Buildings Detection from Very High Resolution Satellite images Using Segmentation and Morphological Operations

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***Abstract*— Extraction of high0resolution satellite image buildings is difficult task for researchers in remote sensing area. In the proposed work Region Growing Segmentation, morphological operations and perceptual0grouping techniques are developed and to detect the buildings in high spatial0resolution images. The necessary algorithm for the implementation of0Region growing segmentation is developed using MATLAB0software and its performance is tested by inputting several images. It is founded that0the proposed algorithm successfully detect the rectangular building footprints. The efficacy of the designed algorithm is tested by0repeating the experiment multiple times successfully.**

Keywords- Region Growing segmentation, MATLAB, Morphological operations, perceptual grouping.

I. INTRODUCTION

In VHR satellite images Detection of building is most complex tasks in areas of remote sensing image understanding and machine visualization. Because of the complex background interference, shadows, shooting angle, some building are covered by other buildings, some of buildings are cover by big trees, compare to neighbors buildings like apartments small buildings are properly not visible and other factors, it is most complex task to identify buildings in VHR satellite imageries. The correct and perfect separation is very tough the buildings residues a daunting demand for urban area. Segmentation, military simulation, automatic map generation, urban planning are the applications.

Satellite and aerial images are main in acquiring data about objects on the Earth surface. For several functions and the major consideration is to classify the objects in0aerial images. Several examples are rescue processes and defense functions. Since from the past human employed to study the different images in different time means seasons such as spring, summer, autumn, and winter to distinguish the building stuffs, and human understanding of these stuffs are expensive and is not practical because of superiority of information functions. In aerial images, the detection and other constructions become a common issue. Other functions such as creating a maps for the geographic knowledge base systems, the urban scheduling are also more. The possible of identifying and proper recognition the building is mechanically know the scene proper composed from the image. Next going functions to be measured are scheduling of residential improvement, estimation of damage and recognition of military intention. Because of basic geometrical character of building. The detection of building from image is hard work because of with the construction and other considerations. The main purpose here to classify the construction of point to point importance and segmenting it from the background so that it can be represent for later understanding.

The organization of following paper is as follows: the literature survey is given in section II. Next the methodology and Result is followed in section III and IV. Conclusions are shows lastly in the in section V.

II. LITERATURE SURVEY

Number of work as carried out in literature to get0the efficient techniques in0image0 segmentation method is discussed in this section.

D. Koc San et.al [1] a strategy was enhanced for the rectangular and circular shaped0buildings detection from0high resolution satellite0image using Hough transforms techniques. In image the building hole and cracks are predictable in starting stage of this work and this is incorporated to the classification of Supported0Vector0Machine. Additionally to exact taken image groups, the group's classification NDVI, and DSM are also composed. Next the building parts can be

978-1-5386-7523-6/18/$31.00 ©2018 IEEE
DOI 10.1109/ICDI3C.2018.00031

distinguished, then edges are recognized0using the canny edge detection technique. The image is converted into vector image using the Hough transform technique, it is a very helpful method for detecting the0curves of the objects. Based on the perceptual groupings method vector lines and curves are imply the building edges can be composed, then construct0building edges area. The method is executed using a program written in MATLAB0v. In the existing work a scheme was used for0detection of the circular0and rectangular type of the buildings from very0high0resolution satellite imagery using0Hough0transform..

AmitRaikar et.al [2], discussion about Satellite imagery,which includes important data and it, is also source of knowledge for several different applications. Hence, extracting the most important features from these images is a demanding task. Therefore, there is requirement of addressing dissimilar problems before implementing processes like dividing the features and classify them. Building is measured as a significant point in satellite image. Thus the building recognition has a huge number of functions. Few functions to mention are: civilian, commercial and military. This method is also helpful in natural or artificial disaster, where the functions like finding out the existence of building can be implemented. During the improvement of task we familiar with two problems, low signal-to-noise ratio and weak object signal in the particular images. Most of the previous techniques discussed in this approach are not completely computerized. This paper challenged to present completely computerized method to accurately classify the building from high-resolution panchromatic images.

R Attarzadeh et.al [3], a new method i.e. automatic building0detection from high0resolution satellite imagery is determined as a significant area of research in machine vision and remote sensing. Several techniques for extraction of buildings from satellite images have been presented so far. These techniques mainly have measured radiometric, geometric, edge recognition and shadow criteria strategies to implement the building extraction. In this approach, we developed a new object based technique for automatic and0robust extraction and detection of building in the high spatial0resolution images. To attain the goal, we employ secure and changeable features together. Secure features are derived from inherent features of building phenomenon and changeable features are0extracted employing SEparability and THresholds investigation device. The projected method has0been useful on a Quick Bird imagery of an urban field in Isfahan city and visual confirmation shows that the projected technique presents hopeful results.

Xin Huang et.al [4],In this research work, freshly constructed morphological building0index (MBI) is used a building detection scheme planed. The commission errors are usually concurrent to0road, and soil and viewed area due0to their characteristics of structural and spectral feathers of buildings; the blunder errors communicate to various roofs standards.

M.Vakalopoulou et.al [5], discussion about the computerized man-made object recognition and building0extraction from single satellite images is, also, is most demanding tasks for different urban scheduling0and monitoring engineering applications. To this ending, in this paper offers a mechanical building recognition framework from very high0resolution remote sensing information based on DCNN (deep convolution neural networks). The core of the developed technique is bases on a supervised classification process using a very big dataset of training. An MRF form is then responsible for attaining the best labels concerning the recognition of scene buildings. The experimental0out comes and the executed quantitative confirmation specify the relatively hopeful potentials of the developed technique.

As mentioned above the work carried0out in literature has its draw backs to address the above issue Region Growing Segmentation, morphological operations and perceptual grouping0techniques are implemented for very0high resolution0satellite image

III. METHODOLOGY

The functional flow of this approach is as show in Figure. Detecting the rectangular building boundaries by using perceptual grouping method. This approach contains a three important steps such as: edge-preserving method and method of smoothing bilateral filter [9], image segmentation, perceptual grouping of many-sided boundaries of building. After pre-processing, lines and line intersections of image primitives are detected and test relationships with their, one and other it's create a group of building hypotheses.

In First stage of this work, we are taking a satellite image is pre-processed using gray conversation; histogram equalization is used to increase the image contrast and reduce the image noise by bilateral filter [9]. Second stage of this work, the Region Growing image segmentation are used to extract by the two detected building contours. In last stage of thus work, line segments is detected by perceptual grouping method and also used totrackclosed building contour, then perform morphological operations used for filter perceptual grouped image then we get a detected buildings.

Fig. 1. Block Diagram of Building Detection Proposed System

A. Pre-Processing

In pre-processing stage the noise is reduced and building edges are preserved. The input image pre-processed by histogram equalization and bilateral filter. Bilateral filter is a non-linear filter which preserves edges and also decreases the noise and smoothens the input image. The filter takes both range and space. Here the edges are preserved in order to adjust the human perception, only perceptually comparable

results, comparable colours are smoothed, same time it conserve the perceptually detected edges. The above technique is further processed by conventional Histogram Equalization. It increases the difference of images converted by the intensity image.

The input image with a very high resolution is taken from the satellite. The RGB image is converted into gray scale image. The contrast of the gray scale image is enhanced by using a histogram equalisation method. This method adjusts the intensity of the image and also decrease the noises. Next, the bilateral filter is used to decrease the noise and preserve the edges of the image. The flow chart of the pre-processing technique is as shown in Fig2.

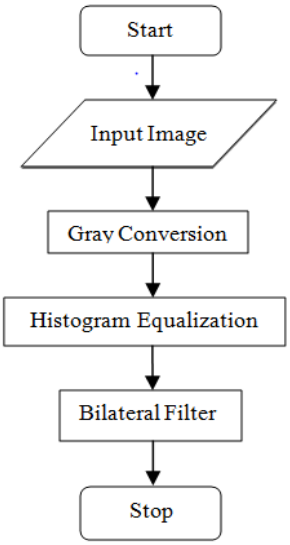

Fig. 2. Flow chart of Pre-Processing

A.1. Bilateral filter

This filter is a non-linear filter, which performs preserving the edges, reducing the noise, smoothing for detected image. Intensity of other pixels values are replaced by each pixel intensity value with a weighted average and this pixel must be an adjacent pixel. This weight is based on a Gaussian distribution operation and depends on the distance of pixels values. The edges are preserved by radiometric difference.

B. Image Segmentation

The process of partitioning an input image into multiple segments. In the proposed work Region Growing Segmentation method is used. This method compares present line segments with the extracted line segments. The previous line segment drawbacks are avoided and concentrated only on the useful features to obtain meaningful line segments and decrease their complexities.

B.1 Region-growing method

Region growing method is a region-based image segmentation method. The main assumption is neighbouring pixels within one region have similar values and classifies as a pixel based image segmentation so that it involves the selection of initial seed points.

In this method, select the very low pixels as a seed points in the image and grouping similar adjacent pixel or seed point, in the image. Similarly pixels or seed points of similar pixel connections are carried out and different pixel in the image are disjoint. This method is help full for detecting the rectangular buildings in the region.

C. Perceptual Grouping

There are several techniques for grouping fragments of edge. The combination tasks are depending on cue data, whereas several specifically study the global end property of edges. Without exception, they all useful on comparatively plain images with simple background. The difficulty of determining whole edge collections of an entity in a complicated real image which are unsolved. Perceptual grouping has historically played main role in edge grouping. This result inspires lots of sub-sequent work on edge grouping employing Gestalt[8] principles. Significantly, although unary Gestalt principles have established to be helpful for edge grouping when employed alone, perceptual grouping is used to extract line segments to obtain the closed building contour, After getting low-level lines, perpendicular line intersections and U-shapes are formed, this is enough line intersections will form a rectangular shaped building boundary

D. Morphological Operations

Fill operation: It is applied to fill the holes in the grayscale image. A hole is nothing but area of dark pixels isolated by light pixel which represents a binary image. The benefit of fill technique is to fill the holes in the image by explaining a region of dark pixels surrounded by light pixels and generating one more binary image.

Open operation: The morphological open operators are generally used to the binary image. It is applied to extract the features that are smaller than the value of pixels and preserves the big amount of structure in the image to extract the objects from the input image. The majority of false buildings are removed by setting the threshold value.

IV. RESULT

The region growing method algorithm is given in section 3 are developed using MATLAB R 2011 and tested for its performance using different test images such as fig3a shows the input image stored in dataset. Next, to enhance the test image for further processing gray scale conversion is used and histogram equalization image which is as shown in the fig3b.fig3c and fig3d shows the bilateral filter and binary image outputs.fig3eshows the filled holes of the previous image, fig3f is noise removal image and the detected image is indicated in fig 3f.

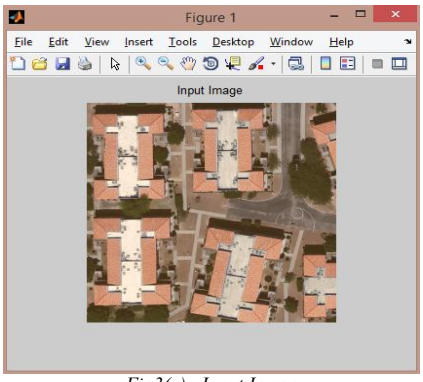

Fig3(a). Input Image

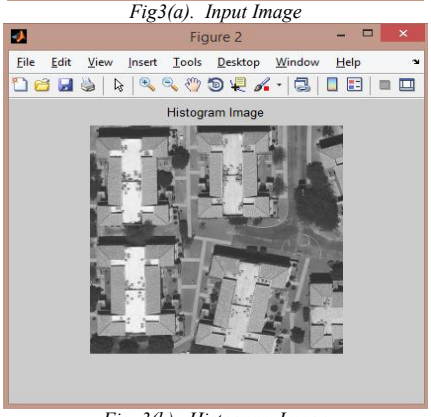

Fig. 3(b). Histogram Image

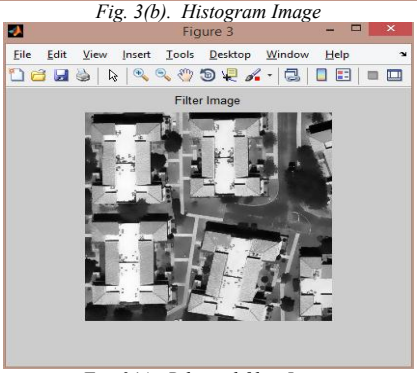

Fig. 3(c). Bilateral filter Image

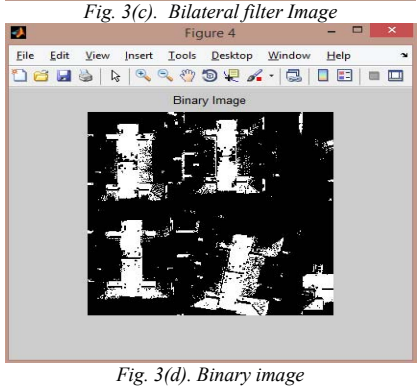

Fig. 3(d). Binary image

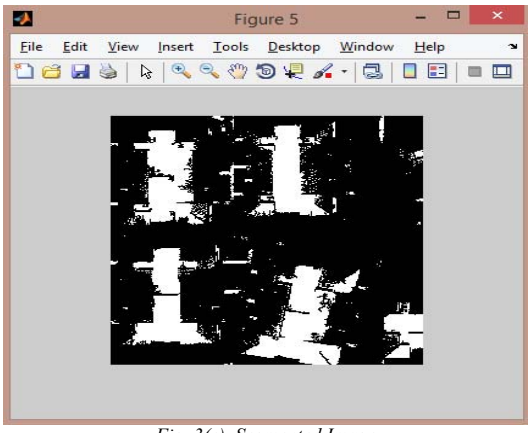

Fig. 3(e). Segmented Image

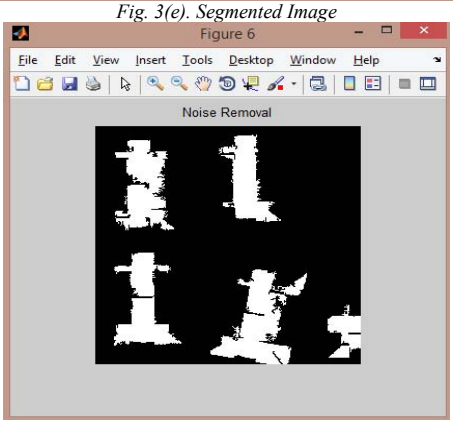

Fig. 3(f). Noise removal image

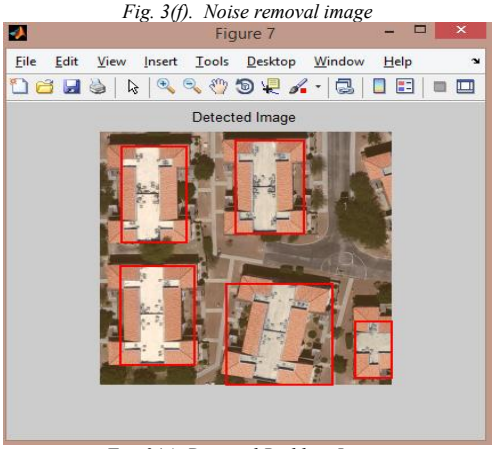

Fig. 3(g). Detected Building Image.

V. CONCLUSION

In this work, a new procedure for building detection based on the combination of line segmentation, perceptual grouping and morphological operations, is presented. An effective approach is proposed for detecting the rectangular building from VHR satellite image by using the image segment detector which is attached with perceptual grouping strategy. The proposed results with good accuracy are achieved and also state that proposed procedure can remarkably improve building detection efficiency. Thus the proposed system overcome the existing drawbacks are regarding background inference and

false detection. This model is accurate for understanding the image, detection of target and scene classification tasks.

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