

# IEEE Gujarat Section Geoscience and Remote Sensing Society- Chapter Newsletter

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January 2014 landsat-8 image- largest reservoir was at its full capacity



January 2018 landsat-8 image- reservoir is at just 13% of its total capacity

## Satellite images show the severe water crisis of Cape Town leading to Day Zero

Satellite imagery has unmasked Cape Town's water crisis. The view from Landsat-8 brings the crisis into focus showing how dramatically the water reservoirs of the city have depleted over the last few years.

Day Zero- the day when the taps will run dry in the second largest city of South Africa

A three-year drought, growing population, and climate change have Cape Town reeling under severe water crisis. And in a few weeks from now, the tourist city of South Africa would be forced to shut most of its water taps.

City officials have been saying that by April 12 the taps would run dry. Earlier, they had said that the day would come on April 22.

Source: Geospatial World



**IEEE Gujarat Section GRSS Chapter Wishes  
all Members & their Families  
A Happy, Healthy and A Prosperous New Year 2018 !!!**



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## Editor's Pen



'Citizen Science' is a beautiful concept. Given the fact that a substantial fraction of educated population gets gradually distanced from mainstream scientific pursuits, despite the fact that many have an inner urge to participate in scientific endeavours, at least as a creative pastime.

Just as many scientists cultivate deep interest in literature or music (some are known to be accomplished in these fields), many in non-science professions display amazing scientific intuition.



Realising its importance, many countries have already set up extensive network of 'Citizen Science' enthusiasts. Periodic conferences and exchange-meets facilitate growth in scientific thoughts across society at large. Science, after all, should not remain confined only to 'ivory towers'. In India perhaps, the concept of 'citizen science' has yet not caught up as much as it has, in Europe and Australia. The areas of discussions in the meets there, are not limited only to classical Astronomy, Ornithology or Climate Change sciences. There is no reason why Remote Sensing and related geosciences should not be taken in the fora of Citizen Science. There are several instances of non-science professionals making amazingly innovative (at times totally 'out-of-the box') ideas that led to new scientific results.

It is therefore desirable that professional Societies, such as ours, facilitate live interface of experts with societal counterparts. It had been our endeavour to convey the Newsletter contents in a popular language, without compromising the scientific rigour. Circulating our Newsletter amongst interested sections of citizens will strengthen this interface.

The present issue of the Newsletter comprises of several interesting columns. We are privileged to obtain expert responses to our Interview questions from experts like Prof Akira Hirose and Dr Ryo Natsuaki, Tokyo University. Among many honours, Prof Akira Hirose was awarded the Certificate of Recognition of Invaluable contribution as an AdCom member to the IEEE GRSS in 2017. Dr Ryo Natsuaki has vast experience of Space Missions, especially the Japanese missions. Prof Anjana Vyas has graciously agreed to write the lead article on global perspectives of Geospatial Education for this Issue. The Issue provides meticulously compiled summary of all the events (along with photos), organised by the Chapter during 2017. We are pleased to carry other regular columns as well.

Congratulations to our members on their achievement in the year 2017. Hope to see their tribe flourishing in subsequent years. Dr Anup Kumar Das received Green Asia Award for the year 2017. Dr Sriram Saran joined prestigious Arecibo Observatory at Puerto Rico as a post-doc scientist. Dr Bindi Dave joined CEPT as Assistant Professor after completing her PhD. It is a pleasure to welcome new members in our fold. This will surely enrich the subsequent issues of our Newsletter.

Timely support Mr. Ashish Upadhyay, in compilation of this Issue is kindly acknowledged.

**Dr. Abhijit Sarkar**

**Editor, IEEE GUJARAT SECTION -GRSS CHAPTER**

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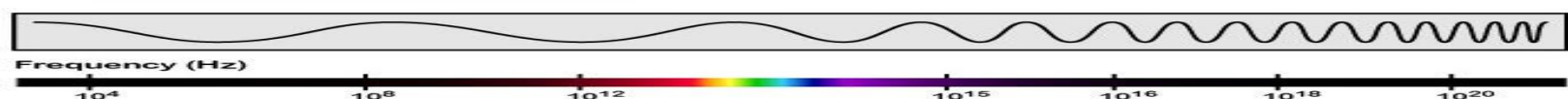
Indian Remote Sensing  
Upcoming Missions-

Indian Space Research organization is gearing up with next generation remote sensing satellites, to name a few Microsat, HRSAT constellation, Resourcesat-3, 3S, Oceansat-3/3A with high resolution, Optical and Thermal imaging capabilities

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## Message from the Chairman's Desk

The IEEE – Gujarat Section GRSS society chapter is in 6th Year after its formation. During these years, growth and performance of Society is steadily increasing by organizing outreach program, advance training program and reaching to institutes who intend to enter in this area of research in Gujarat region. During this year society has organized maximum number of events in the basic training and advancement in the area of remote sensing and GIS applications. Society has served the purpose of bringing out professionals from International and National institutes at a common platform. Chapter has also contributed towards working as a technical sponsor for International Conference. Thus, chapter has established its presence at National and International level which has built a confidence not only to our members but also brought up laurel from International and National professionals. All this is feasible by team effort of our members who have worked hard as IEEE volunteer of the society. After overwhelming response from first newsletter, our editorial team has brought out the current issue of the news letter.

At this moment, I congratulate IEEE GRSS members for their outstanding contribution in bringing out the current issue of the New Letter in a timely manner.



*Dr. Shiv Mohan*

**Dr. Shiv Mohan**

**Chairman**

**IEEE Gujarat Section Geoscience and Remote Sensing Society- Chapter**

**e-mail id: shivmohan.isro@gmail.com**



IEEE-Gujarat Section GRSS members meeting at Hotel Ashray – Feb. 12, 2017

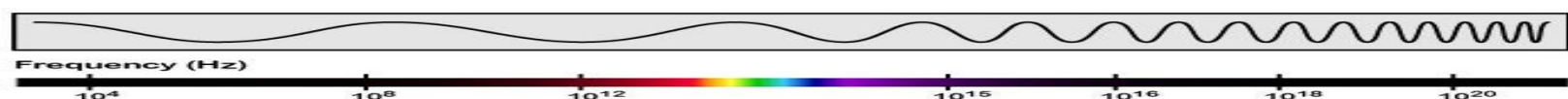
### ISRO - 2017



15 February 2017: ISRO Makes History by Launching 104 Satellites with One Rocket



Panchromatic Image of Quatar, Doha taken on June 26, 2017 from carto-2S – Image: ISRO



## Event Reports

### EXPERT LECTURE ON INTRODUCTION TO REMOTE SENSING FOR UNDERGRADUATE STUDENTS OF BOTANY BY DR. SHIV MOHAN (FEBRUARY, 2017)

Lecture for undergraduate students of Botany department bringing out primarily the role of remote sensing in Botany was organized at M G Science Institute, Ahmedabad on 17<sup>th</sup> February 2017. The lecture was delivered by Dr Shiv Mohan, Chairman, IEEE-GRSS-Gujarat section. He introduced the basic concepts of remote sensing and brought out the response of plant to various interaction with electromagnetic waves. He emphasized that a clear understanding on plant's interaction with electromagnetic waves can identify useful bio-physical parameters measurable by present day remote sensing instruments. He also brought out various large scale applications demonstrating potential of remote sensing for vegetation characterization, disease detection, assessment of plant pigments etc. Lecture was participated by more than 200 undergraduate students, who interacted actively with the speaker.



*Dr Shiv Mohan delivering the lecture*

### DISTINGUISHED LECTURE PROGRAM ON HYPERSPECTRAL REMOTE SENSING: DIMENSIONALITY REDUCTION AND FEATURE EXTRACTION FOR PRECISION AGRICULTURE BY PROF. LORI M BRUCE (MARCH 2017)

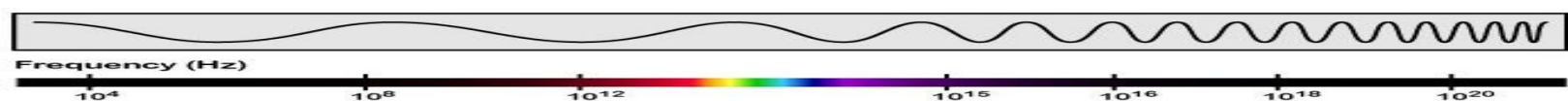


IEEE Distinguish Lecture Program (DLP) on "Hyperspectral Remote Sensing: Dimensionality Reduction and Feature Extraction for Precision Agriculture" by Prof. Lori M Bruce of Mississippi State University, USA was organized on March 17, 2017 at CEPT University, Ahmedabad.

Prof. Bruce made a brief introduction and overview of hyperspectral remote sensing, data visualization, data analysis and spectral un-mixing techniques. In the 2-hour long lecture, data dimensionality reduction method, calibration, data fusion approach and applications of hyperspectral remote sensing on agricultural bio-chemical properties were discussed at length. There were about 70 students and researchers representing various institutes like Space Applications Centre,

Physical Research Laboratory, CEPT University NIRMA University, Gujarat University and various other institutions of Ahmedabad and Gandhinagar attended the lecture and interacted with the faculty.

*Dr Lori M Bruce interacting with participants at CEPT University*





## EXPERT LECTURE ON ADVANCING CAREERS IN SCIENCE & ENGINEERING: THE IMPORTANCE OF MENTORS, ADVOCATES, AND SPONSORS BY PROF LORI M BRUCE - (MARCH 2017)

A lecture on advancing careers in Science and Engineering focusing on the importance of mentors, advocates and sponsors was delivered by Prof Lori M Bruce to Engineering faculty and students of L D Engineering College, Ahmedabad on March 17, 2017.

Prof. Bruce interacted with the students and addressed several questions posed by the Students. The lecture was preceded by an overview lecture on Hyperspectral remote sensing. The lecture was attended by students and Faculty of L D College of Engineering in addition to professionals from ISRO/PRL and other research organizations.



*Dr Chaitanya Sanghvi of L D College of Engineering Felicitating Prof Bruce University*

## NATIONAL WORKSHOP ON CURRENT FACETS OF BOTANY - (JULY 2017)

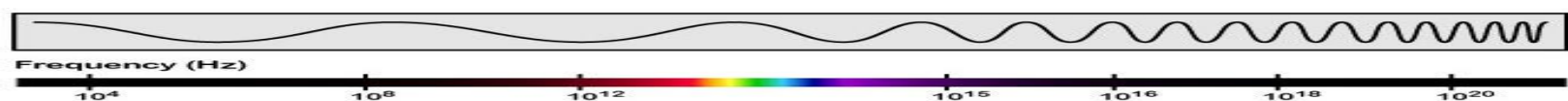


*Inauguration of the Workshop (Left to Right: Prof. P. S. Nagar, Prof. G. Sandhya Kiran, Dr. Ajai and Dr. Satyanshu Kumar)*

National Workshop on "Current Facets of Botany" was organized at Maharaja Sayajirao University (MSU) of Baroda in collaboration with Indian Society of Geomatics (ISG Vadodara chapter), Indian Science Congress Association (Vadodara Chapter) and Indian Women Scientists' Association (Vadodara Branch) during July 24-30, 2017. This workshop was tailor made for practicing remote sensing scientists/engineer, academicians and students working in the fields of Botany, Geology, Geography, Planetary Sciences and Life sciences. Experts from MSU, ISRO, IIT-Bombay, and other reputed institutions were invited to deliver lectures in the workshop. Participants were drawn from different Indian universities/institutions.

The major objectives of the workshop were to disseminate knowledge on the theory and practical aspects of remote sensing data acquisition, data processing and analysis including ground truth.

At the end of the workshop, participants were asked for their feedback and most of them felt that duration of the workshop was bit short for the participants to have a complete understanding of all the advanced remote sensing techniques. However, the lectures by all the speakers were highly appreciated by the participants.



## ONE-DAY TRAINING WORKSHOP ON INTRODUCTION TO REMOTE SENSING AND GIS FOR CIVIL ENGINEERING APPLICATIONS AT L.D. COLLEGE OF ENGINEERING - (SEPTEMBER 2017)

IEEE-GRSS Gujarat in collaboration with L. D College of Engineering and Indian Society of Geomatics (Ahmedabad Chapter) organized a one-day training workshop on 'Introduction to Remote sensing and GIS for Civil engineering' on Sept 16, 2017 at L D College of Engineering, Ahmedabad. Eminent faculties selected from the Space Applications Centre (ISRO), Physical Research Laboratory (PRL) and IEEE-GRSS Gujarat delivered lectures in the workshop. In the workshop several applications of satellite remote sensing and GIS including basics to advanced techniques in optical and microwave remote sensing, GIS and their applications in civil engineering and hydrology were presented. Main



*Inauguration session of the workshop at L D College of Engineering*



*Dr. Shiv Mohan Addressing the gathering in the workshop at L D College of Engineering*

topics were: Basics of Remote sensing and Applications, Basics of microwave remote sensing and Applications, Basics of GIS and applications, Satellite based surveying techniques and Applications of Satellite data in Hydrological Modeling. Renowned faculty from ISRO and PRL delivered these lectures.

Around 100 professionals, mostly faculty and research scholars from institutions in Gujarat participated in the Workshop. Participation certificates were distributed to all the participants at the end of the workshop. The workshop was highly appreciated by the participants.

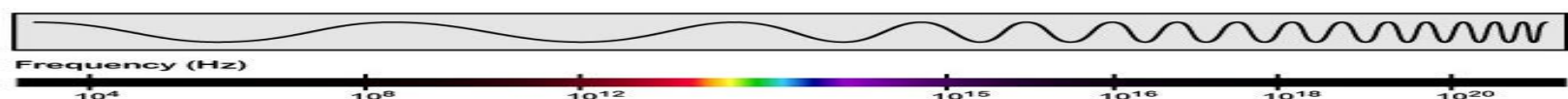
The participants expressed their interest for similar training workshops in future involving more applications using the technology

## EXPERT LECTURE -HARNESSING TECHNOLOGIES FOR SPACE AND EARTH APPLICATIONS BY DR. KUMAR KRISHEN, L.D COLLEGE OF ENGINEERING, AHMEDABAD (NOVEMBER 2017)

IEEE-GRSS Gujarat organized an expert talk on "Harnessing Technologies for Space and Earth Exploration" by Dr. Kumar Krishen, Senior Technologist for Exploration Technology Office at NASA Johnson Space Center at L D College of Engineering, Ahmedabad on Nov 17, 2017. Dr. Krishen shared the highlights of his more than 52 years of service to NASA. He talked on exploration and enabling the development of space and expanding the human experience into the far reaches of space. This includes increasing human knowledge of nature's processes using the space environment, exploring and settling the solar system, achieving routine space travel, and enriching life on Earth through people living and working in space. Space missions conducted by several nations provide extensive experience, research and technology and infrastructure



*Welcome address by Prof Usha Neelkantan, Head, EC department, LD College of Engineering*





for future envisioned programs in support of human exploration and development of space. He highlighted research areas important for a human mission to Mars include advanced human support, renewable



*Dr. Krishen delivering the expert lecture*



*Dr. Krishen interacting with the students and faculty members*

resources and utilization of planetary resources, space transportation, automation and robotics, space power, information processing and communications systems, sensors, and instruments.

## **NATIONAL SEMINAR ON IMPACT OF CLIMATE CHANGE ON BIODIVERSITY“AN APPROACH TO REACH THE UNREACHED THROUGH SCIENCE & TECHNOLOGY” AT M.S. UNIVERSITY, VADODARA - (NOVEMBER 2017)**

IEEE-GRSS Gujarat supported a National Seminar on “Impact of Climate Change on Biodiversity-III”, organized by Indian Science Congress Association (Baroda Chapter) in collaboration with Department of Botany and Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Indian Society of Geomatics (Vadodara Chapter) Indian Women Scientists' Association (Baroda Branch) on 29th November, 2017 at C.C.Mehta Auditorium, The Maharaja Sayajirao University of Baroda, Vadodara. Dr Ashok Saxena, Ex-President of Indian Science Congress Association was the Chief Guest of the function. Dr.VijayLaxmiSaxena (Ex. General Secretary, Chairperson, ISCA-Kanpur) and Dr. Yogini C. Pathak (Ex General Secretary, Council Member of ISCA) were the Guests of Honour. The inaugural function was presided by Patron of the Seminar and Vice-chancellor of the MSU-Baroda,

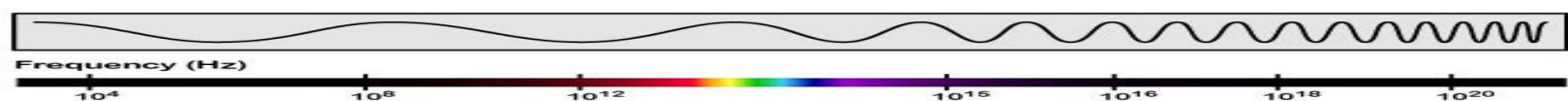


*Welcome address by Prof Sandhya Kiran*

Prof. Parimal Vyas. Introduction to the theme of the seminar was given by Prof. G.SandhyaKiran, (Head, Department of Botany, Faculty of Science, MSU- Baroda, Chairperson, ISG, IWSA and ISCA (Vadodara Chapters). The seminar received a huge response from all over the country and was attended by more than 240 participants. There were four invited lectures on different themes related to biodiversity. More than 70 different papers pertaining to 7 themes of the seminar were received in the oral and poster presentation categories. The panel discussion provided a feedback by participants. Following are some of the highlights:

a) Climate Change has not been an overnight development but it is prevalent since decades. Hence, it could not be dealt with and rectified in a day or few weeks. Researchers should focus on long term research which spans for 25-30 years.

b) Being sensitized towards the problem of biodiversity loss and the desire to conserve it does not mean taking up some facts and figures from different sources and presenting them. It requires serious actions and plans.



Then followed Prize distribution wherein, three prizes were given away for best papers of oral and poster session each.



*Release of Souvenir cum Abstract book by Chief Guest and Guests of Honour at the inauguration function- From the left- Prof. G. Sandhya Kiran, Prof. H.R.Kataria, Prof. Yogini Pathak, Dr. Ashok Saxena, Prof. P.C. Mankodi, Dr. VijayLaxmiSaxena.*



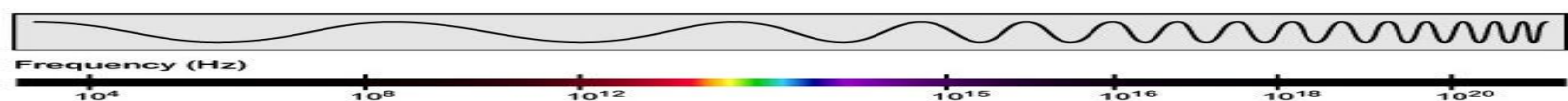
*Prize distribution to the best paper awardees*

## **EXPERT LECTURE - "INTRODUCTION TO HYPERSPPECTRAL DATA WITH FOCUS ON SPECTRAL UNMIXING" BY DR. SUMIT CHAKRAVARTY AT NIRMA UNIVERSITY - (DECEMBER 2017)**

IEEE-GRSS Gujarat in association with Nirma University, Ahmedabad organized an expert lecture on Hyperspectral data by Dr. Sumit Chakravarty, Electrical Engineering Department at Kennesaw State University, USA on December 11, 2017. With a brief introduction of hyperspectral remote sensing, speaker discussed a variety of techniques for the exploitation of hyperspectral data and unmixing problems. Present status of unmixing problem, relevance to ENVI software and current research in this area was discussed. Also, future problems like use of social media data and its integration to remote sensing was also informed. Lecture created interest among participants, which was evident during question- answer session. There were about fifty participants representing various educational and research institutes like Space Applications Centre (ISRO), Physical research laboratory and Nirma University.



*Dr. Sumit Chakravarty delivering the lecture in Nirma University, Ahmedabad*





## IEEE GRSS – Gujarat Chapter activities outside Gujarat

### IEEE-GRSS CHAPNET PROGRAM: TOKYO- JAPAN, OCT 4-5,2017

In order to enhance activities and interaction of various group, Chapnet program of IEEE GRSS (Japan, Indonesia and India-Gujarat) in collaboration with Technical Committee on Space,



*Dr. Shiv Mohan presenting in Chapnet program in Tokyo*

Aeronautical and Navigational electronics organized a special session in the workshop on "Subsurface Electromagnetic

Measurements", during Oct 4-5, 2017. Dr. Shiv Mohan presented some of the research work involving subsurface imaging.



*Snapshot of a session in progress during Chapnet, Tokyo*

(website: [http://drr.science-japon.org/doc/drr\\_2017\\_full\\_program.pdf](http://drr.science-japon.org/doc/drr_2017_full_program.pdf) )

### TECHNICAL SUPPORT TO INTERNATIONAL CONFERENCES / SYMPOSIA:

Dr. Shiv Mohan, Chairman of IEEE-GRSS Gujarat represented the society to extend technical support as member of technical committee to the following conference / symposium:

- IEEE International Conference on Aerospace Electronics and Remote Sensing Technology, Bali, Indonesia, 2017
- International Symposium on Geoinformatics, ISYG 2017 Indonesia, 2017

### INVITED TALK AT IEEE WORKSHOP – IIT, MUMBAI (JUNE 2017)

In order to enhance the scope of IEEE GRSS presence in India, Dr Shiv Mohan delivered a thought provoking talk on the activities of GRSS and its importance in India at IEEE Workshop on "Remote Sensing and GIS in the service of India's Development" held at IIT- Bombay in Mumbai during June 8-9, 2017.

*Dr. Shiv Mohan presenting a talk on IEEE GRSS activities and its importance in*



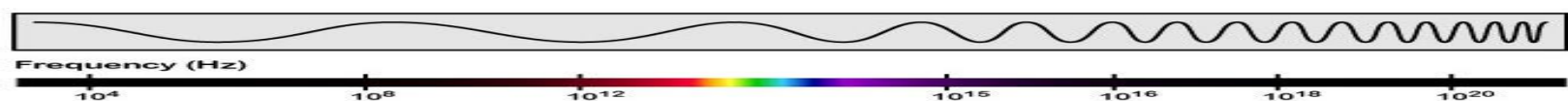
*Dr. Paul Rosen, Global Director, IEEE GRSS and Dr William J. Emery, Vice President, Publications, IEEE GRSS and*

### CHAPTER'S PARTICIPATION IN ACRS, NEW DELHI (OCTOBER 2017)

IEEE-GRSS Gujarat Chapter actively participated in the IEEE-GRSS India meet organized at the Asian Conference of Remote sensing (ACRS) held in New Delhi during October 23-27, 2017. The meet was presided by Dr. Paul Rosen, Global Director of IEEE GRSS and attended by section chairs and office bearers of various IEEE-GRSS sections of India. In the meeting various ongoing and future activities of IEEE-GRSS India were discussed and it was proposed to hold annual inter-chapter meets of GRSS in India. IEEE-GRSS India rented a stall in the conference to showcase various activities of the society for wider publicity of GRSS in India.



*Chapter chairs with Dr. Paul Rosen at the IEEE GRSS stall in the conference venue on 24th Oct 2017.*



## An Interview with Prof. Akira Hirose & Dr. Ryo Natsuaki

**Akira Hirose** received the Ph.D. degree in electronic engineering from the University of Tokyo in 1991. In 1987, he joined Research Center for Advanced Science and Technology (RCAST), the University of Tokyo, as Research Associate. In 1991, he was appointed as Instructor at RCAST. From 1993 to 1995, on leave of absence from the University of Tokyo, he joined the Institute for Neuroinformatics, University of Bonn, Germany. He is currently Professor with the Department of Electrical Engineering and Information Systems, the University of Tokyo. The main fields of his research interests are wireless electronics and neural networks. In the fields, he published several books such as Complex-Valued Neural Networks, 2nd Edition (Springer 2012). Previously he served as the Founding President of Asia-Pacific Neural Network Society (APNNS) (2016), President of Japanese Neural Network Society (JNNS) (2013-2015), Vice President of the IEICE Electronics Society (ES) (2013-2015), Editor-in-Chief of the IEICE Transactions on Electronics (2011-2012), Associate Editor of journals such as the IEEE TRANSACTIONS ON NEURAL NETWORKS (2009-2011), IEEE GEOSCIENCE AND REMOTE SENSING NEWSLETTER (2009-2012), Chair of the Neurocomputing Technical Group in the IEICE, and General Chair of International Conference on Neural Information Processing (ICONIP) 2016 Kyoto and Asia-Pacific Conference on Synthetic Aperture Radar (APSAR) 2013 in Tsukuba. He currently serves as a member of IEEE Computational Intelligence Society (CIS) Neural Networks Technical Committee (NNTC) (2009-), Founding Chair of the NNTC Complex-Valued Neural Network Task Force (2010-), Governing Board Member of APNNA/APNNS (2006-), IEEE GRSS Tokyo Chapter Chair (2013-2015), and General Chair of International Geoscience and Remote Sensing Symposium (IGARSS) 2019 Yokohama. Dr. Hirose is a Fellow of the IEEE, Senior Member of the IEICE, and a Member of JNNS and APNNS.

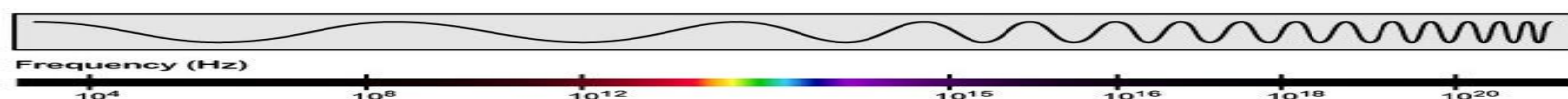


**Ryo Natsuaki** received B. S., M. S. and Ph. D. degrees in electrical engineering from The University of Tokyo, Japan in 2009, 2011 and 2014, respectively. He was Aerospace Project Research Associate of Japan Aerospace Exploration Agency (JAXA) from 2014 to 2017. He is currently a Lecturer with the Department of Electrical Engineering and Information Systems, The University of Tokyo. His research interests include active remote sensing with synthetic aperture radar (SAR). He is a member of IEEE Geoscience and Remote Sensing Society (GRSS) and the Institute of Electronics, Information and Communication Engineers (IEICE). He currently serves as a secretary of IEEE GRSS All Japan Chapter and an assistant secretary of IEICE technical committee on Space, Aeronautical and Navigational Electronics (SANE).

### 1. What are the Japanese Space-based SAR missions in the horizon? What are the collaborative segments in these missions?

Japan Aerospace Exploration Agency (JAXA), with which one of the authors (RN) was, currently aims three goals for future SAR missions. One is to continue our historical L-band spaceborne SAR mission since JERS-1. L-band SAR is helpful in environmental and/or disaster monitoring worldwide because of its long wavelength. The forthcoming ALOS-4 is planned launched into the same orbit as ALOS-2 with the same resolution and wider swath width. Thus we will be able to use long-term observation data. JAXA under the Ministry of Education, Culture, Sports, Science and Technology (MEXT) collaborates on ALOS-4 with Geophysical Information Authority of Japan (GSI) and other corresponding agencies. Another one is to encourage new SAR satellite users. The Ministry of Economy, Trade and Industry (METI) and private sectors collaborate to make a short development-time and low-cost SAR satellite ASARO-2. Proposing innovative SAR concepts is also an important goal. JAXA plans to mount SAR sensor on super low altitude satellite SLATS series while a program under the Council for Science, Technology and Innovation (CSTI) (ImPACT program) is developing a 100kg weight 1m resolution SAR satellite for on-demand observation.

### 2. In recent time, much attention has been given to High Resolution SAR Imaging. This calls for high resolution Digital Elevation Model for the globe for topography correction of SAR data and for several other





**applications. Presently, DEM available freely to the User Community is of 30 m grid spacing or coarser. What are the current & future SAR missions that promise availability of high resolution DEM?**

Especially in Japan, GSI produces 5m resolution DEM freely. However, 30m resolution is the de-facto standard for free DEM products in the world. The latest "ALOS World 3D" that made from optical sensors aboard previous ALOS follows this standard too. Currently, TerraSAR-X and TanDEM-X are making a high-resolution "WorldDEM" dataset and, in near future, an incoming optical satellite ALOS-3 will update the global DEM, but none of them will update the standard soon. Unfortunately, making a high-resolution DEM is not a high-priority mission for future SARs because it competes with accurate deformation detection. Researchers must purchase, develop by themselves or be provided via research agreement for high-resolution DEM.

**3. How important is to plan for SAR missions exclusively aimed at Deformation monitoring at global scale?**

Recently, deformation detection is one of the highest priority for SAR missions. It has been applied swiftly not only in seismology and volcanology but also in, for example, civil engineering and glaciology. These fields demand to measure the areal deformation of their target. Current SAR satellites including Sentinel-1 and ALOS-2 have been designed to monitor the ground deformation frequently.

**4. The atmospheric correction of InSAR data is quite complex in the tropical region due to more dynamic troposphere. What are the solutions the future holds for atmospheric correction of InSAR data?**

The essential point which makes it difficult to remove the tropospheric effect is that it is proportional to the radio frequency as well as the deformation component in InSAR. Solutions are searched in multiple directions. Making an accurate tropospheric model is the most major one. Current models are too coarse in both temporal and spatial resolution compared with SAR. It will be improved to make a far dense model in the future. Using lower frequency is another solution. It can be chosen when the deformation is relatively large. A frequent observation can solve this problem forcibly. Given a sufficient number of data, we can avoid the data with undesirable atmospheric conditions. Anyway, the atmospheric correction is a highly demanded process for all InSAR users.

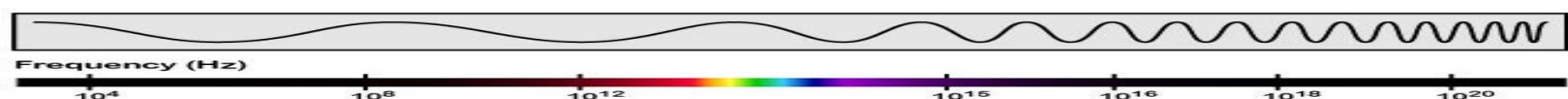
**5. Your research students working in your Lab and in the University of Tokyo are fortunate to get your guidance. Request a few words from you for Indian research students on challenges in Remote Sensing and InSAR.**

This field has significance both as basic engineering and useful science. The former includes the development of new theory and methods dealing with electromagnetic-wave propagation, scattering, diffraction, refraction, and so on and so forth, and also adaptive signal processing and applied mathematics. The latter is closely related to the nature and human society, and making contributions to the studies of glaciers, seismics, subsidence, agriculture and infrastructure. Young people have many to do very fortunately! Let's discuss latest results and findings on journals and at conferences.

**6. Readers of this Newsletter will be happy to learn about the IEEE International Geoscience & Remote Sensing Symposium and other important events in 2018 & 2019. What kind of events, researchers, academics and professionals will look forward to in the coming couple of years?**

The GRSS holds the flagship conference series, namely,

- IGARSS 2018: Valencia, Spain, July 23-27, 2018, Feria Valencia Convention & Exhibition Centre  
Theme: Observing, Understanding, and Forecasting the Dynamics of our Planet
- IGARSS 2019: Yokohama, Japan, July 28 – August 2, 2019, Pacifico Yokohama Conference Center  
Theme: Environment and Disasters
- IGARSS 2020: Hawaii, USA, July 19-24, 2020, Hilton Waikoloa, Big Island
- IGARSS 2021: Brussels, Belgium, July 11-16, 2021



## ARTICLE CORNER

# Geospatial Education: Lessons from Global Scenario

Dr. Anjana Vyas, Executive Director- Centre for Advanced Geomatics,  
Adjunct Professor-Faculty of Technology, CEPT University, Ahmedabad-380008  
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### INTRODUCTION:

Geo-Informatics is ever expanding subject touching almost all areas of human endeavour ranging from retail to institutional domains. Direct and indirect use of Geo-Informatics to individuals, communities, governments, public bodies, industries on national and global level increases its appeal. Technological pace of the subject is ever increasing and envelope of technological advances is expanding fast. Being multidisciplinary at its core, the advances in Geo-Informatics flow from many directions and thus, are diverse and rapid. Geo-Informatics is a force multiplier as it enhances the learning in many disciplines which incorporate Geography as one of the facets. Even without direct utility, this multiplicative character expands it to touch humanities, sciences and engineering domains. The human resource demand of Geo-Informatics is likewise quite diverse given the application areas pertaining to research, academics, industry and governments. The infrastructure of learning and teaching being the source of human capital, so intensely related to, progress of Geo-Informatics is indeed vast and multidimensional. Specialized knowledge of the subject is provided by plethora of courses offered through various universities and industrial institutions.

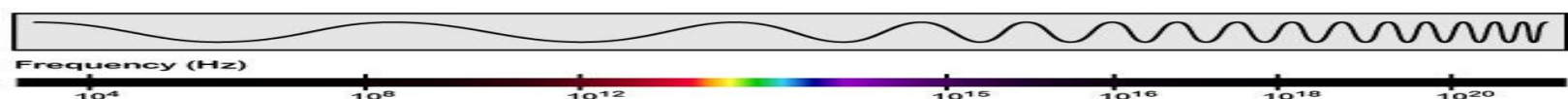
The learning pedagogy, like those of many other disciplines, is adapting various methods of teaching and learning through classroom-based, e-learning and project based techniques. E-learning program is the most recent methodology of collaborative education. The present scenario of teaching and learning infrastructure being very vast, needs improvements in methods related to pedagogy and evaluation on regular basis. This paper is an outcome of a study carried out to catch a hold on the pedagogy innovations required for teaching and learning of Geo-Informatics.

### ANALYTICAL APPROACH:

Major approach of study are delineated below:

- Respondent surveys was planned to bring out salient features of existing programs and also the improvements needed for future through opinions of learned respondents.
- Universities' data was collected and analysed to draw inferences on patterns and statistics of teaching.
- In depth survey of selected universities engaged in Geo-Informatics teaching was carried out to decipher pedagogy, subject fields and placement results, with the idea of capturing the benchmark.

Education plays a vital role in building knowledge and intelligence. Much research has pursued to understand the nature of learning and education, how it occurred, and how it influences the impact of teaching, training and education. The theories based on scientific evidence are considered more valid than opinion-based, or personal experience-based. Knowledge-based theory require a clear idea of its explanation. Impact of education is a change in an individual's knowledge and skill which gives an opportunity to participate actively with other people. Education is a formal system providing sound theoretical knowledge as well as practical understanding. The education system has grown from preaching to teaching, chalk-board to smart-board, chalk and talk to presentations, verbal lecturing to on-line accessibility and Learning. The internet accessibility in majority of developing and developed countries had made e-learning more acceptable. It has become more popular and advocated methods in recent times. It is important to investigate the role of various learning methods prevailing in modern education and training systems offered by the academic institutions.





**GEO-INFORMATICS: CONTENT AND COMPONENTS:**

Geo-Informatics is comparatively a newer discipline. It is a convergence of several disciplines like Geography, computer science, information technology, mathematics and statistics. It is characterised by emergent computer-based tools, software and techniques. Geo-Informatics contains a strong and well defined intellectual core in the science of map making leading towards decision making. As a global scientific field Geo-Informatics constituted at local, regional and national levels, represent ideas, ideologies and practices. Table 1 reveals the subjects and application areas of Geo-Informatics respectively.

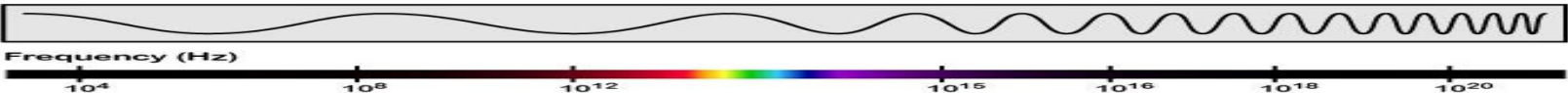
**Table 1: Geo-Informatics: Glimpses of Subjects and Applications Area**

Subject Areas	
<b>GEOGRAPHICAL INFORMATION SYSTEM</b>	Remote Sensing & Digital Image Processing
<b>DIGITAL PHOTOGRAMMETRY: LIDAR, 3-D TECHNOLOGY</b>	Global Positioning System (GPS) and Global Navigation Satellite System(GNSS)
<b>GEODESY</b>	Cartography and Digital Mapping
<b>SPATIAL DATA MINING</b>	Spatial Statistics
<b>PROJECT MANAGEMENT</b>	Various Applications in Geo-Informatics
Applications Area	
<b>URBAN PLANNING</b>	Meteorology
<b>ENVIRONMENT</b>	Land Information System
<b>INFRASTRUCTURE</b>	Earth and atmospheric study
<b>NAVIGATION</b>	Climate Studies
<b>DISASTER MANAGEMENT</b>	3-D and Virtual GIS

Universities design programmes and courses with content according to the specialization, industrial need and pedagogy of the respective institution.

**FUTURE TRENDS OF GEO-INFORMATICS:**

Geo-Informatics has remained primarily to create and manage the data, analyse the data and communicate the information through geo-visualisation. Development of visual simulation and virtual reality, real time monitoring, web portals with continuous sensor-derived data, based on logical relationships in mathematical or statistical form, are some of the examples. The future is expecting Geo-Informatics easy to use, more intuitive, more analytic, more embedded with a variety of technologies for real-time decision support, on-line tracking, high resolution mapping satellites, possibilities of data exchange between different vendors and applications, virtual/augmented reality and towards intelligent decision support Geo-



Informatics system. Michael Goodchild has discussed five very important challenges of future of Geo-Informatics in an article published in ArcWatch (Goodchild, 2011).

- Indoor information: majority of our task is happening in the indoor. Geographical Information System has worked through GPS signals, during outdoor. The future is in the direction of GIS-based services help us determining indoor positions.
- Future is knowing where everything is, with position and location.
- Internet of things.
- Real-time Geographical Information System, in the future, it will involve much more real-time situation monitoring and assessment and will need new kinds of tools that treat information as continually changing. Decisions will have to be made on the basis of information available at the time and deal with uncertainties about the future in rational ways.
- Multiple views of the world. Basically the definition used differently by different people.

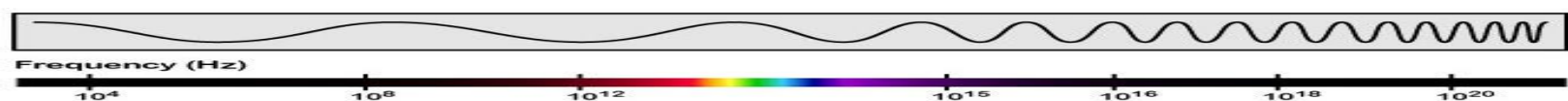
Geo-Informatics represents a set of software tools which are utilized for a scientific approach towards the analysis of spatial data and more importantly for the use of decision-making for a static situation and dynamic datasets. A research survey represents the industrial growth of Geo-Informatics of 10% and 8% in the year 2010 and 2011 respectively. The comprehensive report (Global GIS Market 2016-2020) estimates that the global Geo-Informatics market will grow with the CAGR of more than 10% during 2016-2020. (<https://www.technavio.com/report/global-enterprise-application-gis-marke>) With the view of increasing importance of Geo-Informatics, GSDI (Global Spatial Data Infrastructure) has emerged with the main purpose of information transparency and sharing between the academic institutions and governments, the citizens, society as a whole, private businesses and governments all have an equal and unbiased right to use spatial information as it is a global treasure.

### GEO-INFORMATICS EDUCATION AND LEARNING – ANALYSIS:

Education and training play vital role in the utilization of the technology. Shared and coordinated knowledge that geospatial technology and GIS deliver provides a deeper understanding of our present and will also help to better understand our future development. But it is not enough to explain new technological developments during congresses or workshops; it is also necessary to promote these new ideas and to distribute the knowledge by applying new learning strategies. (Vyas A and Koenig G, 2014). Education is a media through which the foundation of the knowledge and skill is built. With the advancement in the data collection and analytical capabilities of remote sensing, geographical information system, global positioning system, the database management system has become one of the important areas. The nations have allocated funds for technology, research, education and capacity building. Assessment of delivery methods can gauge the efficacy of e-learning and provide a guideline for introduction of e-learning techniques. It can act as a tool for mentoring the designers of the courses. Assessment can help in meeting the objectives, and provide invaluable experience to the learners too. (Koenig G, Jochen S, 2006). This research exercises for both the groups: students as well as designers of the course.

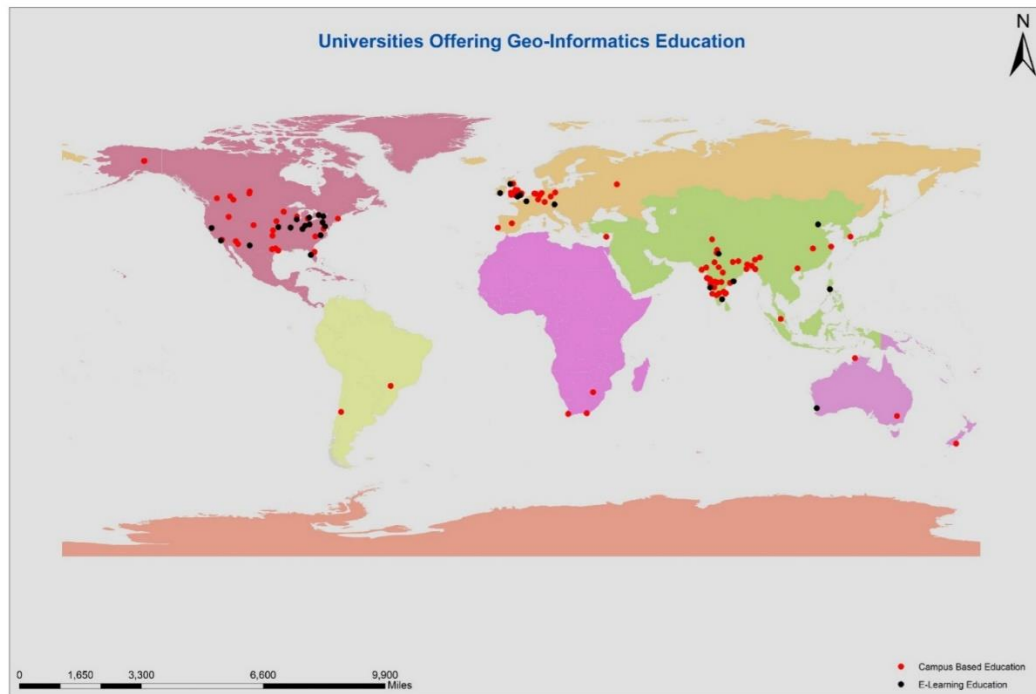
Analysis of this case study is done through scanning of data available of all the major universities. The information on the courses offered, the type of the courses, the duration, etc. have been collected. In total there are 115 universities data have been gathered and analysed. There are at least two universities from each continent to keep the orthogonality. Those are represented on Map 1.

Out of 115 universities selected, about 52% universities offer campus-based teaching while 40% offered e-learning teaching followed by 9% universities offer both types of teaching. A ratio between the campus-based and e-learning for the undergraduate programme is 0.53 and the same is 0.65 for post graduate programmes. It is to be noted that the certificate courses are more of e-learning type than the campus-





based. About 66% of universities offered postgraduate level degrees and about 17% of them offered undergraduate degrees.



**Map 1: World spread of Geo-Informatics Universities**

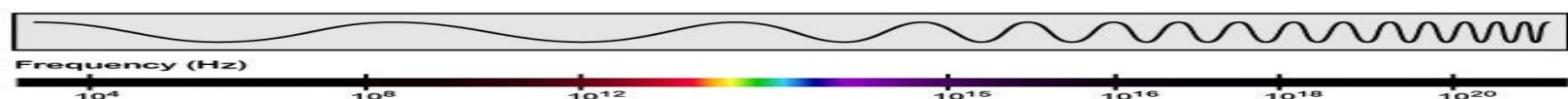
There are 7% universities offer certificate courses followed by 4% universities offering doctorate degree in Geo-Informatics. Looking through the spread of selected universities, for this analysis reveals that North American universities form almost half of the total number of the universities offering courses in Geo-Informatics. Of the total campus based education, there are 26 universities from North America followed by 20 in Europe and Asia it numbers 12. E-learning programmes offered by universities represent similar trend, 25 and 11 in North America and Europe respectively followed by Universities in Asia.

#### **GEO-INFORMATICS EDUCATION DOGMA:**

From the 115 universities, a random selection has been done for 24 universities across the globe which offer education in Geo-Informatics. Data about the professional careers of graduates in Geo-Informatics from these universities have been collected through different social media. These graduates are employed in various fields, at various levels and various locations. It was very interesting to note that many of these graduates having Geo-Informatics degree and knowledge are not necessarily working in the same specialised field of Geo-Informatics.

#### **FIELD OF PROFESSION: DOMINANTS AND MINOR:**

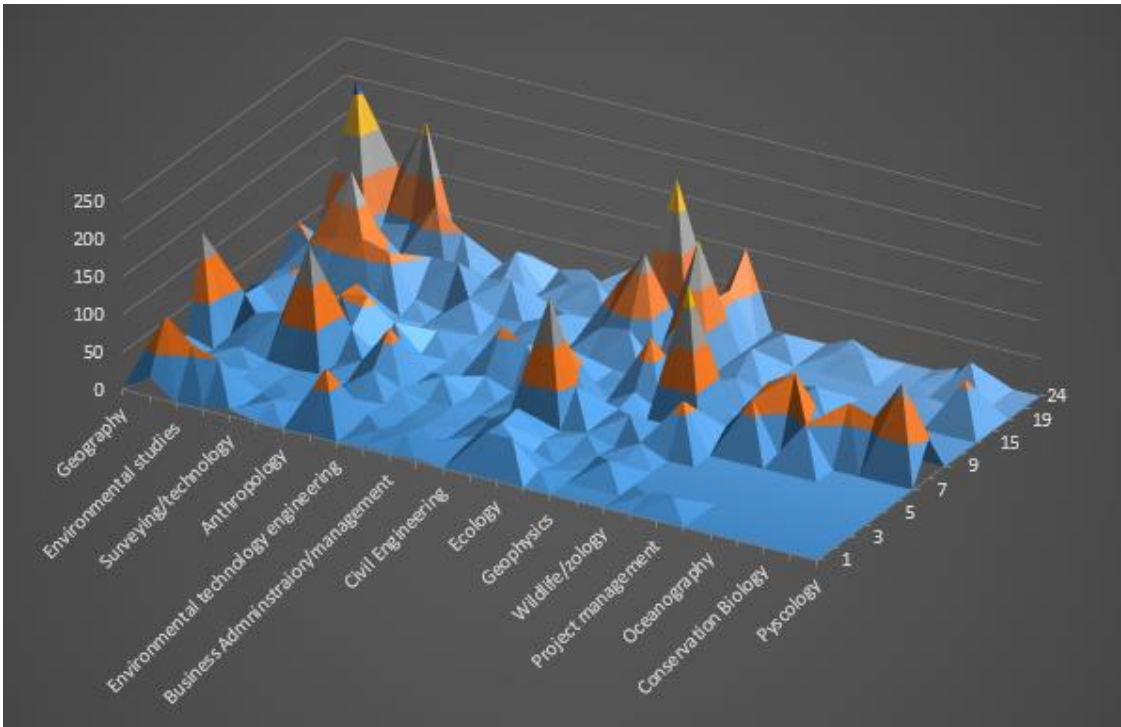
The analysis considers the dominant and minor fields in which the skilled graduates has chosen as profession. One of the analysis reveals that considering, each university defines a dominance in one or more fields, but not necessarily the graduates gets a placement in the same or similar domain. Secondly, the minor field defined as the field where very less number of graduates are pursuing their professional career. The result of this analysis could empower the university to redesign, upgrade and modify the offered programme, even decide on introducing a new course or closing down the current course. This analysis may provoke a university to carry out an extensive research to understand the demand and supply gap prevailing between industry and academia. The analysis reveal two distinct doctrine:



- Universities receive an attention to upgrade, enhance and modify the philosophy of the Geo-Informatics programme in their respective areas, can compare with the global scenario.
- Students can use this analysis as the guideline to choose the university according to respective desired professional realm.

**TRENDS OF DIFFERENT FIELDS:**

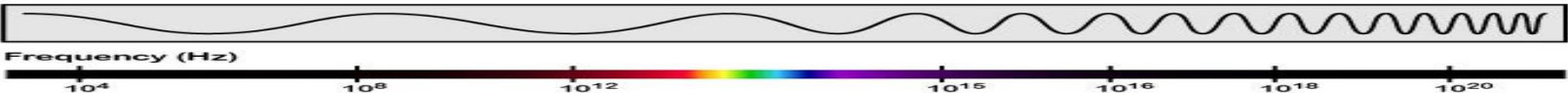
The analysis is extended further for 24 universities, selected out of 115 universities such that those offer similar subjects in Geo-Informatics at post-graduation. Three data sets, i.e., universities, no. of students opted for post-graduation in Geo-Informatics and the discipline, represented through a 3-D model. This inference from this statistics emerges the students' desire to take Geo-Informatics as a specialisation or higher studies. For instance, more number of students from disciplines like Geography, surveying technology and environmental studies opting for post-graduation in Geo-Informatics, followed by graduation in oceanography, forestry, biology students opt for Geo-Informatics as higher studies.



Graph 1: Trends of different field

Table 2: Program Structure for respective specialisation

Field	Common Course Content
Geography	GIS, Remote Sensing, Urban Settlements, Spatial Statistics, Computer Aided Mapping And Thematic Atlas, Social Geography
Environmental Studies/Science	GIS, Climate Analysis, Map Analysis, Geospatial Analysis, Remote Sensing
GIS & Cartography	GIS, Remote Sensing, Urban, Spatial Statistics, Applications Of GIS, Lidar, Surveying
Geology & Earth Science	Maths, Geophysical Studies, Basic GIS





<b>Information Science/IT</b>	Programming Languages, Maths, Map Services, Web GIS, Cloud GIS, Mobile GIS, Real Time GIS
<b>Anthropology</b>	GIS, History, Language, Applications Of GIS, World History, Map Services, Computer Aided Mapping And Thematic Atlas, Geography.
<b>City Urban &amp; Regional Planning/Urban Affairs</b>	Planning Theories, GIS, GIS Modelling, Plan Preparation
<b>Civil Engineering</b>	Surveying, GIS, Basic Remote Sensing,
<b>Remote Sensing</b>	Remote Sensing, Advance Remote Sensing, Photogrammetry, Basic GIS, LIDAR, Applications Of GIS
<b>Disaster Management/Development</b>	Disaster Management, GIS, Geography, Applications Of GIS, Remote Sensing, Computer Aided Mapping And Thematic Atlas, Spatial Statistics.

Above mentioned observations guides the academic institutions to design their subjects and syllabus as well as address those institutions offering graduation in these basic degrees.

### CONCLUSION:

This study contains a brief survey about the various teaching and assessment methods used by educational institutions across the globe. It elaborates over pedagogy used for teaching and training of Geo-Informatics. Through benchmarking done with the use of extensive surveys and deep analysis, a guideline for programme development in context of Geo-Informatics has developed. The study also showcases the perspective of industry-academia gap.

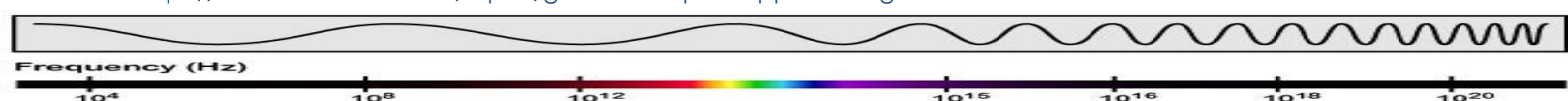
In the recent time of advancement in the communication technology, it observes the more number of e-Learning courses are offered. It is also true in Geo-Informatics. A ratio between the campus-based and e-learning for the undergraduate programme is 0.53 and the same is 0.65 for post graduate programmes observed in 115 universities offering Geo-Informatics.

Of the total campus based education, larger number of universities falls in North America, followed by Europe. Asian countries remains less than 50% of the North American universities offering Geo-Informatics. Data about the professional careers of graduates in Geo-Informatics from these universities have been collected through different social media to analyse the graduates employed in various fields, at various levels and various locations. This ultimately guides the universities on upgrade, enhance and modify the philosophy of the Geo-Informatics programme in comparison with global scenario and the students' avails the opportunity to match respective professional realm and choose the intuitions for higher studies.

3-D model derived from the data collected of 24 universities, no. of students opted for post-graduation in Geo-Informatics and the discipline, directs the academic institutions to design their subjects and syllabus as well as address those institutions offering graduation in basic degrees.

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- <https://www.technavio.com/report/global-enterprise-application-gis-marke>



## Members Updates



IEEE-GRSS-Gujarat member **Dr. Sriram Saran** was awarded PhD degree in Physics from Gujarat University in August 2016. He joined Arecibo Observatory (Puerto Rico, USA) in April 2017 as a Postdoctoral Research Scientist and is currently working on the radar observations of Asteroids, Comets and Terrestrial planets.

IEEE-GRSS-Gujarat member **Dr Bindi Dave** was awarded her PhD from CEPT University in November 2017, for the dissertation thesis titled "Multi-Temporal C-band Polarimetric SAR data for Agricultural Crop Classification". Since January 2017, she has been appointed as an Assistant Professor at Faculty of Technology, and Program Coordinator for the M.Tech Geomatics Program at CEPT University, Ahmedabad.

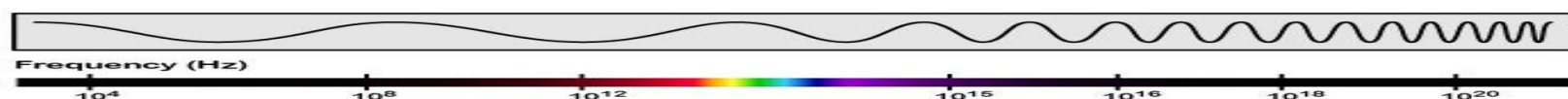


IEEE-GRSS-Gujarat member **Dr. Anup Kumar Das** received Green Asia Award for the year 2017 from the Chinese Taipei Society of Photogrammetry and Remote Sensing, during 38th Asian Conference on Remote Sensing (ACRS-2017) held in New Delhi on October 23-27, 2017 for significant contribution directing to a greener Asia through research on microwave satellite remote sensing based techniques for forest above-ground biomass retrieval and monitoring of biomass change.

## New Members



**Dharmendra Kumar Pandey** received B.Tech. degree in ECE and M.Tech. degree in RF & Microwave Engineering from Indian Institute of Technology, Kharagpur, India, in 2007 and 2009, respectively. He was associated with Hybrid & Microwave Division (HMD R&D), Astra Microwave Product Ltd., Hyderabad, India as senior design engineer in design & development of RF & microwave systems and subsystems. Since 2010, He has been with Microwave Techniques Development Division (MTDD), Space Applications Centre (ISRO), India as Scientist working on microwave remote sensing. His scientific research interests include algorithm development for geophysical parameter retrieval using polarimetric Synthetic Aperture Radar (SAR), radiometer and scatterometer and simulation & modelling for terrestrial and planetary surfaces. His recent activities relate to the algorithm development for retrieval of surface soil moisture and vegetation parameters using polarimetric SAR and radiometer data





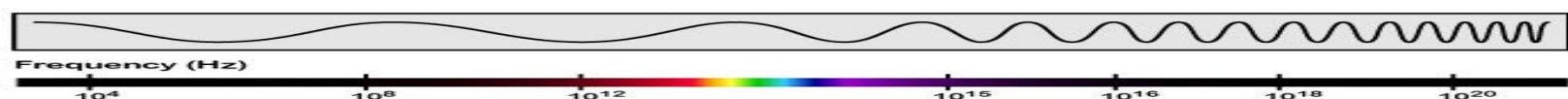
**Tanish Zaveri** received his BE degree in Electronics Engineering from Sardar Vallabhbhai Regional College of Engineering, Surat in 1998 and obtained his M.Tech degree in Biomedical Engineering from Indian Institute of Technology, Bombay, India in 2005. He completed his Ph.D. in Computer Engineering from Sardar Vallabhbhai National Institute of Technology, Surat in the year 2010. He joined Electronics and Communication Engineering Department of Institute of Technology, Nirma University in the year 2000 and is currently working as a Professor in Electronics and Communication Dept., Institute of Technology, Nirma University. He has more than 18 years of teaching experience. He has received DST travel grant in year 2010 to present his research work at Georgia Tech. Univ., Atlanta.

He is presently principle investigator of five sponsored research project from funding agencies like ISRO and GUJCOST. He became senior IEEE member in April, 2014. He is also senior member IEEE Signal Processing Society and GRSS society and Life member of Indian Society of Technical Education, Computer Society of India, IETE, Indian Society of Remote Sensing (ISRS) and Indian Unit for Pattern Recognition and Artificial Intelligence (IUPRAI). He has published papers in various reputed national and international Journals and conferences. His current area of research is multi polarized SAR and hyperspectral data processing Image processing, Biomedical Imaging, Video processing and multimedia systems.



**Pooja Shah** received B.Tech. degree in Computer Engineering and M.Tech. degree in Computer Science and Engineering and currently pursuing Ph.D degree on satellite image processing and SAR polarimetry in Nirma University, Ahmedabad. Presently, she is a faculty with CE Department and is IEEE senior member. She teaches courses related to Image Processing, Data Communication and networking and Cyber Crime at both Under Graduate and Post Graduate Levels. She has worked as the Branch Counselor of IEEE student branch at Nirma University from 2012-17. She has been working

on several interdisciplinary research projects with Electronics and communication department, chemical engineering department and Institute of Science at Nirma University. She is Co-Investigator of research projects funded by SAC-ISRO under the schemes RESPOND, NISAR-AO and AVIRIS-AO.





## Readers' views on the previous issue of the Newsletter vol 4 issue-1, December 2016

*"The newsletter is excellent - very impressive! It has a great balance of news, information, and implicit benefits of IEEE participation"*

- Dr Paul Rosen,  
JPL/NASA, USA

*"This (the newsletter) is fantastic"*

- Dr Paolo Gamba, Vice  
President ( Executive) IEEE GRSS  
University of Pavia, Italy

*"India has a great Earth observation program and the Newsletter well reflects the success of this program"*

- Dr Alberto Moreira,  
Director, DLR, Germany

*"very active year in 2016"*

- Dr Hampapuram Ramapriyan,  
Science Systems and  
Applications Inc., USA

*"Good material for reading"*

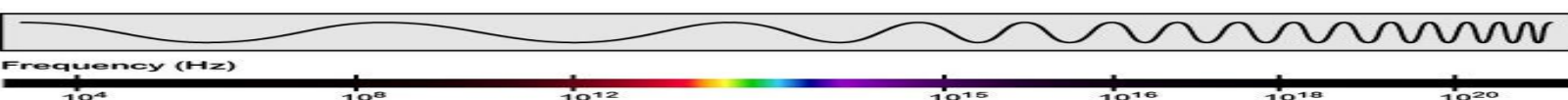
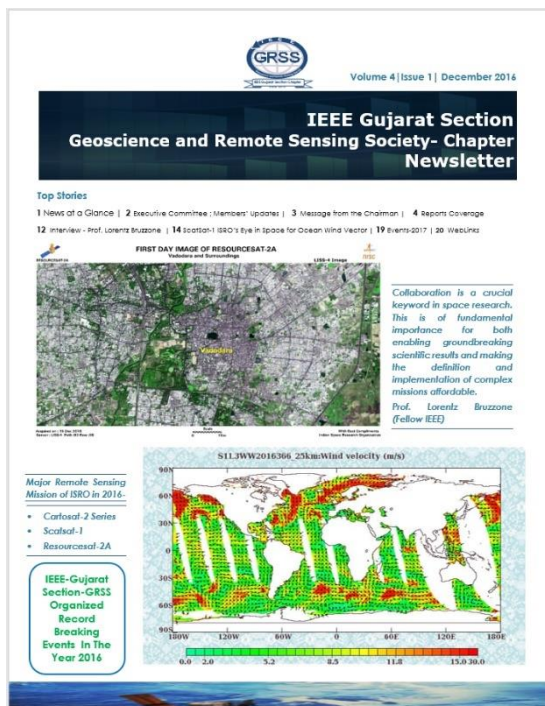
- Prof J K Garg, IndraPrastha  
University, New Delhi

*"A very extensive, informative & good Newsletter"*

- -Rajeev Jyoti, Group  
Director, SAC/ISRO

*"Excellently informative!  
It presents Gujarat activities visually, descriptively, and very attractively"*

- Prof Akira Hirose,  
University of Tokyo,  
Japan



## EVENTS CALENDAR - 2018



- |  |                      |
|--|----------------------|
| 1. Hands-on Training on "Soil Moisture and Agricultural Monitoring using Microwave Remote Sensing" ,SAC Bopal Campus-  | February 07-09, 2018 |
| 2. IEEE-GRSS Gujarat chapter- Members meet, Hotel Planet Landmark-   | February 07-09, 2018 |
| 3. Lecture on "Statistics and Information Theory in Remote Sensing with SAR", by Dr. Alejandro C. Frery, Univ. of Brazil – IEEE Distinguished Lecture Program (DLP) jointly organized by IEEE-GRSS Gujarat and CEPT University-Ahmedabad | February, 15 2018    |
| 4. IEEE Distinguished Lecture Program (DLP) –  | October 2018         |
| 5. National workshop on applications of Geospatial Technology  |                      |

*Others program to be annaounces soon*

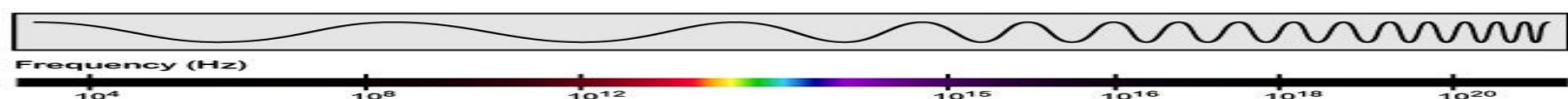
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