



Comparing the Capability of Sentinel 2 and Landsat 8 Satellite Imagery in Land Use and Land Cover Mapping Using Pixel-based and Object-based Classification Methods

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Extended Abstract

Introduction: Having accurate and up-to-date information on the status of land use and land cover change is a key point to protecting natural resources, sustainable agriculture management and urban development. Preparing the land cover and land use maps with traditional methods is usually time and cost consuming. Nowadays satellite imagery provides the possibility to prepare these maps in less time and with greater accuracy. In order to prepare land use and land cover maps using satellite imagery, different classification methods are used. In a general division, these methods can be divided into two groups of pixel-based and object-based classification methods. Despite the fact that the Sentinel 2 satellite has recently been launched and its images have been freely available to users, there has not been enough research on the use of this satellite imagery in land use and land cover mapping. Therefore, in present research, we tried to investigate the capability of Sentinel 2 satellite imagery in land use and land cover mapping of Bastam basin in Lorestan province, using pixel-based and object-based classification methods and compare it with Landsat 8 satellite imagery.

Material and methods: In order to conduct this research, training samples were collected by field survey, using existing maps, creation of false color images and Google Earth software in six classes including garden, bare land, forest, agriculture, residential and river. The 90, 280, 680, 59, 180, 85 and 70 training samples were collected in the river, agriculture, forest, garden, residential, bare land and pasture classes, respectively. The 70% of collected samples were used as training samples and 30% of the rest were used as test samples. After performing the necessary preprocessing, images classified using the Maximum likelihood, Minimum distance,

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Mahalanobis distance algorithms of pixel-based method and the Nearest neighbor algorithm of object-based method. The object-based classification method consists of two main stages of segmentation and classification. In this research, Multi Resolution Segmentation algorithm was used for segmentation. Classification was done by the Nearest Neighbor method in eCognition software. Accuracy assessment of classification results was performed using test samples and overall accuracy, Kappa coefficient, user accuracy and producer accuracy indices.

Results: The overall accuracy and Kappa coefficient for Sentinel 2 satellite images were classified using Maximum likelihood, Mahalanobis distance and Minimum distance were calculated (85.2% and 0.77), (88.77% and 81.8) and (71.1% and 0.56) respectively. For Landsat 8 satellite images were classified using Maximum likelihood, Mahalanobis distance and Minimum distance the overall accuracy and kappa coefficient were observed (84.10% and 76%), (82.83% and 0.73) and (63.50% and 48.3%) respectively, which indicates a relatively higher potential Sentinel 2 image compared to Landsat 8 images in the pixel classification of land use and land cover. In addition, the results of the object-based classification by the Nearest neighbor method showed that the Sentinel 2 images with overall accuracy 89.70% and kappa coefficient 0.83 had better performance than Landsat 8 images with overall accuracy 88% and Kappa coefficient 0.81.

Discussion and conclusion: According to the results, it can be concluded that of Sentinel 2 satellite images have a better relative performance than Landsat 8 satellite imagery in the preparation of land use and land cover maps, this seems to be due to the higher spatial resolution of the Sentinel 2 satellite (10-meter pixel in near infrared and visible bands) compared to Landsat 8 (30-meter pixel in near infrared and visible bands). The highest level of user and producer accuracy were observed in the forest land cover, it seems that the reason for this is the vast forest area in the study area and as a result of increasing the number of training samples in this land cover. Comparison of the performance of the pixel-based and object-based classification methods showed that the use of the object-based classification method improves the results of land use and land cover classification. Finally, it is important to note that, despite the better performance of Sentinel 2 satellite imagery and object-based classification method than Landsat 8 satellite images and pixel-based classification method, but the results of Landsat 8 satellite imagery, and pixel-based method was acceptable as well.

Keywords: Sentinel 2, Landsat 8, Nearest Neighbor, Maximum Likelihood, Minimum Distance, Mahalanobis Distance.