Classification and Change Detection of Urban Built-up Lands Using Remote Sensing Images

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Received: 11 March 2017 Accepted: 12 October 2017

Extended abstract

Introduction

Urbanization and use of urban lands is the result of social and economic development. Urbanization is a major concern in many parts of the world. By 2050, the world's urban population is expected to double from about 3.3 billion in 2007 to 6.4 billion in 2050. Today, changes in land use occur without clear planning and little attention to their environmental impacts. At present, the built-up lands cover 400,000 square kilometers of the Earth's surface and it is expected to increase to 120,000 square kilometers by 2030. Recently, urban studies, classification of built-up lands and land-use change detection in urban areas using remote sensing data have been highlighted on an unprecedented manner. Various spectral indices have been proposed for rapid detection and accurate classification of built-up lands using satellite images. The purpose of this study is to compare the performance of the indices and the introduction of a new index for classification of the built-lands using satellite images to determine spatial and temporal differences of land-use in the city of Tehran.

Methodology

The data used in this study is Landsat 7 ETM + and Landsat 8 OLI / TIRS satellite images for Tehran. In this research, we have initially used the MNDWI index and the Otsu thresholding method to separate water surfaces from the waterless surfaces. Then, for the purpose of masking the water in the image, water mask was created. Finally, using indices such as Urban Index (UI), Normalized Difference Built-up Index (NDBI), Index-based Built-up Index (IBI), Normalized Difference Impervious Surface Index (NDISI), visible red/green-based built-up indices (VrNIR-BI and VgNIR-BI), visible blue based built-up index (VbSWIR1-BI) and Otsu , the built-up lands are separated and classified. The accuracy of the classification was examined using 3500 reference points for each image.

Results and discussion

The histogram of the spectral indices of two satellite images and the Otsu method has showed

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that for the ETM + sensor, all indices except NDBI and VrNIR-BI show double distribution signs. For the OLI / TIRS sensor, only the IBI, VgNIR-BI and VbSWIR1-BI indices show signs of a dual distribution. The classification accuracy results show that the VbSWIR1-BI index has the highest overall accuracy and the NDISI index has the lowest overall accuracy for both Landsat 7 and Landsat 8 images. The temporal and spatial variations of the built-up lands indicate that the highest increase of built-up lands can be found geographically in the western and southwestern part of Tehran. According to the results of the VbSWIR-BI index, built-up lands in the studied area between 2001 and 2015 increased to 6.38%.

Conclusion

The rapid development of geography and remote sensing technology has led to creation of different spectral indexes for classification. A review of studies on spectral indices indicates that the blue band coupled with the near infrared band, has not been used for classification of built-up and non-built-up lands and the results of this study have shown that this index is good and has been able to classify the built-up lands and increased classification accuracy. This index also enables the determination of changes in spatial and temporal built-up lands in Tehran accurately.

Keywords: Landsat 7 and Landsat 8 images, Classification, spectral indices, change detection, urban growth.

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