remote sensing

Editorial

Editorial for Special Issue "Remote Sensing in Applications of Geoinformation"

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1. Introduction

The diffusion of knowledge and information is currently more forceful than ever. Indeed, we are witnessing the enormous transformative power of the knowledge revolution that our societies, industries and economies are subject to. One of the drivers in the current knowledge-based society is remote sensing which is commonly defined as the acquisition of information about an object without making physical contact with it. In a more restricted sense, remote sensing refers to the science and technology of acquiring information about the Earth's surface. Remote sensing delivers a wealth of information which would otherwise be inconceivable. Geoinformatics is defined as the scientific discipline for the acquisition, storage, analysis and presentation of geospatial information.

Geoinformation is a field that greatly benefits from the technological advances in remote sensing. The numerous advantages of using remote sensing in geoinformation are demonstrated by the large number of application-oriented endeavors already undertaken. Depending on the need (i.e., scientific, societal, mapping, planning, hazard mitigation, etc.), emphasis may be placed on different facets of geoinformation.

This Special Issue of Remote Sensing comprises a contribution to the multi-faceted range of applications of remote sensing in geoinformation. It hosts eight papers focusing on a broad range of scientific contributions underscoring this synergetic approach to remote sensing and geoinformation. These papers were selected from the presentations at the "7th International Conference on Remote Sensing and Geoinformation of the Environment (RSCy2019)" held in Paphos, Cyprus, from 18 to 21 March 2019.

The next section summarizes the individual articles hosted in this Special Issue entitled "Remote Sensing in Applications of Geoinformation". The articles are presented in alphabetical order based on the first author's name.

2. Overview of Contributions

The study by Alonso and Renard [1] proposes modeling air temperatures, measured during four mobile campaigns carried out during the summer months, between 2016 and 2019, in Lyon (France), in clear-sky weather. The study proposes the usage of regression models based on 33 explanatory variables from traditionally used data, namely, from remote sensing by LiDAR (light detection and ranging) or Landsat 8 satellite acquisition. Three types of statistical regressions were explored: partial least square regression, multiple linear regression and random forest regression. The authors have shown that variables such as surface temperature, normalized difference vegetation index and modified normalized difference water index have a strong impact on the estimation model. This study contributes to the emergence of urban cooling systems.

The aim of the study by Barbierato et al. [2] is to create a general-purpose set of ecological metrics by combining remote sensing and proximate sensing (Street View) approaches with data retrieved from Google Street View, to quantify urban forest ecosystem services and provide a widely transferable methodology. In this respect, remote sensing metrics were calculated by combining high-resolution multispectral images and LiDAR data to produce indices at different altitudes with respect to the ground. The ecological metrics from proximate sensing were then calculated by semantic segmentation using pretrained deep segmentation neural networks. To estimate the validity of this approach, a set of ecological metrics was used to classify contiguous homogeneous areas of a city through a spatial clustering algorithm.

Dimopoulos and Bakas [3] investigate how complex machine learning models work, regarding real estate price predictions, and present the various models and the corresponding results. They explain the analyzed dataset as well as its variables. The machine learning methods utilized for the target task are presented, as well as the generic algorithm to obtain the closed-form formula for the higher order regression model, via an automated, stepwise method. They also present the sensitivity analysis results of the predictors, regarding real estate prices; the influence of the dataset volume is also investigated, by a parametric study, for a variety of partitions of the given dataset. Important constraints have been identified, such as the transparency of models and the repeatability of the results.

Kokinou and Panagiotakis [4] present novel pattern recognition techniques applied to bathymetric data from two large areas in the Eastern Mediterranean. Their objectives are: (a) to demonstrate the efficiency of this methodology, (b) to highlight the quick and accurate detection of both hydrocarbon related tectonic lineaments and salt structures affecting seafloor morphology and (c) to reveal new structural data in areas poised for hydrocarbon exploration. In this work, they first apply a multiple filtering and sequential skeletonization scheme inspired by the hysteresis thresholding technique. Subsequently, they categorize each linear and curvilinear segment on the seafloor skeleton (medial axis) based on the strength of detection as well as the length, direction and spatial distribution. Finally, they compare the seafloor skeleton with ground truth data.

The study by Kordelas et al. [5] examines the applicability of a novel automatic local thresholding unsupervised methodology for separating inundated areas from non-inundated ones and proposes alternatives to the original approach to enhance accuracy and applicability for both Camargue (France) and Doñana (Spain) wetlands. Each examined alternative approach relies on a specific band or band combination, acknowledged as effective by the underlying physics, and a specific approach for estimating splitting thresholds. The different Sentinel-2 based inputs examined for estimating thresholds include: (a) Band 11 (SWIR-1); (b) product of Band 12 (SWIR-2) and Band 8A (NIR); and (c) product of SWIR-1 and NIR (near infra red). The different methods for estimating splitting thresholds include: (a) minimum entropy thresholding and (b) Otsu's algorithm. The results of the alternative approaches are compared against reference maps, provided for Doñana and Camargue by local research institutes, based on locally developed water detection models.

The mapping of soil nutrients is a key issue for numerous applications and research fields ranging from global change to environmental degradation and from sustainable soil management to the precision agriculture concept. The characterization, modeling and mapping of soil properties at diverse spatial and temporal scales are key factors required for different environments. The paper by Mohamed et al. [6] focuses on the use and comparison of soil chemical analyses, visible near infrared and shortwave infrared spectroscopy, partial least-squares regression, ordinary Kriging, and Landsat-8 operational land imager images, to inexpensively analyze and predict the content of different soil nutrients (nitrogen (N), phosphorus (P) and potassium (K)), pH and soil organic matter in arid conditions. To achieve this aim, 100 surface samples of soil were gathered to a depth of 25 cm in the Wadi El-Garawla area (northwest coast of Egypt) and chemical analyses and reflectance spectroscopy in the wavelength range from 350 to 2500 nm was utilized.

Solar maps are becoming a popular resource and are available via the web to help plan investments for the benefits of renewable energy. These maps are especially useful when the results have high accuracy. LiDAR technology currently offers high-resolution data sources that are very suitable for obtaining an urban 3D geometry with high precision. Three dimensional visualization also offers a more accurate and intuitive perspective of reality than 2D maps. The paper by Prieto et al. [7] presents a new method for the calculation and visualization of the solar potential of building roofs in an urban 3D model, based on LiDAR data. The paper describes the proposed methodology to (a) calculate the solar potential, (b) generate an urban 3D model, (c) semanticize the urban 3D model with different existing and calculated data and (d) visualize the urban 3D model in a 3D web environment. The paper presents the workflow and results of application to the city of Vitoria-Gasteiz in Spain.

Themistocleous et al. [8] conducted a study to determine if plastic targets on the sea surface can be detected using remote sensing techniques with Sentinel-2 data. A target made up of plastic water bottles with a surface measuring 3 m $\times$ 10 m was created and was subsequently placed in the sea near the Old Port in Limassol, Cyprus. An unmanned aerial vehicle (UAV) was used to acquire multispectral aerial images of the area of interest during the same time as the Sentinel-2 satellite overpass. Spectral signatures of the water and the plastic litter after it was placed in the water were taken with a Spectra Vista Corporation HR1024 spectroradiometer. The study found that the plastic litter target was easiest to detect in the NIR wavelengths. Seven established indices for satellite image processing were examined to determine whether they can identify plastic litter in the water. Further, the authors examined two new indices, the plastics index and the reversed normalized difference vegetation index to be used in the processing of the satellite image. The proposed plastic index was able to identify plastic objects floating on the water surface and was the most effective index in identifying the plastic litter target in the sea.

3. Conclusions

The scientific contributions in this Special Issue aim at informing and updating the scientific communities involved in geoinformation and remote sensing on findings in important areas of remote sensing in applications of geoinformation. Remote sensing and geoinformation technologies have a pivotal role in innovation; they also offer solutions to major environmental issues and contribute to the modernization of many scientific developments, with a significant impact on the quality of life and the economy.

Remote sensing has long been proven to be a valuable tool in a wide range of disciplines for the study of the environment, such as, weather, monitoring of air pollution, the environmental control and management, mapping of geomorphological structures and the prevention and mitigation of natural disasters, etc. Remote sensing has also found fertile ground in the field of geoinformation, as is very aptly indicated by the examples in this volume.

On the one hand, the technological advances in remote sensing are proliferating at a fast pace. On the other hand, the evolving field of geoinformation is increasingly becoming a societal commodity. Fusion of remote sensing and geoinformatics opens new challenging routes for further investigations, research and experimentation. By presenting state-of-the-art data sources, technologies and methodologies, this Special Issue aspires to stimulate further research in the increasingly expanding field of applications of remote sensing in geoinformation.

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