

41st IIRS Outreach Programme on Hyperspectral Remote Sensing and its Applications?
sponsored by NNRMS and organized by IIRS/ ISRO, Dept. of Space, Govt. of India,
21/01/2019 to 01/02/2019

RAJA SHRIPATRAO BHAGAWANTRAO MAHAVIDYALAYA, AUNDH, SATARA

Indian Institute of Remote Sensing, ISRO, Dehradun
Department of Space, Government of India
SUMMARY REPORT OF PROGRAM

Date: 28/02/2019

To,
The Principal,
R.S.B. Mahavidyalaya, Aundh
Tal. Khatav, Dist. Satara

I am submitting summary report of Outreach Programme. Please accept it.

1. Name of Programme: Distance Learning Course on 'Hyperspectral remote sensing and its Applications'

2. Duration: 21/01/2019 to 01.02.2019

Total Days: 12

3. Number of enrolled students: 62

4. Name of Coordinator: Dr. Telore Namdev Vasant

5. Name of Resource Persons: i) Dr. Vaibhav Garg ii) Richa U Sharma
iii) Hitendra Padalin

6. Objectives of the Programme:

- i. To know concepts of Hyperspectral Remote Sensing (HRS).
- ii. To know applications of HRS.

7. Outcome of the Programme:

- i. Participants become aware of Hyperspectral Remote Sensing.
- ii. Participants become aware of applications of HRS in different fields.

Centre Coordinator


(Dr. Namdev V. Telore)
Dr. Namdev V. Telore
Co-ordinator

IIRS Outreach Programme, Dehradun
Centre: R.S.B. Mahavidyalaya, Aundh, Dist.: Satara

Principal


T/C PRINCIPAL
Raja Shripatrao Bhagwantrao
Mahavidyalaya, Aundh (Satara)



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अंतरिक्ष विभाग
भारतीय सुदूर संवेदन संस्थान
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सत्यमेव जयते

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डॉ. प्रकाश चौहान
निदेशक
Dr. Prakash Chauhan

Director
No. : IIRS/GIT&DL/EDUSAT/2018/41

दिनांक: २१ दिसंबर २०१८
Date: December 21, 2018

विषय: २१ जनवरी २०१९ से "हाइपरस्पेक्ट्रल सुदूर संवेदन और उसके अनुप्रयोगों" पर प्रारम्भ होने वाले ४१वें आई-आई-आर-एस आउटरीच कार्यक्रम की घोषणा के संबंध में।
Sub: Announcement of 41st IIRS Outreach Program on "Hyperspectral remote sensing and its Applications" commencing from January 21, 2019.

महोदय/महोदया,
Sir/ Madam,

पृथ्वी अवलोकन (ई ओ) भारतीय अन्तरिक्ष अनुसंधान संस्थान का एक महत्वपूर्ण कार्यक्रम है, जिसके अंतर्गत पिछले पचास वर्षों में कई उपग्रहों को अन्तरिक्ष में प्रक्षेपित किया गया है। इन उपग्रहों से प्राप्त आंकड़ों का उपयोग प्राकृतिक संसाधन व आपदा प्रबंधन में किया जाता है। भारतीय सुदूर संवेदन संस्थान (भा.सु.सं.स.) भू-स्थानिक प्रौद्योगिकी के अंतर्गत शिक्षण, प्रशिक्षण तथा क्षमता संवर्धन को समर्पित एक महत्वपूर्ण संस्थान है। इस संस्थान द्वारा अब तक 40 उपग्रह एवं इंटरनेट आधारित आउटरीच पाठ्यक्रम संचालित किए जा चुके हैं। इन पाठ्यक्रमों से लगभग 885 भारतीय विश्वविद्यालयों/ संस्थानों के करीब 89,000 से अधिक प्रतिभागी लाभान्वित हुए हैं। इस कार्यक्रम को आगे बढ़ाते हुए हम सहर्ष ४१वें आई-आई-आर-एस आउटरीच कार्यक्रम को प्रारंभ करने की घोषणा करते हैं। २१ जनवरी २०१९ से प्रारम्भ होने वाला यह कार्यक्रम "हाइपरस्पेक्ट्रल सुदूर संवेदन और उसके अनुप्रयोगों" पर आधारित है। यह कार्यक्रम कार्यरत सरकारी एवं गैर-सरकारी तथा छात्रों हेतु लक्षित है। यह कार्यक्रम प्रतिभागियों को अपने कार्यस्थल पर रहते हुए ज्ञान को समृद्ध करने का एक अनूठा अवसर प्रदान करेगा।

The Indian Space Research Organisation (ISRO) has a vibrant Earth Observation (EO) programme since last 50 years with launch of several satellite missions. The Indian Remote Sensing Satellite (IRS) series of satellites provide space based information for monitoring and management of natural resources and Disaster Management Support. The Indian Institute of Remote Sensing (IIRS) is a premier Institute under ISRO engaged in training, education and capacity building on use of geospatial technology for natural resources monitoring and disaster management since last five decades. The Institute has so far conducted 40 Satellite and Internet based Outreach Programmes, benefitting more than 89,000 participants from 685 Indian universities/ institutions/user Departments/user ministries in India. To promote the use of Geospatial technology, IIRS announces the 41st IIRS Outreach Program on "Hyperspectral remote sensing and its Applications" commencing from January 21, 2019. The course is targeted to working professionals and students and will provide a unique opportunity to the learners to enhance their knowledge by attending the course at their respective working places.

हाइपरस्पेक्ट्रल सुदूर संवेदन से एक बड़ी संख्या में संकीर्ण वर्णक्रमीय बैंड जोकि इश्यमान निकटतम अवरक्त से लघु तरंग अवरक्त की सीमा में है, का मापन होता है। हाइपरस्पेक्ट्रल डेटा की संकीर्ण अवशोषण पहचान करने की क्षमता के कारण यह वनस्पति की भौतिक-रासायनिक विशेषताओं, मिट्टी के भौतिक और रासायनिक गुणों, खनिज संरचना और बर्फ की विशेषताओं, पेड़ की प्रजातियों, आक्रामक पौधों को पहचानने और महत्वपूर्ण भूगर्भीक विशेषताओं की पहचान करने में सक्षम है। हालांकि, बड़ी संख्या में बैंड की उपस्थिति का वजह से, हाइपरस्पेक्ट्रल डेटा को अलग भिन्न प्रकार के विश्लेषण की आवश्यकता होती है जिसमें फीचर चयन, संकेत को हटाने, अवशोषण सुविधाओं का पता लगाने और अग्रिम वर्गीकरण तकनीक शामिल हैं। इस पाठ्यक्रम से प्रशिक्षुओं को हाइपरस्पेक्ट्रल सुदूर संवेदन, हाइपरस्पेक्ट्रल डेटा प्रसंस्करण और इसके अनुप्रयोगों के बारे में जानकारी प्राप्त होगी। इस पाठ्यक्रम में कुल म्यारह सत्र होंगे। पहले से छठे सत्र मुख्य रूप से हाइपरस्पेक्ट्रल सुदूर संवेदन के सिद्धांत, हाइपरस्पेक्ट्रल संवेदन और प्रसंस्करण तकनीकों से संबंधित विषयों पर केंद्रित होगा; जबकि सातवें से ग्यारहवें सत्र में हाइपरस्पेक्ट्रल डेटा के विभिन्न अनुप्रयोगों में केंद्रित करेंगे।

Hyperspectral remote sensing deals with measurements in a large number of narrow spectral bands over a contiguous spectral range. Because of its ability to detect narrow absorption features hyperspectral data are related to specific vegetation physio-chemical characteristics, soil physical and chemical properties, mineral composition and snow characteristics, mapping tree species, recognizing invasive plants, and identifying key geologic features.

भारतीय अंतरिक्ष अनुसंधान संगठन Indian Space Research Organisation

41st IIRS Outreach Programme on Hyperspectral Remote Sensing and its Applications

Course Duration- January 21- February 01, 2019

Course Director & Coordinator- Dr. Anil Kumar and Mr. Vinay Kumar

Course Summary:

Hyperspectral remote sensing is one of the advance technology in remote sensing which has enormous potential for extracting earth resource information. Hyperspectral remote sensing deals with measurements in a large number of contiguous spectral bands with a narrow spectral bandwidth. Because of its ability to detect narrow absorption features hyperspectral data are related to specific vegetation physio-chemical characteristics, ocean biological constituents, soil physical and chemical properties, mineral composition and snow characteristics.



Figure 1: 41st IIRS Outreach Program: Inaugural Session

To familiarize the participants on the topic, a two week online course on **Hyperspectral Remote Sensing and its Applications** was organized through IIRS Distance Learning program from **January 21- February 01, 2019**. A total of 1730 participants from 179 institutes joined the course. During the course, eleven sessions were conducted which focused mainly on Basics of Hyperspectral Remote Sensing, Hyperspectral data processing, dimensionality reduction, classification and Applications of Hyperspectral data in Forestry, water resource management, Urban Applications, Agriculture and soil etc. At the end of the course a panel discussion was conducted on February 04, 2019. The course contents of this course are also available in IIRS e-learning portal under CMS and Youtube Channel- <https://www.youtube.com/user/edusat2004>

Dr. Namdev V. Telore
Co-ordinator

IIRS Outreach Programme, Satradun
Centre: R.S. & Maharaajaleya, Aurangabad, Satara

Ninth session

In the field of mineral exploration, remote sensing has significant contribution such as mapping of geological faults and fractures and host rock that localize ore deposits based on their spectral signatures. However a major limitation of using remote sensing approaches to mineral exploration with broad-band multispectral sensors is the insufficient spectral resolution to map hydrothermal alteration minerals, which exhibit subtle differences in spectral signatures at narrow band width in electromagnetic spectrum. The advent of new hyperspectral sensor technology, in terms of both sensor and technique development, has provided opportunity to revisit previous remote sensing approaches to mineral exploration as well as development of improved methods. This session will explain the use of hyperspectral remote sensing for the geological applications such as identification and mapping of minerals.

Tenth session

The morphology of cities is very complex spatially due to immense heterogeneity in their structure. With time, the conditions are changing at fast pace within the urban canopy due to changing environments, human movements, and reconstruction and technological advancements. Knowledge about chemical compositions and radiative properties of both novel and older construction materials is required to ensure about their dynamic impacts. This session talks about Hyperspectral Remote Sensing for urban applications for land cover classification based on a priori knowledge about materials' spectral characteristics.

Eleventh Session

The remote sensing technique has been known for providing spatial and temporal information of natural resources. Its application in the field of water quality monitoring and assessment is at nascent stage. With the advancement in the field of sensor technology such as "hyperspectral sensors", remote sensing provides great opportunity to assess and monitor water quality of surface water bodies. The substances in the surface water significantly change the backscattering characteristic. Remote sensing techniques depend on the ability to measure these changes in the spectral signature backscattered from water and relate these measured changes by empirical or analytical models to a water quality parameter. The optimal wavelength used to measure a water quality parameter is dependent on the substance being measured, its concentration, and the sensor characteristics. In similar line, attempts have been made to analyse snow physical parameter like snow grain size mapping using hyperspectral data.

Outline of the Course

Sessions	Date & Time (HRS)	Lecture Topic	Faculty
I.	21.01.2019 1600 to 1730	Hyperspectral Remote Sensing: An Overview and Applications <ul style="list-style-type: none">- Principle of hyperspectral remote sensing- Causes of absorption,- Multispectral Vs Hyperspectral,- Terrestrial, airborne and space borne hyperspectral sensors- ISRO Program on hyperspectral imaging- Overview of hyperspectral data processing,- Hyperspectral data processing softwares- Limitations of hyperspectral data	Shri. Vinay Kumar

Third session
This session will cover data dimensionality reduction techniques including the reduction of data, both spectrally with MNF, ICA and specially using Pixel Purity Index to identify pure pixels for the classification.

Fourth session
One objective of hyperspectral data processing is to classify collected imagery into distinct material constituents relevant to particular applications, and produce classification maps that indicate where the constituents are present. Such information products can include land-cover maps, surface mineral maps, vegetation species for agricultural or other earth science studies, or manmade materials for urban mapping. This fourth session will cover hard and soft classification algorithms, role of indices for hyperspectral data as well as accuracy assessment methods while focusing on specific class extraction.

Fifth session
This session covers about demonstration on ground spectro-radiometer for spectral data collection of various earth surface features. This session also includes generation of spectral library collected using spectro-radiometer and spectral resampling of spectral library with respect to pre-processed hyperspectral image.

Sixth session
Several hyperspectral tools are developed for information extraction from hyperspectral remote sensing data which often includes large data sets. This session will cover demonstration on hyperspectral data processing which includes pre-processing (sensor and atmospheric error correction). This session also covers about land cover classification of hyperspectral data with the help of collected ground spectra using per pixel (Spectral Angle Mapper) and sub pixel (Linear Spectral Unmixing) techniques in the ENVI software.

Seventh session
The identification of individual tree species/community has long been of interest using field spectro-radiometric techniques. The different spectral response patterns can typically be related strongly to tree species differentiation (color, leaf morphology, canopy morphology). Species vary by leaf angle, crown structure and color and hyperspectral data is more suitable to identify fine spectral differences. Hyperspectral imagery can be used to classify forest cover based on species composition and foliar chemical characteristics. Hyperspectral imagery can be used to derive estimate of foliar chlorophyll and foliar nitrogen concentrations. Ecological research is likely to benefit from the increased spectral resolution that hyperspectral remote sensing can provide.

Eighth session
Hyperspectral remote sensing provides near laboratory quality reflectance spectra of each single pixel which helps to extract vital information regarding the chemical constitution of the various materials including soil constituents. Studying the peculiar spectral absorption and reflectance features helps for predictive modelling and quantification of various soil properties like soil salinity, organic matter content, soil clay mineral composition, soil pollution etc. These approaches will help for better assessment of various soil degradation processes as well as soil quality.

Organizer and Speaker(s):

	Anil Kumar is Scientist/Engineer 'SG' and Head PRSD at Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun, India. He received his B.Tech degree in Civil Engineering from University of Lucknow, India and M.E. degree as well as inservice part time Ph.D in soft computing from Indian Institute of Technology, Roorkee, India. His current research interests are in the area of Soft computing, Digital Photogrammetry, GPS and LiDAR.
	Hitendra Padalia is Scientist/Engineer 'SF' at Forestry and Ecology Department of Indian Institute of Remote Sensing, ISRO, Dehradun. He received M.Sc. in Forest: Economics and Management and Ph.D. degree in Forestry from FRI University, Dehradun. His research interests are hyperspectral microwave RS and modelling applications for forestry and ecological studies.
	Vaibhav Garg is Scientist/Engineer 'SE' at Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun, India. He is basically a Civil Engineering graduate, he did his masters from MNIT Jaipur with specialisation Water Resources Engineering. He did his PhD from Civil Engineering Department, Indian Institute of Technology Bombay, Mumbai, India. His current field of interest is surface water hydrology and water quality studies.
	Manu Mehta is Scientist/Engineer 'SE' at Indian Institute of Remote Sensing, ISRO, Dehradun. She received her M. Tech. degree in Optoelectronics and Optical Communication from Indian Institute of Technology, Delhi. Her current interests include aerosol remote sensing over land and ocean, spatio-temporal analysis, radiative transfer modelling and aerosol retrieval from satellite data.
	Vinay Kumar is Scientist/Engineer 'SE' at Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun, India. He received his B.E degree in Mining Engineering from BIT Sindri and M.Tech. degree in Geomatics Engineering from IIT Roorkee. His research interest is in the area of Hyperspectral Remote Sensing (HRS), including automatic end member extraction, simulation of HRS data from multispectral data and fusion of HRS and SAR data.
	Richa U Sharma is Scientist/Engineer 'SD' at Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun, India. She received her B.Sc in Maths Physics, Geology and MSc. in Geology from Govt. Holkar Science College, Indore and Diploma in Geoinformatics from IIRS- ITC joint programme. Her current research interest is hyperspectral remote sensing in geological applications.

INDIAN INSTITUTE OF REMOTE SENSING
Indian Space Research Organisation
Department of Space, Govt. of India

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41- IRS Outreach Programme on Hyperspectral Remote Sensing and its applications

View Student Attendance Attendance Status Study Material

S.No.	RegNo.	Name	DOB	Mobile No.	Email	ID_Proof	Date	Status
1	20194167740	Shaktisagar Dhole	1-30-1988	9067651326	mides.shakti@gmail.com	View	2019-01-02 14:29:59	Approved
2	20194167833	rahul bhosale	3-21-1997	9765854454	rahubhosale4614@gmail.com	View	2019-01-07 11:50:06	Approved

Dr. Namdev V. Talors
Co-ordinator
IRS Outreach Programme, Dehradun
Center R.S.S. Mahavidyalaya, Aundh, Dist. Satara

Principal
Raja Shripatrao Bhagwantrao
Mahavidyalaya, Aundh (Satara)

भारतीय अंतरिक्ष अनुसंधान संगठन/ INDIAN INSTITUTE OF REMOTE SENSING
भारतीय अंतरिक्ष अनुसंधान संगठन/ INDIAN SPACE RESEARCH ORGANISATION
अंतरिक्ष विभाग, भारत सरकार/ DEPARTMENT OF SPACE, GOVERNMENT OF INDIA

ऑफ-कैंपस प्रमाणपत्र/ ऑनलाइन प्रशिक्षण कार्यक्रम
OFF - CAMPUS OUTREACH CERTIFICATE PROGRAMME

संस्थान की सहभागिता का प्रमाण पत्र
CERTIFICATE OF PARTICIPATION OF INSTITUTE

संस्थान को सहभागिता का प्रमाण पत्र
CERTIFICATE OF PARTICIPATION OF INSTITUTE

यह प्रमाणित किया जाता है कि राजा श्रीपतराव भगवंतराव महाविद्यालय, औंध, महाराष्ट्र ने भारतीय अंतरिक्ष अनुसंधान संस्थान, इसरो देहार्दुन द्वारा संचालित ऑनलाइन प्रशिक्षण पाठ्यक्रम "हाइपर स्पेक्ट्रल रिमोट सेंसिंग और उसके अनुप्रयोग" में भाग लिया। इस ऑनलाइन पाठ्यक्रम का संचालन दिनांक 21 जनवरी, 2019 से 01 फरवरी, 2019 तक किया गया।

This is to certify that Raja Shripatrao Bhagawantrao Mahavidyalaya, Aundh, Maharashtra, has participated in online training programme conducted by Indian Institute of Remote Sensing, ISRO Dehradun on "Hyperspectral Remote Sensing and its applications". This online programme was conducted during January 21, 2019 to February 01, 2019.

संस्थापक निदेशक, अंतरिक्ष विभाग, भारत सरकार
Head, Govt. Services, IT & Distance Learning Department (ISRO/ISIR)

ग्रुप प्रमुख, अंतरिक्ष अनुसंधान संगठन, अंतरिक्ष विभाग, भारत सरकार
Group Head, Geospatial Information & Outreach Programme Group, IRS

Dr. Namdev V. Talors
IRS Outreach Programme Dehradun

Principal
Raja Shripatrao Bhagwantrao
Mahavidyalaya, Aundh (Satara)



भारतीय सुदूर संवेदन संस्थान/ INDIAN INSTITUTE OF REMOTE SENSING
भारतीय अंतरिक्ष अनुसंधान संगठन/ INDIAN SPACE RESEARCH ORGANISATION
अंतरिक्ष विभाग, भारत सरकार/ DEPARTMENT OF SPACE, GOVERNMENT OF INDIA



बहिः परिसर संपर्क/ विस्तार कार्यक्रम प्रमाण पत्र
OFF - CAMPUS OUTREACH CERTIFICATE PROGRAMME

COR413232019

समन्वय का प्रमाणपत्र
CERTIFICATE OF COORDINATION

यह प्रमाणित किया जाता है कि राजा श्रीपतराव भगवंतराव महाविद्यालय, औंध, महाराष्ट्र कार्यरत डॉ. डॉ नामदेव वसंत तेलोरे, ने "हाइपर स्पेक्ट्रल रिमोट सेंसिंग और उसके अनुप्रयोग" विषय पर इस संस्थान द्वारा दिनांक 21 जनवरी, 2019 से 01 फरवरी, 2019 तक संचालित ऑनलाइन प्रशिक्षण पाठ्यक्रम को समन्वित किया।

This is to certify that **DR. NAMDEV VASANT TELORE**, working with **Raja Shripatrao Bhagawantrao Mahavidyalaya, Aundh, Maharashtra**, has coordinated the online training course on "**Hyperspectral Remote Sensing and its applications**" conducted by this institute during January 21, 2019 to February 01, 2019.

दिनांक/ Date: 08-04-2019
देहरादून/ Dehradun

प्रमुख,
नियोजन सर्विसेस, सूचना प्रौद्योगिकी एवं दूरस्थ अधिगम विभाग
Head, Geoweb Services, IT & Distance Learning Department, IIRS

समूह प्रमुख,
भू-स्थानिक प्रौद्योगिकी एवं आउटरीच कार्यक्रम समूह
Group Head, Geospatial Technologies & Outreach Programme Group, IIRS