Chapter 11

Image Enhancement: Application of Dehazing and Color Correction for Enhancement of Nighttime Low Illumination Image

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ABSTRACT

This chapter describes a novel method to enhance degraded nighttime images by dehazing and color correction method. In the first part of this chapter, the authors focus on filtering process for low illumination images. Secondly, they propose an efficient dehazing model for removing haziness. Thirdly, a color correction method proposed for color consistency approach. Removing nighttime haze technique is an important and necessary procedure to avoid ill-condition visibility of human eyes. Scattering and color distortion are two major problems of distortion in case of hazy image. To increase the visibility of the scene, the authors compute the preprocessing using WLS filter. Then the airlight component for the non-uniform illumination presents in nighttime scenes is improved by using a modified well-known dark-channel prior algorithm for removing nighttime haze, and then it uses α-automatic color equalization as post-processing for color correction over the entire image for getting a better enhanced output image free from haze with improved color constancy.

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INTRODUCTION

Main degradation of outdoor images occurs due to bad atmospheric phenomena such as hazy or foggy weather effect. Scattering of atmospheric particles reduces the visibility in terms of color variation contrast and makes difficult to recognize the object’s prominent features to be identified by human and computer vision systems. So haze process yield poor visibility in day as well as night time or on low dim light effect. In the past few years images taken from worst weather situations and restoring them has made greater impact and progress. These image restorations are vital in various outdoor applications like surveillance, intelligent vehicles, object recognition, and remote sensing. Due to the ambiguity between the unknown depth of haze and the object underlying scene haze removal is very difficult. Another major issue related to haze images is perceivability degradation due to lag of missing information in terms of color effect due to effect of low illumination.

Considering into account of the illumination characteristics of night-time imaging, a modified algorithm for image enhancement is proposed in this chapter. In the first phase of proposed method Weighted Least-Squares (WLS) is used for filtering application to visualize the fine detail within an image respectively by Perona et. al (1900). WLS is an edge preserving filter which computes detail layers and recombines them with approximate pixel intensity value. The dehazing method based on Prior method is adopted as the key parameters of dehazing method using the local patch process Tarel et. al (2009) to obtain the better conditions of nighttime imaging. The illumination level of nighttime hazy image can be artificially enhanced through flexibly selecting the color correction method. In contrast to the classical model of color transfer with the strategy of overall to overall transfer, the modified model focuses on the different characteristics of various regions in the original image, and it works well even though the nighttime image is interfered by various artificial light sources. Various preprocessing methods are providing in terms of histogram, bilateral histogram, spatial filtering, Homo-morphic filtering. But in this chapter, the application of edge preserving application is done for better result. Similarly, for dehazing Presented by Perona et. al (1900) in order to use for haze removal methods are based on a) Image Enhancement b) Image Fusion c) Image restoration. The main object of haze removal algorithms is to enhance and restore the exact information of the scene from hazy image. In a haze removal model, primarily a haze density distribution map of hazy image is created. It enables to segment the hazy image into scenes according to generated density distribution function improving the scene with proper brightness, contrast and information contest of image. Here in, we focus to find methods to enhance and restore the dehazed images. Visibility restoration plays an important role in image processing applications.
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