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RESEARCH ARTICLE

A Modular Support Vector Machine for Active Learning of Urban Remote Sensing Images Classification in Algeria

Belkacem Marir[1] · Mahdi Kalla[2,3] · Fouzi Douak[4] · Abdelhamid Daamouche[5]

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Abstract

In this work, we present a new strategy of active learning, based on a modular version of support vector machine (MSVM) applied to urban remote sensing images in Algeria. In general, the training set is highly imbalanced, which gives more complex models; this difficulty is solved by dividing the problem at hand into a set of sub-problems, where each sub-model could be simpler to solve. The support vector machine is introduced to solve the problem of classification based on image remote sensing data related to atmospheric conditions and illumination reflectance. The aim of the proposed method is to improve the accuracy in order to understand the correlated elements of urban structures (the site, the built, the parcels, the network, the space), to generate the final classification result. In particular, we propose a new method based on the modular support vector machine (MSVM) adopted to active learning method, using three different clustering methods (i) k-means, (ii) fuzzy c-means (FCM), and (iii) Gustafson–Kessel (GKclust). Experimental results obtained on two QuickBird multispectral images of Sétif and Batna cities in the eastern of Algeria confirm the capabilities of the proposed methods based on the ensemble of model trained with different task decomposition compared to a traditional model using active learning. This method improves each class presents a main register in urban structure tissues.

Keywords Active learning · Classification · Support vector machine (SVM) · Modular-SVM (MSVM) · Urban remote sensing images (RS) · Urban structure elements (USE)

Introduction

It is well-known that the city, which is a very complex living organism; is shaping, moving and also transformed. Previous studies found that the city is a dynamic system that can be divided into three types: a random or stochastic model (Batty 1976; de Almeida et al. 2003; Capozza and Helsley 1990) that evolves randomly in space without being supported by equations, a deterministic model managed by mathematical laws and finally models that have a behavior and very complex structure that seems to wander at random as it takes the qualities of the first two, called chaotic internal elements of the urban system (the site, the built, the parcels, the network, the space) (Manson 2001; Frankhauser 1993) which are linked by forming a self-organized urban structure elements(USE) which defined as the organization mode of elements.

Several researches on the modeling of cities were introduced to understand the USE (Batty 1976; Serra 1982). Recently, with innovations in data, technologies,

✉ Belkacem Marir
belkacem.marir@univ-batna.dz

Mahdi Kalla
m_kalla1@yahoo.fr; lrnatl@yahoo.fr

Fouzi Douak
douak_fouzi@yahoo.fr

Abdelhamid Daamouche
ahdaamouche@yahoo.com

[1] Institute of Architecture, University of Batna 1, 05000 Batna, Algeria

[2] Laboratoire des Risques Naturels et Aménagement de Territoire (LRNAT), Université de Batna 2, 05000 Batna, Algeria

[3] Department of Earth Science, University of Batna 2, 05000 Batna, Algeria

[4] Department of Industrial Engineering, University of Abbes Laghrour Khenchela, 40004 Khenchela, Algeria

[5] Institute of Electrical and Electronic Engineering, University of Boumerdes, 35000 Boumerdes, Algeria