Survey on shadow detection

shadow detection techniques

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***Abstract*—Accurate shadow detection can be hard due to the variations of light the background and similarity between under a particular set of conditions of the objects and the background. There have been many researches done on shadow detection. Many algorithms and methods have been developed for different environmental conditions to detect shadow from the images. This paper reviews some methods to detect shadows and analyzes their correctness. This paper is aimed to provide a survey on various algorithms and methods of shadow detection with their comparative study and advantages and disadvantages.**

***Index Terms*—Shadow and shadow detection**

I. INTRODUCTION

Shadows in digital images are either helpful or troublesome in image processing and pattern recognition tasks. Shadows are usually cast by elevated objects such as buildings, bridges, towers,etc. when they are light by the sunlight at the time of exposure. Shadows can provide additional geometric and semantic clues about the shape and position of its casting object and the position of the light source . there are mainly two light sources: direct sunlight, which can be regarded as a point light source; diffuse skylight, which can be regarded as an area light source. Shadows will occur when direct light from a light source is partially or totally blocked.

The shadow and non shadow regions are created only when the light energy is fallen on the object. A self shadow occurs in the portion of an object which is not illuminated by direct light. A cast shadow is the area projected by the object in the direction of direct light. Based on the intensity, the shadows are of two types − hard and soft shadows. The soft shadows retain the texture of the background surface, whereas the hard shadows are too dark and have little texture. Thus the detection of hard shadows is complicated as they may be mistaken as dark objects rather than shadows. Though most of the shadow detection methods need multiple images for camera calibration, the best technique must be able to extract shadows from a single image.

II. BASIC OF SHADOW

Shadow:

A shadow is created when direct light from any source of illumination is obstructed either partially or totally by an object[4]. If the light energy is fallen less, that area is represented as shadow region whereas if the light energy is emitted more, this area is represented as non shadow region.

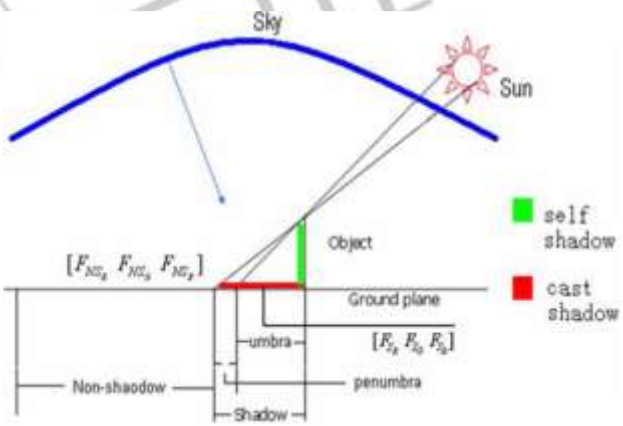

Figure 1Shadow will occur when direct light is occluded[4]

Self and Cast Shadow:

Shadow often degrades the visual quality of images. There are two types of shadows: the self-shadow and the cast shadow. A self-shadow is the shadow on a subject on the side that is not directly facing the light source. A cast shadow is the shadow of a subject falling on the surface of another subject because the former subject has blocked the light source. A cast shadow consists of

two parts: the umbra and the penumbra. The umbra is created because the direct lighth as been completely blocked,while the penumbra is created by something partly blocking the direct light The brightness of all the shadows in an image depends on the reflectivity of the object upon which they are cast as well as the illumination from secondary light sources[3].

As shown in Fig. 1, the illumination on nonshadow region is daylight that on penumbra is skylight and part of sunlight; that on umbra is only skylight. Since skylight is a component of daylight, pixel intensity in shadow must be lower than that in nonshadow background[4].Self shadows usually have a higher brightness than cast shadows since they receive more secondary lighting from surrounding illuminated objects.

Again cast shadow can be classified into two parts: umbra and penumbra. The part of a cast shadow where direct light is completely blocked by its object is called umbra, while the part where direct light is partially blocked is called penumbra. These regions are created due to multiple lighting. And the difference between the two lies in the contrast they have to the background.

III. SHADOW DETECTION TECHNIQUES

Model Based Techniques:
Model based techniques have limited applicability and are applied to specific problems (say aerial images) and simple objects only. These are dependent on prior information about illumination conditions and scene geometry as well as the object which also turns out to be a major drawback. a method of combining intensity with TAM image. Shadow detection based on TAM information and the accuracy of shadow is improved by intensity information. By combining TAM and intensity, it is improving quality of results. It avoids segmentation and requires one threshold. TAM used to detect shadows that describes attenuation relationship between shadow and non-shadow regions. It requires rough segmentation and four thresholds. It fails to give accurate results in complex scenes.

Image baesd Techniques:
In these techniques, image shadow properties like color and intensity, shadow structure and boundaries are used .Never the less, if any of that information is available, it can be used to improve the detection process performance.

Color Based Shadow Detection:
The color/spectrum model attempts to describe the color change of shaded pixel and the color feature that is illumination invariant. These methods mainly focus on the fact that, the shadows have a common color range than the objects. Li Xu Feihu et al. [6] proposed a method where two kinds of shadows are detected by creating a hard shadow mask and a vague shadow mask in gradient scale and is then combined together and filtered to remove both kinds of shadows.

Texture Based Shadow Detection:
The principle behind the textural model is that the texture of foreground objects is different from that of the back ground, while the texture of shaded area remains the same as that of the background[6]. The several techniques have been developed to detect moving cast shadows in a normal indoor environment.

Shadow detection using Segmentation:
In the detection process shadow and non shadow regions are separate . Morphological filters are solve the problem and to improve the quality by their effectiveness and to increase the capability in the shape preservation is performed by the possibility to adapt them according to the image filtering techniques (extracting the borders and shape of the surface)[6].

Geometry Based Shadow Detection:
Geometric model makes use of the camera location, the ground surface, and the object geometry, etc., to detect the moving cast shadows.

Based on Intensity Information:
A comparative study on the shadow detection methods, based on Intensity information, based on photometric invariants information, and color and statistical information method, gray-scale pixel intensity value in the presence of illumination changes fails to detect shadow region accurately. Shadow Detection using color Information:
To detect shadow pixels using the color information, first the Hue-Saturation-Intensity color space, LAB color space. These color features are selected due to their remarkable difference between the shadows, background and object pixels. The shadow pixels based on each of these calculated features are detected separately.

IV. LITERATURE REVIEW

Jiandong Tian, Jing Sun, and Yandong Tang Proposed Shadow detection based on tri color attenuation model. In this paper a novel method focusing on extracting shadows from a single outdoor image. The proposed tricolor attenuation model(TAM) that describe the attenuation relationship between shadow and its nonshadow background is derived based on image formation theory,, needs a rough segmentation but does not need an accurate one. It requires rough segmentation and four thresholds[5].

Jiandong Tian, Linlin Zhu and Yandong Tang Proposed New detection method for single color image in outdoor scenes. Combine TAM and intensity information to avoid the segmentation step and derive only one threshold to substitute previous four simple ones. Shadow attenuate pixel intensity, and degree of attenuation are different in the three RGB color channels.Shadows are dark in TAM images, which provide strong information for shadow detection sometimes the TAM based channel subtraction procedure may cause not only shadows[5] ,but also some other objects become dark, falsely classified as a shadow.TAM and intensity information to avoid the segmentation, intensity information is simply used to improve the boundary accuracy and details of the detected shadows[5].

The tricolor attenuation model (TAM) was proposed to detect shadows in a single image. Shadow identification was done, followed by generation of an invariant image, on which segmentation was performed. TAM was then used to detect the shadows, but dark areas were misclassified as shadows [9]. TAM uses the concept of intensity attenuation of pixels in the shadow region which is different for the three color channels. In [9], methodology for shadow detection is proposed by enhancing the TAM image using adaptive histogram equalization. This improves the contrast of the TAM image and thereby improving the quality of detection results.

Wenxuan Shi and Jie Li proposed To detect shadows from a single color aerial image. two ratio maps, which are the ratio value of the hue over the intensity and the ratio value of saturation over the intensity , to obtain candidate shadow and nonshadow regions. Shadow detection in color aerial images. Hue singularity pixels are extracted[12] . The candidate shadow and nonshadow regions are constructed on the base of the modified ratio maps by using the thresholding method, best shadow detection accuracy[12].

HSI model is proposed to improve the RGB model. The Hue Saturation Intensity (HSI) color model closely resembles the color sensing properties of human vision . To formula that converts from RGB to HSI or back is more complicated than with other color models[12].

V. SUMMARY

In this paper, first the basics of the shadow, how shadow occurs, then different types of shadows are disclose which appear in the images. Secondly, we have provided a comprehensive survey of shadow detection methods in indoor outdoor scene. Paper presents comparative analysis of different methods.

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