A METHOD FOR PROCESSING SATELLITE IMAGE TO LIMIT THE SPREAD OF SLUMS IN THE REGIONS OF MARRAKECH

Mohammed AIT OUSSOUS, NourEddine ALAA, Youssef AIT KHOUYA

Abstract— The slums are now a reality to be recognised. They were undoubtedly the prior nightmare of inhabitants in the world. Marrakech region experienced strong population growth. There is also a major investment in the tourism sector in the city and its outskirts. Unable to access any property, for lack of means, the newcomers live in these slums, and build shelters. What makes things more difficult? The solutions exist and are even multiple. First, shanty towns should be included in urban planning to allow for consistent management and better integration of informal settlements in the city. Then, plots could be created for these people to avoid disorganized construction. In this work, we are interested in detecting the boundaries of the villages near Marrakech from their satellite images, as a study case: Sidi Zouine village (31.67,8.34). Our approach has two stages: The first, using k nearest neighbour method for classification of the satellite image. The second, using a mean filter to regularize this classification. Our method gives satisfactory and encouraging results to detect the edge of the village and can be used as a tool to control the spread of slums.

Index Terms- Classification, Satellite Image, k-Nearest Neighbour (k-NN), median filter.

1 INTRODUCTION

THE image processing is the set of methods and techniques operating on them in order to make this operation possible, simpler, more efficient and more enjoyable, improve the visual image and extract information deemed relevant. The reader interested in this vast subject may consult the following references for more details [1], [2], [3], [4], [8].

Here we focus particularly on edge detection of the village from their satellite image to limit the spread of slums which is a district precarious illegal buildings formed by a poor suburb in or near a big city. This form of urban sprawl is growing almost always occupied government land without authorization, and therefore these parts become places of crime by excellence.

We are interested in the region of Marrakech is the first tourist destination in Morocco, appreciated for its quality of life and its landscapes, its rich heritage and historical conditions of easy access. It is perceived as a destination of confidence.

Tourism is the engine of development and plays a leading role in economic development of the city by its ripple effects on other sectors. It helps to diversify the activities of the city and to preserve heritage. In addition, Marrakech hosts 1 million tourists and 20% of the activity comes from the market which is very dynamic and can cope with the instability of the international market. Sector development calls for several measures on strengthening infrastructure and improving the urban environment and particularly the fight against the spread of slums.

- *NourEddine AlAA is currently professor of image processing in University Cadi Ayyad, Laboratory LAMAI , BP 549 Marrakech Morocco. E-mail: n.alaae@uca.ma*
- *Mohammed Ait Oussous is currently prereparing his PHD in University, Cadi Ayyad Laboratory LAMAI , BP 549 Marrakech Morocco. E-mail: med.Aitoussous@gmail.com*
- *Youcef Ait Khouya is currently prereparing his PHD in University, Cadi Ayyad Laboratory LAMAI , BP 549 Marrakech Morocco. E-mail: youness.youssef @yahoo.fr*

In this paper we propose a method based on remote sensing to control the spread of slums in the regions of Marrakech. We took as an example Sidi Zouine village located 30Km from the center of Marrakech.

Our approach has two steps: the first is the classification of satellite image by the algorithm k-NN which is a method of supervised classification [] (Schowengerdt, 1997). It affects an element to the class most represented among the k closest elements of the training set. The parameter k can reduce the effects of noise on classification. The second, using a mean filter to regularize this classification and obtain the detection of the outer contour of the village.

This article is organized as follows: first time we discussed the classification method and more specifically the method of k-NN, then we explain the method used for post processing used to regulate our classificationthe and based on mean filter. In the last section we presente experimental results and discussion.

2 CLASSIFICATION AND TREATMENT OF SATELLITE IMAGE

2.1 Principle of the classification method k-NN

The classification is a method of data analysis that aims to separate the image into several classes of interest, ie to aggregate data in homogeneous subsets [1], [6], [7], which share common features. It may be supervised or automatic (ie unsupervised). In the supervised case, it requires a subset of data with known classes, called learning base in order to classify new data. Concerning our problem, we must determine two classes, the class of pixels buildings and the fields. For this we adopted the method of k-NN [1], [5], which is a supervised learning algorithm where the result of new instance query is classified based on majority of k-NN category. The purpose of this algorithm is to classify a new object based on attributes and training samples. The classifiers do not use any model to fit and only based on memory. Given a query point, we find k

number of gold objects (training points) closest to the query point. The classification is using majority vote among the classification of the k objects. Any ties can be broken at random. The k-NN algorithm use the neighborhood classification as the prediction value of the new query instance. The algorithm of k-NN is as follows [1], [5]:

For each pixel (x,y) in the image:

- Calculate distances between every pixel and vector based B_{i} of the database: d ((x,y), B_{i})
- Search the k vectors of the training set closest to the pixel, ie, those with the k smallest distances.
- Assigns the pixel to the class most represented among these k vectors.

2.2 Post treatment

After classification, usually we get isolated pixels, poorly sorted and contains areas of small discontinuities. To improve the mapping, we must rectify by reallocating these isolated pixels. In our case to regularize the classification we used a mean filter followed by an adaptive thresholding.

The principle of the filter medium is very simple: a pixel is replaced by the average of itself and its neighbors. In the definition of neighborhood that the filters will vary.

Because of the variety of image content filtering (size M x N) we apply an adaptive thresholding to free ourselves of local contrast and allow good detection of edges in all regions of the image. We choose a threshold of the form:

$$t=m+ßs$$

$$m = \sum u(x,y) / MN$$

$$s = \sqrt{\sum (u(x,y) - m)^2 / MN}$$

m and s are respectively the mean and standard deviation of the image u obtained in first step and we set β equal to 0.6. The thresholding is to compare the gray level of each pixel (x,y) of the image with a global fixed threshold t. In our case we use the new value of pixel thresholding given by the following expression:

$$U(x,y) = 255 \text{ if } u(x,y) \geq t \text{ and } U(x,y) = 0 \text{ if } u(x,y) < t$$

Where U is a new image obtained after post treatement.

3 Application

Images used are of size (512 ×512) pixels obtained from google maps, with a scale equal to (1/(20000)). The algorithm of k-NN is tested on these images and the parameter k is set at 3. Figure (2) shows the obtained results. The calculation time time is proportional to the size of the training set, which is logical since the algorithm calculates the distance between each new object and each element of the training set. To improve the classification obtained by taking into account the spatial information provided by neighboring pixels in the image, thresholding on the average yields good results as shown in Figure (3).

5 Conclusion

In this article, we are concerned with the problem of slums in limited regions of Marrakech from satellite images of high resolution. Our approach has two steps: the first is the classification of satellite images by the technique of k-NN, the second . Our method gives satisfactory results and encouraging, and this, by comparing the contours detected at different times which are intended to confirm the spread of slums around.

As a perspective, we have two proposals: one is to use a better method for classification, the second segmentation is performed directly in the satellite image by Level Set bypassing classification.

Fig. 1. Image of Sid Zouine from google maps(31.67,8.34)

Acknowledgment

The authors wish to thank Professor Michel Pierre of the ENS Cachan France for his valuable discussion.

References

[1] Bahram, Javidi, Image recognition and classification: Algorithms, Systems, and Applications, Marcel Deckkeerr 2002 .

[2] Chan, F. T. and J. Jackie Shen , Image Processing and Analysis - Variational, PDE, Wavelet, and Stochastic Methods. Society of Industrial and Applied Mathematics, 2005.

[3] Morris , T., Computer Vision and Image Processing. Palgrave Macmil, 2004.

[4] lan.Duda R.O., Hart P.E., Stork D.G. Pattern classification (2ed., Wiley), 2000.

[5] R. A, Schowengerdt, Remote sensing : models and methods for image processing. Academic Press, Second edition.R. Nicole, "The Last Word on Decision Theory," *J. Computer Vision,* submitted for publication. (Pending publication) , 1997.

[6] O.Zammit, Détection de zones brûlées après un feu de forêt à partir d'une seule image satellitaire Spot 5 par techniques SVM. Université de Nice-Sophia Antipolis , 2008.

[7] Samson, C. Contribution à la classification d'image satellitaires par approche variationnelle et équations aux dérivées partielles. Thèse de doctorat de l'Université de Nice-Sophia Antipolis , 2000.

[8] Ünsalan Cem , Kim L. Boyer, Multispectral Satellite Image Understanding From Land Classification to Building and Road Detection Springer 2011.

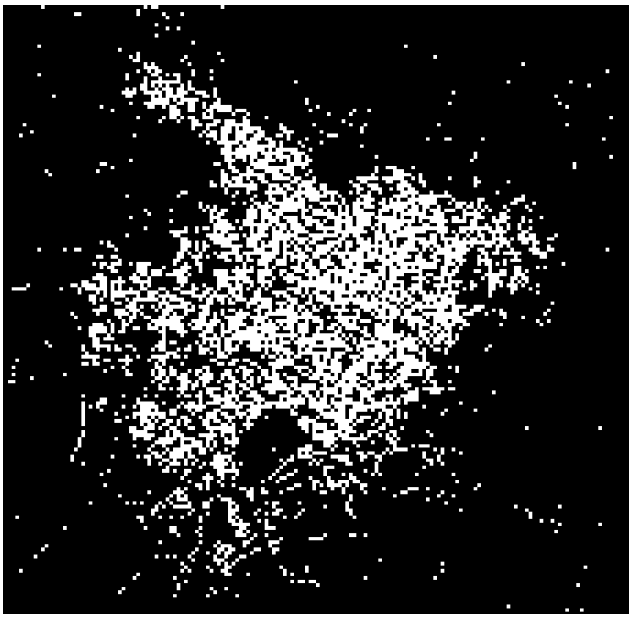

Fig.2 Image after classification by K-NN

Fig. 3 Final image after post treatment