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Separate Building from High Resolution GoogleEarth pro Image Using Morphological Operation

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Abstract— Accuracy in building detection from the high-resolution image is quite difficult because construction strategies are different from the locality, size of the place, the layout of the area and material used for the construction. For the find building have to consider the characters of building like roof reflection, roof color, contrast, and the building allocation in high, low, and medium density. In the present study, the morphological operation is used for the separation of the building. The Google Earth Pro images with the resolution 4800×2718 for Aurangabad Maharashtra India city are used for the study. According to the locality, the building is count. The resulting accuracy is 79.73%.

Keywords— Building detection, morphological operation, GoogleEarth Pro image, Area in pixel.

Introduction

The images of Google earth pro is havingthe resolution 4800×2718 and acquires image from Digital Globe's, Quick Bird satellite via Google Earth pro. The resolution depends on the selected area. Generally Google Earth Pro image having 4800 pixels resolution and Google Earth having 1000 pixels resolution. The spatial resolution of the Google earth image varies from 60 cm, 2.5m, 15m [1, 2]. Automatic building extraction from high-resolution satellite imageryis considered as vital field of research in remote sensing and machine visions owing to the increasing importance of the urban studies in the context of urban sprawl and climate change, along with protection of the environment [3]. Automatic procedure till not going to effective[4] because it has multiple steps to find the result this is because verity building spectral features as man-made object and different object required for the construction of building and also the building spectral features matches with other man-made objects like road, parking lot, etc. [5]. Pixel-based method for extracting building from the high-resolution satellite images used for the semi-automatic extraction of building [6][3][7]. Pixel-based method improves the quality of the classification process by detecting boundaries [8]. The building can be represented with a group of pixels in high-resolution satellite imagery since the pixel is small in size. The object-oriented image analysis has been applied for remote sensing data [9-16]. The human visual interpretation system can understand typical patterns and their relations with real objects but in addition to the grey value varies with other features such as the texture, shape, size, and inter-objects relationships are effective in developing these patterns [17]. Spectral features for building extraction, particularly where there is a spectral overlap between the building and other urban features, due to this limitation the object-based image analysis seems necessary because of considering spatial, contextual, and geometric concepts [8]. A review has been conducted in relation to building extraction from high-resolution satellite imagery by making use of the object-based image analysis [18-22]. In another research, a Quickbird image was used for the object-based image analysis to extract the urban features for making a building inventory of Bangkok city [19]. The Multi-level segmentation approach was used to detect different urban objects in appropriate size and the segments classified in a hierarchical scheme. The fuzzy membership function was applied to utilize different shape, size, and spectral feature characteristics for building detection. [20]

I. Building Detection

A. Principle

From the literature review, this paper focusing on the extracted building from Google Earth pro image with high resolution since the work on these images has less no of work. In the present paper images acquired by Google Earth pro with maximum resolution level so can appear the buildings from the image. The present study performs thresholding after preprocessing images. The building threshold range has to confirm for the extraction and provided to Otsu's threshold. Then after the morphological operations are applied to the threshold image. Lastly, the buildings are separated by the marking borders to the individual building.

Thresholding is used to separate the regions of the image corresponding to an object from its background [23]. Thresholding is a very convenient way of performing segmentation. Here, the difference in intensities or colors in the foreground and background regions of an image to generate a binary image. Thus thresholding can be defined as an image processing function that is used to segment an image by setting all

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pixels whose intensity values are above a threshold to a foreground value and the remaining pixels to a background value [24-25]. It can also be used to see what areas of an image consist of pixels whose values lie within a specified range, or band of intensities (or colors). The input to a thresholding operation is typically a grayscale or color image [26].

- Otsu's Thresholding:

Otsu shows that minimizing the intra-class variance is the same as maximizing inter-class variance:

$$\sigma_b^2(t) = \sigma^2 - \sigma_w^2(t) = \omega_1(t)\omega_2(t)\left[\mu_1(t) - \mu_2(t)\right]^2 \quad (1)$$

Which is expressed in terms of class probabilities ωi and class means μi which in turn can be updated iteratively. This idea yields an effective algorithm. [27]

- Morphological operations:

Fill operation: It is used to fill the holes in the grayscale image I. A hole is defined as an area of dark pixels surrounded by light pixel. The following MATLAB syntax is used to ill holes in the image:

Ifill = imfill(Ibw,holes) (2)

Where I is a binary image. The advantage of fill operation is to fill the gaps in the image by describing an area of dark pixels bounded by light pixels and producing another binary image I2.

- Open operation: The morphological open operators are normally applied to the binary image. It is used to remove the features that are smaller than the value of p pixels and retains the large structure in the image. The following MATLAB syntax is used to extract the objects from the input image:

IM = bwareaopen(Ifill, p) (3)

The experiments represent threshold value of 40 pixels (p = 40) which is found to be appropriate for the extraction of majority buildings [27]. Following are the result after the opening operation.

- Post Processing

The opening operation generally smoothes the contour of an object, breaks narrow strips, and eliminates thin protrusions. Then building is separated using rectangular box. For that the region growing concepts are used.

- Regional Descriptor

After the segmentation through the morphological opening the regional descriptor separates the buildings using bounding box. A region may be represented by its boundary, and its boundary described by some features such as length, regularity. Features should be in sensitive to translation, rotation, and scaling. Both boundary and regional descriptors are often used together.[28] Fig.3 represent the regions of building selected by the boundaries which are separated by the backgrounds.

Data

The described methodology was applied to the Google Earth Pro images of an urban area in Aurangabad city which are populated with medium density. These images cover the area named as N8, Vasundhara colony, Samarth Nagar which are situated different location of city. As it can be observed, these three images include buildings with different sizes, roof covering, forms, and arrangements.

II. EXTRATION PROCESS

In the present paper Geoeye-1 satellite imagery used with the 40 cm resolution to evaluate the performance of our methodology. The high resolution image with 3 bands Red(R), Green (G) and Blue (B). The image is segmented using ENVI4.4 software. This method find the most of the building automatically. The propose method flow is given in below

- Preprocessing:

Image Segmentation:

GeoEye-1 image is of 40cm resolution and large in size. So processing the large image is quite difficult thus the first operation done on image is the image is get segmented so processing get easier. For the segmentation ENVI 4.4 software used. The image is divided into subset using ROI.

Image Binarazation:

The subset image is feed to the MATLAB program and the image is converted in to the binary image with the help of conversion. Before binarization the image is inverted so that the

III. RESULTS AND CONCLUION

Resulted images for the Aurangabad areas like Vasundhara colony, Samarth Nagar, and N8 which are well located with the buildings. The area are Medium density areas.

Fig. 2 Vasundhara Colony and Resulted Image

Fig. 3 Samarth Nagar and Resulted Image

Fig. 4 N8 and Resulted Image

TABLE I. TOTAL COUNT OF BUILDINGS

Subset	TP	FP	FN	Total Buildings	Miss Factor %	Branching Factor %	Building Detection %
N8	370	100	100	570	0.270	0.270	78.72
Vasundhara colony	330	179	85	594	0.258	0.542	79.52
Samarth Nagar	310	183	73	566	0.235	0.590	80.94
Avarage					0.254	0.468	79.73

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