DAVID LE VINE

Distinguished Lecturers Can Talk at Your Chapter Meeting

The Distinguished Lecturer Program provides the IEEE Geoscience and Remote Sensing Society (GRSS) Chapters with talks by experts on topics of interest and importance to the GRS community. The Chapters can choose from a changing list of topics from speakers who are interested in coming to Chapter meetings to give a talk. The GRSS covers the cost of the visit. Details can be found at the GRSS website under the "Education" tab (http://www.grss-ieee.org/education/distinguished-lecturers/).

Briefly, a Chapter contacts a lecturer from the list of available speakers. Once the initial details of the visit have been worked out (e.g., the date and a rough budget), the Chapter fills out the application form located on the website. The lecturer is responsible for preparing the budget and will work with the Chapter regarding scheduling. The GRSS will reimburse the Distinguished Lecturers for their travel expenses. Reimbursement is given directly to the lecturer from the IEEE/GRSS, so the Chapter does not have to worry about financial issues.

Information about the speakers and additional details about how to take advantage of the program are available on the GRSS website (look for "Distinguished Lecturer" under the "Education" tab). The application form that should be submitted for approval prior to a visit is located there.

The Distinguished Lecturers are volunteers who are willing to travel and interested in visiting your Chapter. Don't hesitate to contact them. Please feel free to contact Program Chair David Le Vine with questions at d.levine@ieee.com. Also, if there are ways we can make this program serve you better, please let us know. Finally, there are several speakers available to lecture in languages in addition to English (see the abstracts for languages available). The new 2017 lecturers and their abstracts are given next.

GUSTAU CAMPS-VALLS, IMAGE PROCESSING LABORATORY, UNIVERSITAT DE VALÈNCIA, SPAIN

Gustau Camps-Valls received his B.S. degree in physics in 1996 and in electronics engineering in 1998 and his Ph.D. degree in physics in 2002 from the Universitat de València, Spain. He is currently an associate professor (hab. full professor) in the Department of Electronics Engineering and a research coordinator in the Image and Signal Processing Group (http://isp.uv.es). He was a visiting researcher at the Remote Sensing Laboratory at the University of Trento, Italy, in 2002 and the Max Planck Institute for Biological Cybernetics, Tübingen, Germany, in 2009, and he was an invited professor at the Laboratory of Geographic Information Systems of the École Polytechnique Fédérale de Lausanne, Switzerland, in 2013. He is a Senior Member of the IEEE.

He is interested in the development of machine-learning algorithms for geoscience and remote sensing data analysis. Additionally, he is the author of 130 journal papers, more than 150 conference papers, 20 international book chapters, and is editor of the books *Kernel Methods in Bioengineering, Signal and Image Processing* (IGI, 2007), *Kernel Methods for Remote Sensing Data Analysis* (Wiley, 2009), and *Remote Sensing Image Processing* (MC, 2011). He is a coeditor of the forthcoming book *Digital Signal Processing with Kernel Methods* (Wiley, 2017). He holds a Hirsch's index h = 45 (see his Google Scholar page) and entered the Institute for Scientific Information list of Highly Cited Researchers in 2011, and Thomson Reuters ScienceWatch identified one of his papers on kernel-based analysis of hyperspectral images as Fast Moving Front research. In 2015, he obtained the prestigious European Research Council consolidator grant for the Statistical Learning for Earth Observation Data Analysis research project. He is a referee and program committee member of many international journals and conferences.

Since 2007, he has been a member of the Data Fusion Technical Committee of the IEEE GRSS, and he has been a member of the Machine Learning for Signal Processing Technical Committee of the IEEE Signal Processing Society since 2009. He was a member of the Meteosat Third Generation–Infrared Sounder Science Team of the European Organisation for the Exploitation of Meteorological Satellites. He is associate editor of *IEEE Transactions on Signal Processing*, *IEEE Signal Processing Letters*, and *IEEE Geoscience and Remote Sensing Letters* and was an invited guest editor of *IEEE Journal of Selected Topics in Signal Processing* (2012) and *IEEE Geoscience and Remote Sensing Magazine* (2015).

MACHINE LEARNING FOR REMOTE SENSING DATA ANALYSIS

Machine learning has become a standard paradigm for the analysis of remote sensing and geoscience data at both local and global scales. In the upcoming years, with the advent of new satellite constellations, machine learning will have a fundamental role in processing large and heterogeneous data sources. Machine learning will move from mere statistical data processing to actual learning, understanding, and knowledge extraction. The ambitious goal is

Digital Object Identifier 10.1109/MGRS.2017.2648643
Date of publication: 16 March 2017

to provide responses to the challenging scientific questions about the earth system.

In this tutorial, we will present the remote sensing image-processing chain and take the attendants on a tour of different strategies for feature extraction, classification, unmixing, retrieval, and pattern analysis for remote sensing data analysis. We will present powerful methodologies for supervised remote sensing data classification, i.e., extracting knowledge from data, including interactive approaches via active learning, classifiers that encode prior knowledge and invariances, semisupervised learning that exploits the information of unlabeled data, and domain adaptation to compensate for shifts in the ever-changing data distributions. The latest advances in the field of unmixing will be reviewed, covering sparse approaches, spatial–spectral methods, and methods constrained by physical models. We will pay attention to recent advances in biogeophysical parameter estimation that involves remote sensing data characteristics, such as spatial and temporal structures or the presence of heteroscedastic noise. Beyond theory, we will also present the results of recent studies illustrating all of the covered issues. Finally, we will provide MATLAB code and demos to the attendees to try the different methodologies and provide a solid ground for their future experimentations.

DAVID G. LONG, BRIGHAM YOUNG UNIVERSITY, PROVO, UTAH

David G. Long received his Ph.D. degree in electrical engineering from the University of Southern California, Los Angeles, in 1989 after receiving his B.S. and M.S. degrees in electrical engineering at Brigham Young University (BYU) in 1982 and 1983, respectively. From 1983 through 1990, he was employed at NASA's Jet Propulsion Laboratory (JPL) in the Radar Science and Engineering Section. He was responsible for the design and development of the NASA Scatterometer (NSCAT) system to measure ocean surface winds from space. NSCAT successfully flew aboard the Japanese *ADEOS* spacecraft in 1996. He was a group leader in the Radar Systems Engineering Group at JPL, where he supervised work on the design and analysis of spaceborne scatterometer and synthetic aperture radar systems, including NSCAT, SIR-C, and *Magellan*. He was the original experiment manager for SCANSCAT (now known as SeaWinds, it was first launched in 1999 on *QuikSCAT*, again in 2003 on *ADEOS-II*, and again as RapidScat on the *International Space Station* in 2014).

Since 1990, Dr. Long has been on the faculty of the Electrical and Computer Engineering Department (www.ee.byu.edu) at BYU (www.byu.edu). He is a full professor teaching radar, remote sensing, communications, and signal processing. He is the director of the BYU Center for Remote Sensing and head of the Microwave Earth Remote Sensing Laboratory (www.mers.byu.edu). Since 2012, he has been an associate dean of the Ira A. Fulton College of Engineering and Technology (www.et.byu.edu).

SATELLITE SCATTEROMETRY: WINDS, VEGETATION, AND ICE

Remote sensing is the study of the environment from a distance. Recent developments in satellite-based sensors and computer processing techniques offer unique perspectives of our planet. Microwave remote sensing includes active (radars) and passive (radiometers) sensors. This talk focuses on the applications of a class of active microwave remote sensors known as scatterometers. Satellite scatterometers have been built and flown by several groups and nations, including the United States, the European Space Agency, India, and China. Wind scatterometers are satellite radars designed to measure near-surface vector winds over the ocean. The scatterometer does not directly measure the wind. Rather, it measures the normalized radar backscatter (σ^o) of the surface. Then, from multiple σ^o measurements, the wind blowing over the ocean's surface is inferred. Scatterometer wind measurements have wide application in air–sea interaction and weather observation. Wind scatterometers typically operate at one of two bands, C (5.4 GHz) or Ku (13.4 GHz). Ku band is more sensitive to wind but also to the adverse effects of rain. However, this sensitivity can be exploited to simultaneously estimate wind and rain.

Scatterometers also collect σ^o measurements over land and ice. While the low resolution (25 km) of the scatterometer measurements can limit their utility in land and ice studies, reconstruction processing enables the generation of enhanced resolution σ^o images from past and present scatterometers. Such enhanced resolution scatterometer images have been proven to be useful for high resolution wind/rain estimation as well as in a variety of studies of polar ice and tropical vegetation. In particular, enhanced resolution scatterometer observations have been used over land to study the deforestation of tropical rain forest and desertification. Over the glaciated regions of Greenland and Antarctica, the radar signal is very sensitive to melting conditions and can thus be used to monitor global warming conditions. The contrast between ocean and ice scattering enables the tracking of major Antarctic icebergs in all weather conditions. In this talk, a brief overview of scatterometer remote sensing is provided and a number of applications of microwave remote sensing are described.

LORI MANN BRUCE, MISSISSIPPI STATE UNIVERSITY, STARKVILLE

Lori Mann Bruce is a Giles distinguished professor of electrical and computer engineering, the associate vice president for academic affairs, and dean of the graduate school at Mississippi State University. As dean of the graduate school at a research, land-grant institution, Dr. Bruce is responsible for providing leadership and academic oversight for the approximately 4,000 graduate and professional students enrolled in more than 150 graduate programs. Dr. Bruce serves as an advocate for graduate education at the university level and provides leadership to graduate enrollment management, academic curricula, academic policies and procedures, assistantship and fellowship programs, and professional development programs.

Prior to her current position, Dr. Bruce served as associate dean for research and graduate studies in the Bagley College of Engineering, director of the Raspet Flight Research Center, associate director of the Geosystems Research Institute, and professor of electrical and computer engineering. As a faculty member, her graduate teaching and research endeavors have been focused on hyperspectral remote sensing. She has served as the principal investigator (PI) or co-PI on more than 20 funded research grants and contracts, totaling approximately US$20 million from federal agencies. As a faculty member, she has taught 45 sections of 17 different engineering courses and has successfully advised 75 Ph.D. degree and master's degree students as a major professor or thesis/dissertation committee member. Her research has resulted in more than 130 refereed publications, and her research in remote sensing for agricultural and environmental applications has been presented to audiences across the United States and in 15 countries.

HYPERSPECTRAL IMAGE ANALYSIS WITH APPLICATIONS OF UAVs FOR PRECISION AGRICULTURE

Hyperspectral sensors inherently acquire high-dimensional optical data resulting from fine spectral sampling. In recent years, smaller, lighter, and more affordable hyperspectral sensors have been developed, allowing them to be utilized on a variety of platforms, including unmanned aerial vehicles (UAVs) or drones. As a result, hyperspectral data are now more often high dimensional not only spectrally but also spatially and temporally. This seminar will provide a broad overview of techniques commonly employed for the analysis of high-dimensional data (such as linear transform-based approaches and data-partitioning methods) as well as more specialized techniques designed for hyperspectral imagery (spectral band grouping, multiclassifier and decision fusion, and game theory approaches). The seminar will also include examples of applying such methods to hyperspectral imagery for precision agriculture applications, including vegetative species mapping and vegetative stress characterization. Practical details will also be provided regarding the field campaigns and UAV image collection for these studies.

CHRISTOPHER S. RUF, UNIVERSITY OF MICHIGAN, ANN ARBOR

Chris Ruf is a professor of atmospheric science and electrical engineering at the University of Michigan. He has worked at Intel Corporation, Hughes Space and Communication, the NASA Jet Propulsion Laboratory, and Penn State University. He is the principal investigator of the NASA *Cyclone Global Navigation Satellite System* (*CYGNSS*) mission. Dr. Ruf has been involved in microwave remote sensing for more than 33 years, with a research emphasis on spaceborne microwave sensor design and calibration and the development and validation of ocean and atmosphere geophysical retrieval algorithms. He has contributed to the science, calibration/validation, and engineering teams for *TOPEX*, *GeoSat Follow-On*, *Jason-1*, *SMOS*, WindSat, *Aquarius*, GPM, *SMAP*, and *Juno*. Prof. Ruf is a Fellow of the IEEE and former editor-in-chief of *IEEE Transactions on Geoscience and Remote Sensing* (*TGRS*). He has been the recipient of four NASA Certificates of Recognition and seven NASA Group Achievement Awards as well as the 1997 IEEE TGRS Best Paper Award, the 1999 IEEE Resnik Technical Field Award, the 2006 International Geoscience and Remote Sensing Symposium Best Paper Award, and the 2014 IEEE GRSS Outstanding Service Award.

NASA CYGNSS *EARTH VENTURE MISSION*

The NASA *CYGNSS* is a spaceborne mission launched in December 2016 with a goal to study tropical cyclone (TC) inner core processes. *CYGNSS* attempts to resolve one of the principal deficiencies with current TC intensity forecasts, which lies in inadequate observations and modeling of the inner core. The inadequacy in observations results from two causes, i.e., 1) much of the inner core ocean surface is obscured from conventional remote sensing instruments by intense precipitation in the eyewall and inner rain bands, and 2) the rapidly evolving (genesis and intensification) stages of the TC life cycle are poorly sampled in time by conventional polar-orbiting, wide-swath surface wind imagers. *CYGNSS* addresses these limitations by combining the all-weather performance of global navigation satellite system bistatic ocean surface scatterometry with the sampling properties of a constellation of satellites.

The *CYGNSS* constellation comprises eight observatories in 510-km circular orbits at a common inclination angle of 35°. Each observatory contains a Delay Doppler Mapping Instrument (DDMI) that consists of a multichannel global positioning system (GPS) receiver, a low-gain zenith antenna, and two high-gain nadir antennas. Each DDMI measures simultaneous specular scattered signals from the four GPS transmitters with the highest probable signal-to-noise ratio. *CYGNSS* measurements of a bistatic radar cross section of the ocean can be related to the near-surface wind speed in a manner roughly analogous to that of conventional ocean scatterometers and altimeters. *CYGNSS* has spatial and temporal sampling properties that are different from conventional wide-swath polar imagers. Spatial sampling is marked by 32 simultaneous single pixel swaths that are 25 km wide and typically hundreds of kilometers long. The temporal sampling is best described by a probability distribution of the revisit time, with a median and mean value of ~3 and ~7 h, respectively. A summary of the current mission design will be presented, including the DDMI science payload, the spacecraft, the constellation orbital architecture, the mission concept of operations, and the wind speed retrieval algorithm and performance characterization.

GRS