Foreword
Remote Sensing Data Fusion

Recent development in geospatial technology has greatly enhanced the data acquisition capabilities for photogrammetry and remote sensing. Tremendous amounts of geospatial data are collected from a variety of sensors, including conventional visible and near infrared imaging, multispectral and hyperspectral imaging, laser ranging, and synthetic aperture radar. Besides such imagery data, there exists also a large amount of other geospatial data, such as surveying, GPS, topographic, hydrologic, environmental, atmospheric, and ecologic data. The value-added exploitation of such geospatial data challenges us to develop innovative methods that will ultimately lead to more effective information extraction and decision making. Data fusion techniques, which jointly use data of different forms from a variety of sources, are meant for this purpose.

A collection of eight papers in this special issue address the recent advances in remote sensing data fusion in a rather broad spectrum. The data collection platforms involve unmanned aerial vehicles (UAV, Du et al.), conventional aircrafts (Di et al.; Lee et al.; Youn et al.), and satellites (Alparone et al.; Chastain et al.; Cakir and Khorram; Watanachaturaporn et al.). The study data include visible images, multispectral images, hyperspectral images, laser ranging measurements, as well as digital elevation models and other thematic maps. In terms of the fusion techniques, the collection addresses pixel-based image fusion (Alparone et al.; Cakir and Khorram), feature-based image fusion (Lee et al.; Youn et al.), and decision-based fusion (Chastain et al.; Di et al.; Watanachaturaporn et al.). Moreover, the applications covered in this collection are also diverse, including precise image registration, building and road extractions, image enhancement, anomaly detection, and vegetation mapping.

A brief summary of the collected papers is presented below. Du et al. address multiple band registration within one frame and frame-to-frame mosaicking. This classical photogrammetric subject reemerges to be significant when light and low altitude flight and off-the-shelf cameras become popular in a variety of civilian and defense applications. Cakir and Khorram introduce the correspondence analysis approach to image fusion where the last component is replaced as opposed to the first one in the principal component analysis. Evaluation is conducted by comparing the statistical properties of the fused images with those of the reference image. Alparone et al. introduce a quality index to measure the similarity between two images, which should be kept unchanged after fusion operation to minimize the spectral and spatial distortions. In the work of Di et al., the high dimensionality issue in hyperspectral images is approached via band selection based on the covariance matrix, while the outcomes from individual band subsets are combined by fuzzy integral fusion. Lee et al. first detect buildings from lidar data and then refine them with the segmentation results from color images. The final precise and reliable buildings are determined using line segments matching and perceptual grouping. Youn et al. utilize images and lidar data for urban road extraction in two sequential steps. The first step uses lidar intensity and true ortho images generated from a lidar surface model to find non-road areas, while the candidate road pixels are selected based on a free passage measure in the second step. Watanachaturaporn et al. apply the support vector machines approach to the classification of multispectral images and auxiliary data such as digital elevation model, geophysical and geological data to acquire accurate land cover and land use maps. The performance is demonstrated by comparing the results with the outcomes from a decision tree classifier, and back propagation and radial basis function neural network classifiers. Chastain et al. report a case study for vegetation map production by fusing remote sensing and topographic data into independent mathematical functions via a discriminant analysis classification approach.

A lot of people have contributed to this special issue. As editors, we highly appreciate that the authors shared their most recent accomplishments with this special issue. Although the responses to this special issue were unprecedentedly overwhelming, each submission was reviewed by at least two experts in the topic area. We are very much indebted to as many as 60 reviewers (see below) who have carefully, critically and constructively reviewed the manuscripts. Finally, we would also like to thank the *PE&RS* editor-in-chief, communications director, and technical editor for approving the special issue topic, providing timely consulting on *PE&RS* policies and necessary help in achieving an effective printing process. Without the collective efforts of all of the above individuals, this special issue would not have been possible to present to the readers.

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