Workshops

WS 1
Lidar Waveform: The Potential and Benefits for Topographic Mapping

Charles K. Toth, PhD, *The Ohio State University*
Nora Csanyi May, PhD, *Fugro EarthData, Inc.*
12:15 P.M. to 5:15 P.M., 0.4 CEU

Registration Fee: $85 Student*, $165 Member, $265 Non-member

INTERMEDIATE WORKSHOP

Intended audience:
In general, people involved in all aspects of lidar. The proposed workshop is primarily beneficial to lidar data providers, both who have already started to look into full waveform applications or those who are just about to explore this emerging technology. In addition, government program managers and decision-makers should also find this workshop valuable.

This workshop will provide an introduction to lidar waveform data concepts and processing. Participants are expected to have basic understanding of lidar technology. The structure of this workshop will be the following:

I. Introduction to Lidar Waveform Data
   A. What is lidar waveform data?
   B. Short history on the evolution of waveform data
   C. The characterization of waveform data
II. Acquiring Lidar Waveform Data
   A. Large footprint systems
   B. Small footprint pulsed lidar systems
III. Real-time Processing of Lidar Waveform Data
   A. Return and intensity signal detection (advantage/disadvantage of waveform vs. discrete returns)
   B. Compression of lidar waveform data
   C. Storing lidar waveform data
IV. Post-processing of Lidar Waveform Data
   A. General analysis of waveform data; typical waveforms
   B. Already existing applications using lidar wave form data
   C. Emerging applications, including land-cover (object) classification, better error characterization, etc.
V. Summary and Future Trends
   A. Existing systems
   B. Outlook on market developments

WS 2
Remote Sensing of Wetlands

John Lyon, *U.S. Environmental Protection Agency*
Ross Lunetta, *U.S. Environmental Protection Agency*
Ric Lopez, *U.S. Environmental Protection Agency*
12:15 P.M. to 5:15 P.M., .4 CEU

Registration Fee: $85 Student*, $165 Member, $265 Non-member

INTRODUCTORY WORKSHOP

Identifying and characterizing wetlands can be greatly enhanced by the use of remote sensor and geospatial technologies. Basic image interpretation supplies a great deal of information, as does computer-enhancement of remote sensor data. The utility of these approaches comes from their application over time and space, and leads one to an understanding of the influences of hydrology, soils, plants, and topography that occasion the presence of wetlands, and allows their remote detection.

These presentations show how technologies and field work can greatly add to the identification of wetlands in a variety of ecosystems. Topics to be addressed include: Wetland characteristics and indicators; Imagery of wetlands; Field work and wetland features; Interpretation of imagery; Multispectral and hyperspectral imaging; Detailed moderate and fine spatial and spectral resolution sensing and analyses; Thematic mapping of wetlands; use of geographic information systems and modeling; and other topics of interest. Ample question and answer periods allow the attendees insight on their own issues and applications.

Workshops

WS 3
Unmanned Aerial System (UAS) Concepts

Kevin Gambold, *Unmanned Experts LLC*
Stephen Rolfe, *Unmanned Experts LLC*
7:45 A.M. to 5:15 P.M., CEU 0.8

Registration Fee: $120 Student*, $215 Member, $315 Non-member

INTERMEDIATE WORKSHOP

The civilian aviation sector of unmanned aerial vehicles (UAV) and systems (UAS) is rapidly expanding, and is predicted to match the successful military application of UAVs. Recent studies have drawn up over 53 different mission types for civilian UAS, grouped into 5 mission sets of Survey, Law Enforcement, Border Patrol, Communications and Disaster Relief.

Companies are looking to this area to solve specific operational problems, using the traditional strengths of UAS over manned platforms, epitomized by the phrase 'the 3 Ds: Dull, Dirty and Dangerous'.

This UAS Concepts Workshop was designed to provide experienced airborne photogrammetry and remote sensing operators, technologists, and scientists with an understanding of UAVs/UAS that goes beyond an introductory level, and allows them to speak knowledgeably of this area to their management, customers, and peers.

This day-long instructional program includes:

I. Overview; UAS Terminology and Classification; UAS Roles and Mission Sets
II. Control Systems; Data Links; Hardware
III. Payloads: EO/IR/LLTV/SAR/GMTI/Hyperspectral
IV. Concept of Operations; Launch Recovery Systems; Communications
V. Deployment Considerations; Future Employment of UAS

Our instructors have extensive operational UAS experience and have delivered leading-edge UAS training materials to a wide spectrum of audiences.

This course assumes that attendees have an intermediate to advanced understanding of airborne operations, and a basic understanding of photogrammetric and remote sensing principles that have their equivalents in military intelligence, surveillance, and reconnaissance (ISR) fundamentals.

WS 4
Hyperspectral Remote Sensing Data Processing: Background and Approaches

William Farrand, *Farr View Consulting*
7:45 A.M. to 12:15 P.M., CEU 0.4

Registration Fee: $85 Student*, $165 Member, $265 Non-member

INTRODUCTORY WORKSHOP

Imaging spectrometry, commonly referred to as hyperspectral remote sensing, provides high-resolution spectral information for environmental, natural resources, and urban characterization projects. In this workshop, students will be provided with an introduction to hyperspectral data, a review of the phenomenology of reflectance and emission spectroscopy, and a discussion of hyperspectral sensors and data types. The main emphasis will be on providing background on the processing approaches that can be applied to hyperspectral data. This review of processing approaches will include a discussion of pre-processing and atmospheric correction approaches. In terms of data analysis, methods that will be described include endmember determination approaches, spectral mixture analysis, spectral matching approaches, and covariance-based processors. In addressing the topic of hyperspectral data processing, a key factor is its basis in reflectance spectrometry. This basis will be discussed in the context of why some materials are more amenable to mapping than others. Commercially available data processing packages that are available for processing hyperspectral and multispectral data will be discussed as well as a discussion of the processing approaches within those packages. Certain processing techniques are better suited to certain applications and the reasons for this are addressed.

I will provide a package of materials to the students that will include hard copies of the material presented and an extensive list of references on the topics addressed. An in-class exercise will be given if time allows.

Topics to be addressed

I. Define Imaging Spectrometry (hyperspectral remote sensing)
II. Background of Reflectance and Emission Spectroscopy
III. Atmospheric Correction Approaches
IV. Endmember Determination Approaches

V. Dealing with the Mixed Pixel Problem
VI. Spectral Matching Approaches
VII. Covariance-based Processing Approaches
VIII. Commercially Available Hyperspectral Imaging (HSI) Software Packages
IX. HSI Processing Techniques and Approaches Available within those Packages
X. Descriptions of Available and Soon-to-be available Hyperspectral Systems
XI. Summary and Final Discussion

Who Should Participate

This half day workshop is intended for users of remote sensing data. This includes analysts who may have used multispectral data or some other form of remote sensing data and are now interested in using hyperspectral data in their work. This workshop is also appropriate for managers who must make decisions about what kind of remote sensing data to purchase for their projects and/or what kind of multi- or hyperspectral image processing software that they should purchase. This workshop will provide an introduction to the power of hyperspectral data in remote sensing projects.

Continuing Education Credits (CEU's)

ASPRS is pleased to announce that Continuing Education Units (CEUs) are awarded for the ASPRS workshops. This program is being offered in conjunction with George Mason University.

The Continuing Education Unit (CEU) is a nationally recognized unit of measurement for participation in non-credit continuing education programs.

Adults who successfully complete George Mason University's approved programs will be awarded continuing education units. A permanent record of CEUs awarded will be maintained in the university database and will be easily accessible for certification and verification purposes.

The objective of the CEU is to:

- Provide a nationally established record of professional development learning activity
- Encourage adult students to utilize educational resources to meet their personal and educational needs
- Recognize individuals who continue their education and keep themselves current in their chosen professions
- Enable individuals to have an accurate source of their current CEU activity
- Provide a system to document continuing education experiences in meeting certification requirements.

George Mason University, Office of Continuing Professional Education is registered with the National Association of State Boards of Accountancy (NASBA), as a sponsor of continuing professional education on the National Registry of CPE Sponsors. State boards of accountancy have final authority on the acceptance of individual courses for CPE credit.

NATIONAL REGISTRY OF CPE SPONSORS

WS 5
Advanced Thematic Accuracy Assessment

Russell G. Congalton, *University of New Hampshire*
Kass Green, *Kass Green and Associates*
7:45 A.M. to 12:15 P.M., CEU 0.4

Registration Fee: $85 Student*, $165 Member, $265 Non-member

ADVANCED WORKSHOP

This workshop is for those that have already performed one or more thematic accuracy assessments and/or have taken the Introductory Workshop on Assessing the Accuracy of GIS Information Created from Remotely Sensed Data. This workshop focuses on going beyond the basic principles and practices of thematic accuracy assessment. The workshop will begin with a brief review and then quickly switch focus to a discussion of the issues related to sample design considerations including sample unit, sample size, and sampling scheme and reference data collection issues. Analysis of the error matrix will be demonstrated by use of the software to compute both Margfit and Kappa. Each participant will leave with a copy of this software. Finally, development and use of the fuzzy error matrix will be presented and discussed. Example case studies will be used to demonstrate the appropriate considerations and issues throughout the workshop. Each participant should come prepared with questions and issues from their own work to share with the group and explore together.

I. Introduction
II. A Review of the Basics
  A. Positional accuracy
  B. Thematic accuracy
    1. the error matrix
III. Advanced Sample Design Considerations
  A. Common issues
  B. Creative solutions
  C. Must document
IV. Issues in Reference Data Collection
  A. Trade-offs with sources
  B. Collection methods
  C. Efficiencies
  D. Objectivity and bias
V. Demonstrating Analysis Techniques
  A. Kappa
  B. Margfit
VI. Fuzzy Accuracy Assessment
  A. Motivation
  B. Methodology
VI. Conclusions

Workshops

WS 6
Analysis and Application of Polarimetric Synthetic Aperture Radar (SAR) Data

Yong Wang, *East Carolina University*
7:45 A.M. to 12:15 P.M., CEU 0.4

Registration Fee: $85 Student*, $165 Member, $265 Non-member

INTERMEDIATE WORKSHOP

Since the successful launch of SeaSat SAR of USA into space in 1978, a new era of acquiring and analyzing spaceborne imaging SAR data began. Then there were/are other successfully launched spaceborne USA and non-US SARs that have collected data globally. Today, there are many successful studies in which SAR data are used as the primary data sources. The studies include the global/national landuse and land cover, national land survey, agriculture, forestry, fishery, resource exploitation, environmental protection and monitoring, disaster prevention and mitigation, and national security. Therefore, the objectives of the workshop are:

I. To Introduce Active Microwave Remote Sensing – Why SAR, and What are the Characteristics of SAR Imagery,
II. To Study Polarimetry – In-depth Discussion on Superposition of Radar Waves, Linear, Circular, Elliptic Polarizations, and Polarimetric Radar and Analysis of Polarimetric Data,
III. To Decompose Polarimetric SAR Data – an Alternative to Study and use Radar Datasets from the Point of View of the Scattering Properties of Targets, and
IV. To Showcase the Analysis and Application of Pola - rimetric SAR Data using Software Publically Available and Downloadable.

This is a shortened and revised version of a previously developed workshop given at the ASPRS 2010 meeting in San Diego, California with a focus on the analysis and application of polarimetric SAR data. Also, since the San Diego workshop, revision and updating to the workshop materials have been made to address the issues raised by the attendees. Recent research activities related to the analysis of NASA/JPL/UAVSAR polarimetric data will be added through the demonstration using public domain software. Finally, public-domain free SAR data analysis software (s/w) will be provided to the attendees and demonstration to use the s/w will be given.

WS 7
Advanced Hyperspectral Sensing of the Terrestrial Environment

Prasad Thenkabail, *U.S. Geological Survey*
Dean Riley, *Aerospace Corporation*
John Lyon, *U.S. Environmental Protection Agency*
12:15 P.M. to 5:15 P.M., 0.4 CEU
Registration Fee: $85 Student*, $165 Member, $265 Non-member

ADVANCED WORKSHOP

Hyperspectral sensing has created a wealth of opportunity to understand our changing world. It is now incumbent to focus on applications and best methods to derive true productivity. The instructors will share their deep knowledge on important economic themes of the terrestrial environment domestically and internationally. The issues of vegetation, croplands, geological and mineral exploration, and coastal/wetland applications hold great import in our growing and increasingly commodity driven world. These applications derive needed information and power decision-making through current paradigms of sustainability, Food and Water Security, nation building through resource management, coastal and marine spatial planning, and so forth. Attendees should have some knowledge and bring their own applications questions for attention during and at the end of the Workshop.

I. Overview of Advanced Hyperspectral Remote Sensing
II. Hyperspectral Sensing of Vegetation and Croplands
III. Hyperspectral Sensing of Geology and Mineral Deposits
IV. Hyperspectral Sensing of Wetlands and Coastal Regions
V. The Big Picture: Driving Decision-making for Societal Benefit
VI. Applications-driven Question and Answer Period

WS 8

Object Oriented Image Classification: From Feature Extraction to Land Cover Mapping

Kass Green, *Kass Green and Associates*
Russell G. Congalton, *University of New Hampshire*
12:15 P.M. to 5:15 P.M., .4 CEU

Registration Fee: $85 Student*, $165 Member, $265 Non-member

INTRODUCTORY WORKSHOP

This workshop introduces attendees to object oriented image classification. Unlike per pixel classifiers which rely only on the spectral characteristics of a feature, object oriented classifiers are capable of utilizing all feature characteristics including color, tone, texture, shape, height, and context. While powerful in the classification of moderate resolution data (e.g. Landsat), object oriented classification is pivotal for using high resolution (e.g. NAIP and commercial satellite imagery), because of the imagery's mixture of shadow and illuminated features, and the need to group pixels together to map land use land classes (e.g. a suburb or a forest) instead of individual features such as single trees. With the recent explosion in availability of high resolution imagery, knowledge of object oriented image classification is critical to map users and producers alike.

Topics covered by the course include:

I. A Brief Summary of the Basic Concepts of Image Classification – Common Constructs of Photo Interpretation, Per Pixel Classification and Object Oriented Classification
II. Objects Verses Per Pixel Classification – When to use What
III. Principles of Object (segment) Creation – What's Inside the Black Box
IV. Approaches to Labeling Objects Including Hierarchical, Expert Rule, and Classification and Regression Tree (CART) Methods
V. Special Considerations for the Accuracy Assessment of Maps Created from Object Oriented Classifications
VI. Overview and Comparison of Object Oriented COTS Software and Tools

Real life case studies will be interspersed throughout the workshop and will include using object oriented classification to map

I. General Land Cover and Land Use for Urban Water Run-Off Management
II. Detailed Vegetation Associations of Grand Canyon National Park, and
III. Benthic Habitat and Propeller Scars in the Gulf of Mexico.

Workshop participants currently using object oriented classification are encouraged to discuss their projects and be prepared for a lively discussion on the pros and cons of different approaches.

WS 9

Thermal Remote Sensing

Charles E. Olson, Jr., Professor Emeritus, *University of Michigan*
12:15 P.M. to 5:15 P.M., .4 CEU

Registration Fee: $85 Student*, $165 Member, $265 Non-member

INTRODUCTORY WORKSHOP

An examination of factors affecting thermal signals upwelling from terrain features. Effects of these factors on applications of thermal data in agriculture, forestry, geology, water/wetland management, and wildlife management.

Who should attend:
Anyone involved in or considering use of thermal sensors for crop, forest or land-use monitoring, geo-botanical prospecting and/or modeling of thermal energy upwelling from terrestrial features.

Topical Outline

I. The Energy Flow Profile for Thermal Remote Wensors
   A. Energy sources
      1. target as source
      2. role of solar energy
   B. Emissivity and Exitance
   C. Atmospheric transmission effects
   D. Sensor response (spectral bands)
      1. detectors and spectral bands
      2. Instantaneous-Field-of-View (IFOV)
         a. spatial resolution vs. thermal sensitivity
         b. mixed-pixel responses
   E. Multi-spectral thermal data
II. Emittance of Terrain Materials by Day and at Night
   A. Plants
   B. Soil and rocks
   C. Water
   D. Man-made materials
III. Applications
   A. Agriculture
   B. Forestry
   C. Geology
   D. Wildlife management
   E. Water/wetland management
IV. Considerations in Data Acquisition
   A. Thermal data in multi-spectral systems
   B. Flight planning