

NTIRE 2019 Image Dehazing Challenge Report

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Abstract

This paper reviews the second NTIRE challenge on image dehazing (restoration of rich details in hazy image) with focus on proposed solutions and results. The training data consists from 55 hazy images (with dense haze generated in an indoor or outdoor environment) and their corresponding ground truth (haze-free) images of the same scene. The dense haze has been produced using a professional haze/fog generator that imitates the real conditions of haze scenes. The evaluation consists from the comparison of the dehazed images with the ground truth images. The dehazing process was learnable through provided pairs of haze-free and hazy train images. There were 270 registered participants and 23 teams competed in the final testing phase. They gauge the state-of-the-art in image dehazing.

1. Introduction

Haze is a common atmospheric phenomenon produced by small floating particles that reduce the visibility of distant objects due to light scattering and attenuation. This results in a loss of local contrast for distant objects, in the addition of noise to the image, and in a selective attenuation of the light spectrum. Image dehazing is a challenging ill-

posed problem that has drawn a significant attention in the last few years.

In the last decade a significant amount of literature focused on single image dehazing research. The performance of the top methods continuously improved [30, 32, 19, 5, 1, 22, 31, 2, 27, 11] showing that the field reaches maturity. Despite this growing interest, the field lacks standardized benchmarks to allow for evaluating objectively and quantitatively the performance of the existing dehazing techniques.

Basically, a major issue preventing further developments is related to the impossibility to reliably assess the dehazing performance of a given algorithm, due to the absence of reference haze-free images (ground-truth). A key problem in collecting pairs of hazy and haze-free ground-truth images lies in the need to capture both images with identical scene illumination.

In general the existing dehazing quality metrics are restricted to non-reference image quality metrics (NRIQA) [24]. For instance, the Fog Aware Density Evaluator (FADE) [13] estimates the visibility of a hazy/foggy scene from a single image without corresponding ground-truth. Unfortunately, due to the absence of the reference (haze-free) images in real-life scenarios, none of these approaches has been generally accepted by the dehazing community.

Recent works synthesize hazy images, using the optical model and known depth to synthesize the haze effect. For instance, FRIDA [33] dataset designed for Advanced Driver Assistance Systems (ADAS) is a synthetic image database with 66 computer graphics generated roads scenes.

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Appendix A contains the authors' teams and affiliations.

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