, and AI. This book brings together, in one source, information security across multiple domains.Information Security Handbook addresses the knowledge for emerging multidisciplinary research. It explores basic and high-level concepts and serves as a manual for industry while also helping beginners to understand both basic and advanced aspects in security-related issues.



Title of the book : Advanced Network Technologies and Intelligent Computing

Title of the chapter : Patient Feedback Based Physician Selection in Blockchain Healthcare using Deep Learning

Publisher : Springer

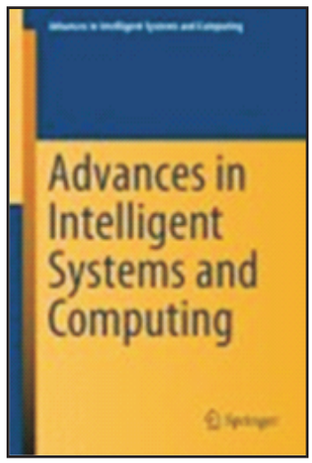
ISBN : 978-3-030-96040-7

Month and year of publication : February, 2022

Authors : Narendra Kumar Dewangan and Preeti Chandrakar

About the chapter

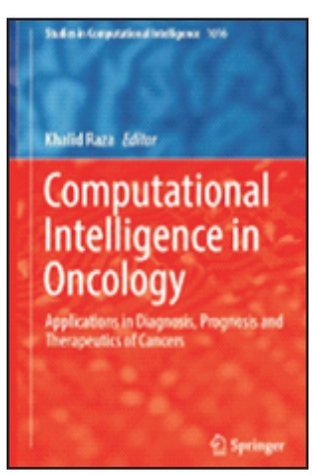
This chapter proposed a blockchain-based healthcare system that takes feedback from the patients. This proposed system uses a deep learning model based on RNN (Recurrent Neural Network), which optimizes the patient's feedback and suggests selecting the recommended physician for the next cycle of patient appointment. This proposed system is implemented using PHP-based blockchain and uses a customized hash solving consensus algorithm. This system is implemented in a private blockchain.



Title of the book : Advances in Intelligent Systems and Computing
Title of the chapter : Ensemble Approach for Stock Market Forecasting using ARIMA and LSTM Model
Publisher : Springer
ISBN : 978-981-16-7329-0
Month and year of publication : March, 2022
Authors: Satya Verma, Satya Prakash Sahu and Tirath Prasad Sahu

About the chapter

Stock market is a place where volatility is a major concern. At the same time, stock market data is not consistent due to missing information on some trading days. Forecasting of stock performance is challenging due to the volatility issue. This chapter aims to forecast stock closing price and predicts the direction of the stock price in the next trading day. Threshold-based ensemble ARIMA-LSTM is proposed for stock price prediction. ARIMA, LSTM, and ensemble ARIMA-LSTM are implemented and tested on the dataset of Apple, Microsoft, IBM, and S&P 500. Also, the proposed method is tested and evaluated against existing hybrid methods ARIMA-SVM, ARIMA-RF, and ARIMA-ANN for directional accuracy check.



Title of the book : Computational Intelligence in Oncology
Title of the chapter : Application of Convolutional Neural Networks in Cancer Diagnosis
Publisher : Springer
ISBN : 978-981-16-9223-9
Month and year of publication : March, 2022
Authors : Rejaul Karim Barbhuiy, Naeem Ahmad and Wasim Akram

About the chapter

This chapter presents an overview of a generic CNN architecture followed by a discussion on major advances in CNN models and their applications for cancer image analysis.

SPONSORED RESEARCH PROJECTS

Title of the project : Developing a Map Plan to Support Children Return to School in Identified Villages and Skill Development of Youth of Select Areas by RK Foundation

Sponsoring agency : RK Foundation

Amount Sanctioned : Rs. 1.43 Lakhs

Principal Investigatior (PI) : Dr. Anoop Ku. Tiwari, Department of Humanities and Social Sciences

Co-PI : NA

Project Summary

Along with the objective of RK Foundation this project proposed to prepare a module and blue printwith a vision on education, entrepreneurship, skill development and continual education for the underprivileged specially the children aging between 10-18 years. The outcome is expected to be designed to address the gaps in the availability of job opportunities and available skilled recourses. This project shall focus on identifying talent among underprivileged children and make a five year or longer program to nourish the identified talents. This research will identify 50 Girls and 50 boys from school and those at risk of dropping out, will be helped. The children will be identified among the very poor and vulnerable families from different localities of Raipur district .This research will provide counseling, scholastic materials, dialogue meetings and trainings, and collect the responses of the steps taken in order to collect data to prepare a module and blue print with a vision on education, entrepreneurship, skill development and continual education.

Title of the project : Assessment of Seasonal Hydrological Interactions of Kharun River with Groundwater in Raipur City, Chhattisgarh: Implications to the Vulnerability of Sustainable Water Supply

Sponsoring agency : SERB, New Delhi

Duration : March 2022 - February 2025

Amount Sanctioned : 45.87 Lakhs

Principal Investigatior (PI) : Dr. D.C. Jharia, Department of Applied Geology

Co-PI : NA

Project Summary

DST- SERB funded Rs. 48,34,049/- toassess seasonal hydrological interactions of Kharun river with groundwater in RaipurCity, Chhattisgarh. In this study systematic hydrogeological investigations be carried out. Groundwater levels will be monitored through selective wells. aquifer rechargeresponse to rainfall will be observed and analyzed. Infiltration tests will be conducted in this study todetermine the infiltration rate of soil in the field. Electrical resistivities survey will be carried out atproper places in the study area to delineate the subsurface geology of the study area. The analysis ofwater samples collected from different locations of the study area will be analyzed for major ion andtrace element chemistry employing the standard methods. Stable isotope analysis will be carried out for

hydrogen and oxygen isotope. In the proposed study, the spatial extent ofthe urbanization and undergone changes in terms of a haphazard and unorganized growth over the lastfew decades will be assessed. Different thematic layers will be assessed and correlated to understand the river water and groundwater interactions. The present study will facilitate understanding the hydrological interactions of the Kharun river with groundwater to resolve the arising scarcity problem and help to provide a sustainable water supply for a growing population.

Title of the project : Development of CADx System for Psoriasis Area and Severity Index (PASI) Measurement of Psoriasis Patients from 2D Digital Images

Sponsoring agency : SERB, New Delhi

Duration : February 2022 - January 2025

Amount Sanctioned : 34.96 Lakhs

Principal Investigatior (PI) : Dr. N.D. Londhe, Department of Electrical Engg.

Co-PI : NA

Title of the project : Development of a Framework for Successful Knowledge Management Implementation in Steel Industry in Developing Countries

Sponsoring agency : SERB, New Delhi

Duration : March 2022 – February 2024

Amount Sanctioned : Rs. 13.06 Lakhs

Principal Investigatior (PI) : Dr. S.K. Mukti, Department of Mechanical Engg.

Co-PI : NA

Project Summary

Knowledge is recognized as a strategic resource and companies have started managing organizational knowledge to gain sustainable competitive advantage. Considerable efforts and investments have been made by organizations on Knowledge Management (KM) initiatives to achieve business excellence. The objective of KM is to create, store, extract, disseminate and make the requisite knowledge available for intelligent business-related decision-making. The objective of study is the development of a framework for successful knowledge management implementation in steel industry in developing countries.

Title of the project : Development of High Throughput digital Metallography Tool for Analysis Steel Microstructure using Artificial Intelligence

Sponsoring agency : SERB, New Delhi

Duration : February 2022 - January 2025

Amount Sanctioned : Rs. 29.81 Lakhs

Principal Investigatior (PI) : Dr. Subhas Ganguli, Department of Metallurgical and Materials Engineering

Co-PI : Dr. S.K. Sinha, Department of Metallurgical and Materials Engineering

Project Summary

This project is about creating computer vision on microstructure of steels. The microstructure is the backbone of the structure-property correlation study, and it provides animportant platform for understanding the existing alloy system and design the novel one. In this exercise the recognition of micro constituents such as ferrite, pearlite, bainite, martensite, carbide etc., remains as a metallurgist skill dependence complex task. The primary challenge that the present research likes to address is the automatic recognition and classification of microstructure using the latest AI technologies and the one's used for image analysis. This research project aims at developing a robust and high throughput digital platform for smart analysis of microstructure image. While the research goal of the project is, to develop an AI-based high throughput smart image processing model that can cater to the goals of Industry 4.0 in steel processing.

Title of project: Time Delay and Disease Effects on the Dynamics and Stability of the Ecological Systems: Mathematical Modelling, Controlling, Prediction, Application and Management

Sponsoring agency : SERB, New Delhi

Duration: February 2022 - January 2025

Amount Sanctioned : Rs. 6.6 Lakhs

Principal Investigatior (PI) : Dr. S. N. Raw, Department of Mathematics

Co-PI : NA

Project Summary

Mathematical modelling study of the disease dynamics of ecosystems with time delay is used generally for the understanding the complex factors and its prediction. This project will be a platform to know the importance of mathematical modelling to explain such type of situation and give the best possible solution, control, application and management for restoring the health of the environment/ecosystems which has immense ecological, economic and authentic potential.

PUBLISHED RESEARCH PAPERS

(January-March 2022)

Title: AHP Based Site Suitability Analysis for Water Harvesting Structure Using Geospatial Technique
Authors: Chandra Shekhar Dwivedi, Raghib Raza, Arvind Chandra Pandey, D. C. Jhariya
Journal: Water Resources Management and Sustainability
Web: https://doi.org/10.1007/978-981-16-6573-8_22

Title: 3D-Mathematical Model to Simulate Groundwater flow and sulfate concentration in Tantaria watershed, Bemetara district, Chhattisgarh, India
Authors: Suvendu Kumar Sahu, D. C. Jhariya
Journal: Environment, Development and Sustainability
Web: https://doi.org/10.1007/s10668-022-02115-x

Title: Assessment of the groundwater quality by using multivariate approach and non-carcinogenic risk of uranium in the inhabitants of district Bastar, Chhattisgarh, Central India
Authors: Mayank Singh, Pokhraj Sahu, Kavita Tapadia, D. C. Jhariya
Journal: Water Supply
Web: https://doi.org/10.2166/ws.2022.024

Title: Land surface temperature and spectral indices: A seasonal study of Raipur City
Authors: Subhanil Guha, Himanshu Govil, Ajay Kumar Taloor, Neetu Gill, Anindita Dey
Journal: Geodesy and Geodynamics
Web: https://doi.org/10.1016/j.geog.2021.05.002

Title: Channel responses to flooding of Ganga River, Bihar India, 2019 using SAR and optical remote sensing
Authors: Armugha Khan, Himanshu Govil, Haris Hasan Khan, Praveen Kumar Thakur, Ali P Yunus, Padmini Pani
Journal: Advances in Space Research
Web: https://doi.org/10.1016/j.asr.2021.08.039

Title: EEG based functional brain networks analysis in dyslexic children during arithmetic task
Authors: NP Seshadri, B Geethanjali, Bikesh Kumar Singh
Journal: Cognitive Neurodynamics
Web: https://doi.org/10.1007/s11571-021-09769-9

Title: One-dimensional convolutional neural network and hybrid deep-learning paradigm for classification of specific language impaired children using their speech
Authors: Yogesh Sharma, Bikesh Kumar Singh
Journal: Computer Methods and Programs in Biomedicine
Web: https://doi.org/10.1016/j.cmpb.2021.106487

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Title: An ECC-based lightweight remote user authentication and key management scheme for IoT communication in context of fog computing
Authors: Uddalak Chatterjee, S. Ray, M. K. Khan, MouDasgupta, Chien-Ming Chen
Journal: Computing
Web: https://link.springer.com/article/10.1007/s00607-022-01055-8

Title: Entrepreneurial motivations: evidence from a developing region in India
Authors: Sachin Meshram, AM Rawani
Journal: International Journal of Process Management and Benchmarking
Web: https://www.inderscienceonline.com/doi/pdf/10.1504/IJPMB.2022.120424

Title: Three Dimensional Photoelastic Investigation for Analyzing Stress Concentration Factor in Isotropic Square Simply Supported Plate with Hole Subjected to Transverse Loading
Authors: Moon Banerjee, Nitin Kumar Jain, Shubhashis Sanyal
Journal: Current Applied Science and Technology
Web: https://li01.tci-thaijo.org/index.php/cast/article/view/253531

Title: Spacer effects on thermal-hydraulic performance of fluid flow at supercritical pressure in annular channel-CFD methodology
Authors: Satish Kumar Dhurandhar, SL Sinha, Shashi Kant Verma
Journal: Journal of Mechanical Engineering and Sciences
Web: https://doi.org/10.15282/jmes.16.1.2022.10.0693

Title: Non-linear vibration analysis of especially orthotropic tapered micro-plates with arbitrary located crack: A non-classical analytical approach
Authors: Bhupesh K Chandrakar, NK Jain, Ankur Gupta
Journal: Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science
Web: https://doi.org/10.1177/09544062211019776

Title: Assessment of dimensional accuracy of 3D printed part using resin 3D printing technique
Authors: BN Dhanunjayarao, NV Swamy Naidu
Journal: Materials Today: Proceedings
Web: https://doi.org/10.1016/j.matpr.2022.03.148

Title: Performance analysis of melting behavior of phase change material encapsulated within differently shaped macro-capsule

Authors: Ankur Sharma, Satish Kumar Dewangan

Journal: International Journal of Energy and Environmental Engineering

Web: https://doi.org/10.1007/s40095-021-00431-y

Title: Performance analysis of shell and helical tube heat exchanger using CuO/water and Al2O3/water nanofluids

Authors: Palash Soni, Fanindra Kumar Verma, Ranjeet Ranjan, Vivek Kumar Gaba

Journal: World Journal of Engineering

Web: https://doi.org/10.1108/WJE-10-2021-0584

Title: Experimental Investigation of silica-gel based composite adsorbent for adsorption refrigeration system

Authors: Palash Soni, Anirban Sur, Vivek Kumar Gaba

Journal: Thermal Science and Engineering Progress

Web: https://doi.org/10.1016/j.tsep.2022.101194

Title: Prioritizing Indicators for Sustainability Assessment in Manufacturing Process: An Integrated Approach

Authors: Vikas Swarnakar, Amit Raj Singh, Jiju Antony, Raja Jayaraman, Anil Kr Tiwari, Rajeev Rathi, Elizabeth Cudney

Journal: Sustainability

Web: https://doi.org/10.3390/su14063264

Title: Numerical Simulation of Three Dimensional Fracture Mechanics Problems of Functionally Graded Pipe and Pipe Bend Using XFEM

Authors: Vaibhav Sonkar, Somnath Bhattacharya, Kamal Sharma

Journal: Iranian Journal of Science and Technology, Transactions of Mechanical Engineering

Web: https://doi.org/10.1007/s40997-021-00470-0

Title: Adhesive wear performance of self-lubricating functionally graded cemented tungsten carbide prepared by spark plasma sintering

Authors: Rityuj Singh Parihar, Raj Kumar Sahu, Srinivasu Gangi Setti

Journal: International Journal of Refractory Metals and Hard Materials

Web: https://doi.org/10.1016/j.ijrmhm.2022.105788

Title: Surface integrity of ball burnished bioresorbable magnesium alloy

Authors: GV Jagadeesh, Srinivasu Gangi Setti

Journal: Advances in Manufacturing

Web: https://doi.org/10.1007/s40436-021-00387-6

Title: Modeling the Surface Integrity of Ball Burnished Biocompatible Magnesium Alloy by Soft Computing Techniques

Authors: GV Jagadeesh, SrinivasuGangiSetti

Journal: Transactions of the Indian Institute of Metals

Web: https://doi.org/10.1007/s12666-022-02536-2

Title: Tribological Performance Evaluation of Ball Burnished Magnesium Alloy for Bioresorbable Implant Applications

Authors: GV Jagadeesh, SrinivasuGangiSetti

Journal: Journal of Materials Engineering and Performance

Web: https://doi.org/10.1007/s11665-021-06228-8

Title: Parametric study of electric discharge machining of titanium grade 2 alloy in distilled water

Authors: B.K. Baroi, Jagadish, P.K. Patowari

Journal: Materials Today Proceedings

Web: https://doi.org/10.1016/j.matpr.2022.02.275

Title: Abrasive Water Jet Machining for a High-Quality Green Composite: the Soft Computing Strategy for Modeling and Optimization

Authors: Jagadish, Manjunath Patel G C, Tatjana V. S, Zhang L Jabir M

Journal: Journal of the Brazilian Society of Mechanical Sciences and Engineering

Web: https://doi.org/10.1007/s40430-022-0337

Title: A review on sustainability, health, and safety issues of electrical discharge machining.

Authors: B.K. Baroi, Jagadish, P.K. Patowari

Journal: Journal of the Brazilian Society of Mechanical Sciences and Engineering

Web: https://doi.org/10.1007/s40430-021-03351-4

Title: Non-linear vibration analysis of especially orthotropic tapered micro-plates with arbitrary located crack: A non-classical analytical approach

Authors: Bhupesh K Chandrakar, NK Jain, Ankur Gupta

Journal: Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science

Web: https://doi.org/10.1177/09544062211019776

Title: Study of tribo-mechanical properties of laser clad Al2O3-TiB2-TiN-BN□Ti-6Al-4 V alloy

Authors: Dipanjan Dey, Kalinga Simant Bal, Imran Khan, Ishan Bangia, Anitesh Kumar Singh, Asimava Roy Choudhury

Journal: Optics & Laser Technology

Web: https://doi.org/10.1016/j.optlastec.2022.107982

Title: Influence of heat-treated temperature and its rate on structural, mechanical, and corrosion properties of (Ti-Mo-Zr)60CoXCrY high entropy alloys for lightweight applications
Authors: Kiran Kumar Karnati, Vamsi Krishna Kattab, Eshwaraiah Punna, Swamy Naidu Neigapula Venkata, Balaji Rao Ravuri
Journal: Phase Transitions
Web: https://doi.org/10.1080/01411594.2022.2041636

Title: (Ti-Mo-Zr)60AlxSiy High Entropy Alloy: Correlation Between Microstructure, Mechanical, and Corrosion Properties
Authors: Kiran Kumar Karnati, Vamsi Krishna Kattab, Eshwaraiah Punna, Swamy Naidu NeigapulaVenkata, Balaji Rao Ravuri
Journal: Silicon
Web: https://doi.org/10.1007/s12633-022-01779-4

Title: Aerodynamic Flow Modelling of NACA 0010 using 2D Panel and Jukouwski Methods
Authors: Vasishta Bhargava, Satya Prasad Maddula, Swamy Naidu Venkata Neigapula, Md. Akhtar Khan, Chinmaya Prasad Padhy, Dwivedi Yagya Dutta
Journal: Aircraft Engineering and Aerospace Technology
Web: https://doi.org/10.1108/AEAT-07-2021-0199

Title: Solution of transient heat transfer in graded- material fins of varying thickness under step changes in boundary conditions using the Lattice Boltzmann Method
Authors: Abhishek Sahu, Shubhankar Bhowmick
Journal: Heat Transfer
Web: https://doi.org/10.1002/htj.22493

Title: Material modelling and limit angular speed analysis of porous trigonometric functionally graded rotating disk
Authors: Royal Madan, Shubhankar Bhowmick
Journal: Advances in Materials and Processing Technologies
Web: https://doi.org/10.1080/2374068X.2022.2036043

Title: Limit elastic speed analysis of rotating porous annulus functionally graded disks
Authors: Royal Madan, Shubhankar Bhowmick, Lazreg Hadji, Abdelouahed Tounsi
Journal: Steel and Composite Structures
Web: https://doi.org/10.12989/scs.2022.42.3.375

NOTEWORTHY RESEARCH WORK

Title of work (PhD thesis): Pattern Recognition Based Protection Schemes for Power Transmission Line

Name of scholar : Dr. Ashok Valabhoju

Name of supervisor: Dr. AnamikaYadav, Associate Professor, Department of Electrical Engineering, NIT Raipur

Summary of work:

Dr. Valabhoju has completed PhD thesis on "Pattern Recognition Based Protection Schemes for Power Transmission Line" Theme of the Thesis: Electrical Power Transmission Line Protection. In this thesis he has designed, modeled and simulated the CG state 400kV power transmission network. For this real existing power transmission network, different Artificial Intelligent and pattern recognition techniques based protection schemes have been developed and reported in this thesis.

Dr. Ashok Valabhoju from National Institute of Technology Raipur, Raipur, India has been awarded with the CIGRE Thesis Award by CIGRE Paris, France for his PhD thesis on "Pattern Recognition Based Protection Schemes for Power Transmission Line". The International Council on Large Electric Systems (CIGRE) is a global nonprofit organization in the field of high voltage electricity. It was founded in Paris, France in 1921. Dr. Valabhoju has completed his Ph.D. thesis under the guidance of Dr. AnamikaYadav, Associate Professor in the Department of Electrical Engg. NIT Raipur. He had also worked as JRF in sponsored research project at CPRI Bangalore.

Dr. AshokValabhoju
Ph.D. Scholar
Department of Electrical Engineering
NIT Raipur

Dr. AnamikaYadav
Associate Professor
Department of Electrical Engineering
NIT Raipur

CONFERENCES / STTPs ORGANIZED

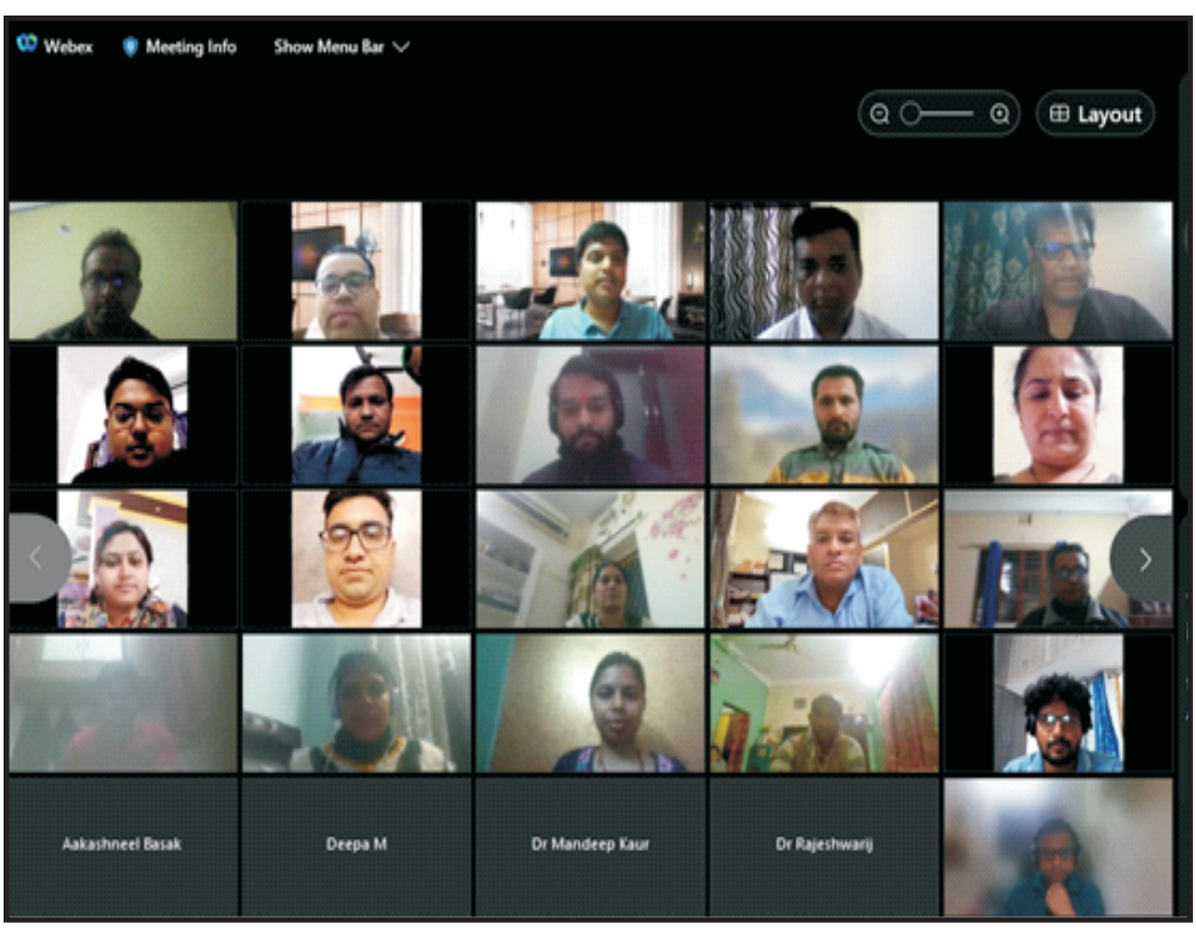
Title : Ten Days Online FDP on Data Science and its Applications

Organizing Department : Jointly organized by the Department of Computer Science and Engineering NIT Raipur and the Department of Computer Science and Engineering NIT Warangal

Duration : January 10-19, 2022

Organizing Secretaries : Dr. Aakanksha Sharaff and Dr. Sanjay Kumar Panda

Department of Computer Science and Engineering (CSE) in association with Electronics & ICT Academy, NIT Warangal, organized an online Faculty Development Programme (FDP) on Data Science and its Applications from January 10-19, 2022. The academy of E&ICT was set up at NIT Warangal with financial assistance from MeitY, GoI. The program, was inaugurated by Dr. A. B. Soni, Dean (Faculty Welfare) and Dr. D. S. Sisodia, HoD, CSE, and was coordinated by Dr. A. Sharaff, Assistant Professor, CSE, NIT Raipur and Dr. S. K. Panda, Assistant Professor, CSE, NIT Warangal.



Title : 2nd International Conference on Materials and Technologies (Materials TECH 2022)

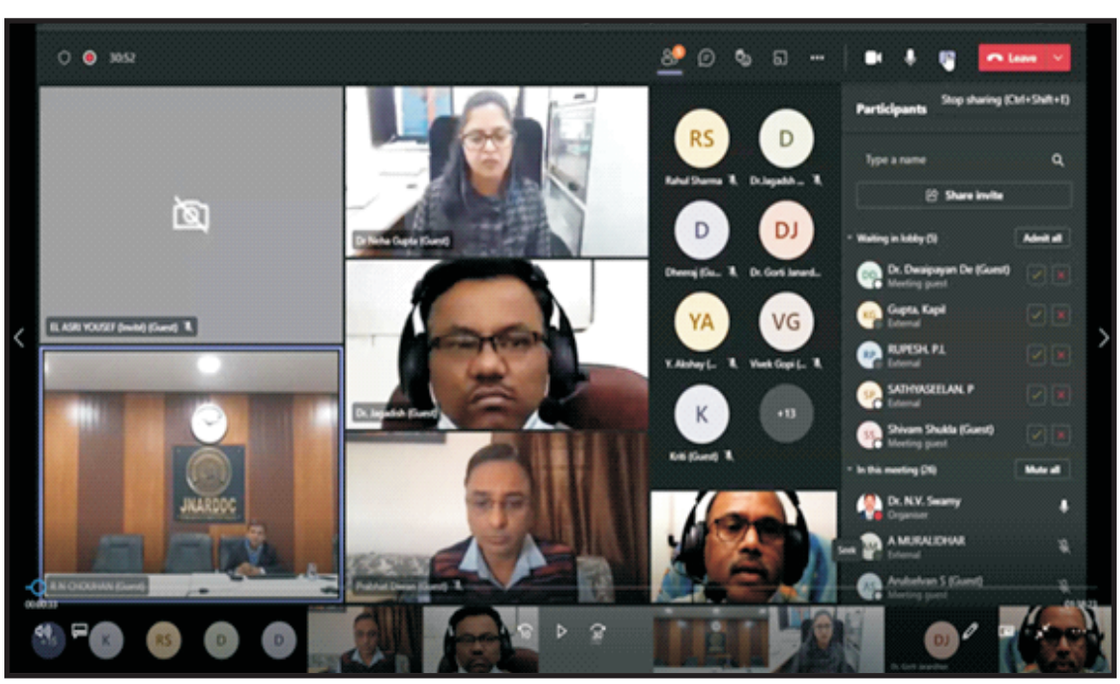
Organizing Department : Metallurgical and Materials Engineering & Mechanical Engineering

Duration : January 28-29, 2022

Chairperson : Dr. M. K. Manoj

Organizing Secretaries : Dr. N. V. Swamy Naidu, Dr. Neha Gupta and Dr. Jagdish

Advanced Material Science and Engineering is the study of all the materials that we see around us every day and forms a bridge between almost all fields in sciences and engineering. In this Conference (MATERIALTECH 2022) discussions were held on the designing and development of novel materials for engineering applications required for the industrial and socio-economic development of a nation. Around 240 participants applied, out of which 205 were shortlisted under categories of oral and poster presentation. Total registered participants were 160. In total 155 paper presentations were made that included 153 oral presentations and 2 poster presentations. International participants from Bulgaria, Canada, Malasiya, UK, Ukraine, Morocco, Portugal participated in the conference. The selected papers were peer reviewed and published in Material Today proceedings free of charge. The 2 day schedule comprised of 2 keynote lectures, 12 technical sessions and one poster presentation session. Day 1, keynote lecture was delivered by International speaker Prof. Kapil Gupta from University of Johannesburg, South Africa. He spoke on the topic "'Materials and Manufacturing Technology for Sustainability". Day 2, keynote lecture was delivered by industry expert and alumni of NIT Raipur, Mr. R. N. Chouhan. He is a Scientist at the Jawaharlal Nehru Aluminium Research Development and Design Centre Nagpur. The topic of his lacture was "Circular Economy in Non-ferrous metal sector: Indian perspectives".



Title : International Conference on Advances in Mechanical Engineering, Industrial Informatics and Management (AMEIIM-2022)

Organizing Department : Mechanical Engineering

Duration : February 25-26, 2022

Chairperson : Dr. S. Sanyal

Organizing Secretaries : Dr. N. V. Swamy Naidu, Dr. Suraj Kr. Mukti and Dr. Jagdish

The aim of "AMEIIM-2022" was to showcase state-of-art methodologies and technologies in mechanical, metallurgical, industrial, production engineering and management. It focused on new ideas and development to propagate latest innovations and practices.

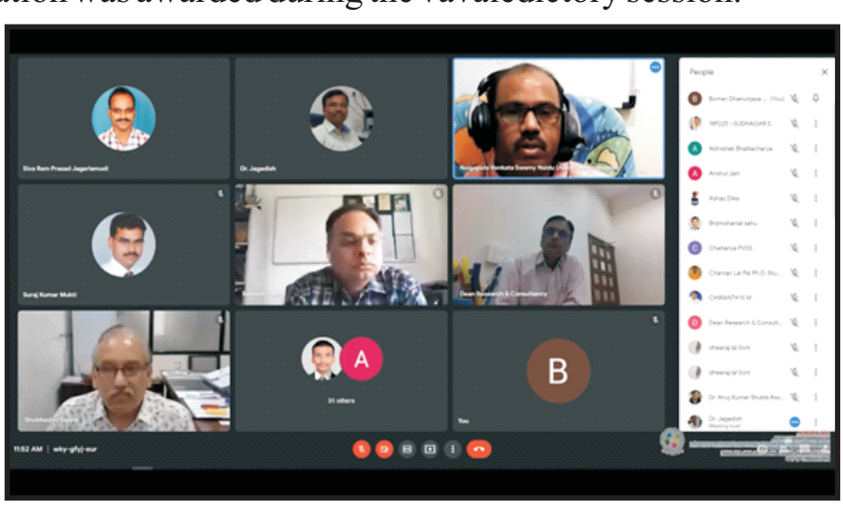
This conference focused on recent progress in theoretical and experimental approaches, as well as novel technological applications, that have advanced the frontier of this field.

Around 123 participants had applied, out of which 67 were shortlisted under the category of oral presentation. Total registered participants were 59, out of which 57 paper presentations including one international participant from Italy have published the paper.

Papers selected after the peer review process will be published in American Institute of Physics (AIP) proceedings. The 2 day schedule includes 2 keynote lectures and 7 technical sessions.

On the 1st day of the conference, the keynote lecture was delivered by International speaker Prof. Raul Fangueiro, Professor and Senior Researcher, Coordinator of Fibrenamics, University of Minho, School of Engineering, Portugal. He spoke on the topic "'Multifunctional and Multiscale Fiber-Based Materials and Composites". 2nd day keynote lecture was delivered by industry expert and alumni of NIT Raipur, Mr. R. N. Chouhan, Scientist, Jawaharlal Nehru Aluminium Research Development and Design Centre Nagpur. His speech on was on the topic "Circular Economy in Non-ferrous metal sector: Indian perspectives".

Abstract Book, fee receipts and participant certificates were shared with participants. Best Oral presentation was awarded during the vavaledictory session.



Title : International Conference on Applied Computational Intelligence and Analytics (ACIA-2022)

Organizing Department : Information Technology

Duration : February 26-27, 2022

Chairperson : Dr. S. P. Sahu

Organizing Secretaries : Dr. Rakesh Tripathi, Dr. Govind P. Gupta and Dr. T. P. Sahu

The First International Conference on Applied Computational Intelligence & Analytics (ACIA-2022) was organized by the Department of Information Technology, NIT Raipur from 26-27 February, 2022 in online mode. The theme of this international conference was computational intelligence and its application in different domains such as data science and analytics, cyber security, network and system. The main aim of the ACIA-2022 conference was to select and share quality research articles based on the current scientific developments on computational Intelligence and its application. There were mainly three tracks based on the application of computation intelligence like data science and analytics, network and system, and cyber security.

On the first day of the conference, Prof. Raj Kumar Buyya, Director, Cloud Computing and Distributed Systems (clouds) Lab, University of Melbourne, Australia, delivered the keynote talk on "Neoteric frontiers in cloud and edge computing". In this keynote talk, he discussed about the various development in edge computing and cloud services and its vast utility in various applications of computing and services. On second day of the conference, Dr. Dhaval Patel, Senior Research Scientist, IBM TJ Watson Research, US, had delivered the keynote talk on "Time Series Anomaly Detection Toolkit for AI". This conference was attended by more than 120 participants including 48 presenters and 50 listeners. Conference proceedings of ACUA-2022 will be published with AIP.

Title : 1st International Conference on Computational Intelligence and Network Security (ICCINS-2022)

Organizing Department : Computer Science and Engineering

Duration : March 03-04, 2022

Chairperson : Dr. Dilip Singh Sisodia

Organizing Secretaries : Dr. K. Jairam Naik and Dr. Preeti Chandrakar

The "ICCINS-2022" conference was aimed at providing state-of-art methodologies and technologies in computing, communication and security like soft computing, distributed, cloud, big data, IoT & Industrial-IoT computing, cryptography & cryptanalysis, privacy, data hiding, intrusion detection, and block chain technologies. It provided an opportunity to network, collaborate and exchange ideas among the renowned delegates, researchers, faculties and students in Computing, Communication and Security. The papers presented successfully in the conference will be published in American Institute of Physics (AIP) proceedings. Two Keynote speeches were delivered by experts from KKDU, Asudi Arabia & IIT Roorke. In total 32 papers were presented in the ICCINS-2022 while 100 papers were received from different countries, including Pakistan, Italy, Saudi Arabia and South Korea.

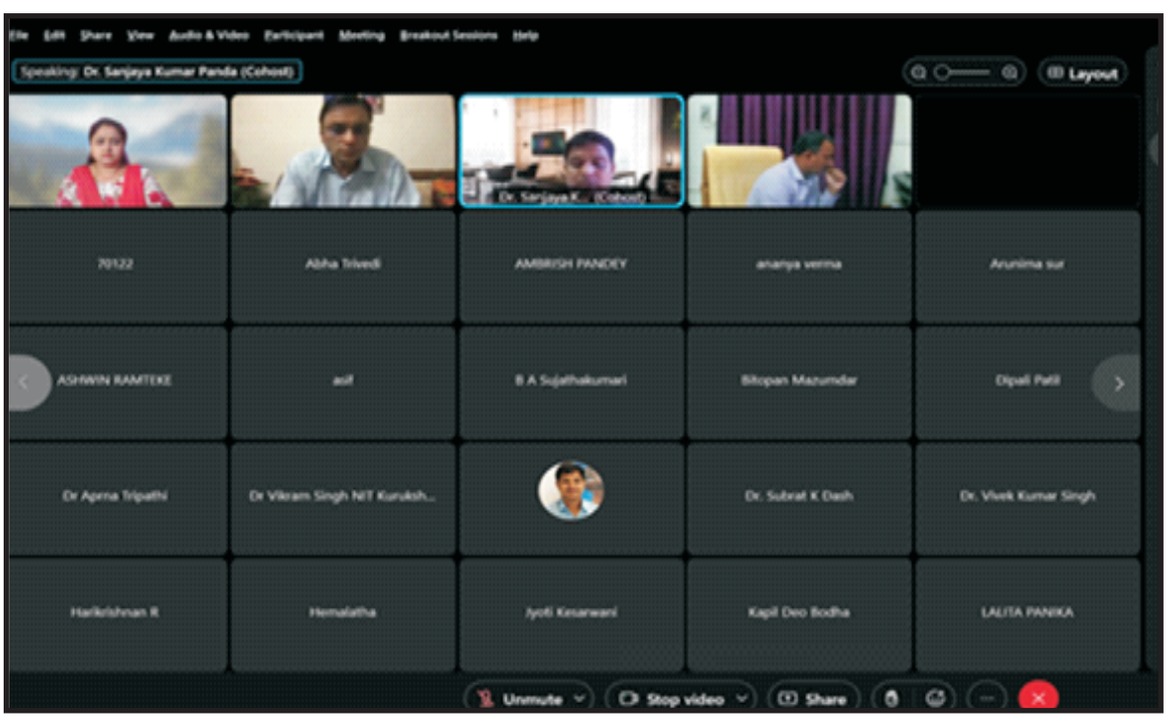
Title : 2nd Online FDP on Data Science and its Applications

Organizing Department : Jointly organized by the Department of Computer Science and Engineering NIT Raipur and Department of Computer Science and Engineering NIT Warangal.

Duration : March 7-16, 2022

Organizing Secretaries : Dr. Aakanksha Sharaff and Dr. Sanjay Kumar Panda

A joint and 2nd online FDP (10 days) on Data Science and its Applications commenced on 7th March 2022. The FDP was inaugurated in the prescence of Prof. P. Diwan Dean R&C, Dr. D. S. Sisodia, Head, Computer Science and Engineering. The co-ordinators of the FDP were Dr. Aakanksha Sharaff, CSE, Dept. NIT Raipur and Dr. Sanjaya Panda, NIT Warangal. The inauguration was precided by Dr. D. S. Sisodia, Head, CSE who encouraged the participants and congratulated the speakers for conducting the another FDP on Data Science and its Applications. In this series the 1st FDP was organised in January 2022 and the 2nd in March 2022, in a short span of 2 months. He also pointed out that Data Science is very demanding research area and it can be justified by the overwhelming response of the participants from home country and abroad. The opening address was delivered by Dr. Sanjay Panda and Dr. Aakanksha Sharaff presented the vote of thanks. Dr. P. Diwan, Dean R&C appreciated the overwhelming response of the participants and spoke about the importance of this FDP. In total, 82 participants registered for this FDP. This FDP received participants from other countries. The participants were from IITs, NITs, centrally funded institutes, industry. This FDP had several hands-on sessions and the speakers of this FDP were from different IITs, NITs, industry personnel.



Title : 4th International Conference on Machine Intelligence and Signal Processing (MISP-2022)

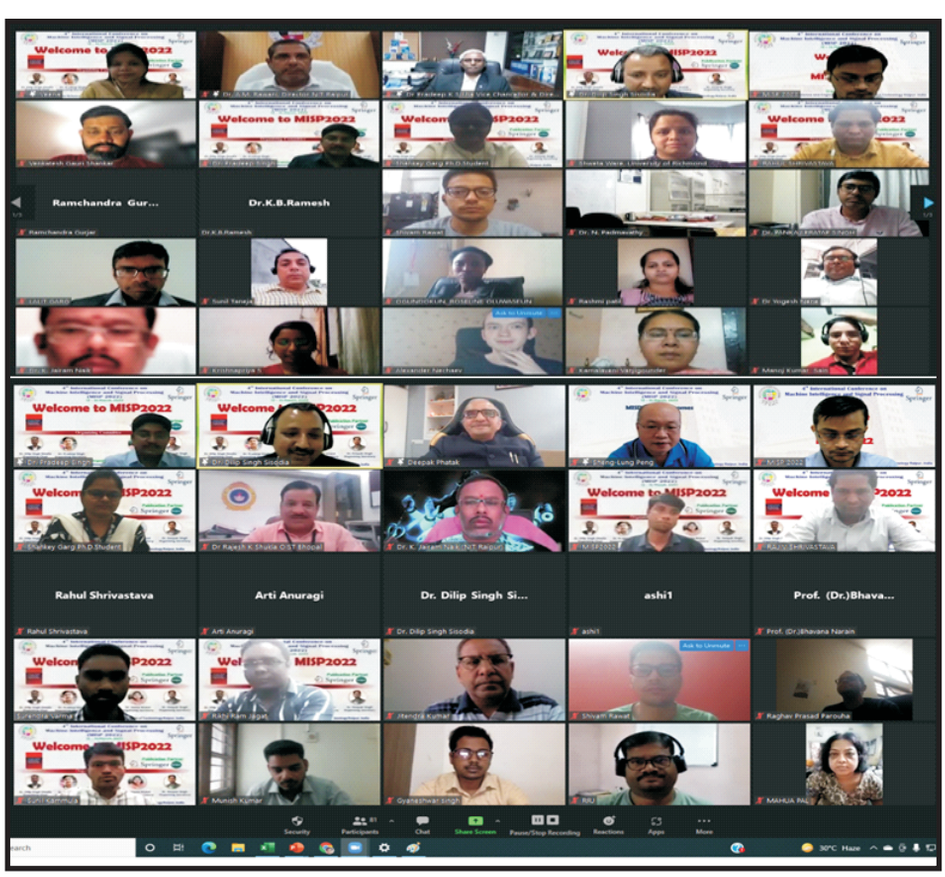
Organizing Department : Computer Science and Engineering

Duration : March 12-14 2022

Chairperson : Dr. Dilip Singh Sisodia

Organizing Secretaries : Dr. Pradeep Singh, Dr. Veena Anand and Dr. Deepak Singh

Department of Computer Science and Engineering (CSE), NIT Raipur, organised the 4th International Conference on Machine Intelligence and Signal Processing (MISP 2022) from 12th to 14th March, 2022, in virtual mode. Dr. D. S. Sisodia, HoD, CSE, was the Chairperson. Dr. P. Singh, Dr. V. Anand and Dr. D. Singh, Assistant Professors, CSE, were the organizing secretaries. The Chief Guest of the event was Dr. D. B. Phatak, Padma Shri, Professor Emeritus, IIT Bombay. The honorable chairs were Prof. R. Buyya, University of Melbourne, Prof. P. K. Sinha, IIIT Naya Raipur and Prof. S. L. Peng, National Taipei University of Business, Taiwan. The keynote speeches were delivered by Prof. L. Garg, University of Malta, Prof. R. B. Pachori, IIT Indore, Prof. H. Wang, Queen's University Belfast, Ms. K. Khatter, Editor, Applied Sciences and Engineering, Springer Nature and Dr. Y. Nene, MD Anaesthesiology, AIIMS Raipur and Regional Medical Officer, Food Corporation of India. During the conference, a total of 152 papers were presented in 30 sessions. The authors from various Indian states and many other countries such as Russia, Nepal, Bangladesh, Nigeria, Morocco etc., shared their research work during the presentations.



Title : International Conference on Applied Mechanics, Machine Learning and Advanced Computation (AMMLAC- 2022)

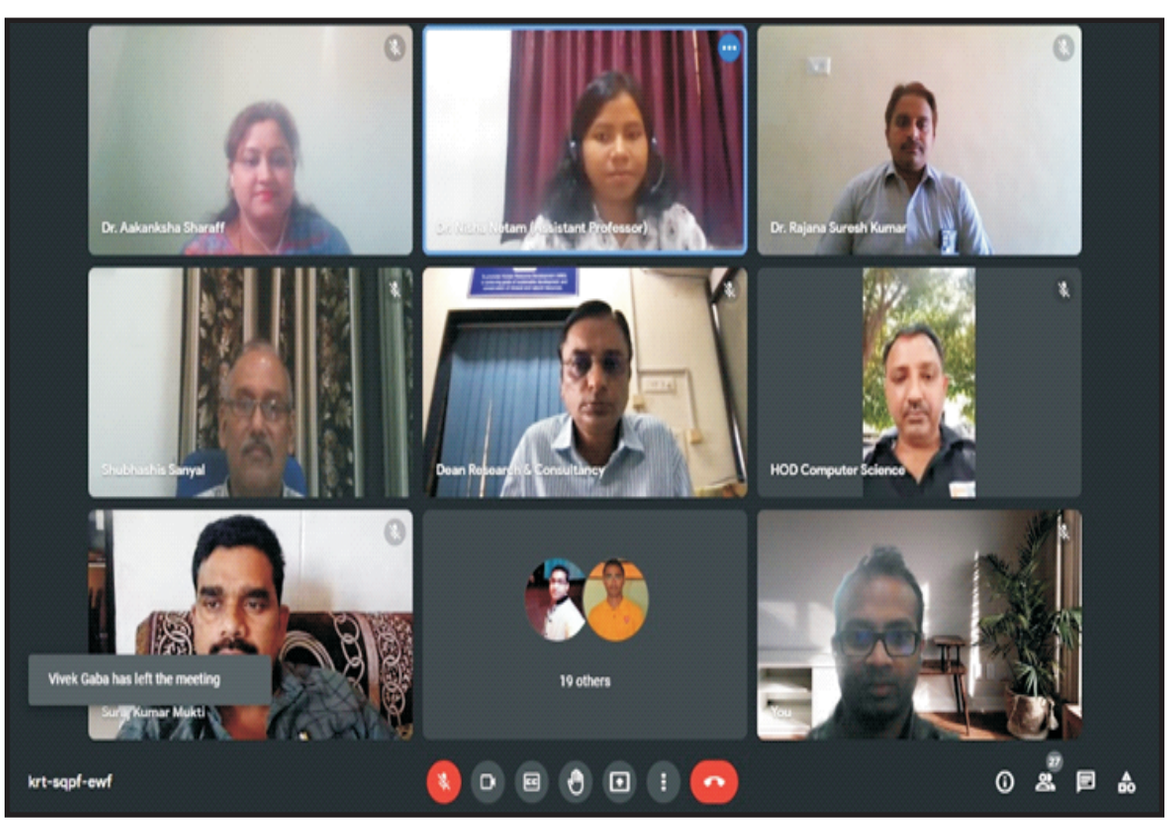
Organizing Department : Mechanical Engineering and Computer Science and Engineering

Duration : March 16-17, 2022

Chairperson : Dr. S. Sanyal

Organizing Secretaries : Dr. R. S. Kumar, Dr. N. Netam and Dr. A. Sharaff

The Department of Mechanical Engineering (ME) and the Department of Computer Science and Engineering (CSE), NIT Raipur organised a two-day virtual International Conference on Applied Mechanics, Machine Learning and Advanced Computation (AMMLAC) 2022 from 16th to 17th March, 2022. The program started with an inaugural ceremony chaired by Dr. S. Sanyal, HoD, ME. The chief guests includes, Dr. Prabhat Diwan, Dean, Research & Consultancy and Dr. S. Bhatia, Assistant Professor, King Faisal University, Saudi Arabia. The conference secretaries were Dr. R. S. Kumar and Dr. N. Netam, Assistant Professors, ME, and Dr. A. Sharaff, Assistant Professor, CSE. Faculty members and research scholars from IITs, NITs, and other reputed institutes shared their findings at this conference. Dr. S. Bhatia delivered a keynote lecture on "Information Retrieval using Sentiment Analysis".



Title : International Conference on Smart Materials and Applications (SMA -2022)

Organizing Department : Physics

Duration : March 25-26, 2022

Chairperson : Dr. Sadhana Agrawal

Organizing Secretaries : Dr. Ayush Khare, Dr. S. M. Saini and Dr. B. K. Sahoo

The conference was based on the theme of Smart Materials and Applications. More than 60 researchers attended the two-day-long event (March 25-26, 2022). The event was sponsored by IOP Publishing House and CADFEN ANSYS. The event was inaugurated by Dr. Prabhat Diwan, Dean R & C, NIT Raipur, in a virtual mode. He welcomed all the participants on behalf of the Director, NIT Raipur. All the participants were overwhelmed by the keynote speech of Dr. Ganesh Ji Omar, Research Scientist, National University of Singapore, Singapore. Also, the event included invited talks by Dr. B. R. K. Nanda, Professor, Department of Physics, IIT Madras, and Dr. Chittaranjan Dash, Research Scientist & Co-founder, Perosol, University of Stuttgart, Germany. The event was successfully organized with the active participation of all faculty members and staff of the Department.

RESEARCH SCHOLARS' CONCLAVE 2022

Duration : June 28-30, 2022

Chairman : Dr. P. Diwan

Organizing Secretaries : Dr. Anamika Yadav, Dr. Awanish Kumar and Dr. Tirath Prasad Sahu

NIT Raipur is organizing a three-day Research Scholar's Conclave on 28-30 June 2022 at NIT Raipur through online/offline mode. This 3-day event is a multidisciplinary Research Conclave, organized by NIT Raipur for the Ph.D. scholars of Institute only. It would be an excellent platform for them to present their research findings and to nurture among the young minds of the Institute the zeal towards as accelerated research and innovation in various R&D sector. This conclave will also provide a forum to identify problems-oriented research and share ideas in diversified topics related to current trends and future advances in areas of science, technologies, and humanities.

The Conclave is open to the Ph.D. scholars of NIT Raipur only. There will be parallel sessions of Research Groups for paper presentations. The experts will evaluate presentations of each participant and the best presentation (from each Research Group) will be awarded with prize and certificate. The Ph.D. Scholars (both full time and part time) who have completed the Comprehensive seminar and not yet given their pre-synopsis seminar are required to submit and present their paper as first author compulsorily.

Abstract submission on the original work of research scholar is invited as per timeline mentioned in the conclave brochure. The decision of abstract acceptance will be judged by a panel of expert reviewers and intimated to the scholar. Scholars can ask their queries on email-ID: researchscholarconclave@nitrr.ac.in and submit their abstract through the website by clicking Submission & Registration tab.

ARTICLES OF PRIME RELEVANCE

Do we need ethical guidelines for AI driven research(s)?

Arindam Bit
Department of Biomedical Engineering, NIT Raipur

The evolutionary revolution had always brought a mixture of perspective in technological alliances. Industrial revolution 4.0 had fostered the dissemination of soft computing technology in the forefront of mankind. It innervates the hardship of all previous industrial revolutions to evolve as a singular entity in technology devices. Most of the soft computing facilities are overwhelmed with AI: Artificial Intelligence credential. AI being driven by the architecture of human brain, is heavily being executed as a solver for most of the industrial complexities. However, there is a strong consciousness difference while dealing with the potential of AI between the mindset of people of the developing country and the developed country. While the mindset of people of developing country drives AI for upgrading industrial infrastructures, mindsets of people of developed country stretch AI capabilities for enhancing societal, economical, and foreign policies. Hence, intervention of a regulatory authority over the AI users to draw a line of AI applications is the need of the hour in the open economic architecture.

AI was originally derived from the architecture of human neural network. Observational facts derived from the natural architecture were limited to the constructive development of algorithms for saving complex logical problems. While doing so, tremendous potential of natural neural architecture was evaluated. Hence, the transformation mechanism(s) and continuous development of algorithms are being executed to transduce the natural phenomena of neural signal transduction into AI architecture. It was found to increase the flexibility of AI to intervene in decision making tasks in most of the executives of industrial arena. Some technological sectors include automobile industry, aerospace industry, shipping industry, food processing industry, production industry, healthcare industry, renewable energy industry, and telecommunication industry.

Automobile industry uses AI extensively for power management, engine efficiency, lubrication management, un-manned vehicle support, navigation, and climate control. It is equipped with auxiliary features and devices to accumulate the realtime relevant data for optimizing the dynamics of the vehicle, while maintaining the ambient conditions at the interior of the vehicle. Triggering of safety driving features are also assisting the driver console with the help of AI in most of the mid range automobiles. Current aerospace industry is heavily equipped with AI for upgrading the generation of flights, engines, its' architecture, propulsion system, aerodynamic design, safety features. In addition to that, AI is also being used to optimize the material composition and selection for various thermal stress regions of the transporter. Shipping industry and naval courtyard uses substantial AI tools for continuous up gradation of the respective naval products. Designing of naval structures for fuel efficiency voyage, management of non renewable energy for in-house power

management, internal architecture design for effective utility features, management planning for cargo loading and unloading mechanisms are few of the areas which are extensively driven by AI tools and products.

One of the SDG program related to food security has driven the AI in food processing industry. It is being used for configuring the texture, quality, shape, production time, production cost, packaging, market demand, and sustainability of demand of the developed food. AI also has been extensively used in retails for effective stacking of food products for greater visibility and decreasing cognitive load for the product ideation. AI has also deeply intervened in production industry. There, it evolves with tools like virtual reality and augmented reality for configuring various components of production line, their respective weightage, their ranking, and sequencing. Augmented reality toolbox also equipped with troubleshooting protocols and trajectories for addressing faulty deeper sub-layers in any production unit. The extension of AI further stretched for the designing and development of the production unit while configuring the utility and outcome of the developed product. The energy per cycle efficiency of the unit, maintenance cost, executive costs, and operational costs are some of the components which are evaluated and optimized with the capability of AI in production industry.

AI has evolved as one of the fundamental pillars of healthcare industry. It drives the industry from design of the product to development of the market. Every segment of this industry is highly doped with the influence of AI. Product development: be it a therapeutic product or diagnostic product, AI intervention often drives the development process of these products as per the market requirement. Thus, the technology can now be often seen been transforming from its usage of creditability to exploitation, drawing ethical lines to the profit making healthcare industries. A lighter side of AI intervention in this industry includes tooling of decision making diagnosis protocols. However, it requires validation from certified clinicians, and thus brings the human-machine cross-talk. This kind of phenomena and practices often raises concern about the standard of the clinical interventions of the AI driven outcome, based on socio-economical structure of region.

Another application of AI includes its intervention in renewable energy industry. As the world is being executed through a continuous and sustainable energy crisis, utility of renewable energy for combat above requirement is heavily doped with AI features. These features / algorithms assists in material selection and synthesis, actuator modeling, energy utility optimization, evaluating the far-sighted long term geographical effect, and economical sustainability. Among many other sectors, developing nations also emphasize on utility of AI in Telecommunication industry. Network configuration, its architecture and design, bandwidth optimization, and satellite positioning optimization are few of the areas being influenced by AI tools.

Some of the non conventional domains where AI is being used extensively as a tool by the people of developed country includes stock market, market capitalism, foreign policy framing,

urbanization planning, climate change, micro-economy architecture framing, annual budget configuration, socio-economic activities planning, and education policy framing. AI is not only used for predicting stock trajectory, but also to understand the response of the stock buyer, and accordingly, the stocks values are largely manipulated to attract more and spontaneous investment, resulting in sustainable growth of unicorns, decacorns and hectocorns firms. In the same way, AI is being extensively used with quotient of socio-cultural studies of developing nations to frame market capitalism by developed countries. Hence, it can be very easily measured by the import-export deficit of trade between a developing nation and developed nation. Whereas, the same phenomena can be adopted by developing nations with greater expenditure populations, equipping AI for enhancing region and nation specific export mechanisms. In recent unrest world, AI is being extensively used by the developed nations to frame their foreign policies while piercing their energy, defense, economic, territorial and financial security. The utility of AI for optimization of the above stated parameters does not only restrict to current time frame, but also these are evaluated for different configured cases for a decade time length. One of the best outcomes of successful implementation of AI in developed nations was found to be the planning of urbanization. In this process, AI plays a vital role to model not only the static parameters, but also the dynamicity of people, its economy, energy management, and evolution of natural resource markers. At the same time, planned urbanization in conjugated with climate change often diversifies the geographical features of the locality. These kinds of diversifications is being optimized by AI tools. It often results in drastic climate change in downstream regions. Hence, it will bring up ethical issues about the boundaries of extensibility of AI utilization. Developed nation often uses AI tools for micro-economy architecture framing. It helps in maintaining sustainablity of SMSE industries, and their effective contribution to the nation development. Further, developed nations often utilized AI for annual budget configuration, socio-economic activity balances, and continuous upgradations of their education policies. It drives them for a higher GDP per capita, enhanced education system producing greater number of Nobel laureates, and higher social indexing.

Hence, from the above observation it is trivial to conform to the utility and exploration of AI with existing resources of developing nations. These need to be driven judiciously for greater impact. However, whenever, it is a matter of greater impact of any technology, particularly, when its impact influences the mankind to the greatest extent, ethical boundaries and monitoring of such technology should be need of hours for systemic and effective implementation of this technology for nation building.

Bandgap Engineered 1.48V $GaAs_{0.95}$ $P_{0.05}$ Solar Cell with Enhanced Efficiency Using BSF Layer Optimization

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Abstract

A very desirable criteria to design a dual junction solar cell to exceed 30% efficiency in multijunction operation, is that we must design a top cell of III-V compound which achieves atleast 20% efficiency. Therefore, we have designed a bandgap engineered $GaAs_{0.95}P_{0.05}$ single junction solar cell with reduced bandgap energy of (Eg) = 1.48eV. Reducing the bandgap energy to 1.48eV from existing 1.72eV for $GaAs_{0.95}P_{0.05}$ cell leads to generate higher short circuit current, but at the same time it reduces the open circuit voltage. Although the reduction in open circuit voltage is not large, the higher short circuit current improves the power conversion efficiency of the $GaAs_{0.95}P_{0.05}$. The optimization of the cell is done using back surface field layer ofAlInP of higher bandgap material. The high short circuit current density of $Jsc = 19.881 mA/cm^2$ with $V_{oc}=1.182V$ achieves the highest efficiency of η= 19.50%, which is very close to 20% efficiency. The solar cell illuminated under 1-Sun in the AM1.5G environment, whichprovids 1000W/m^2 of spectral power density.

Keywords: GaAsP; Photovoltaic Cell; Buffer layer; photonic bandgap; doping; High efficiency.

Introduction

Compound material cells from the III-V group plays important role in the designing of multi-junction solar cell. In last 40 years, a lot of researchers are working on the models to develop III-V compound based solar cell, so that they can exceed the efficiency barrier of the single junction Si solar cell, which is limited to 29.8% [1,2]. The first criteria is to exceed 30% efficiency in tandem cell and to achieve atleast 20% efficiency for the III-V compound based top cell. The flexible bandgap compound material shows very good electrical and optical characteristics. Therefore, they are commonly used in development of optoelectronic devices like solar cells. GaAs, GaInP, GaAsP and perovskites are some of the examples of materials, used as top cell in multijunction operation. GaAs, GaInP and perovskite solar cell already achieved 20% efficiency as single junction solar cell [3-6]. Whereas, the GaAsP solar cell with ~1.7eV bandgap energy have still reported efficiency below 20% [7].

In this work, we designed a reduced bandgap GaAsP single junction solar cell with the help of high bandgap AlInPback surface field (BSF) layer. The BSF layer is optimized to achieve higher

efficiency close to 20%. The SILVACO ATLAS TCAD tool is used to model and determine the electrical and optical performance parameters of GaAsP single junction solar cell [8].

Design and performance of GaAsP solar cell

The schematic diagram of designed GaSP solar cell is given in Fig. 1. It consists of a p/n junction GaAsP cell with AlInP as window and buffer layer. The bandgap of the cell is found to be 1.48V, the total thickness of the cell is 1.3µm. The electrode was provided in the top and bottom surface.

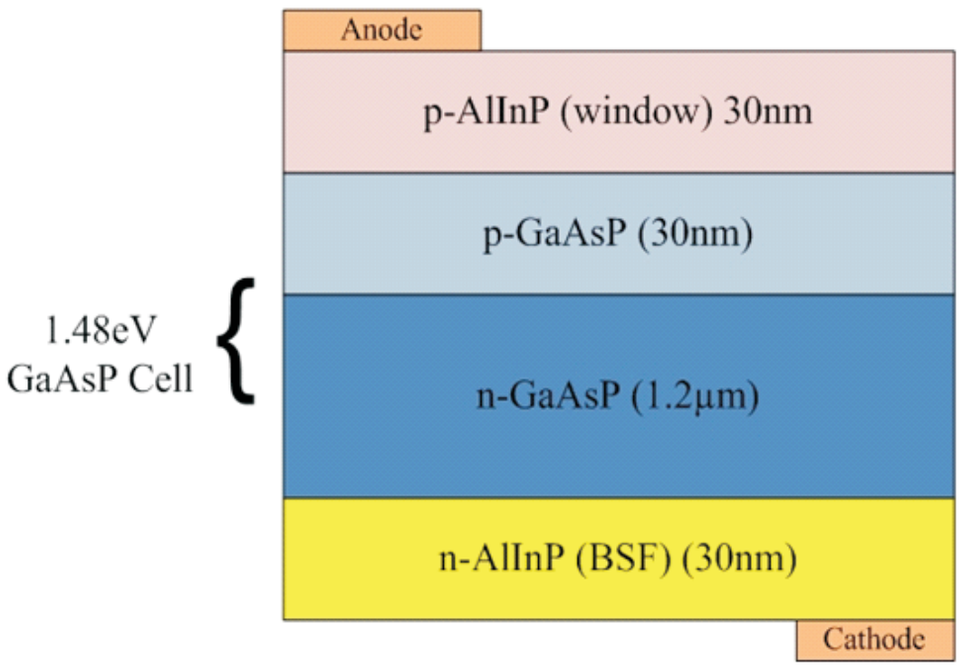

Fig. 1 Structure of reduced bandgap GaAsP single junction solar cell

The current voltage characteristics of the designed GaAsP solar cell is given in Fig. 2. The cell generates good short circuit current density of $Jsc = 19.356 mA/cm^2$ with $V_{oc}=1.150V$ achieves efficiency of $\eta = 18.15\%$ with the fill factor of $FF=80.93\%$. The highest efficiency of $\eta = 19.50\%$. $Jsc = 19.881 mA/cm^2$ with $FF=82.98\%$ and $V_{oc}=1.182V$ is achieved when the doping concentration of the AlInP BSF layer is optimized from Nd=$2X10^{19}/cm^3$ to Nd Nd=$7X10^{19}/cm^3$. The increase in the doping concentration causes the improved carrier transport of the charge carriers and therefore improves the passivation quality in the rear surface. The improved passivation quality enhances the open circuit voltage V_{oc} of the cell from V_{oc} $1.150V$ to V_{oc} $1.182V$. The jump in $32mV$ causes the increment of efficiency from 18.15% to 19.50%. The performance parameter of the GaAsP single junction solar cell is given in Table 1.

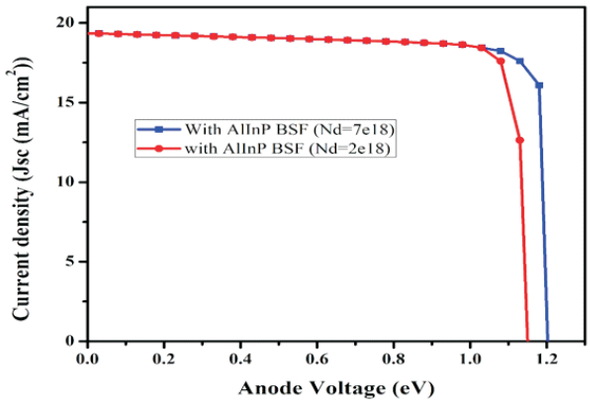

Fig. 2 I-V Characteristics of GaAsP single junction solar cell

Table 1 Performance parameter of GaAsP single junction solar cell

$GaAs_{0.95}P_{0.05}$ material parameter	$J_{sc}(mA/cm^2)$	$V_{oc}(V)$	FF (%)	η (%)
With AlInP BSF (AlInP (N_d = 2e18))	19.356	1.150	80.93	18.15
With AlInP BSF (GaAsP (Na = 3e18))	19.881	1.182	82.98	19.50

Conclusions

The $GaAs_{0.95}P_{0.05}$ single junction solar cell with reduced bandgap of 1.48eV is effectively designed. The optimization of the solar cell is done by varying the doping concentration of BSF layer. The electrical and optical characteristics are determined using Silvaco ATLAS TCAD Tool and ASTM certified AM1.5G spectrum is used to power the solar cell. The enhanced efficiency of 19.50% is achieved for the spectral density of 1000W/m^2.

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