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Successive thresholding scheme for shadow detection of Aerial images

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Abstract

The paper is comparing the methods for enhancement of the computer vision algorithms. In first threshold values are varied to observe the difference of shadow detected area. This area is compared with standard photo editing software tool for shadow detection. Using successive thresholding scheme maximum shadow area is detected. In anticipated Successive thresholding scheme, the customized ratio map, obtained from application of the exponential function to the ratio map, is presented. It extends the gap between the ratio values of shadow and non shadow pixels. The methods applied to find out the true shadow pixel.
Keywords:Coarse-to-fine strategy, color aerial image, shadow detection, successive thresholding scheme (STS)

Introduction

The vital role is played by the shadow detection in improvement of vision tasks. Object identification needs the better pixel of the picture. The identification technique of the images is very important and finds plenty of applications in this modern era e.g. remote sensing and 3-D image processing. Basic reason of the shadow generation is blocking of the light source by some subject.[3]

There are two types of shadows-self shadow and cast shadow. Self shadow is a shadow on a subject on the side that is not directly facing the light source. A cast shadow is the shadow of the subject falling on the surface of another subject. Based on the intensity, the shadows are two types-hard and soft. The soft shadows keeps background texture, while hard shadows are very dark with little texture. Hence the identification of hard shadows is difficult.[2]

The three features, which are intensity values, geometrical properties, and light directions, several efficient algorithms have been presented to detect shadows for gray aerial images. Since gray aerial images only provide the intensity information, some nonshadow regions may be identified as shadows even if the aforementioned three features have been considered. However, for color aerial images, the shadow detection accuracy can be improved by utilizing both the intensity and the color information. [4]

The high wavelength and the low luminance properties are useful for identification of shadows.

According to the two shadow assets, the red, green, and blue (*RGB*) color aerial image is first transformed into the hue, saturation, and intensity (*HSI*) color model, and then, a segmentation practice is pertainto the infiltration component and the concentrationpart to recognize shadows. Later the pixels in a shadow sectiongenerally have big hue value, low blue color value,and small discrepancy between greenandblue color values. The input pictureisaltered into the *HSI*; hue, saturation, and value (*HSV*); luma, blue-difference chroma, and red-difference chroma (*Y CbCr*); hue, chroma, and value (*HCV*); or luminance, hue, and saturation (*YIQ*) color models.

Various Shadow detection Methods:

Sr. No	Technique	Key Idea
1	Chromaticity	Combination of Hue and saturation.
2	Region Growing	Seed spot are selected and total shadow area, growthcontrolled by connectivity
3	Dual-pass Otsu	Pixels value is separated into high andlow level intensity.
4	Color	Color discrepancy of shadowed pixeland background pixels as well asillumination invariance is used.
5	Geometry	The orientation, size and even shape ofthe shadows can be predicted.
6	Intensity Information	Standard deviation is calculated forratio value.
7	Threshold based	Predefined threshold level is used to determineshadow pixels.
8	Color and Statistical Information	Different colormodels are used.
9	Segmentation based	Classification techniques like SVM areused based.
10	Texture-based Shadow Detection	Takes in account the similarity betweenbackground and shadow texture.

11	Edge based	Itis used toidentify missing pixels.
12	Edge subtraction and morphology	Used to discoverbackground edge and foreground edge.

1. Proposed System:

Shadow detection:

Successive Thresholding based algorithm is used to detect shadows for aerial images.

- Input image is converted into ratio map by color transformation method.
- Ratio map is then modified by applying exponential function so that gap between shadow & non-shadow pixels stretches
- A coarse shadow map is achieved by global thresholding method.
- The shadow pixels are located to form region by using connected component analysis & then local thresholding method is pertained to each section iteratively to sense true shadow pixels.
- To verify that the remaining shadow pixel is true, a fine shadow determination progression is applied.

The Flow Chart for Shadow detection is shown in figure.1

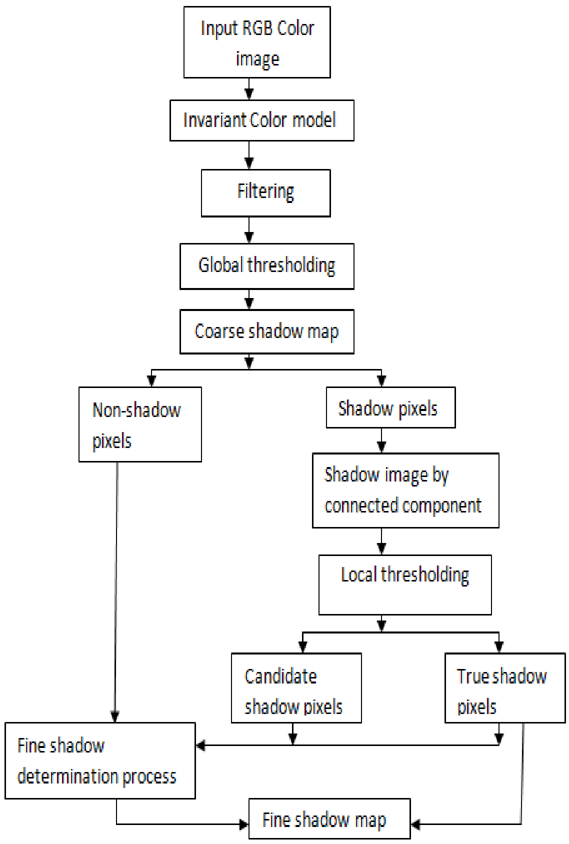

Figure 1flow chart for shadow detection

2. Block Diagram of Shadow Detection:

Block diagram of shadow detection using successive thresholdingis as shown in figure.2

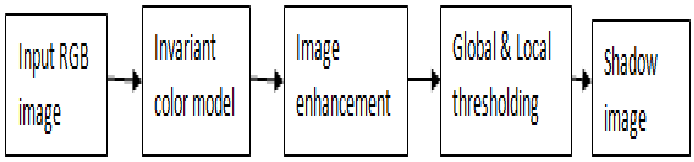

Figure 2 block diagram for shadow detection

The color models are used to recognize the shadow. Shadecontender regions are removed and the pixels are categorized as self-shadow points or as cast shadow points by using the invariant color features.

Related theory:

Shadow detection-

Given an input RGB color aerial picture I, we first transform I to the HSI color model by, and then ratio map R_ can be acquired. Moreover, the anisotropic filter is implemented to R_ to relieve the noise effect without blurring the boundaries between candidate shadow areas and nonshadow areas. In order to refer greater shadow statistics, the morphology dilation operator with 3 × 3 square structuring elements is implemented to R_ to expand the candidate shadow regions. Below the acquired ratio map R_, Otsu's approach is used to determine a threshold T for constructing the coarse-shadow map. In STS-based set of rules, only the candidate shadow pixelsare required to perform theneighborhood thresholding procedure to identify real shadow pixels. For the candidate shadow pixels in the coarse-shadow map, we construct candidate shadow areas by applying the connected component analysis to these pixels. Next, for each candidate shadow location, the neighborhood thresholding procedure is implemented to differentiate real shadow pixels from candidate shadow pixels.

Ratio map acquired via the usage of: shadow ratio = ((4/pi).*atan(((b-g))./(b+g)));

Successive Thresholding based set of rules is used to detect shadows for aerial pictures. Input picture is transformed into ratio map by color transformation approach. Ratio map is then modified by applying exponential function so that gap between shadow & non-shadow pixels stretches.

A coarse shadow map is acquired by applying the global thresholding method. This separates input picture into candidate shadow pixels & non shadow pixels. The candidate shadow pixels are grouped to form candidate shadow area by the usage of connected component analysis & then local thresholding method is carried out to every area iteratively to detect real shadow pixels from candidate shadow pixels. To check whether the remaining candidate shadow pixel is real shadow pixel or not, a fine shadow determination method is carried out.

3. Manually calculated shadow detection results:

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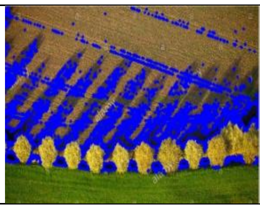
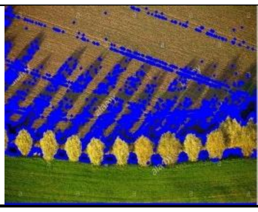
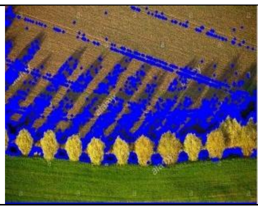
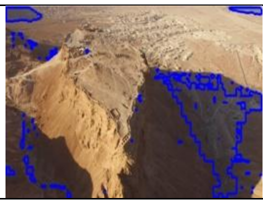
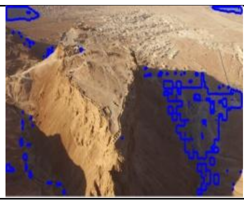
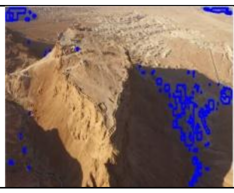
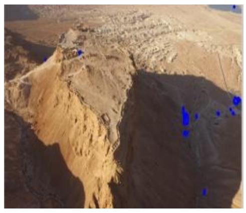
Input Image	Threshold
	0.01
	
	0.02
	
	0.04
	
	0.07
	

Input Image	Threshold
	0.01
	
	0.02
	
	0.04
	
	0.07
	

Input Image first is processed for shadow detection using thresholding Method. The threshold values are varied to observe the difference of shadow detected area. From the results of image first we can observe that when we put 0.01 thresholds nonshadow area is also considered as shadow area. Further increment in threshold will again decrease the area under shadow. In this case we observe very slight area which is added from outside shadow area. Hence shadow area detection is dependent on various threshold values.

Table1 shows the shadow area for different thresholds for four images.

Threshold	Image 1	Image 2	Image 3	Image 4
0.01	75317.5	36693.63	5963.75	2127.5
0.02	75831.88	37806.38	5338.5	2075.5
0.03	69783	38633.25	4084.25	1957.5
0.04	65007.63	38490.13	2285.5	1857
0.05	60761.63	36865.25	1693.75	1762.875
0.06	57275.38	34987.13	1307	1671.125
0.07	54156.63	32405.63	1145.5	1413.625
0.08	51402.25	32405.63	1077.75	1200.625
0.09	49213.5	27830.88	863.875	1012.75
0.1	47100.13	25755.5	636.875	842
By photo Editing tool	75900	36693.63	5340	2075.5

Table.1

Figure 3 below shows the plot of shadow area versus thresholds.

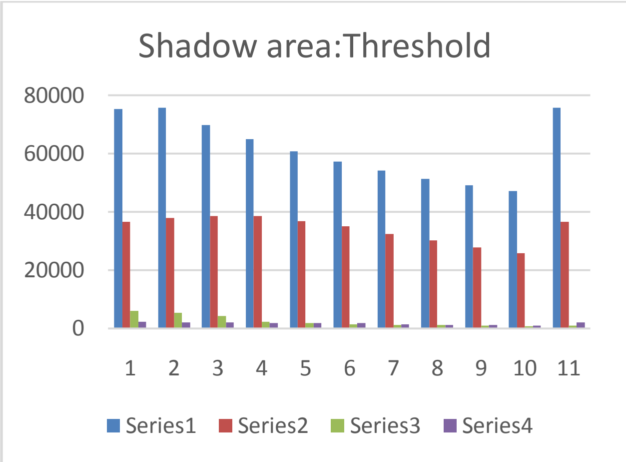
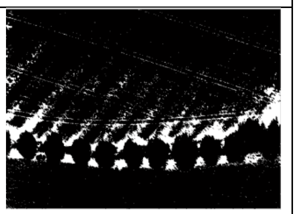
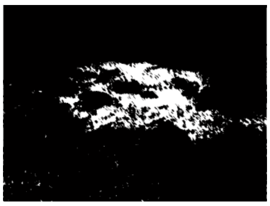


Fig.3

4.Dynamically Calculated shadow detection results:

Input RGB Color Image	Shadow boundaries
	
	
	

Dynamically calculated result gives maximum approximate shadow detected area.

5.Conclusion: This paper proposed successive thresholding scheme (STS) based algorithm. It has been offeredto identify shadows of aerial images. Investigationaloutcomesverifiedthat anticipated STS-based algorithm has superior shadow identificationaccurateness compared toother algorithms**.**

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