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A System Which Supports Shadow Detection and Shadow Removal for High Resolution Remote Sensing Images

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Abstract:
Shadow will occur by sunlight or any light sources. We cannot get clear and quality picture for obtain the shadow in the images. The objective of this paper is detected and removal of shadows plays an important role in application of urban high resolution remote sensing images. Object oriented shadow detection and removal methods are used in this paper. Shadow detection is used during the image segmentation. The suspected shadows are extracted by the statistical features. For shadow removal, support vector machine and adaboost classifier based on IOOPL matching could effectively remove the shadow. According to the homogeneous section shadow removal will be performed. Our method can accurately detect shadows from urban high-resolution remote sensing images and can effectively restore shadows with a rate of over 95%.

Keywords: Object oriented; IOOPL; shadow detection; homogeneous section; and shadow removal

INTRODUCTION

The presence of shadows has been responsible for reducing the reliability of many computer vision algorithms including segmentation, object detection, scene analysis, tracking etc. Therefore shadow detection and removal is an important preprocessing for improving performance of such vision tasks. The availability of spatial resolution satellites such as Quick-Bird, Geo-Eye and Resource 3 for the observation of earth and the rapid development of some aerial platforms such as airships and unmanned aerial vehicles applications of urban high-resolution remote sensing images such as object classification, object recognition, there has been an increasing need to analyze high resolution images for different applications. In urban areas, surface features are quite complex, with a great variety of objects and shadows formed by elevated objects such as trees and high buildings. Although shadows themselves can be regarded as a type of useful information in 3-D reconstruction, building position recognition, and height estimation, they can also interfere with the processing and application of high-resolution remote sensing images. For example shadows may cause incorrect results during change detection. Consequently, the detection and removal of shadows play an important role in a change detection and image fusion. The obstruction of light by objects creates shadow in a scene. An object may cast shadow on itself called self shadow. The shadow areas are less illumined than the surrounding areas. In some cases the shadows provide useful information, such as the relative position of an object from the source but they cause problems in computer vision application like segmentation, object detection and object counting. Thus shadow detection and removal is a preprocessing task in many computer vision applications. Based on the intensity the shadows are two types –hard and soft shadows. The soft shadows retain the texture of the background Surface, where as the hard shadows are too dark and have little texture. Thus the detection of hard shadows are complicated as they may be mistaken as dark objects rather than shadows.

SHADOW DETECTION

Shadows are created because the light source has been blocked by something. There are two types of shadows self shadow and cast shadow. But self shadow is a shadow on a subject on the side that is not directly facing the light source.

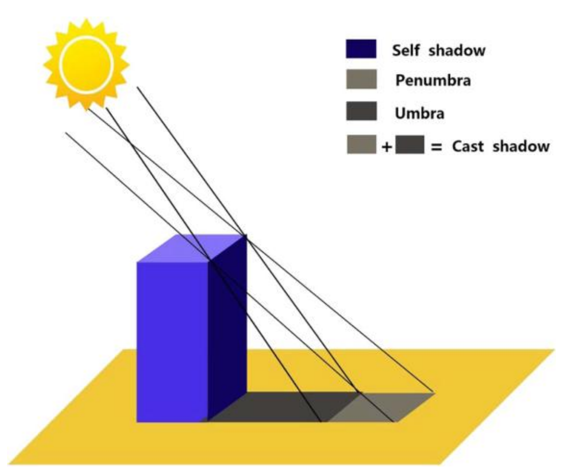

Fig.1. principle of shadow formation

A cast shadow is the shadow of the subject falling on the surface of another subject because the former subject has blocked the light source.

A. SEGMENTATION:

Traditional image segmentation methods are likely to result insufficient segmentation, which makes it difficult to separate shadows from dark objects. The CM constraints can improve situation to a certain degree. To make a further distinction between shadows and dark objects, color factor and shape factor have been added to the segmentation criteria. The parameters of each object have been recorded, including grayscale average, variance, area and perimeter. The segmentation scale could be set empirically for better and less time-consuming results, or it could be adaptively estimated according to data such as resolution.

B.BINARIZATION:

Bimodal histogram splitting provides a feasible way to find threshold for shadow detection, and the mean of the two peaks are adapted as the threshold. In our work, we attain the threshold according to the histogram of the original imageand than find the suspected shadow objects by comparing the threshold and grayscale average of each object obtained in segmentation.

SHADOW PROPERTIES:-

Spectral properties of shadows:

To describe the spectral appearance of a surface in shadow, let us consider the physics of colour generation. The appearance of a surface is the result of interaction among illumination, surface reflectance properties, and responses of a chromatic mechanism. This chromatic mechanism is composed of three colour filters in a colour camera. Ambient light can have different spectral characteristics with respect to direct light. The case of outdoor scenes, where the diffuse light from the sky differs in spectral composition with respect to the direct light from sun.

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Geometrical properties of shadows:

The geometric appearance of a shadow depends on objects and scene layout. However, it is possible to identify some geometrical characteristics of shadows, the shadow boundaries, without any knowledge of the structure of the object or of the scene. Shadow boundaries can be classified into four classes: shadow making lines, shadow lines, occluding lines, and hidden shadow lines.

Detection of Shadow Areas:

In this method, shadow feature is extracted with region growing threshold method. Then object properties such as spectral features and geometric features are combined with a spatial relationship, in which the false shadows are detected and eliminated. Researchers have used several different methods to find the threshold to accurately separate shadow and non shadow areas. By the method region growing thresholding, detection of shadow and non-shadow areas and correctly separating the regions that have same properties are easily carried out. In the Histogram splitting provides a feasible way to find the threshold for shadow. In the histogram average of the two peaks is adopted as the threshold. The shadow objects are found by comparing the threshold and grayscale average of each object obtained in segmentation. In addition, atmospheric molecules scatter the blue wavelength most among the visible rays (Rayleigh scattering). So for the same object, when in shadow and non-shadow, its grayscale difference at the red and green wavebands is more noticeable than at the blue waveband. Thus, a suspected shadow is retrieved with the threshold method at the red and green wavebands. Specifically, an object is determined to be a suspected shadow if its gray scale average is less than the thresholds in both red and green wavebands. The resultant image as shown in fig.2.

Fig.2.Shadow Ddetection

C. ELIMINATION OF FALSE SHADOW

Dark objects may be included in the suspected shadows, so more accurate shadow detection results are needed to eliminate these dark objects. Ray Leigh scattering results in a smaller grayscale difference between a shadow area and a non shadow area in the blue (B) waveband than in the red(R) and green (G) wavebands. Consequently, for the majority of shadows, the grayscale average at the blue waveband(Gb) is slightly larger than the grayscale average at the waveband(Gg).Also, the properties of green vegetation itself make (Gg) significantly larger than (Gb), so false shadows from vegetation can be ruled out by comparing the (Gb) and (Gg) of the suspected shadows.

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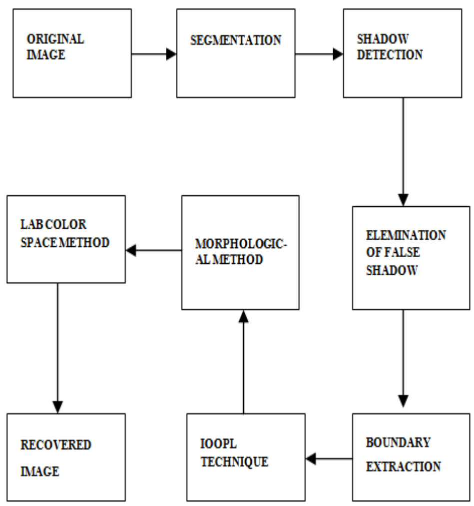
BLOCK DIAGRAM



SHADOW REMOVAL

To recover the shadow areas in an image, we use a shadow removal method based on IOOPL matching. Shadows are removed by using homogeneous sections obtained by line pair matching. There are two approaches for shadow removal. One approach calculates the radiation parameter according to the homogeneous points of each object and then applies the relative radiation correction to each object. The other approach analyzes all the homogeneous section for polynomial fitting (PF) and retrieves all shadows directly with the obtained fitting parameters.

A.INNER OUTER OUTLINE PROFILE LINES:

The objects on both sides of the shadow boundary linked with a building forming a shadow are usually not homogeneous, and the corresponding inner and outer outline profile line sections are not reliable. In addition the abnormal sections on the inner and outer outline that cannot represent homogeneous objects need to be ruled out. Consequently, similarity matching need to be applied to the IOOPL section by section to rule out the two kinds of non homogeneous sections mentioned previously. The parameters for shadow removal are obtained by analyzing the grayscale distribution characteristics of the inner and outer homogeneous IOOPL sections.

IOOPL matching is the process of obtaining the homogeneous sections by conducting similarity matching to the IOOPL section by section. During the process, Gaussian smoothing is performed to simplify the view of IOOPL. The Gaussian smoothing template parameter where $\sigma = 2$ and $n = 11$.

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 with (4). 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. If consistent, then this line pair belongs to the same type of object, with different illuminations, and thus is considered to be matching. If the correlation coefficient is small, then some abnormal parts representing some different types of objects exist in this section; therefore, these parts should be ruled out. The sections that have failed the matching are indicated in red. If more accurate matching is needed, the two sections adjacent to the section with the smallest correlation coefficient can be segmented for matching again.

B.MORPHOLOGICAL METHOD:

Binary images may contain numerous imperfections. In particular, the binary regions produced by simple thresholding are distorted by noise and texture. Morphological image processing pursues the goals of removing these imperfections by accounting for the form and structure of the image. These techniques can be extended to grayscale images .Morphological techniques probe an image with a small shape or template called a structuring element.

C.LAB COLOUR SPACE METHOD:

The L*a*b* color space includes all perceivable colors, which means that its gamut exceeds those of the RGB and CMYK color models (for example, Prophet RGB includes about 90% all perceivable colors). One of the most important attributes of the L*a*b*-model is device independence. This means that the colors are defined independent of their nature of creation or the device they are displayed on. The L*a*b* color space is used when graphics for print have to be converted from RGB to CMYK, as the L*a*b* gamut includes both the RGB and CMYK gamut. Also it is used as an interchange format between different devices as for its device independency. The space itself is a three dimensional real number space, which contains an infinite possible representation of colors.

D.APPLICATION:

Removing shadows from images can significantly improve and facilitate the performance of certain computer vision tasks, such as tracking, segmentation, and object detection, where shadow boundaries are often confused with those of different surfaces or objects. It is therefore of great importance to discover ways of properly detecting shadows and removing them while keeping other details of the original image intact. The Shadow detection and removal over the past decades, covering many specific applications, such as traffic surveillance face recognition and image segmentation.

CONCLUSION

A systematic and effective method for shadow detection and removal in a single urban high-resolution remote sensing successful. In order to get a shadow detection result, image segmentation considering shadows is applied first. Then, suspected shadows are selected through spectral features and spatial information of objects, and false shadows are ruled out. The subsequent shadow detection experiments compared traditional image segmentation and the segmentation considering shadows, as well as results from traditional pixel-level threshold detection and object-oriented detection. Meanwhile, they also show the effects of different steps with the proposed method. For shadow removal, after the homogeneous sections have been obtained by IOOPL matching, we put forward two strategies: relative radiation correction for the objects one at a time and removal of all shadows directly after PF is applied to all the homogeneous sections and correction parameters are obtained. Both strategies were implemented in high-resolution images.

FUTURE ENHANCEMENT:

In the future we improve image segmentation considering shadows can have better segmentation results.

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