Chapter 33
Detection of Urban Areas Using Genetic Algorithms and Kohonen Maps on Multispectral Images

Djelloul Mokadem
Tahar Moulay University of Saida, Algeria

Abdelmalek Amine
Tahar Moulay University of Saida, Algeria

Zakaria Elberrichi
Djllali Liabes University of SidiBelAbbes, Algeria

David Helbert
University of Poitiers, France

ABSTRACT

In this article, the detection of urban areas on satellite multispectral Landsat images. The goal is to improve the visual interpretations of images from remote sensing experts who often remain subjective. Interpretations depend deeply on the quality of segmentation which itself depends on the quality of samples. A remote sensing expert must actually prepare these samples. To enhance the segmentation process, this article proposes to use genetic algorithms to evolve the initial population of samples picked manually and get the most optimal samples. These samples will be used to train the Kohonen maps for further classification of a multispectral satellite image. Results are obtained by injecting genetic algorithms in sampling phase and this paper proves the effectiveness of the proposed approach.

1. INTRODUCTION

With the recent innovations in Earth observation techniques (sensors, satellites, and data), "urban" remote sensing or "remote sensing urban applications" have rapidly gained popularity among urban planners and, more generally, administrations in charge of territorial planning.

DOI: 10.4018/978-1-5225-8054-6.ch033

Indeed, remote sensing makes it possible to increase our understanding of urban areas in different ways, although the real potential of this technique is often challenged by the complexity of the urban environment itself. (Xiaojun, 2011)

Previous studies have been carried out on the urban theme, notably the work of (Antoine, 2009), he tried to develop a method able to detect and qualify changes in small areas from Very High spatial Resolution (VHR) remote sensing data acquired at different dates and from different sources by comparing the textural properties of objects of interest. First, he tried to extract objects by a region growing segmentation and then, their texture are compared.

Another work has been carried out in this direction, (Ashish, 2010) used a technique based on fuzzy clustering approach which takes care of spatial correlation between neighboring pixels of the difference image produced by comparing two images acquired on the same geographical area at different times.

Using always the VHR satellite data, (Tobias, 2017) proposed a novel object-based approach for unsupervised change detection with focus on individual buildings, he first applied a principal component analysis together with a unique procedure to determine the number of relevant principal components is performed as a predecessor for change detection; then he used k-means clustering for discrimination of changed and unchanged buildings.

(Andrew, 2017) used a different technique called Import Vector Machine (IVM) which builds upon the popular Support Vector Machine (SVM) methodology (Ribana, 2012). To obtain the optimum classification, the IVM algorithm explores all possible subsets of training data for optimal selection (termed import vectors) which are derived through successively adding training data samples until a given convergence criterion is met (Ribana, 2012). Data samples are selected according to their contribution to the classification solution.

1.1. Other Literature on Image Segmentation and Visualization on Medical Science

(Chang, 2018) has used computational intelligence and proposed his MapReduce framework with fusion algorithm as techniques of visualization to simulate medical imaging in order to explore areas that cannot be easily achieved by conventional ways.

He (Chang, 2017) also used data analytics and visualization to study how cells and genes can become malignant and harmful to human bodies, the approach he adopted consist in presenting by analytics all complex concepts and sequence of events (taking place every second) in order to facilitate the understanding the complex biological transformations.

On weather studies:

A demonstration using Cloud Computing technologies, MapReduce and optimization techniques was exposed by (Chang, 2017) to simulate temperature distributions, analyze weather data and forecast temperatures based on studying trends from the historical data. Finally, numerical computing is transformed into visualization after classifying results into clusters in order to facilitate the interpretation of output results.

On Social networks:

In (Chang, 2017), the author presented his architecture for the Social Network Analysis Platform (SNAP) and developed his SocialNetwork API with which, he presented how to extract information