International Conference on

Machine Intelligence for GeoAnalytics and Remote Sensing

MIGARS

27-29 Jan 2023

SOUVENIR

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VASAVI COLLEGE OF ENGINEERING

(Autonomous)

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Kyungpook National University, South Korea

Alejandro Frery
Universidade Federal de Alagoas, Brazil

MESSAGE

Vasavi College of Engineering believes that quality education and research with human values will play a key role for societal growth.

Our institute encourages the students and faculty to gain sound knowledge on the fundamentals of technical subjects and to apply them to solve real time problems. As part of R&D policy of the institute, we do encourage the students and faculty to explore the state-of-the-art research in their relevant filed and also contribute in their own areas of interest.

Investigations to discover the reasons for abnormal changes on the earth surface, water and climate are on high demand in recent times. The theme of the conference, MIGARS 2023, is very much relevant to the present context across the globe. We feel immense pleasure to record that Vasavi College is the host for the very first version of MIGARS.

MIGARS 2023 is successful in attracting research articles from 25 countries with an acceptance ratio of 42.29%. I wish the participants of this event will be greatly benefited with the deliberations among active researchers from academia and industry.

Wish you all a great learning experience in this technically enriched event.

Sri P. Ramamohan Rao
President, VAE

MESSAGE

Machine Intelligence for GeoAnalytics and Remote Sensing is observed as a technically enriched conference. As the Secretary of the Vasavi Academy of Education, I feel immense pleasure to have our institute Vasavi College of Engineering as the host of MIGARS 2023. Though it is a first of kind effort of merging two emerging societies of IEEE i.e., CIS and GRSS, it is remarkable to see the outreach of this conference across the globe. I appreciate the sincere efforts of all the Organizing Committee Members of MIGARS as a high-quality conference.

I also appreciate the HOD and Faculty of the Department of IT for their initiation to host MIGARS @ VCE. I wish the faculty and students of IT will get great benefit by having academic and research collaborations with other leading researchers.

Sri M. Krishna Murthy
Secretary, VCE

MESSAGE

MIGARS 2023 emerged as a quality conference. We witnessed lot of applications of Remote Sensing in our day-to-day life. The ultimate purpose of the technical education is to cater the needs of the society with their research and innovation.

Further, there are many job opportunities in the field of Geospatial Data Analytics. In this regard, MIGARS 2023 creates a platform for the young brains to understand the state of the art of research and also the industry expectations.

I thank all sponsors and technical co-sponsors for their extended support.

I wish MIGARS 2023 become a grand success.

Sri. V.M.Parthasarathi
Treasurer, VCE

MESSAGE

It is my pleasure to be part of this magnificent conference – MIGARS 2023 being hosted by the Department of Information Technology of Vasavi College of Engineering (A).

Remote Sensing applications are becoming ubiquitous ranging from crop health to the space research. Climate analytics is a potential area of research, gained a big boom with revolutionary developments in Computational Intelligence and relevant fields. The theme of the conference is very much relevant to the current scenario.

It is noteworthy that there are many articles from 25 different countries covering 6 continents submitted and finally authors from 17 countries are presenting their research work in this conference. I wish to put on records my sincere appreciation to the General Chair, TPC Chairs and other Committee Members of MIGARS 2023, and the Department of Information for their committed efforts.

Vasavi College of Engineering is committed to promote quality research and take every necessary step to inculcate the culture of research along with quality technical education. I wish the faculty and students of our institute will make use of this kind of events to understand the gear up their research activity having possible collaborations with active researchers from Academica and Industry.

I congratulate all the authors who are presenting their research papers and wish a pleasant stay in this beautiful campus with more scientific thoughts for future research.

Sri P. Balaji
CEO, VCE

MESSAGE

Research is essential in effective Teaching and Learning Process. For the past 40 years Vasavi College of Engineering has been considered as one of the leading Engineering Colleges in both the Telugu speaking states. Apart from regular academics our faculty members are also involved actively involved in research and executing many funded research projects from DST, SERB, AICTE and Industry.

Every department in our institute organizes one International Conference in Emerging areas in their relevant fields. The department of Information Technology has successfully organized 2 international conferences in the fields of Computational Intelligence and Data Analytics. MIGARS 2023 has an interesting theme with an emphasis on Computational Intelligence for GeoAnalytics and Remote Sensing. The number of submissions, global coverage and the diversity of the papers that are selected in each technical sessions proves the need of the research to use CI techniques in Remote Sensing.

I sincerely thank the General Chairs and the other OC members of MIGARS 2023 for your guidance to the department of IT to host this event at Vasavi College of Engineering. I strongly believe that MIGARS will encourage the current research activities by the faculty and the students of IT department will be able to take up their projects using their ML and DL models for Remote Sensing applications.

I sincerely thank IEEE Geoscience and Remote Sensing Society (GRSS) and Technically Co-Sponsored by ACM Hyderabad Deccan Chapter for providing Technical So-Sponsorship. Finally, I thank the Science and Engineering Research Board (SERB) and other sponsors for their financial support.

Dr. S. V. Ramana
Principal, VCE

MESSAGE

Dear Participants of MIGARS 2023.

Indeed, it is my privilege to contribute to MIGARS 2023 as an Organizing Chair. Research is inevitable for any student to the learning process. MIGARS 2032 has created a very good platform for many authors to present their research contributions and the deliberations planned in this conference are perfectly towards the theme of the conference. I need to put on records my sincere thanks to the General Chairs of MIGARS for accepting Vasavi College of Engineering as the host. The technical Co-sponsorship from IEEE GRSS made the event to reach many parts of the globe. The technical program includes Tutorial talks, Keynote talks, Industry Research Talks, YP, WIE and STEM talks along with technical paper presentations. We got a very good response from the authors from 25 countries. Thanks to the TPC for their efforts to complete the peer review by the scientific committee involving many active researchers across the globe. 74 papers got accepted from 175 submissions. In these accepted papers, 53 are from India and 14 are from other countries including Brazil, USA, Canada, Morocco, Germany, Iran, Israel, Greece, South Korea, UK, Russia, Ireland, and Pakistan.

The department of Information Technology took at as a challenge to organize this event and I thank all my team for their untiring effort in this successful event.

I wish all the authors explore new research problems and collaborations in this platform.

Dr. K. Ram Mohan Rao
Organizing Chair
Professor & Head
Department of Information Technology, VCE

Tutorial-1

(27 January 2023)

Sumantra Dutta Roy

Professor, Indian Institute of Technology, Delhi, India

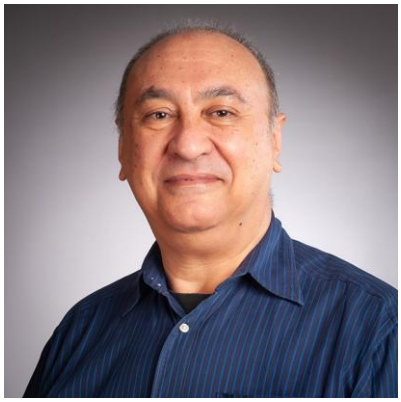
Title: "Deep Networks in Vision: an Unwilling Skeptic's View"

Abstract of the tutorial : The talk will be a random walk through deep architectures for some computer vision tasks, as seen from the eyes of a perennial Doubting Thomas and an unwilling and reluctant skeptic. The talk will focus on the speaker's struggles to come to terms with concepts which have physical significance, but comparatively little in terms of mathematical rigour, or algorithmic efficiency, but have the potential to produce hitherto unseen levels of startling results. The talk will start from scratch, delve a bit into history and timelines, and look into some computer vision applications of deep neural networks based on his limited understanding of traditional machine learning, and try to delve into related concepts, half of which he cannot readily explain well. The talk will use a `confuse if not convince' approach, and fervently hope that the confusion matrix approximates a diagonal one.

Sumantra Dutta Roy is a B.E. (Computer Engineering) from D.I.T., Delhi (1993), and completed his M.Tech and Ph.D. degrees at the Department of Computer Science and Engineering, I.I.T. Delhi, in 1995 and 2001, respectively. He started his career in teaching and research in the Department of Electrical Engineering at I.I.T. Bombay, where he worked from 2001 to early 2007 as an Assistant Professor. From 2007 to 2018, he was an Associate Professor in the Department of Electrical Engineering at I.I.T. Delhi. Since 2018, he has been a Professor in the Department of Electrical Engineering at I.I.T. Delhi. He was a visiting faculty member at Hiroshima University in 2018 and 2019. He is a recepient of 2004 INAE Young Engineer Award (Indian National Academy of Engineering), and the 2004 - 05 BOYSCAST Fellowship of the Department of Science and Technology, Government of India. He has been an Associate Editor of the Pattern Recognition Letters since 2011. His research interests are in Computer Vision and Image Analysis, Pattern Recognition and Machine Learning, Medical Informatics, Biometrics, Video and Image Coding, Music Information Retrieval, and Bioinformatics.

Workshop

(27 January 2023)



Alejandro C. Frery
Victoria University of Wellington, Wellington, New Zealand

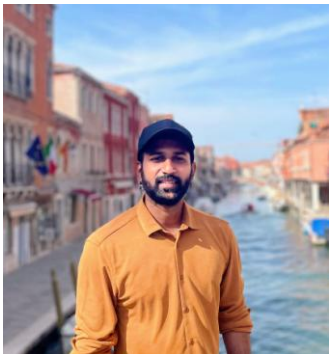
Title: How to turn your conference article into a journal Paper.

Abstract: In this workshop, we will see practical steps leading from ongoing research (materialized in a conference article) to consolidated manuscripts with good chances of being accepted for publication in a journal. To this end, we will review the principles of scientific research, including reproducibility and replicability. We will enhance the importance of preparing a reproducible article using, for instance, Quarto. We will also discuss typing assistants, version control systems, and collaborative tools.

Alejandro C. Frery is the current Vice-President for Publications of the IEEE Geoscience and Remote Sensing Society. His is Professor of Statistics and Data Science with the Victoria University of Wellington, New Zealand. His research interests are Computational Statistics and Signal and Image Processing Analysis.

Tutorial-2

(27 January 2023)



Suraj Reddy R

Scientist SE, National Remote Sensing Centre (ISRO), Hyderabad, India.

Title: Machine Learning for Remote Sensing Data Analysis.

Abstract : Remote sensing data availability has exploded in recent years due to the rapid advancement of Earth observation technologies and data policies, creating significant challenges for effective and efficient processing and analysis. Machine learning gathers substantial context due its ability to typically model complex characteristics in the data to learn new patterns and predict new outcomes while reducing human intervention. The ability of machine learning algorithms to handle a wide range of predictors and accept data without making any assumptions about the distribution of the data makes them the perfect choice for automating and improving remote sensing data analysis to draw fresh conclusions from complicated scenarios. This tutorial's objectives are to (1) provide a fundamental understanding of the requirements for machine learning algorithms in the analysis of remote sensing data, (2) establish a deep understanding of machine learning algorithms used in remote sensing data processing, (3) discuss challenges involved in building machine learning models and the impact of training data on model performance in the context of remote sensing data, and (4) use real-world examples to highlight the advantages and drawbacks of machine learning algorithms.

Mr.R Suraj Reddy is an SE Scientist at Forestry and Ecology group, National Remote Sensing Centre ISRO.
Pursuing PhD on Earth and Space Sciences from Indian Institute of Space Science and Technology, Thiruvananthapuram.
M.S - Computer Science from IIIT Hyderabad
Btech- Physical Sciences at Indian Institute of Space Science and Technology, Thiruvananthapuram
11 years of overall experience as a renowned scientist at NRSC (ISRO) working on remote sensing data applications in Forestry and Ecology. Proficient in use of statistical tools and machine learning algorithms for advanced/novel methods for processing of Multi-source Earth Observation (EO) data and Extensively worked on establishment of eddy covariance flux tower network and estimating carbon sequestration capacity of different forest ecosystems in India.
Areas of specialization include Remote Sensing Data Anaysis, LiDAR Data processing, time series data analysis, Geographic Informtion systems, forest above ground biomass, eddy covariance carbon fluxes.
Intensive research profile includes being the Principal Investigator (PI) for development of actionable Forest Cover Loss alerts using automated processing and analysis of time series remote sensing data, Co-Principal Investigator for establishment of eddy covariance flux towers to measure carbon sequestration capacity of various Indian forest ecosystems, Co-Principal Investigator for reducing uncertainty in forest biomass assessments using multi-source Earth observation data among many other roles.
Published around 20 peer reviewed publications in the fields of specializaton and has over 300 citations.
Awards and recognitions

- Awarded with ISRO Young Scientist award,
- Best Oral Presentation Award – IEEE GRSS Young Researchers Conclave 2020,
- Best Poster Award in National Symposium on “Recent Advances in Remote Sensing and GIS”.

Keynote Speakers

Keynote-1

(28 January 2023)

Laxmidhar Behera
Director, IIT Mandi, India

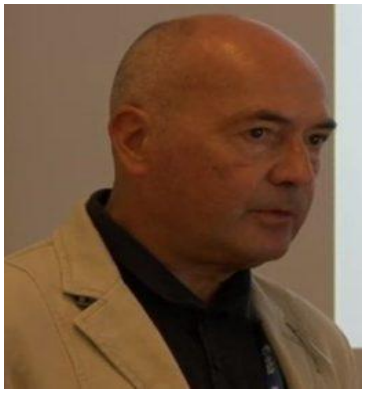
Title: Development of Cognitive Robotic Systems: Challenges and future perspectives.

Abstract: Robots have evolved from caged environments to be able to operate within sociable platforms. Warehouse automation, Smart Education, Healthcare and entertainment have played significant roles for such a transformation where robots behave more human-like. In this talk, some selected applications in warehouse automation will be presented. An example will be presented to illustrate if such robotic systems are really cognitive in real sense! Next, the efficacy of imitation learning will be demonstrated in the development of cognitive robotic systems. The challenges while naturalizing strong AI in robotic systems will be enumerated.

Prof Laxmidhar Behera is currently working as the Director, IIT Mandi on deputation from IIT Kanpur. He simultaneously serves as TCS affiliate faculty as a consultant. During his 27 years of research and teaching career, Prof Laxmidhar Behera has contributed significantly to areas such as Intelligent Systems and Control, Vision based Robotics, Warehouse automation, Brain-Computer-Interface and Drone Technology. His work has a unique blend of theory and experiments. He has established industrial collaboration with TCS, Renault Nissan, and ADNOC, Abu Dhabi, BEL Bangalore while making significant technological development in the areas such robotics-based ware-house automation, vision and drone guided driver assistance system, and drone guided pipeline inspection systems. His team secured 3rd position in the Amazon Robotics Challenge 2017 among top 16 teams across the globe and 4th position in the stow-cum-pick event. He has supervised 24 PhD students to completion and currently supervises 14 PhD students. Besides, he has supervised more than 70 masters' dissertations. He has published three graduate level text books, 112 peer reviewed journal papers, 215 papers in conference proceedings and 17 book chapters. His book entitled Intelligent Systems and Control published by Oxford University press is now in its 5th reprint and is being prescribed as a graduate level text book in many Universities across the world. Recently (April 2020) he published another book on Intelligent Control of Robotic Systems by CRC press Taylor & Francis – this book has been selected as the best Engineering book of the year 2020-21. Six of his papers have been given best paper awards in International/National conferences. He has established international research collaborations with ETH, Zurich, University of Texas, San Antonio, University of Edinburgh, UK, University of Ulster, UK, NAIST, Japan, and Deakin University, Australia. He has worked as Reader at University of Ulster, UK during 2007-2009 and has taken up visiting professor assignments at ETH Zurich, and FHG, Germany. He is a fellow of INAE and senior member of IEEE. He has acted as associate editors of two International Journals published by Taylor & Francis and Hindwai. He currently serves as the Associate Editor of IEEE Trans Systems, Man and Cybernetics: Systems.

Keynote-2

(28 January 2023)



Mihai Datcu

German Aerospace Center (DLR) and University POLITEHNICA of Bucharest (UPB)

Email: mihai.datcu@dlre.de

Title: Quantum computing for Earth Observation.

Abstract: At present, **quantum computing and AI** are the key technologies in the digital era. The progress and transfer of quantum resources for use in practical applications is in constant acceleration. Quantum computing, quantum annealing, quantum circuits, or simulators for quantum computing are currently easily accessible. The exploitation of quantum physics effects such as superposition and entanglement opens new, still unexplored perspectives. Yet, with very limited capacities, hundreds of qubits, they draw the attention stimulating the new area of quantum machine learning. In this context the presentation will focus on relevant aspects of quantum technologies for EO. With the goal to identify if a quantum algorithm may bring any advantage compared with classical methods, will be firstly analysed the data complexity (i.e. data as prediction advantage). Secondly, it will be presented the classes of complexity of the algorithms. Thirdly, it will be identify major challenges in EO which could not yet be solved by classical methods, as for instance the causality analysis.

Data embedding is of key importance. Non-quantum data are many times “artificially” encoded at the input of quantum computers, thus quantum algorithms may not be efficient. For instance the polarimetric SAR data are represented on the Poincare sphere which maps in a natural way to the qubit Bloch sphere. Thus, PolSAR data will not be any more processed as “signal” but directly as a physical signature. Further will be discussed the advantages of quantum annealing (D-Wave) for solving local optimization for non-convex problems. Also, the potential and advantage of the recent TensorFlow Quantum and the implementation of parametrized quantum circuits (PQC). The presentation will address the entire EO data cycle encompassing the particular features from data acquisition, understanding and modelling of the EO sensor, followed by information extraction. The quantum ML techniques are practically implemented using the open access to various quantum computers, as D-Wave, IBM, or Google. Hybrid methods will be discussed for EO, i.e. managing the I/O of the data and maximally use the resources of quantum computers and quantum algorithms.

- G. Cavallaro *et al*., "High-Performance and Disruptive Computing in Remote Sensing: HDCRS-A New Working Group of the GRSS Earth Science Informatics Technical Committee," in *IEEE Geoscience and Remote Sensing Magazine*,
- S. Otgonbaatar and M. Datcu, (2021) "Natural Embedding of the Stokes Parameters of Polarimetric Synthetic Aperture Radar Images in a Gate-based Quantum Computer" in IEEE TGRS, (Early Access).
- S. Otgonbaatar and M. Datcu, (2022) "Classification of Remote Sensing Images With Parameterized Quantum Gates," in IEEE GRSL, vol. 19, pp. 1-5, 2022
- S. Otgonbaatar and M. Datcu, (2021) “Assembly of a Coreset of Earth Observation Images on a Small Quantum Computer”, Electronics, 10 (20), MDPI
- S. Otgonbaatar and M. Datcu, (2021) "A Quantum Annealer for Subset Feature Selection and the Classification of Hyperspectral Images," in IEEE JSTARS vol. 14, pp. 7057-7065, 2021

Mihai Datcu received the M.S. and Ph.D. degrees in electronics and telecommunications from the University POLITEHNICA of Bucharest (UPB), Romania, in 1978 and 1986, respectively, and the *habilitation a Diriger des Recherches* degree in computer science from the University Louis Pasteur, Strasbourg, France, in 1999. Since 1981, he has been with the Department of Applied Electronics and Information Engineering, Faculty of Electronics, Telecommunications and Information Technology,

UPB, he is Full Professor and Director of the Research Center for Spatial Information (CEOSapceTech), UPB. Since 1993, he has been with the German Aerospace Center (DLR), he is a Senior Scientist with the Remote Sensing Technology Institute (IMF). From 1992 to 2002, he had a longer Invited Professor Assignment with the Swiss Federal Institute of Technology (ETH Zurich), Zurich, Switzerland.
Since 2001, he had been initiating and leading the Competence Center on Information Extraction and Image Understanding for Earth Observation, ParisTech, Paris Institute of Technology, France, a collaboration of DLR with the French Space Agency (CNES). From 2005 to 2013 has been Professor holder of the DLR-CNES Chair, at ParisTech, Paris Institute of Technology. From 2011 to 2018, he has been leading the Immersive Visual Information Mining Research Laboratory, Munich Aerospace Faculty. Between 2018 and 2020 he was the holder of the Blaise Pascal international chair of excellence at Conservatoire national des arts et métiers (CNAM), Paris. Between 2020 and 2022 he was involved in the DLR-French Aerospace Lab (ONERA) Joint Virtual Center for AI in Aerospace.

He was a Visiting Professor with the University of Oviedo, Spain; University Louis Pasteur and International Space University, Strasbourg, France; University of Siegen, Germany; University of Innsbruck, Austria; University of Alcala, Spain; University Tor Vergata, Rome, Italy; Universidad Pontificia de Salamanca, Madrid, Spain; University of Camerino, Italy; the University of Trento, Italy, China Academy of Sciences, Shenyang, Universidade Estadual de Campinas (UNICAMP), Brazil; University of Wuhan, China, and the Swiss Center for Scientific Computing, Manno, Switzerland..
He has initiated and implemented the European frame of projects for Earth Observation image information mining (IIM) and is involved in research programs for information extraction, data mining, Big EO Data knowledge discovery, and data understanding with the European Space Agency (ESA), NASA, and in a series of national and European projects. He and his team have developed the operational IIM processor in the Payload Ground Segment systems for the German mission TerraSAR-X, and data mining tools and systems for the Copernicus missions Sentinel-1 and Sentinel-2. He is developing algorithms for model-based information retrieval from high-complexity signals and methods for scene understanding from very-high-resolution synthetic aperture radar (SAR) and interferometric SAR data. His research interests include, information theory, signal processing, explainable and physics aware Artificial Intelligence, computational imaging, and qauntum machine learning with applications in EO. Dr. Datcu is a member of the ESA Working Group Big Data from Space and Visiting Professor withe ESA's Φ-Lab. He was the recipient of the Romanian Academy Prize *Traian Vuia* for the development of the SAADI image analysis system and his activity in image processing in 1987, of the Best Paper Award and the IEEE Geoscience and Remote Sensing Society Prize in 2006, the National Order of Merit with the rank of Knight, for outstanding international research results, awarded by the President of Romania in 2008, and. He was also the recipient of the *Chaire d'excellence internationale Blaise Pascal* 2017 for international recognition in the field of data science in EO and the 2018 Ad Astra Award for Excellence in Science. He has served as a Co-organizer for international conferences and workshops and as Guest and Associate Editor for IEEE and other journals. In 2022 he got the IEEE GRSS *David Landgrebe* Award in recognition of outstanding contributions to Earth Observation analysis using innovative concepts for big data analysis, image mining, machine learning, smart sensors, and quantum resources. He is IEEE Fellow.

YP- Networking

(28 January 2023)

K.S. Rajan

Professor & Registrar Ph.D (University of Tokyo), International Institute of Information Technology Gachibowli Hyderbad, India

Title: "How to engage in Research? – An Interactive session on writing thesis and proposals"

Areas of Interest: Geographical Information Systems (GIS), Remote Sensing, Modelling & Simulation, Regional and Global Environmental Change, Human-Land-Water interactions, Role of S&T in Policy making, Open Source Softwares

Dr K S Rajan, Professor and Registrar at International Institute of Information Technology, Hyderabad. Areas of interest -Geographical Information Systems (GIS), Remote Sensing, Modelling & Simulation, Regional and Global Environmental Change, Human-Land-Water interactions, Role of S&T in Policy making, Open Source Software. Part of many consultancy projects in India and abroad.

Ph.D. in Civil Engineering, University of Tokyo, Japan;
ME in Civil Engineering, University of Tokyo.
B. Tech(Hons) Civil Engineering, Indian Institute of Technology, Kharagpur.

YP- Networking

(28 January 2023)

Avinash Maramraju
Vice President - University Space Missions, Dhruva Space Private Limited

Title: Space as a Career option: Technology Roadmap & Opportunities.

Avinash Maramraju Graduated with MS in Electrical Engineering from the University of Massachusetts in 2003. Graduated with MBA in Finance and IT from the same university in 2006.

Worked for 18 years in different roles, from Business Analyst, Program Manager, Associate Director, Head of Delivery, PreSales Head, etc. in areas of SAP, and Microsoft technologies. Experienced in multiple domains like Infrastructure, Manufacturing, IT, and ITES. Cross over from SAP to Space, leveraging transferrable skills and learning new ones.

Started third Masters's degree in Space System Engineering from Florida State University in Aug 2020, with the roadmap for the doctoral program in the same area Joined Dhruva Space in Nov 2021.

A strong believer that Universities have a critical role in the space economy and have the potential to be game changers in this eco-system Meaningful and outcome-driven collaboration with the universities is the primary objective of my role at Dhruva Space.

Keynote-3

(29 January 2023)

Carlos A. Coello Coello
CINVESTAV-IPN
(Evolutionary Computation Group) Mexico City, Mexico

Title: Where is the research on evolutionary multi-objective optimization heading to?

The first multi-objective evolutionary algorithm was published in 1985. However, it was not until the late 1990s that so-called evolutionary multi-objective optimization began to gain popularity as a research area. Throughout these 37 years, there have been several important advances in the area, including the development of different families of algorithms, test problems, performance indicators, hybrid methods and real-world applications, among many others. In the first part of this talk we will take a quick look at some of these developments, focusing mainly on some of the most important recent achievements. In the second part of the talk, a critical analysis will be made of the by analogy research that has proliferated in recent years in specialized journals and conferences (perhaps as a side effect of the abundance of publications in this area). Much of this research has a very low level of innovation and almost no scientific input, but is backed by a large number of statistical tables and analyses. In the third and final part of the talk, some of the future research challenges for this area, which, after 37 years of existence, is just beginning to mature, will be briefly mentioned.

Carlos Artemio Coello Coello received a PhD in Computer Science from Tulane University (USA) in 1996. His research has mainly focused on the design of new multi-objective optimization algorithms based on bio-inspired metaheuristics (e.g., evolutionary algorithms), which is an area in which he has made pioneering contributions. He currently has more than **550 publications**, including more than 190 journal papers and 50 book chapters. He has received several awards, including the **National Research Award** (in 2007) from the Mexican Academy of Science (in the area of *exact sciences*), the **2009 Medal to the Scientific Merit** from Mexico City's congress and the **2012 National Medal of Science in Physics, Mathematics and Natural Sciences** from Mexico's presidency (this is the most important award that a scientist can receive in Mexico). Additionally, he is the recipient of the **2013 IEEE Kiyo Tomiyasu Award**, "*for pioneering contributions to single- and multiobjective optimization techniques using bioinspired metaheuristics*", of the **2016 The World Academy of Sciences (TWAS) Award** in "*Engineering Sciences*", and of the **2021 IEEE Computational Intelligence Society Evolutionary Computation Pioneer Award**. Since January 2011, he is an **IEEE Fellow**. He is currently the **Editor-in-Chief** of the *IEEE Transactions on Evolutionary Computation*. He is Full Professor with distinction (Investigador Cinvestav 3F) at the Computer Science Department of CINVESTAV-IPN in Mexico City, Mexico.

Keynote-4

(29 January 2023)

D. Nagesh Kumar
Professor, Indian Institute of Science Bangalore, India

Title : Deep Learning and its Applications in Geospatial Data Analytics.

Abstract : Deep Learning (DL) is gaining considerable significance in various domains of Civil Engineering due to its capability learn unknown non-linear processes, dimensionality reduction, data mining, and bid data processing. DL is subset of Machine Learning which is a subset of Artificial Intelligence. Common DL networks such as Deep Neural Networks (DNN) Convolution Neural Networks (CNN), Auto Encoders (AE), and Recurrent Neural Networks (RNN) will be discussed. DL applications in transportation sector, urban infrastructure monitoring, agriculture & forest management earth observation data applications in the domains of UN sustainable development goals, flood mapping, hyperspectral remote sensing etc. will be presented. Deep Learning can play a vital role in knowledge extraction by huge data mining which is essential for sustainable growth in different domains of Civil Engineering.

D. Nagesh Kumar received the Ph.D. degree from the Department of Civil Engineering, Indian Institute of Science (IISc), Bangalore, India, in 1992.

He has been a Professor with the Department of Civil Engineering, IISc, since May 2002. He is a Fellow of the Indian Academy of Sciences (IASc), Indian National Academy of Sciences (INSA) and National Academy of Sciences, India (NASI). He was holding the Prof Satish Dhawan Chair Professor position during 2018-21 He was the former Chairman, Centre for Earth Sciences, IISc, during 2014-20. Earlier, he was with the IIT Kharagpur, India (1994-2002), and National Remote Sensing Centre, Hyderabad, India (1992-94). He was a Boyscast Fellow with the Utah Water Research Laboratory, Utah State University, Logan, UT, USA, in 1999 and Visiting Professor in EMSE, St. Etienne, France in 2012. His research interests include climate hydrology, climate change, water resource systems, deep learning, evolutionary algorithms, fuzzy logic MCDM, and remote sensing & GIS applications in water resource engineering. He has supervised 10 Post Docs (1 in progress) and 22 PhDs (7 in progress). He is the co-author of 8 books and published more than 225 papers including 136 in peer reviewed journals. He has received funding support of more than Rs. 35 crores for sponsored research. He is the Editor in Chief of *Journal of Water and Climate Change*, IWA Publishing, UK and Associate Editor for ASCE *Journal of Hydrologic Engineering*. He is the recipient of *IBM Faculty Award* for his outstanding contributions in modelling hydrologic extremes using microwave remote sensing. He is a Senior Member of IEEE.

WIE/STEM Activity

(29 January 2023)

Dr. Novaline Jacob

Deputy Director (Advanced techniques, Video data & Geospatial Applications Area) ADRIN, Dept of Space

Title: Push Beyond Your Limits to Achieve Your Goals.

Dr Novaline Jacob, Deputy Director (Advanced techniques, Video data & Geospatial Applications Area) at Advanced Data Processing Research Institute (ADRIN) Dept of Space. Joined ADRIN in 1992 after completing M Tech in Remote Sensing from Anna University Chennai. Done PhD in Spatial Information Technology from JNTU Hyderabad. Research Areas of interest include data analytics, spatial dynamic modelling, multi criteria decision making techniques, fuzzy logic, AI/ML, graph theory, operations research etc. has developed workable solutions for various strategic applications, processing & analysing satellite images, geospatial, text, video data.

Published more than 40 research papers in international and national journals/ forums.

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Industry Research Talk

(29 January 2023)

Michal Shimoni
Head of Analytics and Applications Kuva Space, Finland

Title: A New Industrial Era for Spaceborne Remote Sensing

Abstract: In the last few years, we have witnessed the privatisation and commercialisation of the space industry which has changed the way we explore space, observe the earth, and conduct research. Once, it was nearly impossible for a startup to come up with a new space-related solution without investing large sums of money into developing and launching space assets. Not to mention the legal ramifications. Today, small and large companies can both adopt new business models thanks to the substantial drop in satellite and launch prices, the proliferation of ground stations, satellite tracking radars, and cloud services. The talk discusses the technological and commercial environments that led to this industrial revolution. It showcases how new technologies, earth observation and AI-based models, space data, remote sensing satellite constellations, and cloud services interact and shape the future right in front of our eyes. In addition, it illustrates the impact of advanced machine and deep learning methods on data acquisition, processing chains, cloud computing, and data exploration.

Dr Michal Shimoni is an awarded scientific expert in the field of hyperspectral. She has extensive experience implementing spectral imaging in various applications, including security and defence, environmental pollution, precision agriculture, water quality, natural and anthropogenic hazard and urban land cover mapping.

She has a broad knowledge of machine learning, multi-sensor imaging, 3D and physical modelling, and integrating sensors into airborne and space-borne platforms. Due to this, she became a leading expert in several research and development programs of the European Commission, European Space Agency, NATO and European Defence Agency.

Michal is currently employed as the Head of Analytics and Applications for Kuva Space, where she coordinates the development of products and services. She is also an active senior member of the International Society IEEE; within she is an associate editor of the scientific journal IEEE-GRSI and was the technical chair of the IEEE's flagged conference IGARSS in 2021.

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Conference Schedule

(Indian Standard Time)

27 January 2023	
08:00 – 09:30	**In person Tutorial Registration**
09:30 – 12:00	**Tutorial-1** ***Deep Networks in Vision: An Unwilling Skeptic's View*** ***Sumantra Dutta Roy,*** *Professor, IIT Delhi, India*
12:00 – 13:30	**Workshop** ***How to turn your Conference article into a Journal paper*** ***Alejandro C. Frery,*** *Professor, Victoria University of Wellington, New Zealand*
13:30 – 14:30	***Lunch Break***
14:30 – 17:00	**Tutorial-2** ***Machine Learning for Remote Sensing Data Analysis*** ***Suraj Reddy,*** *Scientist SE, National Remote Sensing Centre (ISRO), India*

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28 January, 2023

09:00 – 10:00	***Conference Inauguration***		
10:00 – 10:15	***Tea Break***		
10:15 – 11:15	**Keynote-1**	***Development of Cognitive Robotic Systems: Challenges and future perspectives*** ***Lakshmidhar Behara,*** *Director, IIT Mandi, India*	
11:15 – 12:15	**Keynote -2**	***Quantum Computing for Earth Observation*** ***Mihai Datcu,*** *CEO SpaceTech, University Politehnica of Bucharest (UPB)* *Romania Earth Observation Center (EOC), German Aerospace Center (DLR), Germany*	
12:15 – 13:30	***Lunch Break***		
13.30 – 15:00	**TS1.1.1 : Vegetation (6 papers) (Oral)** **Paper IDs:** ***8584, 3476, 9865, 7124, 7493, 1343***	**TS1.1.2: Agriculture/Urban Models (6 papers) (Oral)** **Paper IDs:** ***9818, 9351, 4448, 5461, 9118, 2912***	**TS1.1.3: Agriculture/Vegetation (8 Papers) (Poster)** **Paper IDs: 2355, 9429, 182, 8800, 527, 2336, 8305, 2311**
15.00 - 15:15	***Tea Break***		
15.15 – 17:00	**TS 1.2.1: Land-based Applications/Google Earth (7 Papers) (Oral)** **Paper IDs:** ***1902, 3566, 4897, 7650, 8666, 8857, 4885***	**TS 1.2.2: Registration/Segmentation/ Statistics (7 Papers) (Oral)** **Paper IDs:** ***1988, 3260, 9296, 3230, 3446, 8497, 1076***	**TS 1.2.3: Hydrology/Hyperspectral/ Multispectral-Image Analysis (9 Papers) (Poster)** **Paper IDs:** ***1050, 2238, 6181, 560, 7397, 1816, 8665, 7087, 2981***
17:00 - 18:30	***YP- Networking*** ***"How to engage in Research? – An Interactive session on writing thesis and proposals"*** ***K.S. Rajan,*** *Professor & Registrar, IIIT Hyderabad, India* ***Space as a Career option: Technology Roadmap & Opportunities*** ***Avinash Maramraju,*** *Vice President - University Space Missions,Dhruva Space Private Limited, India*		

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09:00 – 10:00	**Keynote -3**	***Where is the research on evolutionary multi-objective optimization heading to?*** ***Carlos A. Coello Coello*** *Department of Computer Science*	
10:00 – 10:15	***Tea Break***		
10:15 – 11:15	**Keynote-4**	***Deep Learning and its Applications in Geospatial Data Analytics*** ***D. Nagesh Kumar,*** *Professor, IISc., Bangalore*	
11:15 – 12:45	**TS 2.1.1: Hydroclimatology/Floods (6 Papers) (Oral)** **Paper IDs:** ***4152, 3538, 1354, 4445, 3253, 7307***		**TS 2.1.2: Climate-Atmosphere/Image Processing/Remote Sensing/ MR-Sensors (6 Papers) (Poster)** **Paper IDs:** ***4368, 569, 1069, 1442, 9049, 4534***
12:45 – 13:30	***Lunch Break***		
13.30 – 14:15	**WIE/STEM Activity** ***Push Beyond Your Limits to Achieve Your Goals*** ***Dr. Novaline Jacob,*** *Deputy Director, ADRIN, Dept of Space, Govt. of India*		
14.15 - 15:45	**Industry Research Talk** ***A new industrial era for spaceborne remote sensing*** ***Dr. Michal Shimoni,*** *Head of Analytics and Applications, Kuva Space, Finland*		
15.45 – 16:00	***Tea Break***		
16:00 - 17:45	**TS 2.2.1 :Hyperspectral Imaging/SAR Imaging/Disasters (6 Papers) (Oral)** **Paper IDs:** ***7957, 5718, 1301, 2442, 9320, 3816***		**TS 2.2.2 : Land based Apps/Disasters/Urban Models (6 Papers) (Poster)** **Paper IDs:** ***7143, 1073, 5087, 1257, 7946, 8686***
17:45 – 18:30	***Best Paper Award Presentation & Valedictory***		

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Technical Paper Presentation Schedule

Date: 28 Jan 2023 | Time: 13:30-15:00

TS 1.1.1: Vegetation (Oral)

S. No	Paper ID	Authors	Title
1	8584	Komal Kumari and Shashi Kumar	Machine Learning Based Modeling For Forest Aboveground Biomass Retrieval
2	3476	Eleftherios Lymperopoulos, Paraskevi Tzouveli and Stefanos Kollias	Satellite image super-resolution for forest localization
3	9865	Humaira Sanam, Aby K Mathai and Gnanappazham Lakshmanan	Multi-resolution remote sensing for the species-level classification of mangroves
4	7124	Swarnendu Sekhar Ghosh, Narayanarao Bhogapurapu, Avik Bhattacharya and Saeid Homayouni	Enhancing Plant Area Index Retrieval Using Gaussian Process Regression from Dual-Polarimetric SAR Data
5	7493	Subhajit Bandopadhyay, Barnali Das, Alexander Cotrina Sánchez, Sankar Prasad Banerjee, Bikram P. Banerjee and Subhasis Ghosh	Canopy Scale High-Resolution Forest Biophysical Parameter (LAI, fAPAR, and fCover) Retrieval Through Machine Learning and Cloud Computation Approach
6	1343	Matan Cohen and Maxim Shoshany	Desert-Fringe vegetation patterns Classification using Deep Learning: Comparison of input layers

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Date: 28 Jan 2023 | Time: 13:30-15:00

TS 1.1.2: Agriculture/Urban Models (Oral)

S. No	Paper ID	Authors	Title
1	9818	Manoj Kaushik, Rama Rao Nidamanuri, Aparna B and Ramiya A M	Spectral discrimination of vegetable crops using in situ hyperspectral data and reference to organic vegetables
2	9351	Uferah Shafi, Rafia Mumtaz, Zahid Mahmood, Muhammad Deedahwar Mazhar Qureshi, Raza Ullah Khan, Syed Ishtiaq Hyder and Sikander Khan Tanveer	Assessment of Wheat Productivity Enhancement by Integrated Nutrient Management (INM) using Remote Sensing
3	4448	Bharathi Chaudhury, Anand S Sahadevan and Pabitra Mitra	Agricultural Field Boundary Delineation From Multi-Temporal IRS P-6 LISS IV Images Using Multi-Task Learning
4	5461	Vamshi Krishna Munipalle, Usha Rani Nelakuditi and Rama Rao Nidamanuri	Agricultural Crop Hyperspectral Image Classification using Transfer Learning
5	9118	Rohit Chugh, Malavika Dileep, Usha Rani Nelakuditi, Rama Rao Nidamanuri, and Asha Davood	Spectrally Optimized Feature Identification (SOFI): A Novel Domain Sensitive Band Selection Algorithm for Hyperspectral Image Analysis
6	2912	Mohammad Hamed Shakeri Jahromi, Mehran Yazdi, Alireza Dehghani and Mahdi Rasouli	New scoring model for remote working hubs analysis and decision making

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Date: 28 Jan 2023 | Time: 13:30-15:00

TS 1.1.3: Agriculture/Vegetation (Poster)

S. No	Paper ID	Authors	Title
1	2355	Anindya Palaparthi and Ramiya A.M	Classification of Horticultural Crops in High Resolution Multispectral Imagery Using Deep Learning Approaches
2	9429	Anagha S Sarma and Rama Rao Nidamanuri	Transfer Learning for Plant-level Crop Classification using Drone-based Hyperspectral Imagery
3	182	Reji J and Rama Rao Nidamanuri	Deep Learning Based Fusion Of Lidar Point Cloud And Multispectral Imagery For Crop Classification Sensitive To Nitrogen Level
4	8800	Jayati Vijaywargiya and Rama Rao Nidamanuri	Crop Phenology Extraction Using Big Geospatial Datacube
5	527	Manohar Kumar C. V. S. S., Rama Rao Nidamanuri and Vinay Kumar Dadhwal	Subpixel Level Discrimination of Vegetable Crops in a Complex Landscape Environment
6	2336	Prakash P S, Manuel Fernandez-Urrutia and Chandan M C	A time series analysis of vegetation using Sentinel-2 images and Google Earth Engine
7	8305	Rajit Gupta and Laxmi Kant Sharma	Mapping Canopy Height from ICESat-2 and Landsat-9 using Machine Learning in the Himalayan Corbett Tiger Reserve, India
8	2311	Anna Derkacheva, Gerald V. Frost, Ksenia Ermokhina and Howie Epstein	Neural networks and satellite images in a shrub tundra landscape study: phenomena with fuzzy geometric and categorical boundaries

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Date: 28 Jan 2023 | Time: 15:15-17:00

TS 1.2.1: Land-based Applications/Google Earth (Oral)

S. No	Paper ID	Authors	Title
1	1902	Daison Darlan, Oladayo S. Ajani and Rammohan Mallipeddi	Lunar Landing Site Selection using Machine Learning
2	3566	Priyanka Gupta and Dericks Shukla	Integration of Optical and SAR remote senisng for LULC mapping of Imphal valley using Machine Learning Algorithm
3	4897	Eshta Ranyal, Ayan Sadhu and Kamal Jain	AI assisted pothole detection and depth estimation
4	7650	Chandra Has Singh and Abhishek Rai	Quality Assessment of UAV Data using Multiple RTK Reference Stations in undulating terrain.
5	8666	Parasuram Yadav Palla, Amba Shetty, Raghavendra B. S. and Narasimhadhan A. V.	Virtual Sample Generation of Hyperspectral Mineral Data
6	8857	Archana Pragada and Rajan K.S.	Does Google Earth CRS induce Northward bias with increasing UTM zone number?
7	4885	Vishnu Vardhan M., Harish Kumar S., Mohan Kumar S. and Subrahmanya Kundapura	A NDVI Based Approach To Detect The Landslides By Using Google Earth Engine

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Date: 28 Jan 2023 | Time: 15:15-17:00

TS 1.2.2: Registration/Segmentation/Statistics (Oral)

S. No	Paper ID	Authors	Title
1	1988	Latha James, Rama Rao N, Muralikrishnan S, Anjaneyulu R.V.G. and Srinivas C.V.	A Novel approach for SAR to Optical image Registration using Deep Learning
2	3260	Dhanya S Pankaj and Rama Rao Nidamanuri	A Robust Estimation Method for Automatic Registration of Remote Sensing Imagery
3	9296	Nadeem Akhtar and Manish Mandloi	DenseResSegnet: A Dense Residual Segnet for Road Detection Using Remote Sensing Images
4	3230	Gopinath Bej, Tamal Dey, Abhra Pal, Tapas Sutradhar, Amitava Akuli and Alokesh Ghosh	Segmentation of Watery Low Land Area using Hyperspectral Imaging Technique: A Comparative Study with PPI, N-FINDR, ATGP, and FIPPI
5	3446	Sagnik Kundu, Indranil Misra, S Manthira Moorthi and Debajyoti Dhar	Enhanced IHS Pan-sharpening using K-Mean Segmentation Guided Adaptive Intensity Histogram Matching and CLAHE Enhancement
6	8497	Madhu Krishna Karthan and Naveen Kumar P	Prediction of IRNSS User Position using Regression Algorithms
7	1076	Eduardo Ensslin and Alejandro Frery	Size and Power of Hypothesis Test Based on Geodesic Distances Induced by h-ϕ Entropies

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Date: 28 Jan 28 2023 | Time: 15:15-17:00

TS 1.2.3: Hydrology/Hyperspectral/Multispectral-Image Analysis (Poster)

S. No	Paper ID	Authors	Title
1	1050	Arash Tayfehrostami, Abbas Abedini and Bahman Tajfirooz	Analyzing the variations in the water surface area of Taleqan Dam of Iran using ground-based and satellite observations
2	2238	Rajdeep Pandey and Manabendra Saharia	LoRa-Based Communication System for Monitoring Water Quality of Lakes and Reservoirs
3	6181	Christy Mariya Lukose, Aneesh Kumar R and Radhakrishnan T	Seasonal Analysis of Ground Water recharge using GIS and Remote sensing techniques
4	560	Guru Prasad M S	An Improved Water Body Segmentation from Satellite Images using MSAA-Net
5	7397	Samvedya Surampudi and Vijay Kumar	A new change index for identification of flooding in fully polarimetric SAR data
6	1816	Jayasimha Chilakamarri, Dr. Rama Rao Nidamanuri and Dr. Palani Murugan	Multi-Scenario Target Detection using Neural Networks on Hyperspectral Imagery
7	8665	Renuvenkataswamy Sunkara, Arvind Kumar Singh and Govind R. Kadambi	Class Information-based Principal Component Analysis Algorithm for Improved Hyperspectral Image Classification
8	7087	Feba Treasa Jose, Manohar Kumar C V S S and Rama Rao Nidamanuri	Influence of Atmospheric Correction Models on the Discriminatrion of Crops using Airborne Hyperspectral Imagery
9	2981	Saneev Kumar Das, Pratik Bose, Kalpita Patra and Sujata Chakravarty	UAV Based Multispectral Image Processing Framework: A Band Combination Approach

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TS 2.1.1: Hydroclimatology/Floods (Oral)

S. No	Paper ID	Authors	Title
1	4152	Meghal Shah, Dr. Amit Thakkar and Dr. Hiteshri Shastri	A comparative study of Spatial Interpolation methods for CMIP6 monthly historical and future hydro-climatic datasets for Indian region
2	3538	Parthasarathi Mishra and Srinivasa Ramanujam Kannan	Sensitivity of Temperature Perturbation to Precipitation : A Parametric Study
3	1354	Shivaji Patil, Nitin Mohite and Sandip Palve	Tracing dynamics of groundwater potential zones for a watershed in Pune, India using geo-spatial technique
4	4445	Ashwin Gujrati, Vibhuti Bhushan Jha, Rama Rao Nidamanuri and R. P. Singh	Satellite-based Optical Water Type Classification of Inland Waters Bodies of India
5	3253	K C Arun Kumar, Subhajit Bandopadhyay, Ujjwal Garai, Mridul Das and Rahul Deb Das	Comparative retrieval approaches for concentrated Suspended Particulate Matter (CSPM) detection in the Ganges using Sentinel-2 and Cloud Computing
6	7307	Dk Ritushree, Shagun Garg, Antara Dasgupta, Mahdi Motagh, Sandro Martinis and Sivasakthy Selvakumaran	Improving SAR-based flood detection in arid regions using texture features

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TS 2.1.2: Climate-Atmosphere/Image Processing/Remote Sensing/ MR-Sensors (Poster)

S. No	Paper ID	Authors	Title
1	4368	Manohar Kumar C. V. S. S., Sudhanshu Shekhar Jha and Rama Rao Nidamanuri	Target Detection in Airborne Hyperspectral Imagery and its Sensitivity to Different Atmospheric Correction Methods
2	569	Shubham Singhal, Latha James, Anjaneyulu R. V. G, Srinivas C.V., Muralikrishnan S and Rama Rao N	Cloud Detection from AWiFS Imagery using Deep Learning
3	1069	Rupam Kumar Roy, Amartya Bhattacharya, Anupam Priamvada and Bipasha Paul Shukla	Seedable Conditions of Clouds Using Machine Learning Techniques
4	1442	Shanmukha Kowshik Singaraju, Vishanth Ghanta and Mahesh Pal	OOCS and Attention based Remote Sensing Classifications
5	9049	Sai Sreekar Doranala, Vishesh Vatsal, Adithya Kothandhapani and Ramakrishnan Rajagopalan	Enhanced Efficient Image Dehazing for Onboard Satellite Imagery Processing
6	4534	Manchikanti Suresh Kumar, T Radhika and M Manju Sarma	Orthorectification For Multi Detector High Resolution Sensors

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TS 2.2.1: Hyperspectral Imaging/SAR Imaging/Disasters (Oral)

S. No	Paper ID	Authors	Title
1	7957	Chander Shekhar, Anurag Sharma, Phool Preet, Harendra Singh Negi, Pinaki Roy Chowdhury and Pramod Kumar Satyawali	Mixed and Sub-pixel target detection using spaceborne hyper-spectral imaging data: analysis and challenges
2	5718	Anand S Sahadevan, Rosly Boy Lyngdoh, Nidhin P, Pradyuman Singh Rathore and Deepak Putrevu	SDAT: An Open Source Tool for Processing, Analysis and Simulation of Spectroradiometer Data
3	1301	Gouri Chetia and Bishnulatpam Pushpa Devi	Endmember Extraction without prior Number of Endmembers using Barycentric Abundances
4	2442	Alok Sharma and Srinivasa Ramanujam Kannan	An Iteration-Based Methodology to Cross Compare Volume Matched Indian Ground Radar Reflectivity Observations Against Space Radar
5	9320	Rogério Negri, Andréa Luz, Alejandro Frery and Wallace Casaca	Fire Detection with Multitemporal Multispectral Data and a Probabilistic Unsupervised Technique
6	3816	Aleena Jacob, Kumar Arun Prasad, Surendar Manickam and Karuppasamy Balasubramani	Mapping a Landslide Event on Puthumala, Kerala, India using SAR Interferometry

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Date: 29 Jan 2023 | Time: 16:00-17:45

TS 2.2.2: Land based Apps/Disasters/Urban Models (Poster)

S. No	Paper ID	Authors	Title
1	7143	Ankan Majumdar	Machine learning based mapping of pyroxene on global lunar surface
2	1073	Sourish Chatterjee, Shayak Chakraborty, Anirban Nath, Pinaki Roy Chowdhury and Benidhar Deshmukh	Near-Real-Time Detection of Craters: A YOLO v5 Based Approach
3	5087	Shubham Badola, Varun Mishra and Surya Parkash	Landslide susceptibility mapping using XGBoost Machine Learning method
4	1257	Niraj K C, Ankit Singh and Dericks Shukla	Improved Landslide Susceptibility mapping using statistical MLR model
5	7946	Sanae El Harche, Mohamed Chikhaoui and Mustapha Naimi	Assessment Of Soil Erosion Rate Using Remote Sensing In Tleta Watershed (North Morocco)
6	8686	Aazad Patle and Puneeth Shankar	Urban infrastructure change detection using StaMPS interferometry