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Preface to the special issue "Open Science for earth remote sensing: latest developments in software and data"

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Open source (OS) has gone a long way since it started evolving as an alternative solution that uses community-based development backed by research institutions and companies. Today numerous OS software for processing geospatial data are available and widely used. The "open" paradigm has spread also to standards and data, which are now often available as open data (OD) [1]. Another characteristic of OS is a pervasive community that provides tremendous support to research, development and to everyday work of end-users by pushing the evolution of OS tools [2] and providing feedback via mailing lists and forums. The corresponding advantages in the science of Earth Observation (EO) [3] has motivated this special issue (SI), "Open Science for Earth Remote Sensing: latest developments in software and data".[1] In this SI, the reader will find descriptions of dedicated OS software and cutting-edge practical examples of solutions to problems related to EO. Contributions describe software and report investigations on methods related to remote sensing classification, photogrammetry, laser scanning processing and change detection. In the following sections, we report a brief summary of the contents.

Contributions [4, 5], relate an investigation on digital image analysis using principal component analysis (PCA) based on singular value decomposition (SVD) for detection of burned areas. The first part is theoretical, the second part is a practical application of the method using imagery from MODIS sensor satellite data and OS tools, i.e. GRASS GIS, QGIS, and R. Authors provide proof that uncentered and unscaled SVD may improve the spectral separability of burned areas in some of the higher order components.

Remote sensing data are growing exponentially in variety, volume and velocity, due to more satellites being sent into orbit and more sophisticated sensors that provide higher resolution [6]. Close range sensing from remotely piloted aircraft systems (RPAS) commonly deliver high volumes of data by providing very-high resolution imagery. It is nowadays common to have very large datasets in photogrammetry; authors in [7] present algorithms that can improve the workflow, and they discuss bottlenecks and solutions to reduce computational time. In paper [8] authors use data from RPAS to compare accuracy of machine learning algorithms for classification. They also discuss the impact of data size on training and classification steps. Laser scanning is also becoming a common data-rich source. It provides information on both horizontal and vertical domain. In particular it allows profiling high vegetation thanks to multiple reflections [9]. It also delivers high volumes of data in the form of point clouds [10]. Authors in [11] take fullest advantage of this technology and report their application to an ecological landscape indicator, the fragmentation index, which they extend to the 3D realm using airborne laser scanning data. Change detection is one of the fundamental applications of RS and authors in [12] provide an investigation on using a specific procedure to monitor change related to desertification. The authors' semi-automatic method provides amelioration with respect to unsupervised approaches.

Three software articles in this SI provide an overview and insights in specific software. *Orfeo-Toolbox*, a popular tool dedicated to digital image analysis, is thoroughly described in [13]. *OpenDragon* is a remote sensing educational platform with an integrated programming toolkit; the article by the developers in [14] provides insights on its applications for teaching. Photogrammetric methods allow the creation of 3D models from imagery; aspects of the structure from motion and image dense matching problems are implemented in *MicMac* and discussed in [15].

By no means has this SI pretended to be a complete overview of the numerous OS software and solutions that are available nowadays; this SI, in line with the

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objectives of the journal of Open Geospatial Data, Software and Standards, wants to stimulate to give recognition to the many ways OS has and keeps contributing to geospatial data analysis [16]. It is the editors' motivation to increase support and visibility of research, development and, in general, efforts towards motivating the scientific community to benefit the most from open solutions.

Endnote

[1]https://link.springer.com/journal/40965/topicalCollection/AC_2e95924270638072d6d5f03b92fd6deb

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