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A Survey on Object Based Classification of the Remote Sensing Images for the Identification of Buildings Footprints

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ABSTRACT: In this Survey paper, an investigation carried out to get a novel approach for the identification of the buildings footprints in aerial images that combine a classical segmentation algorithm, the region growing algorithm a user guidance approach and a supervised learning solution based on support vector machine. A series of features based on shape are built for each region and a support vector machine is trained to classify between objects of interest and objects of no interest. The investigation further reads for the different approaches to find out the buildings and its footprints in the remote sensing images or specifically say in the satellite images as provided by user.

KEYWORDS: SVM, remote sensing images, buildings footprints.

I. INTRODUCTION

The mainstream adoption of the geospatially enabled web and of other low cost spatial information production tools for digital maps and geographic information systems has led to an increasing availability of high resolution digital satellite and aerial data unavailable digitally is that it can be processed by computer, either for automated information extraction or for enhancement before an image product is formed. There are multiple extraction and understanding of remotely sensed data, such as urban planning, map updating, site modelling, change detection, disaster monitoring or security and defence applications.

However, the automatic extraction of objects of interest in aerial images faces immense challenges. While the research on automated feature extraction significantly progressed over the last decade, no system has yet been demonstrated to enable reliable feature extraction under a wide range of image content, characteristics and scales. Aerial images are normally poorly illuminated and highly dependent on the environmental conditions [1]. A satellite image took at the same place won't look the same in the morning or in the illumination conditions. Most of the times, the cluttered aerial scenes contain too many objects (or regions), and these regions are ill-defined because of both spatial ambiguities and shadowing effects.

Moreover the buildings often share similar characteristics with other objects that are not of interest. Trees or roads often have a similar colour with building roofs. While the recognition of these features by a user can be quite efficient provided a given amount of training, the most advanced computational solutions primarily rely on atmospheric and photogrammetric models. Furthermore, most of the computational techniques currently used for image feature extraction and classification are generalizations of algorithms which are not specifically designed for remote sensing applications or are not fully automated. As a result, the false positive rate of decision is very high and several features of interest remain undetected. The low accuracy of such algorithms when running on large collections of satellite images leaves a substantial opportunity for new approaches to improve upon the current state-of-the-art techniques in terms of performance, as those aimed in this report.

A. *COMPARISON BETWEEN PIXEL BASED IMAGE CLASSIFICATION AND OBJECT BASED CLASSIFICATION:*

In Pixel based classification, per-pixel approaches identify the class of every pixel separately in the image by comparing the n-dimensional feature vector of each pixel to the prototype vector of each class using pixel's spectral

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information. The feature vectors consist of pixel's grey level values from multispectral bands. Basically pixel based method is lengthy because a number of pure classes has to be taken which should be well distributed in the study area. As we know that pixel based classification techniques isles efficient in handling the shadows and mostly shadow classified are without having the knowledge of aspect and continuity of features which produces an abrupt appearance. Object based classification technique uses spectral and special dimensions (shape of feature) in order to perform classification resulting in quantitative and qualitative images. So as from above observations object based approach is efficient and less time consuming. The pixel based approach can outperform the object based technique within a specific range of the segmentation threshold.

B. ***BASIC:***

Image processing is the process of analysis and working on the different formats of images so as to learn and gain information about the particular provided image. Image processing would help us to get the knowledge about the image in image format or in the information format. This enables the system to work on the provided data set and the organizations to handle the images in the pictorial as well as in the informative formats. One of the main areas where image processing is useful is remote sensing. Specifically the task is to look out for the Ariel information and update it in the GIS so as to acquire the information regarding the provided remote sensing image and update it. Here the data is being divided into segments and then is being further processed to exact the features. After feature extraction the selected data is being trained using Support Vector Machine (SVM). This will help the user to process the extracted data into the next step that is classification. Here classification is done on the basis of SVM. Therefore the output image will be the classified image. Using the above SVM approach we could divide the classes into two classes that are buildings and non-buildings. The SVM works only on the binary data.

C. ***SUPPORT VECTOR MACHINE:***

A Support Vector Machine (SVM) is a discriminative classifier formally defined by a separating hyper-plane. In other words, given labelled training data (separating learning), the algorithm outputs an optimal hyper-plane which categorizes new examples. In machine learning, Support Vector Machines are supervised learning models with connected learning algorithms that evaluate data used for classification and regression analysis. Classifying data is a common task in machine learning. A Support Vector Machine constructs a hyper-plane or a set of hyper-planes on a high dimensional or infinite dimensional space, which can be used for classification, regression, or other tasks. Naturally, a good separation is achieved by the hyper-plane that has the largest distance to the nearest training data point of any class (so called functional margin). In general, the larger is the margin; the lower is the generalization error of the classifier.

II. RELATED WORK

Nabil Zerrouki, Djamel Bouchaffra [4], found out that pixel based classification technique was not properly efficient in handling the shadows and mostly classified shadow without having the knowledge of aspect and continuity of features. Jordan Tremblay-Gosselin and Ana-Maria Cretu [2], observed that Shape descriptors encode an appropriate set of features that allow the objects of interest to be identified correctly in most images, in spite of different shapes and sizes of roofs. B.Ankayarkanni and Ezil Leni [5], studied that the output of the segmentation is the best image out of the three images obtained by the three algorithms K-means, KFCM, Moving KFCM.T. Whiteside and Ahmad W. [3], observed that the object- oriented classification yields multi-pixel features whereas the pixel based classification contain many small groups of pixels or individuals pixel.

Keith Alphonso and Dimitrios Charalampidis [6], discussed that, redefining a boundary point results in a less noisy and simplified footprint that more accurately represents the actual building boundaries. Elizabeth A. Wentz and Qunshan Zhao [7], found out that the derived footprints are properly visible and could be used further in any work if needed. Nurollah Tatar *et ol* [8], surveyed and found that accurately detection of shadows is a critical pre-processing step in many remote sensing image processing application. Here, they also proposed a new object based shadow detection method and take several experiments to compare the method with the traditional pixel based one. Also the sensitivity of their algorithm against the selection of classifier and majority voting threshold is examined.

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W. Liu and V. Prinet [1], uses multiple features, such as shadow ratio, shape feature, distance to straight lines and entropy, with a probability function to identify buildings in high resolution satellite images. Robert C. Welh, Jr. and Norman D. Riggan, Jr.,[9], worked and observed that the addition of the leaf-on data to the image dataset improved overall classification accuracy and it tended to improve the user's accuracy for feature classes such as deciduous and grassland.

Serge Belongie and Jitendra Malik [10], presented a new approach to shape matching a key characteristic of the estimation of the shape context. The approach is simple and easy to apply, yet provides a rich descriptor for point sets that greatly improves point set registration, shape matching and shape recognition. Keqi Zhang, Jianhua Yan and Sin-Ching Chen [11], identified that the region growing segmentation algorithm for identifying building points from non-ground measurements is significant for building footprint extraction. Experiments demonstrated that region growing segmentation based on local plane fitting is robust and not sensitive to seed point election. F.Michael Sims, Victor Mesev [13], found that the optimization allows the analyst to focus on the features of most importance in analysis design.

David Dubois and Richard Lepage [12], observed that pixel-based and object-based building extraction methods use a mix radiometric, textural information, geometrical and contextual information showing a region growing algorithm based on a regular grid of seeds and on the assumption that building roofs can be identified by the red channel is used to separate potential building candidates from the background. Yongmin Kim, Youkyung Han, Younggi Byun, Jaewan Choi, Dongyeob Han, Yongil Kim [14], worked on a proposed method that extracted well buildings that are higher than 2m in study area by using an satellite image and Lidar data, and the described sorting process. Therefore, buildings with various roof colors were classified into the same class.

III. CONCLUSION

In this investigation, we have studied various automatic and user defined methods and approaches which helps us to understand the scenario behind the identification of the buildings and its footprints. Various other methods are seen to be combined and worked out altogether to get the ground result. The ground result to be found is buildings footprints. Apparently all the used or described approaches may or may not give the proper output so we still have to search for more accurate and efficient approach and method to define the problem statement properly.

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