Shadow Detection and Removal Using Concatenation

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Abstract- Shadow detection and removal is an important task when dealing with colour structure images. Shadows are generated light fall in the object. Because the shadow region change during the day based on the position of the sun and the sky fall on the structures. Shadows are decrease in the light that reaches a surface area. Shadow area is detected and segmentation based on image analysing process. Some noise Factors will affect the detection result due to the complexity of the condition. primary colour component image loaded from the shadow and salt and pepper noise is removed from the contra harmonic filter and average colour is computed and the shadow can detected by using binary and morphological function.and finally the original shadow free image is been retrived by concatenation of binary image with each R,G,B planes.

Keywords- Shadow Removal, Contra harmonic Filter, Salt and pepper noise, concatenation

I. INTRODUCTION

SHADOW is a monocular visual cue for perceiving depth and geometry. On the one hand, knowing the shadow location allows us to obtain the lighting direction [6], camera parameters and scene geometry. On the other hand, the presence of shadows could, however, perform many computer vision tasks, e.g., object detection, recognition and tracking[1][2][3].Hence, shadow detection and shadow removal have long been fundamental problems in computer vision research. A shadow is an area where direct light from a light source cannot reach due to obstacle by an object. There are two types of shadows namely cast shadow (a shadow cast by an object or figure in an painting or other picture) and self shadow (an object may cast a shadow on itself). The presence of shadows has been responsible for reducing the reliability of many computer vision algorithms, including segmentation, object detection, objet recognition, scene analysis, tracking, etc. Therefore, shadow detection and removal is an important per-processing for improving performance of such vision tasks. Decomposition or disintegration of a single image into a shadow image and a shadow-free image is a difficult problem, due to complex interactions of geometry and illumination.[8] Many techniques have been proposed over the years, but shadow detection and removal still remains an extremely challenging problem, particularly from a single image. Most of the shadow detection methods have been used in multiple view geometry need multiple images for camera calibration. Also it is difficult to determine dark objects and shadows from a single image. This paper gives a simple method for detecting and removing shadows from a single RGB image[10][11].A shadow detection method is selected based on the mean value of the RGB image and thresholding followed by removal of salt and pepper noise masking RGB planes with binary image and hence retaining the shadow free RGB image.

There are various constraints regarding the input image selection.

1. The image itself shouldn't have any dark object.
2. Only the cast shadow is being removed effectively & not the self shadow of the object in an image.
3. We need to manually set the RGB values at the time of matching the background of an image with the shadow part.

II. OVERVIEW OF SHADOW

A. What is Shadow?

A shadow is an area created where direct light from any source of illumination is obstructed either partially or totally by an object. It is dark area or shape produced by a body coming between rays of light and a surface .If the light energy is fallen less, that area is represented as shadow region whereas if the light energy from the shadow is emitted more, this area is represented as non shadow region.

B. What is Self and Cast Shadow?

Shadow often degrades the visual quality of images. Two types of shadows are self shadow and cast shadow. Self-shadow is an object may cast a shadow on itself object and another is cast-shadow ,a shadow cast by an object or figure in an painting or other picture. Both self and cast shadow has different brightness value. The brightness of all the shadows in an image depends on the reflectivity of the object upon which they are cast .Self shadows usually have a higher brightness than cast shadows. Self shadows receive more secondary lighting from surrounding illuminated objects.

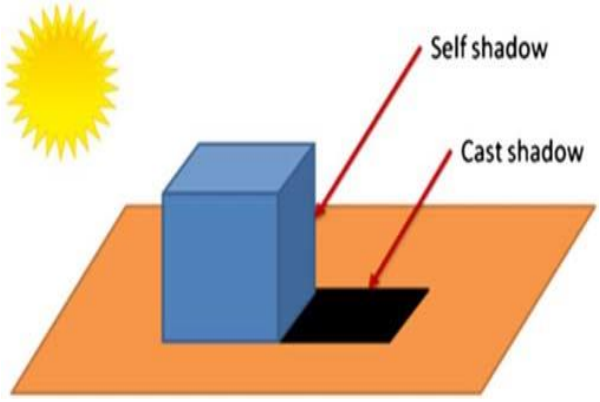


Fig.1: Illustration of cast and self shadows

C. PROPERTIES OF SHADOW:

There are some properties of shadow which can be used to distinguish between an object, the background and shadow. These properties are liste

- A shadow with lower brightness in comparison to the background pixels and this difference changes smoothly between neighbour pixels.
- All RGB values of a shadow are lower than the background in the correspondent pixel.
- Shadow pixels have a lower grey-level or intensity from the object and background.
- The shadow and the background have the same appearance.
- Both a shadow and the background are enhanced by different lights. Background illuminated by direct lights while shadow illuminated by indirect light.
- A shadow has lower circumference or boundaries compared to a background.
- The shadow and object have same motion but their locations are different.
- Skewness in shadow areas and in non-shadow regions are different, which is a good cue for locating shadows.

D. SHADOW DETECTION:

Traditionally, single-image shadow detection methods exploit physical models of illumination and color.[13][14][15]This approach, however, tends to produce satisfactory results only for wide dynamic range images Another approach learns shadow properties using hand-crafted features based on annotated shadow images[8][9]. It first describes image regions by feature descriptors and then classifies the regions into shadow and non-shadow regions. To detect shadows, we must consider the appearance of the local and surrounding regions of the image. The regions which are shadowed tend to be dark, with little texture, but the regions which are non-shadowed may have similar characteristics. Surrounding regions that correspond to the same material and characteristics can provide much stronger authentication.

E. SHADOW REMOVAL:

Early works remove shadows by developing physical models deduced from the process of image formation.[11][12][13] However, these approaches are not effective to describe the shadows in complex real scenes .Afterwards; statistical learning methods are developed for shadow removal based on hand-crafted features which lack of the high-level semantic knowledge for discovering shadows. Our shadow removal approach is based on a simple shadow model where consists lighting of directed light and environment light. We try to identify how much direct light is obstructed for each pixel in the image and relights the whole image using that information. First, we use a soft matting technique to estimate a fractional shadow coefficient value. Then, we estimate environmental light, which enables a shadow-free image to be recovered.

F. CONTRA HARMONIC FILTERS:

The contra harmonic filter will filter the image by the nonlinear contra-harmonic mean method. This function works for only the consistent of 8 bit per pixel and 24 bit per pixel images. The contra-harmonic mean filter which are better at removing Gaussian type noise and preserving edge features. Also the contra-harmonic filter is very good at removing positive outliers for negative values of P and negative outliers for positive values of P. The contra harmonic filter is the nonlinear filter for removing impulse noise. It's most popular because of good denoising power, adaptability and efficiency. It is a nonlinear digital filter technique is used to remove noise. The process of the contra harmonic filter is to allowing the signal entry by entry, replacing each entry by means of relative entries. The pattern of relative entry is called the "window", which signal execute by entry by entry, over the whole signal. For 1D signal, most window signals are producing few entries, whereas for 2 dimensional (2D) (or higher-dimensional) signal (or) image, more difficult window signal are possible (such as "box" or "cross" patterns).

G. RGB COLOUR MODEL:

The RGB colour model is an additive colour method in which red, green and blue light colours are added in various ways of combination to reproduce an array of colours. The colour values of primary colour components in image are obtained which are further dark pixels of shadow regions. Then shadows are detected by comparing average primary colour component values with original primary colour component values of image. The RGB is a color model used largely in display technologies which uses light. In this model, the colors red, green and blue are added together at different intensities to produce thousand of different colors. The The RGB color model is based on the science of the human eye perceives light and translates it into a series of brain waves. This model is extremely common for TV and video displays, digital cameras and other types of light-based display devices. The RGB model is as an "robust" model: as colors are added, in the form of light, the result becomes brighter. For instance, the full combination of red, green and blue produces white light.

III. SHADOW DETECTION AND REMOVAL TECHNIQUES

A. Model Based Techniques:

Model based techniques have limited materiality and are applied to specific problems say aerial images and simple objects only. These are dependent on initial information about illumination conditions and scene geometry as well as the object which also turns out to be a major trouble.

B. Image based Techniques :
In these image based techniques, certain properties of shadow image images such as color or intensity, shadow structure and boundaries etc. are used. Regardless, if any of that information is available, it can be used to improve the detection process performance.

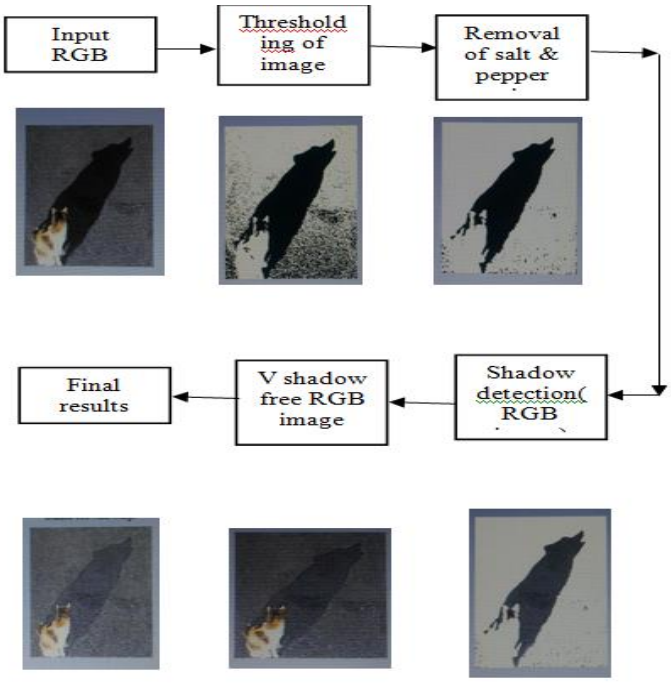
C. Color/Spectrum based Shadow Detection:
The color/spectrum model describe the color change of shaded pixel of image and find the color feature that is fluorescence invariant. The shadows are then discriminated from foreground objects by using heuristic thresholds on HSV color space It obtains a darkness image based on false color spectrum where colors are green, red and blue.

D. Texture based Shadow Detection:
The main principle behind the textural model is that the texture of foreground objects is dissimilar from that of the background, while the texture of shaded area remains the same as that of the background. The several techniques have been developed to detect moving cast shadows in a normal devoted environment.

E. Geometry based Shadow Detection:
Geometric based shadow detection model makes use of the camera location, object geometry and the ground surface ,etc., to detect the moving cast shadows. The geometry-based shadow procedures next examine each pixel to identify that might cast a shadow.

IV. PERFORMANCE ANALYSIS

A. BLOCK DIAGRAM



Input RGB of which the shadow is to be removed. Then the averaging of an image is done which is then followed by thresholding. Some noise gets added in image automatically hence it is filtered. RGB planes are differentiated and each is being masked with the binary image of the original one after that the shadow free image is obtained.

B. ALGORITHM:

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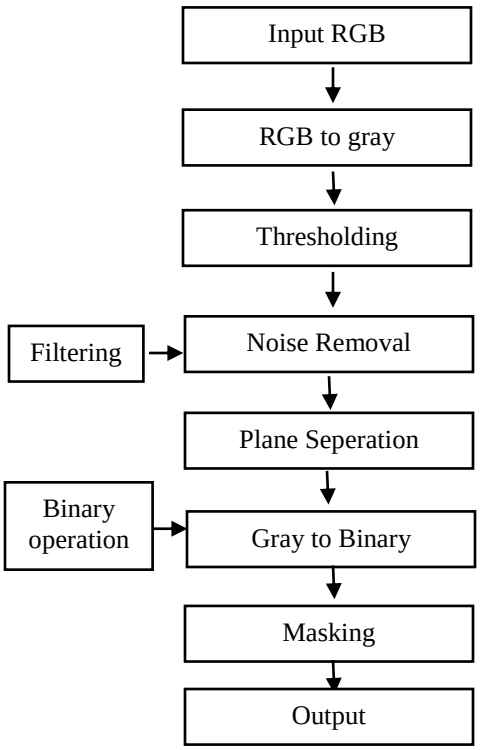


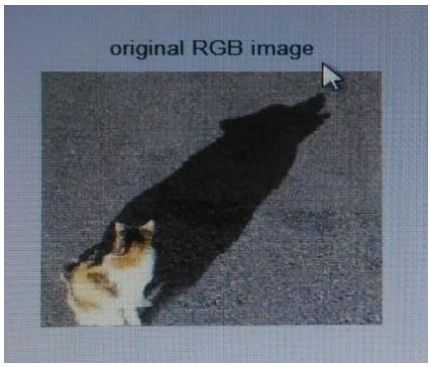
The approach of the algorithm is used to remove the shadow is shown in the figure 1.

The first step is generating or creating the image with shadow. Then remove noise which is applying to the contra harmonic filter. The shadow is to remove properly and average frame is computed. The cause of shadow detection determines the each of the three dimensions colour in the image. So the colour have large values of the average value in the image and the image in non- shadow region have smaller value of the average value in the image. Image is representing by various values of primary colour components. Primary colour component background is selected because these colours are absolute and positive integer value of 255. The threshold function used to extract shadow region in binary bitmap where the pixel value is zero this value is called shadow region and value one region is called non-shadow region.

C. STEPS:
1. Acquisition of a RGB image.
2. This image is converted to a grayscale image. Pixels above

the calculated average value of the image are made white and below that value are made black due to this we get a thresholded image.
3. Then the salt pepper noise is removed by using harmonic filter.
4. RBG planes are separated from the colour image
5. This each plane is then masked with binary image.
6. Then by concatenating results of all the planes we get a shadow free image.

V. RESULTS



VI. CONCLUSION

Shadow detection and removal in single image is a complex subject. The study of shadow detection and removal reveals many issues and thoughts. This conclusion explains it and sort the issues ; hopefully to be useful is future research. This shadow detection and removal approach is better as compared with other existing appearance-based models in camera calibration. We also show that by applying different steps to the detection results, the lighting conditions for each pixel in the image are better reflected, especially for those pixels on the boundary of shadow areas. Our conclusions are supported by quantitative experiments on shadow detection and removal which is shown in block diagram and results are also shown of each operation respectively. From that conclusion it summarizes that after testing with all techniques, this implemented method of shadow detection and removal gives appreciable result.

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