REVIEW OF SHADOW DETECTION AND REMOVAL TECHNIQUES

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ABSTRACT

Shadows are created when light is obstructed by an opaque source. The shadow can be further classified as self-shadow and cast shadow. There are many techniques by which these shadows can be detected and removed. The techniques work at various levels such as pixel, region, boundary, edge, and colour. This paper highlights some of the techniques followed by researchers to detect and remove shadows

Keyword : - *Shadow , Shadow Detection, shadow removal, segmentation*

1. INTRODUCTION

Image processing is one area of research that invites the attention of wide variety of researchers. Image processing, mainly deals with processing of images, videos etc. Image processing is an expertise to increase the quality of an image in terms of visual insight of human beings. Obstruction in the path of light causes shadow. The two types of shadow are cast shadow and self-shadow. The shadow formed on the side that is not directly in front of the light source is called self-shadow. A cast shadow is formed when one objects shadow falls on another object because the former object is in the path of light. Cast shadow contains two parts: - Umbra and Penumbra. The umbra is created because the direct light has been completely blocked, while the penumbra is created by partial blocking of direct light. Shadow contain loss of data. [16] The surface covered by the shadow region present problems for image enhancement functions like image matching, change detection etc [17] . Impressive research has been carried out to explore shadow detection and removal .Shadow detection is the procedure of recognizing shaded pixels in images, whereas shadow removal is to re-establish the spectral information to get a shadow free image [18].

2. REVIEW OF SHADOW DETECTION AND REMOVAL TECHNIQUES

Aradhana and pooja [1] conducted a comparative study on shadow detection and removal techniques. They have discussed the different shadow detection techniques like model, Image, Spectral, Texture and Geometry based. They have concluded that simplest methods were suitable for generalization, but in almost every particular setup, the results could be significantly improved by adding assumptions. Among all the various detection and removal techniques, the texture based shadow detection more efficient than other techniques. In the texture based approach the difference between the texture of foreground and background is used to identify the edge and shadow.

Savita [2] carried out a study of shadow detection techniques and a comparative analysis based on their performance. In their study they have performed a in-depth analysis of techniques to detect shadow namely Intensity based, Threshold based, colour based, Geometric properties based, Chromaticity based, Region based and Morphology based.. They have concluded as the best algorithm or classifier for shadow detection and removal
Is directly propositional to data set characteristics used.

Akmalbek and Adiljon [3] suggest a method to detect shadow and eliminate them based on RGB colour model. The shadow are detected based on intensity information difference and then thresholding using Otsu's

technique. A threshold value is selected and the image is converted to binary. The Otsu's method is implemented after converting the image to HSV from RGB. The direction of the gradient magnitude and direction is computed for each pixel. The shadow removal is based on direct light. They find out the amount of direct light is blocked in a pixel and then relight the region, eliminating the shadow, They compute the mean and variance of each area of the pixel.

Anshul et. al [4] propose a technique called ASEDR to detect and remove shadow. In the method the shadow parameters like entropy, standard deviation, peak signal to noise ration are calculated and compared to identify shadow. In ASEDR method, the image is transformed to grayscale and edge are computed. The features of the image are extracted and the shadow detection phase takes place. The image is now smoothened to give the shadow region. The Gaussian filter is used to further filter the image and to extract out the shadow from the image.

Priya Garg and Kirtika Goyal [5] propose am method to detect and remove shadow based on chromaticity. In their method the RGB image is separated into three components and stored into separate columns. The Red and Blue intensities are divided by the geometric means of RGM respectively. Natural log is taken of the Red intensities and Blue intensities. The direction perpendicular is computed to remove the shading effect if any. The morphological operations and thresholding is performed to remove the shadow from the image.

Vrushali and Shailaja [6] propose a method to detect and remove shadows from a single natural scene image. Their propose method first segments the image. The algorithm used for segmentation is mean shift where both the mean shift filtering and mean shift segmentation takes place. The pair wise region is checked for shadow or pixel with same intensities to detect both shadow and shading areas. They have trained a classifier SVM to detect illumination pairs based on colour and texture histograms. Shadow matting is performed to remove the shadow from the image. In the process of matting the foreground image is subtracted from the background and pixel intensities are checked.

Sarita and Abhishek [7] propose a method to remove the shadow from an image. The method consists of analysing the colour components and extracting the feature based on colour components namely Yellow, Black, Blue, Green, Red and White. The force histogram is constructed that decomposes the image into the corresponding intensity levels. A photo editor is used to crop the image and preserves the colour intensity.

Amareswar Kumar and Mohan Reddy [8] conducted a survey on object oriented shadow detection and removal for high resolution images. The region growing thresholding algorithm is used to detect shadow and extract shadow region features. IOOPL mapping is performed and the difference between the inner layer and outer layer is used to remove the shadow.

Saritha and Govindan [9] suggest a method to detect and remove shadow based on RGB colour space. The shadow is detected based on the mean value of RGB and the removal is done based on multiplying the shadow region by a constant. The image is converted into Lab image and the mean values of the pixels are found out. The classification is performed based on the mean values and the shadow is detected based on the standard deviation. The shadow is removed by multiplying the mean area with a constant and removing the shaded region based on chromaticity

Karim at. al [10] propose a method for shadow detection using satellite imagery. In their proposed method they use HOG for feature extraction and SVM for classification. First HOG is used in shadow regions. There are two samples used. One is training and the other is test. The sample is trained using the SVM classifier and is tested. The pre-processing of the sample image is performed before performing the classification.

Jaccard et. al. [11] proposed a trainable pixel wise segmentation approach. In this method the histogram and classification is generated by random decision tree. A trainable segmentation algorithm for PCM images based on multiscale local BIF histograms is performed. Random forest classifier learns how to collect halo artefacts which is usually done as an extra post processing step in other algorithms.

Hui and Zhenfeng [12] propose a shadow detection method based on colour. The four colour features of shadows in HIS colour model and RGB colour model are analyzed. Otsu's segmentation method is applied to get four binary candidate shadow images. A final shadow detected image is obtained after the intersection of the four acquired images and using morphological operations.

Jaime and Montse [13] propose a method to detect and remove shadow by global MAP-MRF framework formulation of the foreground, background and shadow classification. Develop a region based spectral colour foreground model and pixel wise background model in the RGB domain. Their system avoids the necessity of thresholding. They suggest a shadow removal technique called brightness and colour distortion (BD-CD). The model is combined with region based spatial trimmed gaussian model for the background modelling. Gaussian per pixel is used in the RGB domain.

Aaron and Shackelford [14] propose an object based approach using the fuzzy pixel based classifier utilizing both spectral and spatial information to differentiate between objects. The objects are identified based on pixel and object oriented approach. The fuzzy approach provides the classification map that is more accurate than the maximum likelihood classifier. After the segmentation class label is associated to each segment, since image shapes are encountered instead of pixel, spectral and spatial information can be used to remove shadows. Morphological operations is performed with the help of skeletonizing algorithm.

Pooya et. al. [15] propose a transformation to detect boundaries of cast shadows. Transformations is based on colour index radiometric restoration technique such as gamma correction, linear correlation correction and histogram matching are used. The colour space is found by dividing one spectrum with the maximum value of the other two spectrums. To identify the shadow boundaries the transformed channel is multiplied by 3X3 texture filture to compute the local variance. Histogram matching is used to bring brightness distribution of the two given images as close as possible.

3. CONCLUSIONS

In this paper, we have provided a wide-ranging survey of shadow detection and removal techniques and the algorithm that are used for the detection and removal of shadows. This survey looks into the current trends and the techniques that are followed by the researchers to detect and remove shadows.

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