Automatic Detection of Buildings Using High Resolution Images for Medium Density Regions

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Automatic Detection of Building in Medium Density Image Using Morphological Operation

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Abstract. As the construction material of the building is different hence building detection is a critical task from the HRI. The image qualities, resolution, weather condition while acquiring an image, type of image sensor are some important factors to produce accuracy. Building detection in dense urban areas having problems due to factors like shape, size, color and texture, and image sensor. For the find, the building has to consider the characters of the building like contrast, shape, and the building allocation in high, low, and medium density. In the present study, the mathematical morphological operation is used for the separation of the building. The building is indicated with a boundary. Which gives accuracy up to 82.75% on images.

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Keywords: Automatic Building detection, morphological operation.Google Earth Pro image, median filter, Otsu's Thresholding,medium density image.

1 Introduction

Automatic extraction of the building using remotely sensed data give limitations on the resulting performance. When the high-resolution image was studied for the building exaction it shows the different complexity in a scene that is due to the low and poor contrast or the same spectral reflectance of the objects that appeared in the

image. This gives difficulties for the identification of the building. Again when building roofs are considered building structured to be found that they are varying spectral properties with building construction are diverse, slope angles and flatted building roofs. If the image appears with the verity in construction of buildings then the given flow of algorithm may have problems in exact identification of the building. Self- occlusion in building rooftop and the shadow of building proposed challenges for extraction. Another limitation comes from the same spectral reflection of the concrete building roof and concrete road. The same things happen with concrete parking area available in the urban areas. A sometime non-building objects which is man-made were considered as building and which gives false accuracy. By studying high-resolution images with different modality as dense, medium, and high density the picture gives the information that if the buildings are very closely constructed then that buildings are considered as a single building where it found many buildings are available there. For example row houses, colonies with very close construction, apartments, etc. Automatic extraction of the building applicable for urban planning, disaster management, flood assessment, taxes fixing, urban development planners, military, etc.

2. Literature Survey

Building extraction techniques using high-resolution satellite images can classify with the help of automatic and semi-automatic techniques. From aerial images to find rectangular buildings constructed with the flat roofs having geometric shapes, projection constraints from single-intensity images were use the technique of edge detection [1]. Various technologies have been compared and evaluated based on restrictive standards such as evaluation and quality, information, and quality. These technologies combined for extraction of object and development of aerial image for object extraction basic problems [2]. For large building extraction and escaping shadows of buildings from high-resolution QUICKBIRD panchromatic images edge detection based techniques are applied. This method did not extract petite buildings with little or no shadows. To extract small buildings [3], the spectral information with the development of structural and discourse details and used the image of the IKONOS satellite in Columbia, Missouri. Within the technical scope of the plan, structure, and discourse details are habitually used to differentiate between buildings and parking spaces and alternatives with similar spectral information [4]. Advanced morphological operators, such as Hit or Miss Transforms with variable sizes and structured forms, extract buildings from High-Resolution QUICKBIRD panchromatic images. The accuracy of this method was calculated based on the accuracy rate, which is half of 1 mile, and the letter value

of the letter is 63. To improve the overall accuracy found for building extraction used the "morphological shading index" (MSI) [5], with the "morphological building index" (MBI) that gives building count [6] in an object-based framework [7]. Besides, retrieved the imaginative buildings of the HRS GeoEye-1 shopping mall in Washington, D.C., using the different shape shadow and building operator [8]. The overall accuracy (OA) of the planning method is 95.12%. Multi-index learning (MIL) [9] for improve the classification result of urban area using high resolution images some sort of techniques are applied as MBI find the Building index, MSI, NDVI for vegetation identification. To increase classification accuracy of remote sensing images for the building detection the Generalized Differential Morphological Profile (GDMP) [10] and Differential Morphological Profile (DMP) found that it is superior to the ancient [11]. Preprocessing DMP is used for classification by the neural network, the processing load is reduced by using neural network call boundary feature extraction, discriminant analysis feature extraction, and easy classification feature selection [12]. Their approach is supported by the idea that the building has a rectangular form, which is incorrect in fashionable urban affairs [13]. The rectangular and circular buildings identification from panchromatic high-resolution images and pan-sharpened IKONOS images the Hough transform and support vector machine (SVM) classification techniques are used [14]. To improve the High-Resolution Image classification accuracy, the supportive methods like C voting, P fusion, and OBSA are mixed with the spectrum, structure, and linguistic options for support vector machine (SVM) [15]. Also, the fully sharp image developed with building extraction accuracy is 5 shots larger than the MS image. However, despite the considerable space at the bottom of these buildings, the system cannot extract buildings with little or no shadows [16]. Object-based [17, 18, 19, 20] methods. Building inspection formula, and plan a comprehensive analysis strategy for building inspection.From the litraute survey the images are consider with three densities like dense, medium, and high resolution as per the building locality present in the an image.The dense images are with the very few buildings to be presented in an image. The medium density image with more availabity of building in an image. And high density image with very close presence of building in an image. These desity will be expalin with following images.

Fig. 1. Building densities

3. Data

Google Earth Pro images of an urban area in Aurangabad. These images cover the area named Sangita Colony, Samarth Nager, N8, Sanjivani Nager, Nath Nager, Vasundhara colony, Vedant Nagar, and Khadkeshwar which are situated in different location of the city. These images found buildings of different sizes, roof covering, forms, and arrangements. The high-resolution image with 3 bands Red(R), Green (G), and Blue (B).

4 Building Extraction

The process of building exaction can divide in to three sections 1. Preprocessing, 2.separating buildings from the background and 3.will count the building and building area. The proposed method of flow is given below:

Fig. 2. Flow of Extraction process

4.1 Preprocessing

In preprocessing the image converted to binary image and then after the image is complement. And the resulted image use for further process.

4.2 Otsu's Thresholding

Thresholding is an image segmentation technique in which the interested object in an image are separated by selecting an optimal gray-level threshold value for objects. Manual differentiation an object from the complex background is easier but same task in digital image object separation using thresholding is a different and difficult task to separate using thresholding. To develop thresholding algorithms of an image, the gray-level histogram of an image is used efficiently as a tool [21, 22].Otsu's Thresholding method is simple and effective and represent gray values of image, which comes from global thresholding. The Otsu method was proposed by Scholar Otsu in 1979. Two dimensional Otsu algorithms applied on both pixels gray-level threshold value and its spatial correlation information between neighborhoods. It gives satisfactory segmentation result on noisy images [23].

OTSU'S Method works based on the idea that minimizes the weighted within-class variance. This turns out to be represented the same as maximizing the between-class variance. Hence the histogram is constructed for the given image, it works directly on the gray level histogram. [24]

4.3 Morphological operations

The mathematical morphology is a tool that helps to represent and describe region shapes, like boundaries, skeleton, and convex hull. Mathematical morphology is a powerful approach to multiple image processing problems. In the present paper mathematic morphology is used for preprocessing and post-processing. There are different techniques of morphological operation such as filtering, thing, and pruning are used. [22] Opening operations perform smoothing the contours of an object whereas closing operation smoothies section of contours but opposite to opening operation. The geometric fitting properties of opening operation gives to a set of theoretic formation which helps to boundary extraction of an object. The closing operation has the same geometrical interpretation except it works on outside boundaries. And hence the building is separated. [22]. the morphological operation on 30cm GeoEye-I satellite image gives good amount of the building count. [25]

5. Results

Fig. 3 and Fig. 4 show the result with the output as building both the images show the medium density images. The first step to convert the image to the complemented image and find the threshold values for the building are calculated automatically so that all the buildings are separated. Next step the filters were applied for removing the noise that are the unwanted small objects such as cars and other than building objects.

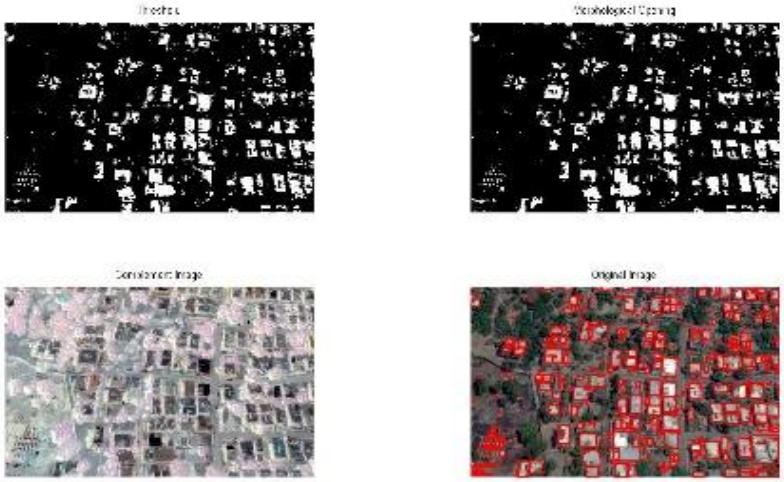

Fig. 3. Samarth Nager

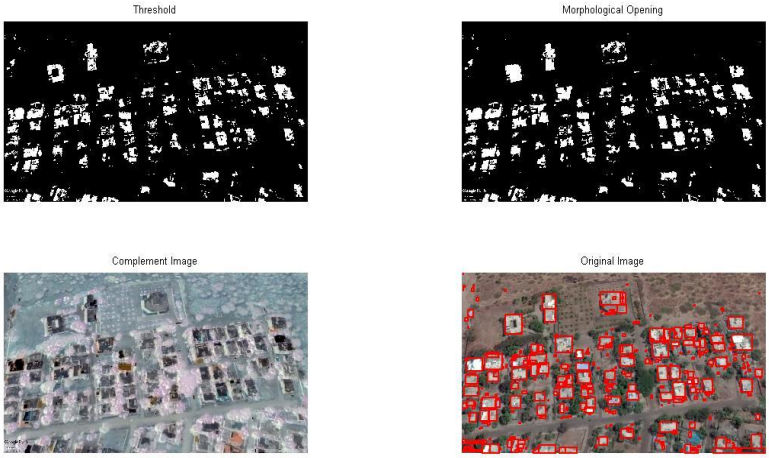

Fig. 4. Samarth Nager

Building count calculated by count each building box and then the area is calculated for each building concerning the Google earth Pro image resolution for available images

Table1: Reuslt Analysis

Area	TP	FP	FN	Total Buildings	Miss Factor %	Branching Factor %	Building Detection %
Samarth Nager	275	146	25	429	0.091	0.531	91.67
Sangita colony	400	129	50	570	0.125	0.323	88.89
Average					**0.21**	**0.17**	**82.75**

Table 1. Result Analysis is Accuracy derived by manually visual inspection. Every building in the output image was either marked as True Positive, True Negative, False Positive, or False Negative using the following definitions: True Positive (TP): Both the automated and manual methods classified the area as building. True Negative (TN): Both the automated and manual methods classified the area as non-building. False Positive (FP): Only the automated method classified the area as building. False Negative (FN): Only the manual classification classified the area as building.

5.1 Statistical measures:

Branching Factor: FP/TP,

Miss Factor: FN/TP

Building Detection Percentage: 100 ×TP/ (TP + FN)

The ‘Branching Factor’ measure the commission errors in presented method incorrectly labeled building areas, ‘Miss Factor’ measure of omission error,

‘Building Detection Percentage’ gives the percentage of building pixels correctly labeled by the automated process.

Conclusion

The result gives a satisfactory result for building detection in medium density images. The morphological operation performs identifiable with median filter after the OTSU’S Method. This count of the building will be verified by the technical department of government for accuracy. This also has lacunas as some buildings do still not identify the further research will be carried out for separating the buildings from the other concreate sturtures like parking and other strutures.

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