



Second Circular

**Prof. Jagdeo Singh Memorial Lecture
&
Workshop
on**

***AI and Automation for Geophysical Exploration and Sustainable
Resource Management***

**Organized By:
Department of Applied Geophysics
Indian Institute of Technology (ISM), Dhanbad**



**Chief Patron
Prof. Prem Vrat
Chairman, BoG, IIT (ISM) Dhanbad**

**Patron
Prof. Rajiv Shekhar
Director, IIT (ISM) Dhanbad**

**Chief Guest
Dr. Kalachand Sain
Director, WIHG, Dehradun**

**Guest of Honour
Prof. Shalivahan
Director, IIPE, Vizag**

**Conveners:
Prof. Saumen Maiti, IIT (ISM) Dhanbad
Prof. Saurabh Datta Gupta, IIT (ISM) Dhanbad**

Date: 5th November 2022

A Tribute to Prof. Jagdeo Singh

Prof. Jagdeo Singh, Founder Head, Department of Applied Geophysics, Indian School of Mines (ISM)(now it is converted to IIT(ISM),Dhanbad) obtained his DIC from Imperial College of London (1944-1946), a contemporary of Nobel Laureate, Prof. P.M.S. Blackett, returned to India and joined Oil and Natural Gas Corporation Limited (ONGC) for a brief period, then joined the Geophysics Department, Banaras Hindu University (BHU) in 1950.

In 1955 he joined the ISM as an Assistant Professor and in 1957 he started serving as Professor and Head, Department of Applied Geophysics, which incidentally coincided with the International Geophysical Year (1957). With the inception of ONGC exclusively for oil and gas exploration and production, there was an enormous need of skilled professionals in this field. This led to the introduction of the two-specialized branches, namely the Applied Geophysics and Petroleum Technology (Engineering) at the ISM, which was previously known as the Indian School of Mines and Applied Geology (ISMAG), established in 1926.

Truly, modern India has produced a good number of visionary educationists. Prof Singh is one of them. Prof. Singh was an excellent teacher and mentor. He not only produced world renowned eminent geophysicists and geophysics leaders by his sheer dedication towards teaching, research, imparting well-designed field training, practicing engineering, surveying and exploring in broad domains of earth and atmospheric sciences, but also by his fatherly and affectionate support.

Prof. Singh retired as the officiating head of the department (HOD) in 1976 subsequently joined as an Emeritus Professor in ISM working till 1978, then went back to his native place. Several memorable awards like Prof. J. Singh medal by Indian Geophysical Union (IGU) and seminar hall and department library in the IIT(ISM) are dedicated in his memory!



***Prof. Jagdeo Singh,
Founder Head,
Dept. of Applied
Geophysics,
Indian School of Mines,
Dhanbad***



Concept Note of Workshop:

Artificial intelligence (AI) is a branch of computer science that the way in which the combination of hardware and software systems can simulate a typical behaviours of the human brain. Machine learning (ML) is a sub-field of AI which deals with a set of algorithm which can able to learn from "data" to make inference/decision. Application of AI and/or ML has been increasingly popular for understanding the behaviour of Earth through the diverse fields of the solid Earth geosciences.

It is challenging because it is needed to understand complex, interacting and multi-scale processes to understand the earth's behaviour. Substantial increase of data availability and increasingly realistic character of computer simulation hold promise for accelerating progress and developing deeper understanding.

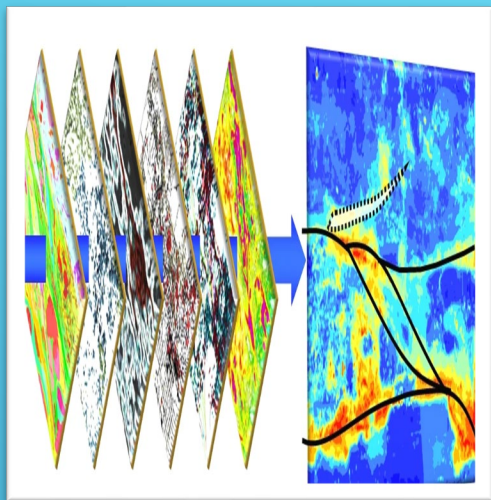


Based on the above capabilities, AI and/or ML can play a key role in this effort. In the domain of solid earth, understanding material properties, chemistry, mineral physics, and dynamics of the solid earth is fascinating and essential to meeting the challenges of energy, water, and resilience to natural hazards that humanity faces in the 21st century.

Rapid urbanization with population growth and maintaining associated demand for energy and resource is a major social concern for developing nations today. Rapid industrial and agricultural growth with rural development have been resulted in shortage of energy and natural resources, degradation of the environment posing serious threat in sustainability and adverse changes in climatic patterns.

Geophysical knowledge with advent of artificial intelligence can find significant and new data-driven applications for understanding of the earth-system/ geo-processes and their surface and/or sub-surface manifestation of natural resources for proper utilization and management and making intelligent/smart decision for sustainable growth and development of nation in rural as well as highly urbanized settings.

Geophysics, while playing a crucial role in developing sustainable systems solves problems based on data acquired over mother earth or earth systems either directly or through remote reference systems. Upon sophisticated data-driven inverse modelling of the observation/ data, practitioner seeks to probabilistic inference about the earth's model parameters related to large scale tectonics, ore-genesis, mapping of ore deposits, concealed ore deposits, lineament/faults and or exploration of oil deposits/petro-physical-hydro-geophysical model. Whatever the resource potential India is having, the proper utilization requires smart and intelligent robust system for taking up key and crucial decision based on artificial intelligence.



The artificial intelligence system is equally effective for proper planning, designing, and constructing dams structures for water demand management and mitigating hazard, safeguarding of lifeline infrastructure and urban gateways. The present comprehensive deliberation on “AI and Automation for Geophysical Exploration and Sustainable Resource Management” includes understanding the various AI and ML techniques including deep learning for understanding earth’s processes, and its surface/sub-surface manifestation of near-surface natural resource exploration (e.g., mineral, coal, uranium, diamond, groundwater, energy mapping, evaluation and exploration, its impact on human life, property and surrounding environment).



Particularly, AI and/or ML algorithms are designed to learn from experience and recognize complex patterns and relationships in data even if there is no deterministic relationship between the input data and target data system. AI and/or ML approach is data-driven, robust, and fast and allows exploration of large function space and also allows measuring uncertainty using probability theory. AI and/or ML is used to tackle a diverse range of tasks in geophysics/geosciences as (a) automation, (b) modelling, (c) inversion and (d) discovery.

About Chief Patron:



Prof. Prem Vrat
Chairman, BoG
IIT (ISM) Dhanbad

Professor Prem Vrat is the Chairman Board of Governors of Indian Institute of Technology (ISM) Dhanbad with additional charge as Chairman BOG of IIT Mandi. An outstanding academic, Prof. Prem Vrat, is the Pro-Chancellor; Professor of Eminence and Chief Mentor at The NorthCap University, Gurugram (formerly ITM University, Gurugram). He is an Honorary Professor at IIT Delhi and Distinguished Adjunct Professor at AIT, Bangkok. He is AICTE-Distinguished Chair Professor. He was Chairman, Board of Governors of WIT, Dehradun, a constituent institute of Uttarakhand Technical University. Prof. Prem Vrat was an Honorary Research Fellow at the Department of Engineering Production, University of Birmingham (U.K.) and as an International Visiting Fellow at University of Western Sydney, Australia. He has extensive experience of more than 52 years in teaching, research, management development and consultancy. He has published more than 502 research papers in reputed journals and proceedings of international and national conferences. He has authored/co-authored 7 books. His book, ‘Productivity Management: A System Approach’ received awards from DMA as well as ISTD.

About Patron:



Prof. Rajiv Shekhar
Director,
IIT (ISM) Dhanbad

Prof. Shekhar has 24+ years of teaching and research experience at the Department of Materials and Metallurgical Engineering, IIT Kanpur, with focus on industrial applications of well-rounded, go-getter academic, his experience ranges from institution building, engineering R&D, project management, policy and administration. He has a multi-disciplinary expertise in metals extraction, manufacturing, environmental remediation, engineering economics, solar thermal energy, electric power system optimization and policy and a good understanding of process for scaling technology from laboratory to industry. Prof. Shekhar completed his Ph.D. from the University of California, Berkeley and has multi-disciplinary research expertise spanning extraction of metals, manufacturing technology, materials processing, environmental remediation, and concentrated solar power with focus on industrial applications. He has been the HOD of Materials and Metallurgical Engineering and a member of the Board of Governors at IIT-Kanpur. The highly-rated Business Incubator was established under his leadership at the SIDBI Innovation and Incubation Centre at IIT-Kanpur. Prof. Shekhar played a major role in the development of IIT Jodhpur where he established the Centre for Solar Thermal Research and Education and headed the Centre for Solar Energy Technologies.

From the Desk of Head of the Department:



The Department of Applied Geophysics, IIT (ISM) was established during the International Geophysical Year in 1957. Since then, it has emerged as one of the premier Geophysics Departments in the country imparting quality teaching and research. The students get admitted through IIT-JEE, JAM, GATE and other competitive examinations at the national level.

The acclaimed academic and R&D structures, along with distinguished faculties, state of art laboratories, and modern facilities for the students of this famous institute are invariably complemented by its past glory of sixty five years.

Over the years, the Department has expanded in manifold ways and offering three years M.Sc. Tech. and five years integrated M.Sc. Tech./M.Tech in Applied Geophysics. The Department has been running a new M.Tech. course on Earthquake Science and Engineering since 2015-16 academic session. In addition, it offers doctoral programme in Applied Geophysics.

The academic programmes encompass many emerging fields of study. The Department is well-equipped with state-of-the-art geophysical instruments for various geophysical disciplines. The Department has a Seismological Observatory with Broadband Recording facility and a number of laboratories, to name a few, geophysical inversion, geophysical instrumentation, rock physics, and coal geophysics. The Department has national programmes such as DRS - I, DRS - II, UGC-SAP - I, II & III, COSIST and CAS. In addition, it has also been supported by the Department of Science and Technology (DST) under its FIST programme. A large number of geophysicists from this Department occupy prestigious positions in national and international oil companies, mineral, R & D, and academic institutes around the world. The Department is evolving in cutting-edge research, and currently, it has an ambitious plan to establish a few new centers of excellence in areas of Mineral Exploration, Tsunami Modeling, Early-Warning Systems for Earthquake/Tsunami prediction, Resource of Unconventional Hydrocarbon, Exploration of Groundwater, AI and Automation for natural resource and sustainability.

CONVENERS



Prof. Saumen Maiti
Associate Professor, Applied Geophysics,
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Prof. Saurabh Datta Gupta
Associate Professor, Applied Geophysics
IIT(ISM) Dhanbad
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Important dates:

Duration of registration: 5th September 2022 to 30th October 2022

Last date of abstract submission: 5th October 2022

Acceptance of abstract: 15th October 2022

Date of Event: 5th November 2022

Registration Link:

https://docs.google.com/forms/d/e/1FAIpQLScD_dT-ruz0w9FeXM-PvOYRswt51mUsF5T1YqoaYCPOcqhNZQ/viewform?usp=pp_url

Registration fees:

Delegates (Industry): Rs. 8,000.00/-

Delegates (Academics Institutions & R & D labs): Rs. 5,000.00/-

Research scholar: Rs. 1,500.00/-

Students: Rs. 500.00/-

Sponsorship:

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Bank Details: A/C No. 0986101024892; Canara Bank; Saraidhela Branch, RTGS Code: CNRB0000986; MICR Code: 826015003; GSTIN: 20AAAAI0686D1Za

About Chief Guest:



Dr. Kalachand Sain
Director,
Wadia Institute of
Himalayan Geology
(WIHG), Dehradun

Dr. Kalachand Sain obtained his M.Sc. (Tech) degree in Applied Geophysics from IIT (ISM), Dhanbad, and Ph.D. in Active Seismology from Osmania University (Hyderabad). He visited Cambridge University (UK) and Rice University (USA) as a post-doctoral fellow, and USGS in Menlo Park (USA) as a visiting Scientist. He is concurrently working as a Director at Wadia Institute of Himalayan Geology (an Autonomous Institute of DST, GoI), Dehradun. Earlier, he was the Chief Scientist & Head of Seismic Group at CSIR-NGRI (Hyderabad). He is also an honorary Outstanding Professor of AcSIR. He is a Fellow of all three Indian Science Academies (INSA, IAS, NASI), Andhra Pradesh & Telangana Academy of Sciences, Alumnus Award of IIT (ISM), Dhanbad, AP Scientist Award, National Award of Excellence in Geoscience by MoES, National Mineral Award by MoM, ONGC Best Paper Award, Gondwana Research Best Paper Award, Raman Fellowship & YS Award of CSIR, DST’s BOYSCAST Fellowship, Krishnan Medal & Decennial Award of Indian Geophysical Union. He has published more than 130 research papers in peer-reviewed scientific journals.

About Guest of Honour:



Prof. Shalivahan
Director,
Indian Institute of
Petroleum
Engineering
(IIPE), Vizag

Prof. Shalivahan obtained his M.Sc. (Tech) degree in Applied Geophysics from Benaras Hindu University (BHU), and Ph.D. in Nonlinear Inversion of Electrical and Magnetotelluric Data using Very Fast Simulated Annealing from Indian School of Mines in 2000. Prof. Shalivahan has received many prestigious awards from national and international bodies such as INSA Best Teacher Award in 2021 from INSA, New Delhi, SEG Outstanding Educator Award in 2020 from SEG, USA and Leadership for Academician Programs in 2020 from MHRD & IIT Kanpur. He has more than 20 years of academic, research and administrative experience. The significant contributions have been made in the interpretation of Resistivity, Induced Polarization (IP), Self Potential (SP), Electromagnetic (EM), Magnetic and Gravity methods. His contributions in Magnetotellurics (MT) characterizing the deeper crustal structure are examples of outstanding academic work. The work may be summarized in three different depth regions: near surface (mineral and groundwater exploration), intermediate (geothermal) and deep crustal studies. He was the recipient of National Geoscience Award, GoI in 2012. He was a visiting professor in Colorado School of Mines, USA. He was the Deputy Director in IIT(ISM) before joining as the Director in IIPE; other than Deputy Director he was also hold the post of the Dean (R&D) in IIT(ISM) Dhanbad.

Advisory Committee Members:	
Prof. Dheeraj Kumar, Mining Engineering, Deputy Director Prof. M. K Singh, Mathematics & Computing, Dean (SW) Prof. Chiranjeev Kumar, Computer Science and Engineering, Dean (Academic) Prof. Sagar Pal, Department of Chemistry and Chemical Biology, Dean (R & D) Prof. Rajni Singh, Humanities and Social Sciences, Dean (MBC) Prof. R. M Bhattacharya, Mining Engineering, Dean (IRAA) Prof.. Keka Ojha, Petroleum Engg., Head, Petroleum Engineering Prof. Mrinal Mukherjee, Head, Applied Geology Prof. Sanjit K. Pal, Head, Applied Geophysics Prof. P. K Khan, Applied Geophysics	Prof. A. K Chaubey, Applied Geophysics Prof. U. K Singh, Applied Geophysics Prof. G.S Rao, Applied Geophysics Prof. M. Agrawal, Applied Geophysics Prof. Arun Singh, Applied Geophysics Prof. Swarandeep Sahoo, Applied Geophysics Prof. Prof. Nriptika Jana, Applied Geophysics Prof. Kripamay Sarkar, Applied Geology Prof. P. R Sahoo, Applied Geology Mr. Mr. P.R.K. Sinha, Joint Registrar (F & A) Mr. Pravodh Pandey, Deputy Registrar (F & A) Mr. Ram Manohar, Sr. SEO, IIT (ISM)

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VENUE

Golden Jubilee Lecture Theatre (GJLT)
Indian Institute of Technology (ISM), Dhanbad