
Sangita Roy, Narula Institute of Technology, Kolkata, India
https://orcid.org/0000-0002-8898-0183

Sheli Sinha Chaudhuri, Jadavpur University, Kolkata, India

ABSTRACT

At present the classical problem of visibility improvement is hot topic of research. An image formation optical model is presented where a clear day image has high contrast with respect to an image plagued with bad weather. A degraded daytime image has high intensity with minimum deviation among pixels in every channel. No reference digital image haze removal is a problem. The static haziness factor for all types of images cannot be applicable for effective haze removal. A minimum intensity channel of the three RGB channels is estimated as transmission of an image with a dynamic haziness factor to be a ratio of minimum to maximum pixel intensity of the hazy image. Adaptive contrast, extinction coefficient, the maximum visible distance of hazy images as well as dehazed images from each image are evaluated uniquely. The resulting high-quality haze free image with linear computational complexity $O(n)$ is appropriate for real time applications. The effectiveness of the technique is validated by quantitative, and qualitative evaluations.

KEYWORDS

Atmospheric Light, Computational Complexity, Extinction Coefficient, Haze Removal, Haziness Factor, Qualitative Evaluation, Quantitative Evaluation, Transmission Estimation

INTRODUCTION

Global warming and pollution are on the rise due to exponential technological growth. As a result, atmosphere is becoming contaminated with APM (Atmospheric Particulate Matter) in the form of fog, dust, vog, industrial waste, etc. Impact of APM leads to decrease in visibility (Mao, 2015). Atmospheric effect and inherent
camera distortion in outdoor image make detection of distant objects difficult and captured images become inadequate in luminance, contrast, brightness and colour. Therefore, visibility improvement, and colour restorations in computer vision applications are very important. In this research work atmospheric scattering based optical image formation and the retrieved model developed by H. Kosmeider in 1924 and revisited by E.J. McCartney 1976 has been studied and analysed (Koschmieder, 1924, & McCartney, 1976). Single image dehazing generates good quality image using DCP(Dark Channel Prior). Fixed value of haziness factor $\omega$ (0.95) and the sky area or bright areas are two drawbacks of the DCP algorithm. This method is efficient, but slow with high time complexity and the output image appears dull (He et al., 2009). The work of R Tan deals with gray or colour image. Data cost and smoothness cost are extrapolated from airlight in the framework of Markov Random Fields optimized by Graph-cut or belief propagation. The method is efficient, but not applicable for real time (Tan, 2008). The algorithm proposed by J.P. Tarel is fast and its complexity is a linear function with the number of image pixels for both colour and gray image. The algorithm is tuned by only four parameters, atmospheric veil inference, image restoration, smoothing, and tone mapping (Tarel et al., 2009). Research work of R. Fattal is based on new transmission estimation that develops refined image formation model where surface shading and transmission function are found to be locally statistically uncorrelated. The result of this effect removes the scattering light and resolves the ambiguity in hidden pixel information to retrieve clear image with original scene colour and contrast (Fattal, 2008). Berman and Avidan emphasised a method based on non-local prior. Uneven degradation depends on the distance between camera and the pixel. Transmission coefficients attenuate every pixel and modulate the amount of haze with the help of haze line to estimate the amount of haze for original haze-free image. The algorithm is linear, fast, deterministic with no training required, but still cannot applicable for real-time applications (Berman & Avidan, 2016). The work based on colour attenuation prior is a linear model with supervised learning. It is robust and efficient. Although it is fast, this method is also not suitable for real time use. The output images are little bit whitish, and scene depth is less (Zhu et al., 2015). Authors are working on fast weather independent visibility improvement algorithm which can be applied in surveillance, satellite image processing, car driving, aircraft landing system, etc. (Roy & Chaudhuri, 2016). Original image geometric structure has been recovered optimally from the joint estimation of scene albedo and depth of single foggy image using Bayesian statistical method. Here, image is modelled with Factor Markov Random Field where scene albedo and depth are considered statically independent and estimated jointly. Natural images and depth statistics are being used for scene albedo and depth estimation for foggy images with canonical maximisation algorithm having alternate minimisation. The method is effective and efficient, but having high computational complexity making the algorithm not suitable for fast applications (Nishino et al., 2012). Inherent boundary constrains on transmission
Lessons Learned from the Design and Development of Vehicle Simulators: A Case Study with Three Different Simulators
www.igi-global.com/article/lessons-learned-from-the-design-and-development-of-vehicle-simulators/203068?camid=4v1a

Preparing for the Forthcoming Industrial Revolution: Beyond Virtual Worlds Technologies for Competence Development and Learning
www.igi-global.com/article/preparing-for-the-forthcoming-industrial-revolution/169932?camid=4v1a

Like a Poke on Facebook Emergent Semantics in Location-Aware Social Network Services
www.igi-global.com/chapter/like-poke-facebook-emergent-semantics/48713?camid=4v1a