Analysis on Single Image Shadow Detection and Removal methods

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Abstract— Shadows are always the part of images that will reduce the correct edge detection, object recognition, image matching, change detection and other image processing techniques. To overcome this false data it is necessary to detect the shadows and remove them. Shadow detection and removal has a major role in deducting the changes that happens in the remote sensing images. It is applicable to identify the natural disasters like landslides, earthquakes etc. To determine whether a particular area is a shadow, we can compare with the nearby regions of image that are likely to be of the same material. There are several techniques followed to achieve the shadow detection which has drawbacks and even now seems to be a tough area to handle the detection methods.

Keywords— Shadow detection, single image, shadow removal, shadow detection and removal analysis

I. INTRODUCTION

A shadow is an area where direct light from light source cannot reach due to obstruction by an object. Shadow in the images will reduce the correct extraction of edge detection, object recognition, image matching, change detection and other processing techniques. To perform advanced image processing functionalities it is necessary to detect the shadows and remove them. Shadow detection and removal has a major role in deducting the changes that happens in the remote sensing images. Which is applicable to identify the natural disasters like landslides, earthquakes etc. To determine whether a particular area is a shadow, we can compare with the nearby regions of image that are likely to be of the same material. There are several techniques followed to achieve the shadow detection which has drawbacks and even now seems to be a tough area to handle the detection methods.

II. SHADOW DETECTION METHODS – ADVANTAGES AND DISADVANTAGES

A. Region Growing

In this technique based on the pixel intensity within the region of shadow the shadow region is deducted and identified. The base pixels are identified which will be considered and set as shadow group mean and standard deviation are calculated and used.

Advantages:
Orientation based techniques

Disadvantages:
When there is a variation of pixel intensity in various regions, then this technique will not be able to make proper detection of shadows.

B. Edge subtraction and morphology

In this technique shadow region is calculated based on the formula. Edge detection is used to detect background and foreground edge. Resultant edge image is calculated based on the difference of both background and foreground edge.

Advantages:
This is best suited in images where dark and light vehicles are available.

Disadvantages:
Since this is based on a formula, this method is computationally expensive.

C. Gradient based background subtraction

In this technique based on the gradient associated to each pixel the foreground is detected based on the Gaussian principle. Boundary of the image is obtained based on the neighboured ratio.

Advantages:
Real time applications can take advantage of this algorithm.

Disadvantages:
Location is used to detect the shadow which may not always be perfect method to achieve the needed functionality.

D. Intensity Information Based Approach

Standard deviation calculation is used to identify the intensity values at the point. Conditions are set for the shadowed pixel.

Advantages:
Mathematical calculation method of implementation will be mostly accurate to get the needed information.

Disadvantages:
Pixel intensity value is susceptible to illumination changes.
III. SHADOW REMOVAL METHODS

Several methods are available to remove the shadow that exists in the image. It is based on the shadow and no shadow region available within the image.

A. Color Transformation

In this method RGB based color images are converted into HSV color space. In HSV space the shadow regions have some special properties that can be used to identify and remove the shadow regions within the image.

B. Shadow Segmentation

This process is based on the higher value of saturation component and lower value of value component available in the HSV color space. Based on these particular properties of shadows the normalized saturation value difference index is constructed to identify shadows.

C. Shadow Compensation

Surface texture does not significantly change when shadowed; neighboring non-shadowed segments are usually used to compensate shadowed ones.

IV. ALGORITHM MODEL FOR SHADOW DETECTION AND REMOVAL

There are several algorithm models available based on the concepts used to detect and remove the shadow. Some of such models are based on: 1. Model based shadow removal, 2. Additive shadow removal and 3. Combined shadow removal.

V. CONCLUSIONS

We have made the intensive study on shadow removal and detection techniques which has their share of advantages and disadvantages, with some of the disadvantages being not accurate output, cost wise high and performance. To overcome these difficulties several other algorithms can be designed based on the surface descriptor that allows to include the physical consideration derived from the image formation model capturing the color surface variations. Shadow removal methods can be based on the improved color constancy computation.

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