A Fast Algorithm for Image Defogging

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Abstract. In smoke and haze environment, images acquired by vision create serious distortion or degradation. Obtaining some inaccurate information from an unclear vision, it will have some bad impacts on outdoor activities. More and more common in recent years, the haze phenomena need to be further research. According to the images analysis of the atmospheric degradation model, this article puts forward the improved algorithm based on dark channel prior and morphology. Given the application of He's algorithm to defog, it makes brightness reduce. Therefore, the article firstly proposes to increase the brightness of image before processing, and then estimates the global atmospheric value, the initial transmission rate and the haze density using morphology method, finally substitutes into the simplified model to get the haze-free image. The experimental results show that the proposed algorithm can recover effectively and quickly degraded images. Meanwhile, this algorithm can keep the detail edges of images.

Keywords: Image defogging, dark channel, atmospheric light, morphology.

1 Introduction

Accompanied by the rapid development of intelligent transportation and machine vision, computer vision system has been widely applied in various fields, such as video surveillance system, road traffic driver assistance system, space cameras and medical equipment and so on. However, the current computer vision system has not yet been fully mature, so there are still some problems to be solved. When environmental factors are relatively poor, like fog, haze and other weather conditions, these images collected by computer vision system appear serious degradation, and thereby this phenomenon will have bad effects on the intelligent transportation system to obtain accurate information.

Currently, the image restoration methods are mainly the following two categories: physical and non- physical model approach [2]. Physical model approach is to explore the physical process of image degradation, and build their degradation model, then obtain the best estimate of the value of the image without fog to improve the quality of the image through solving the reverse process of lowering the quality. Non-physical

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model approach is to ignore the physical causes of image degradation, whose main purpose is to correct the image color and enhance image contrast.

In recent years, haze removal algorithms for single image have been making significant progress. Relative to the foggy images, Tan [3] considers a haze-free image must have a higher contrast ratio compared with the input hazy image and he removes haze by maximizing the local contrast of the restored image. And then he uses the random (MRF) model to further normalize the results. The method can maximize the recovery images details and structure, which is applied in certain scenes to get better results. However, because this method disconnects from the physical model, and as to the higher saturation of the image itself, it is prone to distortion and color saturation easily. Furthermore, the results appear cavity defects in the area of the local depth discontinuity.

Fattal [4] using a simple model based on physical laws, proposes the method based on ICA. This method firstly assumes that the reflectance of the local small square is constant matrix. Secondly, it assumes that the surface reflectance and transmission in a small square is independent, and the reflectance direction can be estimated by ICA. Finally, using MRF model to infer the color of the entire image, the method can produce a clear and natural image and an effective depth chart. But given the limitations of the method model, heavy fog images cannot get a better processing result. Meanwhile, as to the method based on the color statistic, the method cannot apply for the gray-scale image, and usually it is not difficult to handle the heavy fog area without color.

Based on dark channel prior, He et al [5] proposes a dark channel prior to image foggy algorithm. This method presents a clear of image except sky region which has low intensity values at least one channel in RGB color channel. In hazy image, dark channel intensity values are mainly composed of air light. The method directly uses dark channel to estimate transmission map, and employs soft matting to refine it. The method for outdoor images has achieved good results, but for some light areas, the results will distort. In addition, the big question is that soft matting can consume large amounts of memory and computation time, which real-time requirements cannot be met. Thus, this method cannot be widely applied in computer vision system in practice.

Therefore, for the defects of the conventional defogging algorithms to single image, this article presents a fast algorithm based on dark channel prior and morphology. This article aims to guarantee a certain defogging effects, and tries one's best to reduce the complexity of the algorithm so that it can make defogging speed meet the requirements of real-time application system. Based on the analysis of atmospheric foggy image degradation model, the proposed method firstly enhances image brightness and contrast before restoring image, and then uses dark channel prior to obtain the global atmospheric light values of each channel through acquiring the coordinates of the largest and least piece of the original image, and the initial transmission rate, meanwhile estimates the haze density through morphology method, which can be effective to obtain the haze density and keep the edges of images. Finally the foggy images have been restored.