A Conceptual Review of Visibility Refinement Techniques for Outdoor and Night Hazy Images

Praveen Kr Mishra¹, Ramakant Verma², Gaurav Goel³ and Pooja Agarwal⁴

¹Assistant Professor, CSE Deptt., BIT, Meerut
²Assistant Professor, CSE Deptt., BIT, Meerut
³Assistant Professor, IT Deptt., MIET, Meerut
⁴Assistant Professor, MCA Deptt., MIET, Meerut

ABSTRACT

The low-light images or the night image contains extremely a smaller quantity of visual information. So to take out information we have to take image negative. However inverted images have extremely parallel information as the hazy images when images are inverted. Both inverted night images and foggy outdoor images have the similar characteristics. This paper highlights the relative review of techniques for outdoor hazy and night hazy images visibility enrichment and renovation.

Keywords – Outside hazy image, Night Haze image, Dark channel prior, Median filter, Transmission map.

1. INTRODUCTION

In almost each realistic scenario the light reflected from a plane is spread in the environment before it reaches the camera. This is because to the occurrence of aerosols such as soil, fog and haze which redirect light from its original rout of transmission. In long distance photography or foggy scenes, this method has a vital effect on the image in which plane colors become dim and contrasts are reduced. Such degraded images frequently lack visual brightness and appeal, and moreover, they offer a reduced visibility of the scene inside.

Reduced visibility in night condition is a foremost difficulty for many applications of computer visualization. The majority of automatic systems for observation smart vehicles, outside entity detection, etc., suppose that the input images have understandable visibility. Unluckily, this is not always right in many situations; therefore Improving visibility is a predictable job. Optically. Low light night foggy condition and reduced visibility in bad weather is due to the presence of atmospheric particles that have considerable size and division in the participating medium. Light reflected from an entity and light from the atmosphere are scattered and engrossed by those particles, causing the visibility of a picture to be despoiled.

The low-light images or the night foggy image contains very less quantity of image information. We have to go for image negative to extract information. The inverted night foggy images have very similar statistics as the foggy images. In both type of images i.e. inverted night images and foggy images have the same characteristics (as described in [5]) that the intensity of background pixel is always high in all color channel and the intensity of entity is very less in at least one color channel. So by using the statistics [8], the dark channel prior method can be implemented to the low-light images or night images after the inversion of the input images.

2. ATMOSPHERIC OPTICAL MODEL

The optical model has been widely used in the computer vision research field, particularly to describe the formation of foggy images captured by digital cameras. It is based on the physical properties of light transmission through atmospheric conditions, and can be described as [10]
\[ P(x) = Q(x) \cdot t(x) + A_t(1 - t(x)) \] (1)

Where \( P(x) \) is the intensity of the observed hazy image, \( Q(x) \) is the scene radiance, \( A_t \) is the worldwide atmospheric light, and \( t(x) \) is the medium transmission representing the portion of light, which is not scattered and subsequently is received by the camera. On the right-hand side of (1), the first term \( Q(x) \cdot t(x) \) is called the direct reduction; the second term \( A_t(1 - t(x)) \) is called air light. The optical model can be described by direct reduction and air light. Direct reduction describes the decay of scene radiance and is dependent upon medium and scene depth, while air light represents the scattering of light that leads to color shifts in the scene.

3. LITERATURE REVIEW

A. R. Fattal et al. in [1] presented a new method for approximation the optical transmission in foggy scenes given a lone input image. Based on this approximation, the spread light is eliminated to improve scene visibility and get well fog-free scene contrasts. This method allows disambiguates in the data using search for a solution in to the transmission functions are nearly statistically uncorrelated. A comparable principle is used to approximate the color of the fog. Outcome demonstrated the new method abilities to remove the fog layer and provide a consistent transmission approximate which can be used for extra applications such as image refocusing and new view synthesis.

B. R. Tan et al. in [2] presented a new method for terrible climate, for instance vapor and fog, can degrade the visibility of a scene. Due to the significant presence of particles in the atmosphere that absorb and scatter light. The scattering processes and absorption are commonly modeled by a linear grouping of the direct attenuation and the air light. Few methods has been proposed based on this model, and require multiple input images of a scene, which have different degrees of polarization and different atmospheric situations.

The author introduces a programmed method that requires a one input image. This method is based on two essential observations: first, images with improved visibility have extra contrast than images plagued by terrible climate. Relying on this observation, authors build up a cost function which can be efficiently optimized by different techniques.

C. Kaiming He et al. in [3] presented an easy but image prior - dark channel prior is useful to remove fog from a distinct input image. The dark channel prior is a type of statistics of the fog-free outside images. DCP is based on a key observation - many local patches in fog-free outside images contain some pixels which have extremely low intensities in at least one color channel. Using DCP with the fog imaging model, they can directly guess estimate the thickness of the fog and recover a good quality fog-free image. Outcome on a selection of outside fog images express the power of the prior method.

D. K. He, J. Sun [4] presented a simple but efficient iterative method for recovering fog-free scene contrast and increasing scene visibility from an isolated foggy image. Using the fog imaging model with the dark channel prior, the author directly estimated an iterative enhancement unit and the coarse transmission map, based on bilateral filter is applied to enhance the transmission map. The key benefit of projected algorithm compare with others is its speed and effectiveness for both gray level and color images. A comparative study with other state-of-art algorithms is proposed to demonstrate that parallel or better quality outcome of his scheme are obtained with just little fraction time utilization.

E. Jin-Hwan Kim et al. in [5] presented easy and adaptive separate image dehazing algorithm is projected. It is observed that a foggy image has less contrasted in general, the author attempt to restore the original image by enhancing the contrast. The projected algorithm estimate the air light in a given foggy image based on the quad-tree subdivision. After that, the projected algorithm estimates the transmission map to increase the contrast of the output image. To measure the contrast, they develop a cost function, which consists of a standard deviation term and a histogram uniformness term. Experimental results showed that the projected algorithm can remove fog competently and recreate information in original scenes clearly.

F. Xiangdong Zhang et al. in [9] presented a general method for image contrast improvement and noise reduction. The procedure is developed mainly for enhancing images acquired under extremely low light situation where the features of images are nearly unseen. After using better and effective image de-fog algorithm to the inverted input image, the
contrast get improved and the dark surface become bright when the intensity can be amplified. The joint bilateral filter with the original green component is introduced to suppress the noise. Experimental results authenticate the performance of the projected approach.

G. Yi-Jui Cheng et al in [10] presented outside images captured during terrible weather situation usually exhibit visibility degradation. Local light sources result from medium headlights and activation of streetlights. Those images are restored by typical state-of-the-art fog removal techniques then the existence of localized light sources in foggy images may cause the generation of block artifacts. Consequently, author projected a new fog removal approach based on the projected adaptive dark channel prior technique in order to solve the problems connected with localized light sources during image re-establishment. The overall results show that the projected fog removal method can recover fog-free images efficient than other prior state-of-the-art fog removal method while avoid over-saturation.

H. Bo-Hao Chen et al in [11] presented fog removal is the method for horizontal obscuration is eliminated by foggy images captured at the time of bad weather. Fog present a particularly difficult situation; images captured during fog often show color-shift effects because of insufficient spectrum absorption. The author presented a new type of fog removal method which uses a grouping dark channel prior and of mix spectrum analysis in order to repair color shifts and thus achieve efficient restoration of foggy images captured during night low light. The results and qualitative evaluation demonstrate that projected method can provide superior re-establishment results for images captured during fog in comparison with the previous approach.

I. Qingsong Zhu et al in [12] presented a novel and effective single image improvement algorithm for fog image. As author observed that, after using dark channel prior approach the contrast and intensity of fog image will be lower than the real scene, they make a number of experiment and observe that, if processing with a foggy image with huge background region and low contrast, result will become dark in case of DCP. The author introduced a new algorithm to refine the different kinds of an amorphous on the foggy image after apply dark channel prior. The results showed that this method makes the dehazing result more close to actual scene.

J. Wei-Jheng Wang et al in [13] presented the visibility of outside images taken in bad climate will become despoiled due to the presence of fog, smog, mist, and so on. The images are restored by usual state-of-the-art fog removal techniques, such as outside object detection systems, obstacle detection systems, video observation systems, and smart carrying systems. Visibility restoration techniques have been developed to solve this problem, and useful in different computer vision applications. But, completely clear single image using complex structure is hard for visibility restoration techniques to achieve. The results demonstrate that author projected method provides better fog removal in comparison to the earlier method through visual evaluation of different images.

K. Shih-Chia Huang et al in [14] presented Images captured during fog conditions often feature corrupted visibility and undesirable color cast property. In this method, visibility restoration approaches usually cannot sufficiently restore images due to reduced evaluation of fog depth and the perseverance of color cast problems. The author presented a visibility restoration approach using Laplacian-method to remove fog thickness estimation and color cast problems. So, a better image with clear visibility and colorful image can be generated. Quantitative evaluations using experimental outcome show that the projected scheme can improve images captured during bad weather situation, and produces good results.

L. Deepak Kumar Naik et al in [15] presented problem of low light image improvement thereby improvement of scene visibility in outside images. Visibility is a very vital issue in case of computer based observation, crime investigation, driver support systems design etc. The mainly challenge related to visibility is the atmospheric fog and deprived lighting. The problem becomes more challenging if fog is too thick and lighting during night is extremely reduced. Author has been proposed automatic degradation recognition, This method detects the type of image using the threshold value of the image, after that apply the hybrid dark channel prior algorithm for fog subtraction, if the image is despoiled because of atmospheric haze only, otherwise First take
complement of the image for negative and then apply the adaptive DCP to determine the difficulty.

4. LITERATURE GAP STUDY

The inferences drawn from the literature are as follows:

1. The method in [1], fail to examine the possibility of incorporating an estimated transmission method.

2. The model in [2], lack to concentrate on the current constraints. First is the halo at depth discontinuities. Second constraint is that, optimize the cost function.

3. In [4], the future scope is to better its processing speed and aim to apply it in real time entity detection under terrible weather.

4. The method in [5], fail to design a competent filter, which uses the edge information to refine the transmission map accurately but at low computational complexity.

5. The model in [9], includes researching other noise removal filters and make comparison between them. Current challenges include speeding up the processing to apply it to improving robustness to changing lighting conditions, so author also intend to investigate noise modeling in low light images and enhance them based on these models in the future.

6. In [15], author approach fails to make the parameter “φ” adaptive for all weather condition and avoid generation of halo effects and insufficient transmission map estimation.

5. CONCLUSION

In the literature, fog elimination is difficult because the fog is dependent on the indefinite depth information. The complexity is remains same suppose the input is only a single fog image. Therefore, some methods have been projected by using various images or extra information. In the field of fog removal methods are present which built on the priority of well-built assumptions. But practically in some physical situation the assumed models may fail and may provide physically unacceptable output outcome. These models may not improve the great foggy images. If dealing with a fog image with low contrast and large background region, dark channel prior result will become shady, so there is still scope for improvement in visibility of night hazy images.

REFERENCES


[12] Qingsong Zhu ; Shuai Yang ; Pheng Ann Heng ; Xuelong Li; “An Adaptive And Effective Single Image
Dehazing Algorithm Based On Dark Channel Prior”


