

Foreword

WE ARE honored to present this Special Issue to the community as a tribute to Prof. David A. Landgrebe. As his former students and/or colleagues, we have all been inspired and influenced by his insightful vision and pioneering work in the fundamentals of multispectral image processing and analysis. More than a year ago, we teamed together to plan this Special Issue as a recognition of Dr. Landgrebe's lifelong contributions and impacts. We are pleased that this Special Issue is completed and available to our readers.

This Special Issue has a collection of 11 papers. They are grouped into three categories: historical and future developments, methodological advancements, and survey and review.

Starting with Goward et al. (this Special Issue; the same hereinafter), the authors recall Landgrebe's profound contribution that eventually led to the ongoing U.S. Landsat program for over 50 years. Together with the authors, we regard this work as an excellent historical document and inspirational reading for current and future professionals. The work from Zhang et al. is forward looking in examining the status of next-generation remote sensing, with a focus on intelligent satellite platforms, imaging payloads, onboard processing systems, and networking among satellites. Impacts and concerns of these developments are also addressed.

Tao et al. address the classical subject of multispectral/hyperspectral image unmixing for which Landgrebe laid down the basis from a signal processing point of view. The authors exploit the feature extraction capability of recent convolution neural networks and develop a cross-convolution unmixing network (CrossCUN) for hyperspectral unmixing. Sebastianelli et al. apply residuals convolutional neural networks to filter speckle noise in synthetic aperture radar (SAR) images. The experiments on both simulated speckled images and an actual SAR dataset show superior performance in terms of several quality metrics. Hu et al. address a challenge for populating the wide usage of optical images and their combination with other data. The authors report a light-weighted cloud detection network with demonstrated satisfactory performance in images from several satellite platforms. Inspired by Landgrebe's signal processing approach, Fu et al. address their topic at the object level rather than signal level, though the latter forms the basis of this work. Utilizing multiscale aggregation, they present an end-to-end deep learning framework for object search in remote sensing images based on multilayer features. Arguing that the largely ignored metadata contained in publications can possibly be used to estimate the performance of classifiers, Zhao et al. investigate to what degree hyperspectral images can be classified by using only metadata. Different linear and nonlinear prediction methods are trained and

tested by using the metadata of 100 publications. Fisher et al. address the modeling of the imaging process for unmanned aerial systems. In particular, the paper discusses the calibration and retrieval of the signatures of the bidirectional reflectance distribution function for soybeans through a newly available multispectral sensor. Zhang et al. use multisensor multispectral images to map rapeseed and explore their relation to its phenological periods over several years. It is found that effective color transfer is an essential prerequisite for this task, while the overall best mapping results can be achieved through a 2D-CNN classifier.

Ahmad et al. provide a comprehensive survey on hyperspectral image classification, including both traditional methods and recent deep-learning-based models. It is a valuable resource that spans from Prof. Landgrebe's early work on feature extraction to more recent learning based developments. Xu et al. present an extensive review on hyperspectral anomaly detection based on machine learning. Both traditional machine learning and deep-learning-based methods are implemented to demonstrate their performance and properties.

At the conclusion of this Special Issue, we are thankful to all of the contributing authors that shared their most recent work with the community. In particular, we are very grateful for the reviewers that have spent their valuable time and effort to help improve the submissions. Without all of these efforts, this collection would not have been possible as a dedicated memory to Dr. Landgrebe.

JÓN ATLI BENEDIKTSSON
Faculty of Electrical and Computer
Engineering
University of Iceland
IS-107 Reykjavik, Iceland
(e-mail: benedikt@hi.is)

MELBA CRAWFORD
College of Engineering
Purdue University
West Lafayette, IN 47907-2045 USA
(e-mail: mcrawford@purdue.edu)

JOHN KERESKES
Chester F. Carlson Center for Imaging Science
Rochester Institute of Technology
Rochester, NY 14623 USA
(e-mail: kerekjes@cis.rit.edu)

JIE SHAN
School of Civil Engineering
Purdue University
West Lafayette, IN 47907 USA
(e-mail: jshan@purdue.edu)



Jón Atli Benediktsson (Fellow, IEEE) received the Ph.D. degree in electrical engineering from Purdue University, West Lafayette, IN, USA, in 1990.

He is currently the Rector of the University of Iceland, Reykjavik, Iceland, where he is also a Professor with the Faculty of Electrical and Computer Engineering. His research interests include remote sensing, image analysis, signal processing, and biomedical engineering.

Dr. Benediktsson was the Editor-in-Chief of IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING from 2003 to 2008, and the President of the IEEE Geoscience and Remote Sensing Society from 2011 to 2012.



Melba Crawford (Fellow, IEEE) received the Ph.D. degree in systems engineering from The Ohio State University, Columbus, OH, USA, in 1981.

She is currently the Nancy Uridil and Francis Bossu Professor of Civil Engineering with Purdue University, West Lafayette, IN, USA, where she is also a Professor with the School of Electrical and Computer Engineering and the Department of Agronomy. Her research interests include the development of machine learning-based algorithms for classification and prediction, and applications of these methods to hyperspectral and LIDAR remotely sensed data.

Prof. Crawford was the recipient of the GRSS Outstanding Service Award in 2020 and the IEEE GRSS David Landgrebe Research Award in 2021.



John Kerekes (Senior Member, IEEE) received the B.S., M.S., and Ph.D. degrees in electrical engineering from Purdue University, West Lafayette, IN, USA, in 1983, 1986, and 1989, respectively.

He is currently a Research Professor with the Chester F. Carlson Center for Imaging Science, Rochester Institute of Technology, Rochester, NY, USA. His research interests include the modeling and analysis of remote sensing system performance in pattern recognition and geophysical parameter retrieval applications.

Dr. Kerekes was the founding Chair of the Boston Section Chapter (1995–2004) and the Western New York Chapter (2007–2010) of the IEEE Geoscience and Remote Sensing Society (GRSS). From 2010 to 2015, he was on the GRSS Administrative Committee. Since 2017, he has been the GRSS Chief Financial Officer.



Jie Shan (Senior Member, IEEE) received the Ph.D. degree in photogrammetry and remote sensing from Wuhan University, Wuhan, China, in 1989.

He is currently a Professor with the School of Civil Engineering and the Department of Earth, Atmospheric and Planetary Sciences, Purdue University, West Lafayette, IN, USA. His research interests include sensor geometry and positioning, object extraction and reconstruction from images and point clouds, urban remote sensing, and geospatial data mining.

Dr. Shan was the recipient of multiple best paper awards and Elected Fellow of the American Society for Photogrammetry and Remote Sensing. He is on the editorial boards of several remote sensing journals.