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The newest scientific and commercial imaging spectro-radiometers collect high signal-to-noise ratio data with simultaneously high spectral and spatial resolution. The design of these systems and the availability of information-rich data pose unique challenges to system designers and data analysts. These challenges include optomechanical sensor designs, system trade-offs, calibration, atmospheric correction, onboard processing, compression, data exploitation, and information extraction. Equally important is the understanding of hyperspectral phenomenology and its translation into useful exploitation tools for the spectral community. The collection of twelve papers in this special section highlights some of the state-of-the-art advancements within imaging spectrometry design, modeling, algorithms, and applications.

Four papers describe advances in the development of novel instruments. Zhang et al. examine a novel snapshot Fourier transform imaging spectrometer that uses a rapid image registration approach that can be parallelized for speed. Wang et al. present a unique snapshot visible-to-near infrared hyperspectral imaging system with fiber-optic bundle that maps two-dimensional spatial information into single linear dimension for dispersion onto a conventional area detector array. Maione et al. describe a unique narrowband snapshot imaging spectrometer using polarization grating-based spatial heterodyning of a Savart plate interferometer. Hallada et al. provide computational modeling and an experimental demonstration of a Fresnel zone light field spectrometer that incorporates an axial dispersion binary diffraction optic with a light field detector.

Modeling instrument performance is the topic of two papers. Silny and Zellinger examine radiometric sensitivity metrics of spectral remote sensing systems based on a contrast measure that distinguish the total at-aperture signal from the useful portion of signal emanating from the target itself, thereby providing a more accurate measure of utility within an operational environment. In another paper, Silny proposes best practices for modeling the resolution of dispersive imaging spectrometers, including the use of standardized terminology and a physical optics resolution model that accounts for the effects of slit diffraction and partial coherence.

Four papers discuss spectral algorithms and processing. Pieper et al. address the challenges of temperature-emissivity separation in longwave hyperspectral data sets and the performance limitations of commonly implemented techniques. Ziemann and Theiler examine a modification of the popular target detection algorithm known as the subspace adaptive coherence/cosine estimator (ACE). The conventional ACE assumes an unconstrained subspace that is physically unrealistic, so the authors modified the algorithm with constraints to create a simplex for target and background that can improve detection performance. Rauss and Rosario develop a novel deep learning technique based upon belief networks for material classification using longwave infrared hyperspectral data collected over several months that includes variations from diurnal and seasonal cycles. Martin and Gross discuss a technique for estimating the index of refraction of remotely sensed materials using polarimetric longwave infrared hyperspectral data, with the advantage that these estimated parameters are invariant to geometry.

Last but not least, the application of imaging spectrometry is the topic of two papers. Bai et al. examine a unique application of hyperspectral imaging to the analysis of artwork and cultural artifacts. Data is collected of the 15th century Gough Map of Britain to analyze alterations and characteristics of the artifact not recognizable by the human eye or conventional color imagery. Chen et al. apply hyperspectral imaging to geological prospecting using a custom setup that analyzes drill core samples with commercially available visible-to-near infrared and shortwave infrared slit-based imaging spectrometers.

We hope that this special section provides readers with highlights of the recent developments within the broad field of imaging spectrometry. We would also like to take this opportunity to thank the contributing authors and the staff of *Optical Engineering* in helping compile this special section.

John Silny is a senior principle systems engineer at Raytheon Space and Airborne Systems and the chief architect for Space Systems. He holds a B.S. in engineering from Harvey Mudd College, a BA in economics from Claremont McKenna College, an MS in electrical engineering from the University of Southern California, and a MSE in systems engineering from Johns Hopkins University. He has supported the full life cycle for multiple successful EO/IR remote sensing systems. His professional interests include developing cost-effective systems to solve challenging customer problems.

Emmett Ientilucci is an assistant professor in the Center for Imaging, Digital Image and Remote Sensing (DIRS) group at the Rochester Institute of Technology, Rochester, New York. He has degrees in optics and imaging science. Prior to his faculty position, he was a postdoctoral research fellow for the intelligence community. His research interests include radiometry, calibration, hyperspectral imaging, target detection, and the application of physics-based modeling and algorithms to LiDAR and optical remote sensing data. He has over 60 publications, served as referee on 13 scientific journals, been program reviewer for both NASA and the Department of Defense, and is chair of the Western NY Chapter of the IEEE GRSS as well as for the GRSS STRATUS UAS Workshop.

Joseph Meola received BS and MS degrees in electrical engineering from the University of Dayton, Dayton, Ohio, in 2004 and 2006, respectively. He received a PhD degree in electrical and computer engineering from Ohio State University in 2011. He is currently the hyperspectral program lead for the Electro-optic Target Detection and Surveillance Branch of the Sensors Directorate of the Air Force Research Laboratory (AFRL), Wright-Patterson Air Force Base, Ohio. His research interests are in hyperspectral data modeling, sensor calibration and characterization, data exploitation, atmospheric modeling, and target detection.

Thomas Chrien is a mission and systems engineer at Millennium Space Systems. He is a technical generalist working to apply advanced electro-optical systems to solve real-world problems. His educational background includes a bachelor's and master's degree in optical engineering from the University of Rochester, and later in his career, he earned a master's of business administration from Pepperdine University, and a master's of policy analysis from the RAND Graduate School of Policy Studies. Most recently, he has developed low-cost EO sensor systems hosted on small satellites to address critical needs.