Advances in Remote Sensing Imagery Data Processing and Analysis
(January 13-17, 2025)

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Overview

Remote sensing is defined as the act of collecting data about an object or phenomenon from a distance. Human beings, just like other animals, can do this using for example their eyes. It is however with the development of modern technology, and especially the booming of spaceborne sensors, that hard remotely sensed data started flooding the world, and spaceborne Earth observation became a viable tool to keep anthropic and natural environments constantly monitored. Geographers and environmental scientists use remote sensing to measure and characterize phenomena that take place in the Earth's lithosphere, biosphere, hydrosphere, and atmosphere. Most sensing devices record information about an object on the Earth's crust by measuring its reflection of electromagnetic energy at different wavelengths. Remote sensing has many applications in mapping land use and cover, agriculture, soil mapping, forestry, city planning, archaeological investigations, military observation, and geomorphological surveying, among other uses. All these applications have gained significant traction with the increasing availability and maturity of data processing approaches based on Artificial Intelligence (AI).

During this course, we will discuss high-resolution remote sensing imagery data processing and analysis, tapping into recent advances in Deep Learning and AI-based approaches. Due to its main property of transfer learning, it allows us to propose a novel computational framework to address the challenges in high-resolution remote sensing data analysis. Various types of applications will also be addressed, with special regard to Agricultural Remote Sensing (ARS). Going further, this course will highlight fruitful use cases of remote sensing imagery data processing in various areas of engineering. It will contain special sessions for those participants who may not have a strong background in the field. Finally, besides the confidence output, we aim to provide an intensive understanding of how to use the algorithms and to equip the participants with software tools for solving practical problems in the different applications. Lectures will be supported by discussion sessions based on the different problems associated with Remote Sensing Imagery Data Analysis.

In this program, efforts will be made to introduce various tools used for remote sensing image analysis and machine learning such as Data visualization, radiometric and geometric corrections, Transformation and feature extraction, Spectral and spatial analysis of Remote sensing data, indexes and information extraction DL based classification, Radar interferometry, Radar polarimetry application of ML in Earth observation, application of remote sensing in Agriculture, multisensory data fusion, etc. Furthermore, this program will also have sufficient practical sessions to support the lectures. It is expected that participants will attain sufficient knowledge in this area after attending this program.

Objectives

The main objective of this course is to explain the fundamentals of remote sensing imagery data processing and analysis and build confidence and capability amongst the participants in the application of remotely sensed image processing and analysis, including through deep learning and AI approaches. Another aim is to provide exposure to practical problems and their solutions, through case studies, to enhance the capability to identify new applications of remote sensing data processing and analysis and translate the results into the real world, especially in the agriculture field.

Course Contents

1. Introduction to remote sensing and remotely sensed (RS) data motivation, problems to address, limitations and challenges and applications
2. Radiometric & geometric corrections, data storage conventions, data visualization
3. Introduction to management of RS data in a geospatial environment
4. Transformation, filtering, feature extraction
5. Earth Observation Radar, Radar interferometry, Radar polarimetry
6. Spectral and spatial analysis of RS data,
7. Indexes and information extraction
8. Machine-Learning (ML) and Deep Learning (DL) -based classification
9. Case studies and application of Machine Learning in Earth Observation
10. Case studies and application of Remote Sensing in Agriculture
11. Case studies and application in multi-sensor data fusion

* Practical Sessions on (a) management of RS data in a geospatial environment, (b) different case studies of spectral and spatial analysis, and (c) RS data classification problems.

Dates	**January 13-17, 2025** (The number of participants for the course will be limited to fifty)
You Should Attend If…	▪ Students at all levels (B.Tech./M.Sc./M.Tech. /Ph.D.) and aspiring researchers within the broad domain of signal, image and video processing, remote sensing, agriculture, computer vision, machine learning, and artificial intelligence. ▪ Practicing engineers, computer scientists, information technologists, and data-processing specialists working in diverse areas such as telecommunications, seismic and geophysical, medical, and data information systems may find the course useful in their quest to learn advanced techniques for remote sensing data processing and analysis, agriculture field. ▪ Executives, researchers from agriculture, artificial intelligence, image/video processing, computer vision, remote sensing, weather forecasting, and service/government organizations including R&D laboratories. ▪ Faculty from academic and technical institutions.
Fees	The participation fees per person for taking the course are as follows: **Participants from abroad:** USD 200 / INR 18000 **Industry/ Research Organizations:** INR 6000/- **Academic Institutions (Faculty):** INR 3500/- **Academic Institutions (Student)** INR 1000/- ***An additional 18 % GST is applicable for each participation fee as per institute norms.** Students have to submit a letter from their institution/Valid Identity card as proof of full-time student enrollment. The above fees include all instructional materials, computer use for practical sessions, and internet facility. Registration fee should be paid through VNIT Payment gateway **https://pay.vnit.ac.in/home**. Boarding, lodging, and meal charges are not included in the fees. The participants will be provided single/shared accommodation in the Institute Guest House/Guest Rooms hostel on a payment basis.

To Apply	**Step 1. GIAN Course Registration**
	      All interested participants need to be registered using the **Registration Link**
	Step 2. Registration Fee Payment
	      Registered participants have to remit the necessary course fee through the VNIT payment Gateway (**Click Here**), and select the payment category '**Conference/ Seminar/ Workshop'**.
	For more details, please follow the link **https://vnit.ac.in/engineering/ece/dr-deep-gupta/**

The Faculty

Fabio Dell'Acqua is a Full Professor of Remote Sensing at the University of Pavia, Italy. He graduated with honours in Electronics Engineering at the University of Pavia in 1996 and obtained his PhD in Remote Sensing at the same university in 1999. In 2000 he was an Associate Researcher at the University of Edinburgh, UK, while in 2001 he obtained a permanent position as an assistant professor at the University of Pavia, Italy. He can now claim almost 30 years of experience in Earth Observation and signal processing. He taught remote sensing courses at various Universities and Institutes across the globe. His research interests focus on applications of remote sensing, with special regard to agriculture. He has been involved in several international research projects in Earth observation. He was Associate Editor for various journals including Int'l J. of Information Fusion and IEEE GRSM, and guest-edited other journals. From 2011 to 2015 he organized yearly editions of an international School on "Data Fusion in Aerospace Applications". From 2018 to 2024 he was vice-director for Third Mission at the Dpt. of Electrical, Computer, and Biomedical Engineering, University of Pavia. He is the author or co-author of 371 papers, with a total of 4509 citations and a Hirsch index of 32.

Dr. Deep Gupta is an Assistant Professor in the Dept. of Electronics and Communication Engineering at Visvesvaraya National Institute of Technology Nagpur, Maharashtra (India). He received his PhD and Master's degree in Image Processing from the Indian Institute of Technology Roorkee, India in 2015 and 2010, respectively. Dr. Gupta is an IEEE senior member and life member of the Ultrasonic Society of India. He is also a recipient of Dr T.K. Saksena Memorial and the S. Parthasarathy Award from the Ultrasonic Society of India in 2016 and 2013, respectively. He is also the faculty of the Centre for Artificial Intelligence (CAI), Medical Image Analysis (MedIA Lab). His research interests include image processing, computer vision, remote sensing, satellite image processing, multimodal image registration and fusion, medical image analysis, food image analysis by end-to-end learning, histopathological image analysis, event detection, and cognitive analysis. He has authored several papers in refereed journals and conferences of international repute. He is He acts as a regular reviewer for reputed journals such as IEEE Journal of Biomedical and Health Informatics, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Instrumentation and Measurement, IEEE Journal of Translational Engineering in Health and Medicine, IEEE Signal Processing Letters, IEEE Access, IEEE Sensor Journal, IET Image Processing, IET Computer Vision and Biomedical Signal Processing and Control. He is the author and co-author of 100 papers with a total of 1842 citations and H index of 27.

About VNIT Nagpur

Visvesvaraya National Institute of Technology, Nagpur is one of the thirty-one National Institutes of Technology in the country. The Govt. of India conferred on the Institute, the Deemed to be University status (under University Grants Commission Act, 1956 (3 of 1956)) with effect from 26th June 2002. Subsequently, the Central Govt. by Act of Parliament (National Institutes of Technology Act, 2007 (29 of 2007)) declared VNIT Nagpur as an Institute of National Importance along with all former regional engineering colleges. The Act was brought into force from 15th August 2007. Earlier, the Institute was known as Visvesvaraya Regional College of Engineering (VRCE). It was established in the year 1960 under the scheme sponsored by Govt. of India and Govt. of Maharashtra. The college was started in June 1960 by amalgamating the State Govt. Engineering College functioning at Nagpur since July 1956. In the meeting held in October 1962, the Governing Board of the College resolved to name it after the eminent engineer, planner, and statesman of the country Sir M. Visvesvaraya.

About Department of ECE

The Department of Electronics and Computer Science was created in 1994 from the Department of Electrical Engineering. Later, the Department of Electronics and Communication Engineering was created in May 2014. Department of ECE offers B.Tech. in Electronics and Communication Engineering, M.Tech. in Communication System Engineering, and Ph.D. The department has well-qualified and well-motivated faculty members and support staff. There are more than 30 full-time Ph.D. students enrolled in the different areas of signal and image processing, medical image analysis, embedded system design, communication systems, etc. Department has a Centre of Excellence in Commbedded Systems and a Centre for Artificial Intelligence. The department is actively involved in R&D as well as consultancy projects and has collaborations with several industries, academic institutions, and R&D organizations in the country and outside.

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Course Co-ordinator

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