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# Environmental Change Detection Using Multi-Temporal SAR Imagery

Mohammad A. Fazel (1), Saeid Homayouni (1), and Armin Aghakarimi (2)

(1) Remote Sensing Division, Geomatics and Surveying Engineering Department, College of Engineering, University of Tehran, Tehran, Iran (m.a.fazel@ut.ac.ir), (2) Geodetic and Geographic Information Technologies, Technical University, Ankara, Turkey

Monitoring of environmental phenomena in short-, mid- and long-term periods is the first step of any study or plan for natural resource management. As a result, detection and identification of the environmental changes became a main area of research for different applications. Remotely sensed data and especially Synthetic Aperture Radar (SAR) imagery thanks to its independence to weather conditions and sun illumination, and its spatial and temporal resolution ability is a valuable source of information for change detection analysis and provides reliable data for information extraction for various applications.

In general, change detection methods are grouped into supervised and unsupervised methods. Supervised methods work based on multi-temporal land-cover mapping of satellite images. While, unsupervised techniques include the very simple idea of image differencing to more sophisticated statistical modeling of changes in images. Unsupervised methods because of their advantages are more important in many applications. In recent years, the use of kernel based methods in change detection applications became an interesting topic in remote sensing community. Kernel-based methods and machine learning algorithms are the unsupervised paradigms which introduced powerful tools to deal with nonlinear classification.

In this paper, we have presented a fully unsupervised framework for detecting the Urmia Lake changes during 2007 to 2010. This method uses the kernel-based clustering technique. The kernel k-means algorithm separates the changes from no-change classes of speckle free images. This method is a non-linear algorithm which considers the contextual information. For this purpose, at first, difference maps are calculated from multi-temporal data. Then these maps are projected into a higher dimensional space by using kernel function. Finally an unsupervised k-means clustering algorithm is used to obtain change and no-change classes.

The proposed methodology is applied to several dual-pol L-band SAR image datasets acquired by the Advanced Land Observing Satellite (ALOS). The obtained time series change maps is used to evaluate and assess the environmental behavior of the lake area which is facing a very difficult period.