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Coastal Zone Detection in Istanbul using Landsat 8 OLI Image

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Coastal zone, and its environmental management require the information about coastlines determination and monitoring. This study examines different pixel based classification methods for coastline and its environment determination in Istanbul, Turkey. Istanbul has approximately 45% of industrial activity of Turkey and hence this region includes migration from all over of Turkey. For the past 60 years, Istanbul has been experiencing an accelerated urban expansion. Because of this reason, it is very important to determine land cover/use categories of the region for sustainable management activities.

In this study, two different test regions were selected from the European side of the Istanbul. First test site was selected from Black sea part (north of the Istanbul) and the second one was selected from Marmara Sea side (southern part) of the megacity. Test site 1 covers the land cover classes of water surfaces, sand dune, forest area, bare lands and artificial surfaces. Test site 2 covers the land cover classes of water surfaces, agricultural fields, bare lands, green areas and artificial surfaces.

The objective of this study is the testing the potential of two different classification techniques such as advanced non-parametric per-pixel classifier, support vector machine (SVM), and traditional pixel-based parametric classifier maximum likelihood classification (MLC) to extract information on different land cover categories from new generation medium resolution Landsat 8 OLI image. Free distribution of its archive digital dataset with a wider swath-width of 185-km and a 16 day temporal resolution makes the Landsat 8 sensor one of the key primary data sources highly suitable and practical for land cover/use studies. Improved radiometric resolution from 8 bits to 12 bits which is critical in determining the characterization of different land cover/use categories. Moreover, the changes in the sensor design have also resulted in substantial improvements in signal to noise ratios (SNR), almost twice as good as Landsat 7 Enhanced Thematic Mapper plus: ETM+ (Irons et al., 2012; Dube and Mutanga, 2015). 2013 dated Landsat 8 OLI data was classified using MLC and SVM classification methods.

Supervised classification is a technique that based on the statistics of training areas representing different ground targets selected subjectively by users on the basis of their own knowledge or experience (Liu and Mason, 2009). In this study, Maximum Likelihood classification (MLC), which is the most common classification method in remote sensing, was used to derive land use/cover categories. In this method, the pixel is assigned to the class for which the probability of pixel belonging is the highest.

The Support Vector Machine (SVM) which is the non-parametric supervised machine learning algorithm and based on statistical learning theory has been applied for the classification. The significant point of the SVM is to be able to perform the classification in high-dimensional feature spaces with small number of training dataset. (Huang et al., 2002; Pal and Foody, 2010). Kernel functions could construct the optimal hyperplane for the complex data classification (Huang et al., 2002). Radial Basis Function (RBF) which is widely used for SVM classification has been selected as a

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kernel type. The optimum parameters of cost (C) and kernel width (σ) for the RBF kernel have been determined as 100 and 0,111, respectively.

Classified images were assessed with high resolution satellite images and It has been concluded that the accuracy level is comparatively higher in SVM than MLC. The statistical Maximum Likelihood classifier cannot handle complex images so that some of the pixels cannot be classified correctly, but SVM also could overcome the mixed pixel problem into two selected test region.

For the accuracy assessment, confusion matrix was used to calculate overall accuracy. High-resolution satellite image was used to collect ground truth data for accuracy assessment. For first test region, the overall accuracy of the SVM was slightly higher than for the MLC classification, 79,61% versus 78,79 %, respectively. For second test region, the overall accuracy of the SVM was slightly higher than for the MLC classification, 87,45 % versus 86,80%, respectively. Results demonstrated that the use of Landsat8 imagery with the SVM can get satisfactory results of classification accuracy to derive the information about coastlines determination and monitoring

References

Dube, T., Mutanga, O. (2015): 'Evaluating the utility of the medium-spatial resolution Landsat 8 multispectral sensor in quantifying aboveground biomass in uMgeni catchment, South Africa' ISPRS Journal of Photogrammetry and Remote Sensing, 101, pp. 36–46

Huang, C., Davis, L.S., and Townshend, J.R.G.(2002): 'An assessment of support vector machines for land cover classification', International Journal of Remote Sensing,23, (4), pp. 725-749

Irons, J.R., Dwyer, J.L., Barsi, J.A. (2012): 'The next Landsat satellite: the Landsat data continuity mission' Remote Sensing of Environment, 122, pp. 11–21

Liu, J. G., and Mason, P. J. (2009): 'Essential Image Processing and GIS for Remote Sensing', John Wiley Sons, Inc., (2009).

Pal, M., and Foody, G.M.(2010): 'Feature Selection for Classification of Hyperspectral Data by SVM', Geoscience and Remote Sensing, IEEE Transactions on,48, (5), pp. 2297-2307