EE367 Project Proposal - Low-light Image Haze Removal

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1 Introduction

Driving in foggy or rainy night can be a challenging task not only for drivers, but also for car dashboard camera to record a clear view of a vehicle's front screen. In the scene of road accident under the presence of adverse weather, good image quality of dashboard cameras is essential for determining accident liability and for tracking down hit-and-run drivers.

Most of the existing image dehazing models are trained on daytime hazy scene datasets. The main challenge posed for this problem is that for daytime, the light source of the scene is usually uniform and not visible in the scene, while in low-light conditions, other light sources can often be introduced into the dashboard camera such as street lights or car lights to create glow in image [1].

This project aims to study the existing implementations for low-light image quality adjustment and night-time image dehazing and to propose an image post-processing pipeline to improve the quality of image captured under low-light hazy scenes.

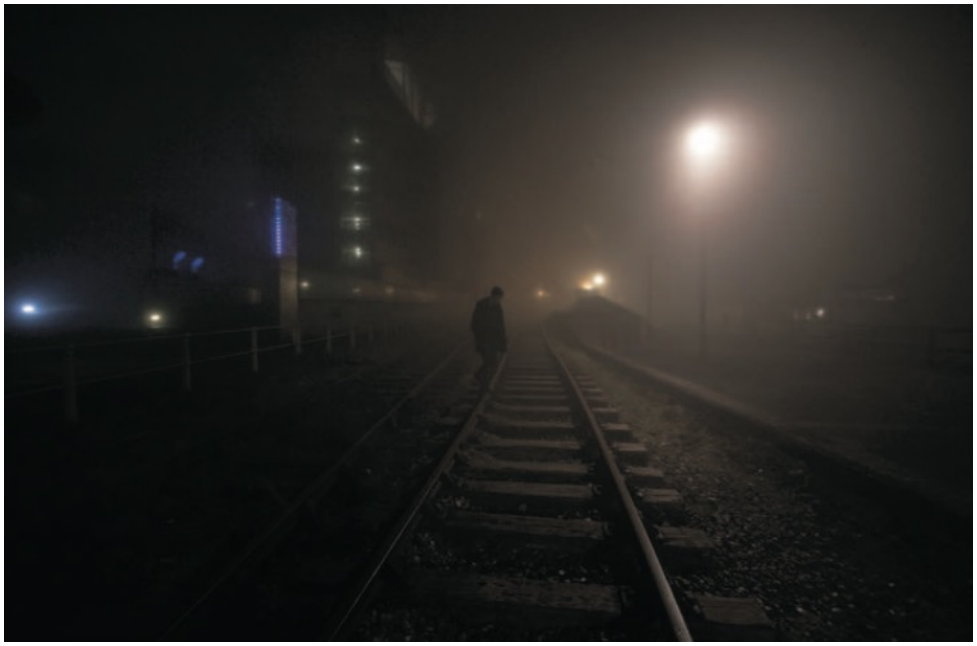

Figure 1: Example Image of Low-light Hazy Scene

EE367: Computational Imaging 2021, Stanford University, CA.

2 Related work

In recent years, extensive research have been conducted on image dehazing and different models were leveraged to bring a huge performance boost on image dehazing.

In 2008, Fattal presented a method to estimate the optical transmission in hazy scenes and then to remove haze by eliminating the measured scatter light [2]. In 2009, He et al. proposed a image prior: dark channel prior for image haze removal [3]. In 2015, Li et al. introduced a method for night-time image dehazing that focusing on reducing the effect of light glow on image [1]. In 2021, Chen et al introduced Principled Synthetic-to-real Dehazing (PSD) framework that pre-trained deep learning-based model on synthetic hazy images and fine-tuned on real hazy images with physical priors.

In this project, we proposed to pre-process the low-light hazy images firstly with low-light image enhancement method and reduce the light glow on image, then implemented one of the deep learning-based dehazing model, and evaluated the overall performance improvement.

3 Milestone and Timeline

Week 1: research on models and datasets to use.
Week 2: preprocess the images in dataset and implemented the model.
Week 3-4: evaluate the model performance and adjust the method accordingly.

References

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[2] Raanan Fattal. 2008. Single image dehazing. ACM Trans. Graph. 27, 3 (August 2008), 1–9. DOI:https://doi.org/10.1145/1360612.1360671

[3] Kaiming He, Jian Sun and Xiaoou Tang, "Single image haze removal using dark channel prior," 2009 IEEE Conference on Computer Vision and Pattern Recognition, 2009, pp. 1956-1963, doi: 10.1109/CVPR.2009.5206515.

[4]. Chen, Y. Wang, Y. Yang and D. Liu, "PSD: Principled Synthetic-to-Real Dehazing Guided by Physical Priors," 2021 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2021, pp. 7176-7185, doi: 10.1109/CVPR46437.2021.00710.