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Editorial

Foreword to the theme issue on geospatial computer vision

Geospatial Computer Vision has become one of the most prevalent emerging fields of investigation in Earth Observation in the last few years. In this theme issue, we aim at showcasing a number of works at the interface between remote sensing, photogrammetry, image processing, computer vision and machine learning. In light of recent sensor developments - both from the ground as from above - an unprecedented (and ever growing) quantity of geospatial data is available for tackling challenging and urgent tasks such as environmental monitoring (deforestation, carbon sequestration, climate change mitigation), disaster management, autonomous driving or the monitoring of conflicts. The new bottleneck for serving these applications is the extraction of relevant information from such large amounts of multimodal data. This includes sources, stemming from multiple sensors, that exhibit distinct physical nature of heterogeneous quality, spatial, spectral and temporal resolutions. They are as diverse as multi-/hyperspectral satellite sensors, color cameras on drones, laser scanning devices, existing open land-cover geodatabases and social media. Such core data processing is mandatory so as to generate semantic land-cover maps, accurate detection and trajectories of objects of interest, as well as by-products of superior added-value: georeferenced data, images with enhanced geometric and radiometric qualities, or Digital Surface and Elevation Models.

This theme issue presents a collection of ten papers lying on this interface between disciplines. Topics of terrain modeling of lunar environments (Wu et al., 2018), very high resolution image classification (Audebert et al., 2018), fallen tree detection (Polewski et al., 2018) post disaster intervention (Vetrivel et al., 2018), tracking (Menze et al., 2018; Zhang et al., 2018) and localization (Qu et al., 2018) show the diversity of tasks that can benefit from integrated approaches from remote sensing and computer vision. Also, the variety of sensors employed in the papers showed that the community is very versatile, moving across sensors as diverse as very high resolution optical (Audebert et al., 2018; Vetrivel et al., 2018; Silva et al., 2018), lidar (Polewski et al., 2018), SAR (Hänsch and Hellwich, 2018), ground based images (Vetrivel et al., 2018) or video sequences (Qu et al., 2018; Menze et al., 2018; Zhang et al., 2018), as well as their combinations.

The proposed methods also show a large diversity going from acceleration of ideas expanding the state-of-art, for example via GPU processing (Silva et al., 2018) for core image processing, 3D scene reconstruction (Wu et al., 2018) localization (Qu et al., 2018) to energy minimization techniques (Polewski et al., 2018), holistic scene understanding (Menze et al., 2018) and convolutional neural networks (CNN) (Audebert et al., 2018). Fusion of CNNs with traditional methods (Zhang et al., 2018; Vetrivel et al., 2018) also has a prominent place and is currently a ground swell in many communities.

This collection of papers confirms recent trends we have observed in the photogrammetry and remote sensing communities: the preponderant transition towards a large use and integration of convolutional neural networks into image processing pipelines (Zhu et al., 2017) and the importance to work in a multimodal setting (Gómez-Chova et al., 2015; Audebert et al., 2018), especially including ground-based images providing information from the ground that is invisible on the aerial view of the object (Lefèvre et al., 2017). We hope that this theme issue will encourage even more this transition, where computer vision and remote sensing scientists join forces to tackle real Earth problems involving large heterogeneous data and therefore requiring methodological innovation pushing the boundaries of the field. We advocate for the joint processing of sensors of complementary nature coupled with an efficient exploitation of existing human knowledge (citizen science and current open geodatabases). The fundamental issue of uncertainty management and propagation starts to be addressed (Qu et al., 2018), and deserves more attention in the forthcoming years.

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