Shadow Detection and Removal Based on YCBCR Color Space

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Abstract:

The shape and direction of an object, as well as the light source, can be revealed by shadows in an image. Thus, for applications such as image segmentation and object detection and tracking, shadow detection and removal is a critical and unavoidable task for some computer vision algorithms. This paper presents a basic framework for detecting and removing shadows from photos using the luminance, chroma: blue, chroma: red (YCBCR) colour space. For detecting shadows, a technique based on intensity statistics in the YCBCR colour space is presented first. A shadow density model is used after the shadows have been discovered. The image is split into various parts with the same density according to the shadow density model. Finally, the shadows are eliminated by relighting each pixel in the YCBCR colour space and adjusting the colour of the darkened regions in the RGB colour space. The most notable aspect of our suggested framework is that after removing shadows, there is no abrupt transition between shaded and non-shadowed areas, and all details in shadowed areas are preserved. To test the suggested framework, a range of shadow images were employed with a variety of situations, and the results are shown to demonstrate its usefulness.

Introduction:

In most natural situations, shadows are a physical phenomenon. Images with shadows and shadings cause challenges with image analysis. In addition, shadows suggest a geometric link between objects, light source, and perspective. A basic approach for shadow detection has been proposed in this framework, which requires intensity information in the YCbCr colour space. The image is then split based on shadow density. Finally, by relighting each pixel in the YCbCr colour scheme, the shadows are erased. The colour of the restored region are also adjusted in the RGB colour space. A basic approach for shadow detection has been proposed in this framework, which requires intensity information in the YCbCr colour space. The image is then split based on shadow density. Finally, by relighting each pixel in the YCbCr colour scheme, the shadows are erased. The colour of the restored region are also adjusted in the RGB colour space.

Related Terms:

- **Morphological Operation**:

Morphological image processing is a set of processes that deal with the shape and morphology of picture features. Noise and discontinuities in the extracted foreground are removed using morphological procedures. Erosion and dilation are the two primary operations. These actions are carried out using a template or structural element, which is a kernel of any size made up entirely of 0s or 1s. Dilation fills in the gaps in the image, whereas erosion removes undesirable elements.

- **Color Histogram**:

A colour histogram shows how many pixels have colors from each of a set of colour ranges that span the image's colour space (the set of all possible colors). The colour histogram, like other types of histograms, is a statistic that approximates an underlying continuous distribution of colour values.

Proposed Framework:

- **Shadow Detection**:

The shadow detection process can be a first stage in shadow compensation, followed by image analysis activities (such as object recognition), or it can be a fundamental phase in which the detection findings are directly employed in 3D shape estimation or other tasks. In any event, shadow detection is the first step in the ultimate image analysis process. Hence, the performance of the final task is highly dependent on shadow detection performance. The proposed framework for shadow detection is depicted in Figure 1.

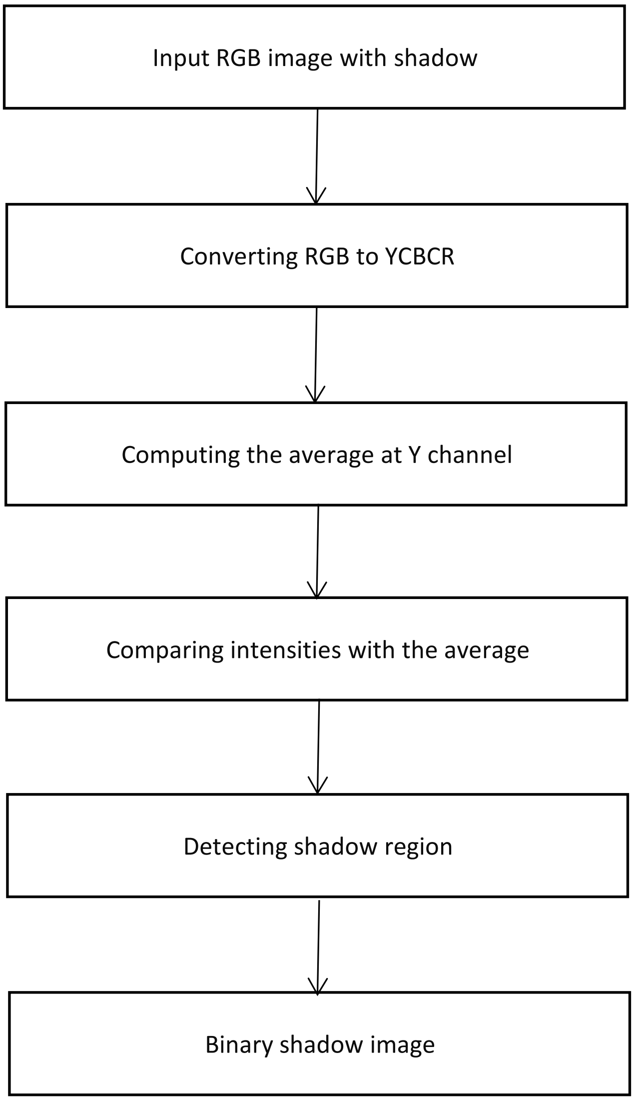

Figure 1: shadow detection

For shadow detection, a method based on intensity statistics is provided. The RGB image is first transformed to a YCbCr comparable image. The Y represents luminance information in the YCbCr colour system, whereas the Cb and Cr represent colour information. After that, the histogram of the Y channel is computed. In the Y channel, histogram dissension results in a stronger contrast image. Following that, the image's Y channel mean is calculated. The image is then iterated by sliding-window iteration. The size of the kernel window is 3*3 matrices. Two ways are used to determine which pixels belong in the shadow. The first step is to classify shadow pixels with an intensity smaller than one standard deviation of the entire image. The sliding window's mean and standard deviations for the non-shadow point are then computed. Shadow pixels are now defined as pixels with an intensity less than the windows' one standard deviation. A morphological procedure is also used to remove solitary pixels. Dilation and erosion are used to remove the misclassified pixels. The shadow detection procedure yields a binary shadow mask, which is utilised as input for the shadow removal process.

- **Shadow Removal**:

The average pixel intensities in the image's shadow and non-shadow sections are first computed, and the difference is then added to the pixels in the Y channel. The average shadow-to-non-shadow-pixel ratio is then calculated. The values of Cb and Cr are calculated next. Because of the ambient light, the ratios of the two pixels are not same in all three color channels. These two pixels will be different not only in intensity, but also in hue and saturation. Thus, correcting just the intensity of the shadowed pixels does not remove the shadow, and we need to correct the chromaticity values as well. The shadow density, which shows the degree of the light's effect, is determined using global brightness. In a sunny region, it becomes 0; in an umbra region, it becomes 1. The shadow area is divided into three regions based on shadow density: sunlight, penumbra, and umbra. The umbra zone's colour average and variance are then changed to match those of the sunshine region. Color and brightness adjustments for small sections in the penumbra are made in the same way that they are in the umbra. Finally, all boundaries between shadowed regions and neighboring lit regions are smoothed by convolving them with a Gaussian mask.

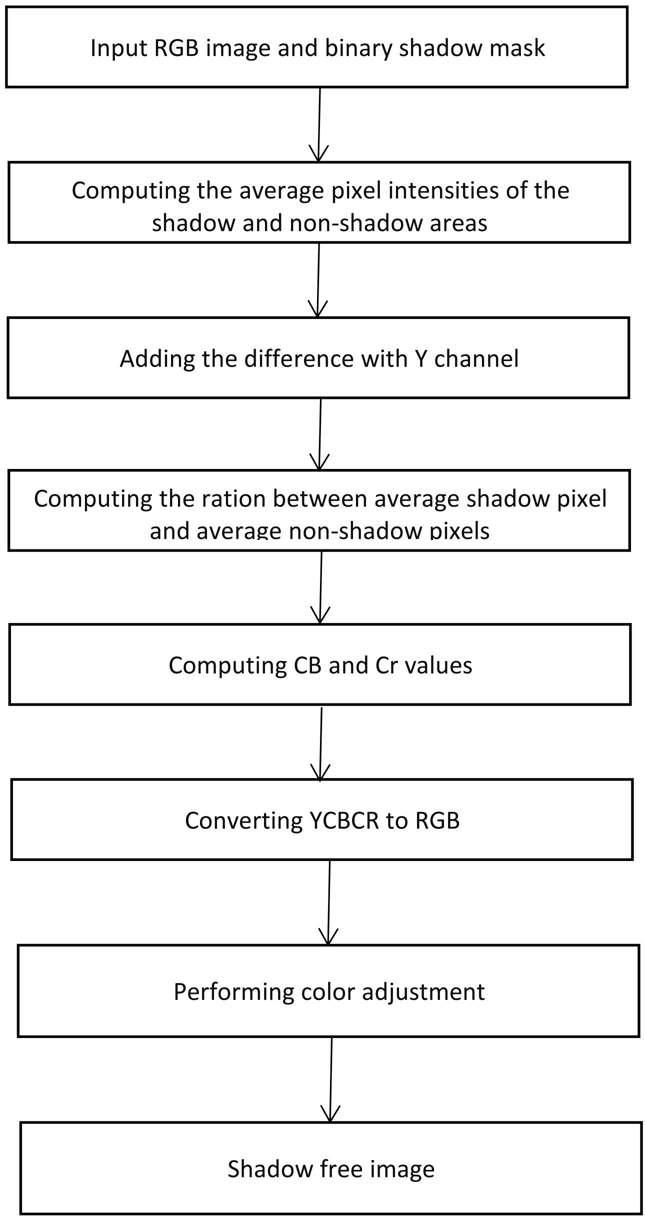

Figure 2:shadow removal

Conclusion:

To sum up, This paper achieves to detect and remove shadows from an image. In order to achieve this task it is a must convert the rgb image to ycbcr . Moreover the using of morphological concept.

References:

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