INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The efficiency of several real-time vision tasks severely degrades when presented with noisy or corrupt images or videos taken in adverse rainy or hazy weather conditions. Therefore, it is of utmost importance to propose robust and effective methods that remove the noise and restore the visual quality of the degraded images and videos. Recently, efforts have been afoot towards data-driven approaches due to their improved performance over prior-based schemes. With this motivation, this thesis presents efficient data-driven methods for the following low-level vision tasks: (a) single image de-raining, (b) single image de-hazing, and (c) video de-raining. In what follows are the four significant contributions of this dissertation.

In the first contributory chapter, a deep learning-based scheme has been proposed for the task of single image de-raining. The designed methodology exploits the spatial domain aspects of the rain-streaks due to their pseudo-periodic nature. In the second contributory chapter, transformed domain characteristics of the rain streaks in the image are exploited for de-noising. Unlike rain-streaks, the haze in an image exponentially varies with the depth of the pixels. Hence, in the third contributory chapter, a scale-space invariant CNN has been presented for the task of single image de-hazing. In the final contributory chapter, the task of video de-raining has been addressed. Unlike the image, video de-raining has an additional complexity of retaining the temporal smoothness in the de-rained videos. Existing approaches tend to separate the spatial and temporal enhancement modules. However, in this work, a unified deep CNN has been presented that simultaneously optimizes the spatial and temporal characteristics of the de-rained videos.

Finally, the thesis is concluded by summarizing the significant contributions and proposing some relevant future research directions.