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COLOR CORRECTION OF AN IMAGE WITH MULTIPLE LIGHT SOURCES USING GRAY WORLD COLOR CONSTANCY ALGORITHM

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ABSTRACT Color constancy is the ability to estimate the color of the light source. Different color constancy algorithms are there like gray world, white patch, gray world 1st order derivative, gray world 2nd order derivative. Here, the color constancy algorithms are generally based on the assumption that the light source across the scene is uniform. But this assumption is not true in all cases. Because some images contain multiple light sources. In this paper, we consider the scenes with multiple light sources. Here we do color correction of an image with multiple light sources using gray world algorithm. Here we use local correction method.ie, we do clustering of images and apply the color constancy algorithm for each patches rather than the entire image. Color correction is done using histogram equalization method.

KEYWORDS : color correction; gray edge algorithm;gray world algorithm; histogram equalisation.

I. INTRODUCTION

The color of a light source has a important role on object colors in the image. Therefore, the same object, taken by the same camera but under different light sources may vary in its measured color values. This color variation introduce some undesirable effects in digital images. It affects the performance of computer vision methods negatively for different applications such as object recognition and tracking. The main reason of color constancy is to correct for the effect of the illuminant color either by computing invariant features or by transforming the input image. Then effects of the color of the light source are removed.

Color constancy is the capability to receive the color of objects in an image invariant to its illumination. The color of objects in an image is strongly dependent on the color of light source falling on an image. The different illuminations falling on an image alters or changes the appearance of images. Objects captured in different illuminations, loses its actual existence or message. Human vision has a natural capability to correct the effects of illumination falling on the objects of an image. The objects captured by digital camera under distinct light sources vary depending on the color of the light source.

The change in illumination depends on different factors like time of day, image captured in darkness and brightness.

There are several color constancy algorithms are present. These color constancy algorithms are based on the assumption that the light source across the scene is spectrally uniform. But this assumption is not true in all cases .For example shadowed regions in an image are illuminated by skylight and non shadowed regions are illuminated by both sunlight and skylight.

Fig 1.Same scenes with multiple light sources.

Fig 1.Scenes with multiple light sources

This paper organized as follows: First, in Section II,color constancy is discussed. Next, in section III, the proposed methodology is explained in detail. Experiments are described in section IV, and section V presents a discussion of the obtained results and some directions for future work in this line of research.

II. COLOR CONSTANCY

Color constancy is an example of subjective constancy and a feature of the human color perception system which ensures that the perceived color of objects remains relatively constant under varying illumination conditions.

A. Illuminant Estimation:one light source

Most color constancy algorithms proposed are based on the assumption that the color of the light source is uniform across the scene. For instance, the white-patch algorithm [7] is based on the assumption that the maximum response in a scene is white, and gray-world algorithm [6] is based on the assumption that the average color in a scene is achromatic. These assumptions are then used to make a global estimate of the light source and correspondingly correct the images.

The framework proposed in [10] allows for systematically generating color constancy as follows:

$$\left(\int \left| \frac{\partial^n I_{c,\sigma}(x)}{\partial x} \right|^p dx \right)^{\frac{1}{p}} = k \boldsymbol{L}_c^{n,p,\sigma}$$

Using this equation we can generate various color constancy algorithms by changing the parameters.

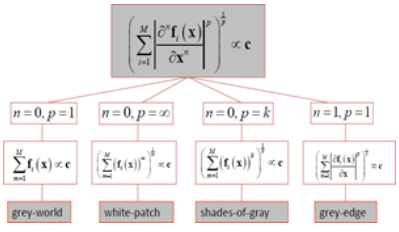

Fig 2. Generation of color constancy algorithms

B Color constancy approaches

Color constancy is based on following two approaches which are further categorized into differentcolor constancy techniques i.e.-

- Pixel Based Approach.
- Edge Based Approach.

A. PIXEL BASED COLOR CONSTANCY

Pixel Based color constancy algorithm mainly focuses on the estimation of illuminant using only the pixel values in an image. These algorithms process all the pixel values of an image to estimate the light source.

B. EDGE BASED COLOR CONSTANCY

Recently, Pixel based method is extended to edge based color constancy algorithms, since most of the details in an image are represented by its edges. Various image derivatives (i.e. edges) are calculated for estimation of color of light source. Edge Based algorithm is based on the assumption that the average edge difference in a scene is achromatic.

C Color constancy techniques

RETINEX BASED WHITE PATCH ALGORITHM:

Retinex is the first color constancy method. Here it considers that an abrupt change in chromaticity is due to change in reflectance model. ie, the illuminant smoothly varies across the image and does not change between nearby locations. Different implementations are proposed using this theory. The white patch algorithm is based on retinex theory algorithm. It works on white patch assumption. The white patch assumption is that the maximum response in RGB channels is caused by a white patch. Hence, Retinex theory was a fundamental step towards color constancy based on one light source.

GRAY WORLD ALGORITHM:

It is based on the grey world assumption. Gray world assumption is that the average reflectance in the scene is achromatic. Here average pixel value which gives the normalized light source color. So, we can estimate the light source color. It is a simple algorithm to find out the colors of the light sources when comparing with other algorithms and it is more sensitive to large uniformly colored surfaces.

GRAY EDGE ALGORITHM:

Basically most of the methods developed in past research are based on single uniform light source. But this assumption is not true in all cases. Since an image can also be affected by more than one light sources. Gray edge algorithm is an extension to the gray world algorithm. It is an edge based and high order color constancy algorithm. here most of the details in an image is represented using edges. Advantages of gray edge algorithms are lower computational cost, less complexity and lower computational run time.

GRAY EDGE 1ST ORDER DERIVATIVE

In gray Edge 1st order derivative 4-neighbouring pixels are considered. The first derivative-based edge detection operator is to detect image edges by computing the image gradient values, such as Roberts operator, Sobel operator, Prewitt operator.

GRAY EDGE 2ND ORDER DERIVATIVE

In Gray Edge 2nd Order the 8-neighbouring pixels [5] are considered. Unlike 4-connected in 8-connected more information for image correction is available. Gray Edge using 1st order derivative does not proof to be efficient because each

pixel considers its 4-neighbouring pixels. So, in this method not all information is available for color correction.

III PROPOSED METHOD

Proposed method include several steps. They are listed below

1) *Clustering of color image.*Here we use k-means clustering method.Then we get the image into clusters.Here we decide the k value.
2) *Cluster based color constancy.*The light color for each cluster is spectrally uniform.Several color constancy algorithms are here.Here we apply grayworld and gray edge color constancy algorithm on each clusters.
3) *Combination of estimates.* Since there is only a limited amount of information available when using a relatively small counters, this may introduce estimation errors. To overcome this lack of information clusters are combined to form a larger patch
4) *Color correction.* Here we using histogram equalization Method. Contrast enhancement techniques in the second subgroup modify the image through some pixel mapping such that the histogram of the processed image is more spread than that of the original image. Techniques in this subgroup either enhance the contrast globally or locally

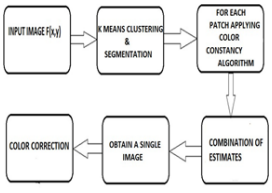

Fig 3.Block diagram of proposed method

IV. EXPERIMENTAL RESULTS

This proposed work we implementing in MATLAB 10,by using graphical user interface(GUI),Initial stage we are applied several color constancy algorithms on input image.ie local correction and global correction is used.

FIG 4. INPUT IMAGE

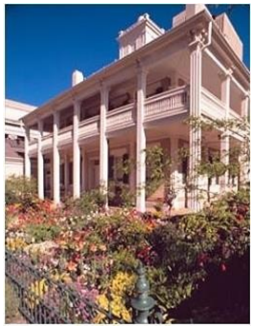

FIG.5 GREY WORLD ALGORITHM USING GLOBAL CORRECTION

Fig 6.Input image

Another method used for color correction is local correction. Here we do k means clustering and applu color constancy algorithms to each clusters.After that we apply histogram equalization method.

FIG 7.GRAY WORLD ALGORITHM USING LOCAL CORRECTION

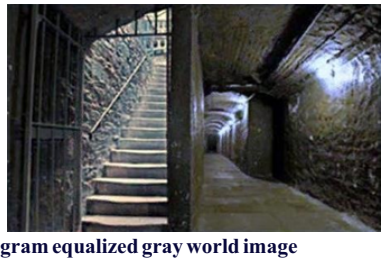

Fig 9 .Histogram equalized gray world image

IV. DISCUSSION

Here we discussed about the color correction of an image with single

light source and image with multiple light sourcesusing gray world algorithm. Color constancy has the capability to reduce the effect of the color of the light source in an image. Patch based illuminant estimation is more accurate than global illuminant estimation when there is more than one light source. Histogram Equalization method is used for color correction. Near future we will extend this work to use image filtering and image enhancement techniques to improve the performance of the available algorithms.

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