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Research Paper Engineering

SHADOW DETECTION AND REMOVAL CAUSED BY MANMADE BUILDINGS IN HIGH RESOLUTION REMOTE SENSING IMAGES

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ABSTRACT *High-resolution aerial images allow a substantial data source for several areas of study. This proposal deals with characteristics of high resolution aerial images, mainly focus to identify shadows from high resolution color aerial image, and also undertaken to confiscate the shaded region in the metropolitan area. The recognition of the edges will be affected mostly by the application of the external parameters. In this process the region growing thresholding algorithm is used to detect the shadow region and extract the feature from the shadow region. The concept of region growing algorithm is checking the neighboring pixels of the initial seed points. Then determine whether those neighboring pixels are added to the seed points or not.*

KEYWORDS : Change detection, Inner–Outer Outline Profile Line (IOOPL), Region Growing (RG), Relative Radiometric Correction, Shadow Detection, Shadow Removal.

INTRODUCTION

Now a day the man survive in the huge region of the universe, so to monitor the land area, satellite imagery is used to detect the earth locality. In aerial images, shadows are spread by buildings presence, especially in metropolitan atmospheres. Shadows can be engaged to sense buildings and approximate the elevation of the buildings. The major difficulty induced by shadows is either a lessening or overall loss of information in an image [1]. The shadows play a vital role in aerial images since the science is in subsistence. By using the huge growth in aerial imagery, progressively high resolution images used for urban development and organization. From the most former days of aerial imagery, the consequences of shadowing have been employed to spotlight ground characteristics in applications such as archaeology and aerial assessment [2]-[3].

We don't have sufficient image processing algorithm to analyze shadow imagery. So this proposal mainly focus to get the aerial image of high resolution, and also undertaken to remove the shaded region in the urban area. Because of ambient light present in image, by comparing two pixels the ratio of them not same in red, green and blue color channels. The two pixels which are compared earlier will be different in hue, intensity and saturation [4]. Thus, correcting intensity of the pixels which are covered with shadow does not confiscate the shadow, and we need to accurate the chromaticity values as well [5]. Using density of the shadow, the area which is covered with shadow is segmented into sunshine, penumbra and umbra regions. For shadow detection there are some existing techniques, those techniques may classified into two Groups: model-based and shadow-feature-based.

An improved algorithm presents that aggregation of the two existing techniques. First, according to the space coordinates of buildings the shadow areas are estimated, calculated from digital surface models and The altitude and azimuth of the sun. Then, to exactly recognize a shadow, the threshold value is obtained from the threshold grayscale value of the shadow areas. In RG, the input is a group of seeds taken by the image. By comparing regions to all the unallocated neighboring pixels, the regions are grown iteratively. The calculation of similarity is obtained by taking the difference among a pixel value of intensity and mean of the regions. The smallest value measured for a pixel by using this method is allocated to the respected region.

Literature Survey

The difference between multi-date IKONOS images by using positional information, for the same calculation feature matching technique is also used [6]. This proposal inspects past and current research and proposes a solution to the difficulty of automatic detection and removal of shadow features [7]. Tests show that while detection and removal of shadow features can lead to improved image quality, results can be image dependent [8]. The consequence of shadowing are in combined regions of dramatic changes in surface elevation, namely in urban area [9]-[10]. Extracting building efficiently from optical multi-angular imagery a hybrid approach is proposed for automatic estimation of relative building height one algorithm is formulated i.e. template matching algorithm [11]. The methodology offers a simple technique to identify and eliminate shadows from RGB image [12]-[13]. The shadows are with inflexible boundaries [14]-[15].

Proposed Algorithm

An improved algorithm presents that aggregation of the two existing techniques.

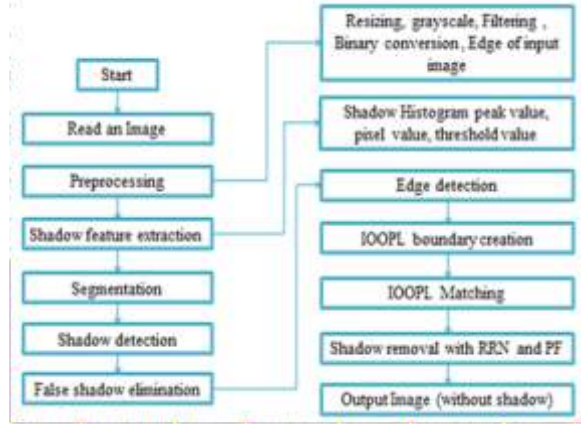


Fig 1 Flowchart of Proposed Algorithm

Every objects present in an image, which are going to be segmented marked by seeds. By comparing regions to the all unallocated neighboring pixels, the regions are grown by iteratively. The calculation of similarity is obtained by taking the difference among a pixel's value of intensity and the mean of the regions. The smallest value measured for a pixel by using this method is allocated to the respected region.

Image Segmentation

Traditional image segmentation methods expected to produce insufficient segmentation that creates difficulties in shadow separation from dark objects. For this situation improvement into a certain degree

achieved through CM constraints. Color and shape factors also added to the segmentation process. The parameters of an image i.e. grayscale average, variance, area and perimeter have been recorded for each object.

Detection of Suspected Shadow Areas

Precisely to separate shadow and non shadow areas, researchers followed different number of methods. For shadow detection there is a possible way to locate the threshold provided by bimodal histogram technique. It can be achieved by using gray scale value with the minimum frequency in the neighborhood of

$$G_q = 1/2\,(G_m + G_s) \quad (1)$$

$$h(T) = \text{Min}\{h(G_q - \varepsilon), h(G_q + \varepsilon)\} \quad (2)$$

Where,

G_m = image average grayscale value;
G_s = left peak of the shadow in the histogram;
T = threshold;
ε = the neighborhood of T;

By performing number of experiments, we have initiated that the average of the grayscale values can be used to restore the right peak.

Elimination of False Shadows

Dark objects might be integrated in the suspected shadows, hence a number of exact shadow detection outcomes be essential to remove these dark objects. Smaller gray scale difference resulted from Rayleigh scattering between two area i.e. shadow and non shadow in waveband of blue and waveband of green. Gray scale average of green waveband G_g is slightly lesser than blue waveband G_b. False shadows can be eliminate by using comparisons of blue and green wavebands.
For an object let it as x,

$$G_b + G_a < G_g$$

Where,
G_a = Correction parameter
G_b = Blue waveband
G_g = Green wave band

Shadow Removal

In this proposal, IOOPL technique is used for shadow removal. By narrowing the boundary of shadow inwards the inner outline can be obtained, expanding the boundary of shadow the outer line can be obtained. In the figure2 R is the vector line of the shadow boundary received from shadow recognition, *R1* is the outer outline, and R2 is the inner outline. R1 and R2 nodes have one-to-one correspondence. The objects on both sides of the shadow boundary correlated through a building forming a shadow are generally not identical, and the corresponding IOOPL sections are not reliable. In addition, the irregular sections on the inner and outer outlines that cannot represent identical objects require to be ruled out. By examining the gray scale distribution characteristics of the inner and outer homogeneous IOOPL sections the parameters for shadow removal are obtained.

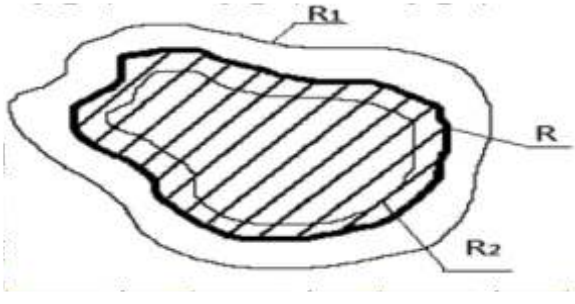


Fig.2 Boundary Extraction

IOOPL Matching

During the IOOPL process, Gaussian smoothing is performed to simplify the view of IOOPL, as shown in Fig. 3. To rule out the non homogeneous sections, the IOOPL is divided into average sections with the same standard, and then, the similarity of each line pair is calculated section by section. If the correlation coefficient is large, it means that the shade and light fluctuation features of the IOOPL line pair at this section are consistent. Line pair belongs to the same type of object when it is consistent with different illuminations, and as a result it is considered to be matching. Some abnormal parts representing some different types of objects exist in this section that means correlation coefficient is small. Hence, these parts should be ruled out, as shown in Fig. 3.

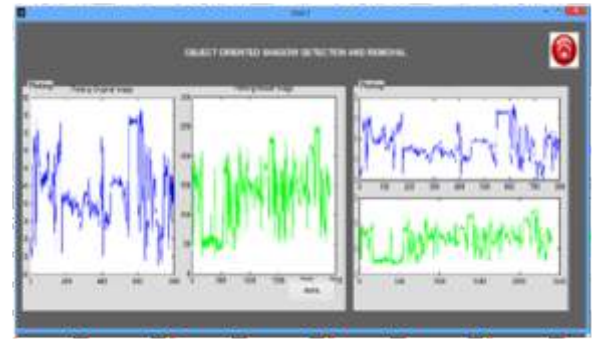


Fig.3. Diagram of IOOPL and IOOPL matching.

Implementation of Shadow Removal

Shadow removal achieved by using two approaches.

- Relative Radiometric Normalization (RRN)
- Polynomial Fitting (PF).

Relative Radiometric Correction

To keep away from the control of scattering light from the environment, each single object considered as a unit for which the shadow removal process is performed for that object. This enhances reliability. Normally utilized relative radiation correction commonly assumes that a linear relationship presents between the gray scale value digital number (DN) of the image to be corrected and the DN of the reference image,

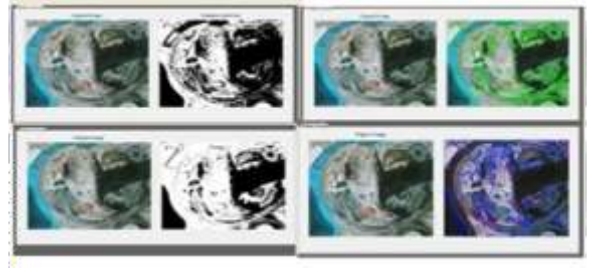
$$DN_{ref} = a \times DN_{rect} + b.$$

Where,

DN_{ref} = reference image digital number;
DN_{rect} = DN of to be corrected image;
a=Gain
b=offset

Result and Discussions

To authenticate that our technique works, the following experiment was performed. The information used for experiment is a IKONOS, QICK BIRD image of Alburj, Dubai, QICK BIRD image Giza-pyramids, Egypt. Each step of this technique is depicted here, and the steps and related results of each step are given from Fig. 4&5. Besides, to compare with our technique, we find out the pixel-level threshold shadow detection result with manually selected proper threshold.



Fig(4)a. gray scale image, b. segmented image, c. false shadow eliminated image, d. boundary extracted image.

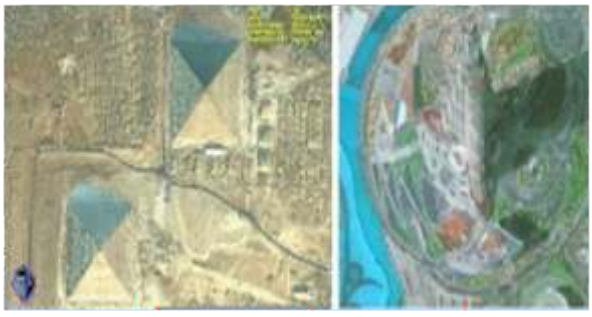


Fig 6 Recovered Image

Conclusion

This methodology has illustrates a group of procedures that execute shadow investigation on high resolution aerial imagery. Each step develops the association between man-made structures and cast shadows to execute structure shape calculation. First image segmentation considered for shadowed image. After the segmentation spectral features of suspected shadows are examined. False shadows eliminated by utilizing previous results i.e. suspected shadow detection. Results obtained from this method compared with traditional segmentation methods. For shadow extraction homogeneous sections found with the help of a technique i.e. IOOPL matching the experimental results revealed that shadow recognition method projected in this proposal can firmly and truly recognize shadows.

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