Simulation of Haze on Real World Images with Generative Adversarial Network

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Abstract

Synthetic generation of hazy images finds extensive applications in diverse domains such as checking the validity of the haze removal methods for autonomous driving. This paper describes two techniques for generation of haze on real-world images by atmospheric model-based and GAN-based methods for the generation of a dataset. Visual and quantitative results show that the GAN-based model can effectively add haze to the original image compared to the atmospheric model-based method.

Methodology

To simulate haze on input clear images this paper works on the simulation of hazy images by two methods [1-3]. Fig. 1 shows the workflow diagram of our methodology. In the first method, the input clear

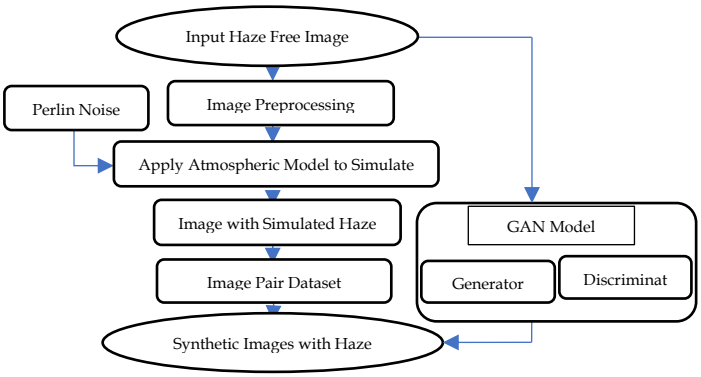

Fig 1: Workflow Diagram of the haze simulation on real-world images

images are initially preprocessed by applying some known approaches including depth map calculation, initial map, and refined transmission map sequentially. Then an atmospheric scattering model is applied to this preprocessed image to simulate a hazy image. Both the hazy image and the haze-free image are taken as an image pair in a dataset. In addition, a GAN-based hazy image is also developed. model is trained with the prepared dataset.

Results and Analysis

We have used the input from the real-world images that are taken with a Canon EOS 800D camera. We have obtained the simulated haze on images by applying both methods.

Table 1: Sample real-world input and the corresponding output images

Real-world input image	Applying the atmospheric model	Applying GAN model
		

Three different indicators for quantitative analysis ar-e applied to the test images and the results are shown in Table 2.

Table 2: Quantitative analysis of input image and output hazy images

	Original Input Image			Hazy Image by Atmospheric Model			Hazy Image by GAN Model		
	FADE	IC	IAB	FADE	IC	IAB	FADE	IC	IAB
Image1	0.179	4.985	82.357	0.4534	3.8385	114.476	0.586	3.4397	126.006
Image2	0.136	7.351	102.16	0.3451	5.6603	135.871	0.446	5.0722	156.303
Image3	0.149	6.025	112.26	0.376	4.6393	147.057	0.4859	4.1573	171.753

From Table 2, we can see that the FADE index of the hazy images is larger than that of the original image. The larger the value of FADE is, the egregious the haze of the image is. It shows that the GAN model can effectively add haze to the original image. It can be also seen from the table that the IC of the hazy images generated by the GAN model is significantly lower than that of the original haze-free image.

Conclusion

In this paper, we prepared a haze dataset using an atmospheric model and also a GAN-based model. We compared both the datasets.

References

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