International Journal of Computational Intelligence Research
ISSN 0973-1873 Volume 13, Number 2 (2017), pp. 253-259

http://www.ripublication.com

Advance Shadow Edge Detection and Removal (ASEDR)

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Abstract

Shadow causes problem during the identification of objects from images in various computer vision applications, so it is a very crucial task to remove shadow from images that’s why in this paper a new technique for shadow removal based on Advance Shadow Edge Detection and Removal (ASEDR) method is proposed. After Shadow removal some image parameters (Entropy, Standard Deviation, Peak Signal to Noise Ratio) outcome of both previous Patch based Shadow Edge Detection Method and projected ASEDR method are calculated and compared with each other. The consequences demonstrate that the projected ASEDR method is superior to the previous Patch Based Shadow Edge Detection method. Patch Based Shadow edge detection method was performed on the original image but our ASEDR methodology used the grayscale form of the original image for the purpose of shadow recognition and shadow elimination. In purposed technique the value of entropy is smaller and standard deviation is larger than earlier method which shows the better shadow removal results.

Keywords: Entropy, Standard Deviation, PSNR, Shadow, Image.

1. INTRODUCTION

Shadows are fundamental element of many natural images. Although shadows, and particularly cast shadows, can give precious information on an acquired scene, e.g.

cues for spatial layout and surface geometry, they can also pose difficult problems and limitations for various computer vision algorithms. The existence of shadows has been responsible for reducing the consistency of many computer vision algorithms, together with segmentation, object recognition, scene analysis, stereo, tracking, etc. Shadows, formed where an object obscures the light source, are an ever present aspect of our visual experience. Shadows can either aid or mystify scene analysis, depending on whether we form the shadows or pay no attention to them. If we can recognize shadows, we can recovered confine objects, recognize object shape, and detect where objects make contact with the ground. Detected shadows also award cues for lighting direction and picture geometry. Alternatively, if we pay no attention to shadows, false edges on the boundaries of shadows and confusion between albedo and shading can cause mistakes in visual processing. For these reasons, shadow recognition has long been measured a crucial factor of scene scrutiny. Although its significance and elongated tradition, shadow recognition remains a very difficult problem, particularly from a distinct image. The major difficulty is due to the complex interactions of geometry, albedo, and illumination.

In this paper, center of attention will be on the dilemma of shadow recognition and elimination from images. Given a shadow image, the ultimate goal is to produce a high-quality shadow-free image which would seem to have been taken in the same scene but without shadows. This implies producing a shadow free image while maintaining original local and textural information within shadow regions and penumbrae. Image processing helps in a variety of real life fields like, optical imaging (cameras, microscopes) and, medical (CT, MRI), Astronomical imaging (telescopes), video transmission (HDTV), computer vision (robots, license plate reader), commercial software's (Photoshop), Remote sensing Field and many more. Therefore Image processing has been spot of research that attracts the attention of ample variety of researchers.

2. RELATED WORK

In 2013, Ashraful Huq Suny et.al [1] projected a straightforward technique to distinguish and eliminate shadows from a single RGB image. This shadow recognition technique is elected on the basis of the mean value of RGB image in A and B planes of LAB equivalent of the image and shadow deduction technique is based on the recognition of the quantity of illumination impinging on a surface. In 2014, The algorithm generated by Hongya Zhang et.al [2] in which shadow features were taken into consideration during image segmentation, and according to the statistical features of the images, suspected shadows were extracted. In 2014, Kaushik Deb et.al [3] proposed a framework using the YCbCr color space to detect and remove shadow from images. After shadow recognition, a shadow density model is applied, according to this model the image is segmented into a variety of areas that have the comparable density. In 2011, A. Germain, N. Salamati and S. Susstrunk [5] proposed a technique to eliminate shadows from actual image derived from a prospect shadow map.

3. PROPOSED WORK

In this proposed work a new approach is defined to detect and remove shadow from images. The consequences of the planned algorithm are far better than the earlier techniques. In this algorithm approach adapted to perform the shadow detection and removal is explained.

Proposed Algorithm (ASEDR)

Step1: First of all convert image into grayscale image.

Step2: Now shadow edge candidates are generated from the image obtained from the step1.

Step3: Now the resulted image obtained from the step2 goes through the feature extraction and shadow edge classifier stage and gives initial shadow detection result.

Step4: In the fourth step image obtained from second step goes through spatial smoothing phase which gives us refined shadow detection result.

Step5: Now we get the shadow edges by removing the non shadow edges from the resulted image obtained in step4.

Step6: After getting the shadow edges we apply the Gaussian filter over the image obtained in step 5 for further filtering the image.

Step7: The resulted image obtained in step 6 is used to remove shadow from the original image

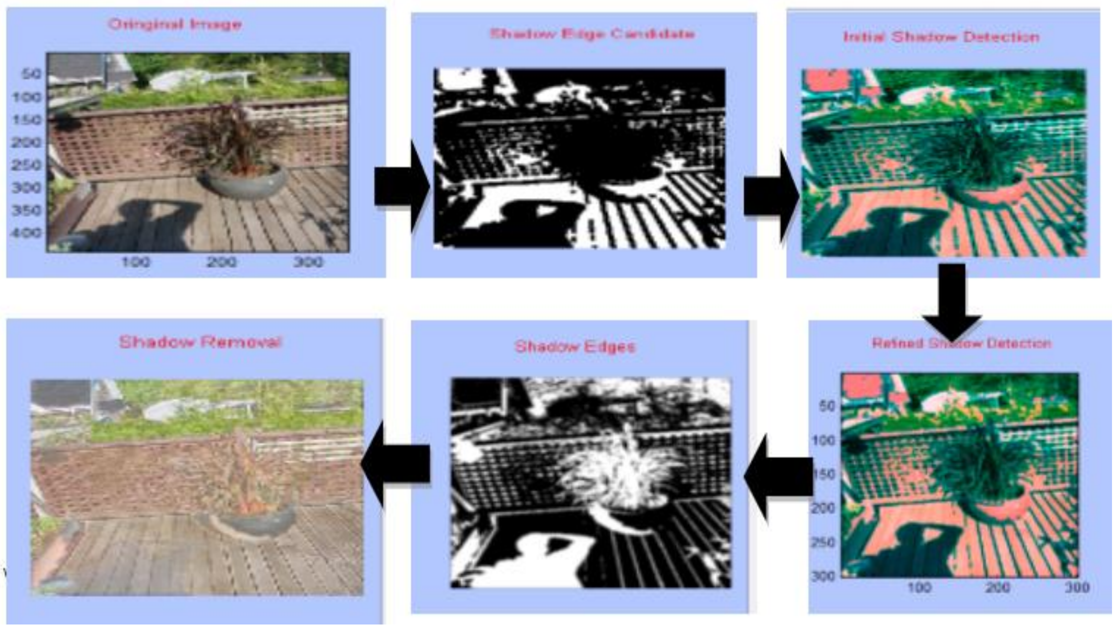

Figure 1. Pictorial Representation of Proposed ASEDR Method

4. EXPERIMENTAL RESULTS

In this paper we have used the 6 images to test the effectiveness of our algorithm as compared to earlier algorithm. For the proposed Advance Shadow Edge Detection and Removal (ASEDR) method we have calculated the various parameters like standard deviation, entropy, peak signal to noise ratio. We have calculated the same parameters for the earlier patch based shadow detection method. Here we are giving the details of all image parameters. The comparison between proposed methodology ASEDR and earlier method Patch Based Shadow Edge Detection method shows that projected method gives smaller value of entropy, large value of standard deviation, Peak Signal to Noise Ratio.

4.1 Result Parameters

1. Entropy

Image entropy is a value which is used to illustrate business of an image that means it contains the quantity of information which must be coded via any compression algorithm.

The images with lower entropy value have very small contrast just like the images containing lots of black sky. On the other side the images with higher entropy value have larger contrast just like the images containing heavily cratered areas on the moon and the higher entropy images cannot be compressed in so far as low entropy images.

Image entropy includes in any image compression test is calculated with the following formula:

$$\boldsymbol{Entropy = -\sum_{i} P_i log_2 P_i}$$

In the above formula, $\mathbf{P_i}$ is the probability that the difference between two adjacent pixels is equal to i, and Log_2 is the base 2 logarithm. In Table 1 comparisons between the entropy value of images by using proposed method ASEDR and earlier method Patch Based Shadow Edge Detection is shown.

Table 1. Comparisons of Entropy: Earlier V/S Proposed Methods

S.NO	Earlier Method	Proposed Method
1.	6.7198	5.9737
2.	7.1892	6.6325
3.	6.4638	5.5576
4.	6.7497	6.47
5.	6.9528	6.49
6.	7.4676	6.5905

Entropy value of an image should be less for the better results as we can see proposed ASEDR method have smaller entropy value as compared to previous method.

2. Standard Deviation

For an arbitrary variable vector H formed of K scalar observations, the standard deviation is represented as:

$$SD = \sqrt{\frac{1}{K-1}\sum_{i=1}^{K}|H_i - \mu|^2}$$

Here μ is the mean of H:

$$\mu = \frac{1}{K}\sum_{i=1}^{K} H_i$$

The square root of the variance is known as standard deviation. In table 2 comparisons between the standard deviation of images by using proposed method ASEDR and earlier method Patch Based Shadow Edge Detection[4] is shown.

Table 2. Comparisons of Standard Deviation: Earlier V/S Proposed Methods

S.NO	Earlier Method	Proposed Method
1.	26.4343	48.2154
2.	36.3658	49.1597
3.	22.9975	44.6919
4.	26.6579	53.5977
5.	31.1556	55.1595
6.	44.6146	50.3112

Standard deviation of an image should be large for the better results as we can see proposed ASEDR method have larger standard deviation as compared to previous method.

3. Peak Signal to Noise Ration (PSNR)

Peak signal-to-noise ratio, frequently known as PSNR, is an engineering name used for the ratio between the highest achievable power of a signal and the power of corrupting noise that affects the reliability of its representation. The higher value of the PSNR , represents the better quality of the compressed or reconstructed image.

PSNR is the peak signal-to-noise ratio measure in decibels (dB).
The following equation describes the PSNR:

$$PSNR = \frac{20log_{10}2^{K}}{\sqrt{MSE}}$$

Here MSE indicates the mean square error and K describes the bits per pixel.

Table 3. Comparisons of PSNR: Earlier V/S Proposed Methods

S.NO	Earlier Method	Proposed Method
1.	13.4628	21.4058
2.	12.7702	20.3045
3.	12.1016	19.2416
4.	10.8494	17.2506
5.	9.6691	15.3739
6.	14.5551	23.1427

PSNR of an image should be large for the better results as we can see proposed ASEDR method have larger PSNR value as compared to previous method.

5. CONCLUSION AND FUTURE SCOPE

Based on the parameters as given in the table above, we can declare that the projected method is clearly better than the earlier method. Although we cannot mark the distinction between the images as obtained from both the methodology with bare eyes, we can most correctly see the value of entropy, standard deviation, PSNR of each of the images as obtained after the use of earlier and proposed technique. For future work, we can test the proposed methodology with different variables (other than above parameters). We can use this to clean vague images for improved path recognition. There are a number of directions which could be used in this method to get better detection and discrimination rates in the future such as finding a proper way to combine the results of each step. The performance can be improved further by employing region-based techniques to recover the shadow region.

REFERENCES

[1] Ashraful Huq Suny and Nasrin Hakim Mithila, “A Shadow Detection and Removal from a Single Image Using LAB Color Space”, IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 4, No 2, July 2013.

[2] Hongya Zhang, Kaimin Sun, Wenzhuo Li, "Object-Oriented Shadow Detection and Removal From Urban High-Resolution Remote Sensing Images," Geoscience and Remote Sensing, IEEE Transactions, Volume 52, Issue 11, November 2014.

[3] Kaushik Deb and Ashraful Huq Suny, "Shadow Detection and Removal Based on YCbCr Color Space", Smart Computing Review, vol. 4, no. 1, February 2014.

[4] Qi Wu, Wende Zhang and B.V.K. Vijaya Kumar," Strong Shadow Removal Via Patch-Based Shadow Edge Detection", 2012 IEEE International Conference on Robotics and Automation RiverCentre, Saint Paul, Minnesota, USA May 14-18, 2012.

[5] A. Germain, N. Salamati, S. Susstrunk, "Removing shadows from images using color and near-infrared," in Proc. of the IEEE ICIP, pp. 1713-1716, 2011.