

A Hierarchical Approach for Rain or Snow Removing in a Single Color Image

Abstract:

In this paper, we propose an efficient algorithm to remove rain or snow from a single color image. Our algorithm takes advantage of two popular techniques employed in image processing, namely, image decomposition and dictionary learning. At first, a combination of rain/snow detection and a guided filter is used to decompose the input image into a complementary pair: 1) the low-frequency part that is free of rain or snow almost completely and 2) the high-frequency part that contains not only the rain/snow component but also some or even many details of the image. Then, we focus on the extraction of image's details from the high-frequency part. To this end, we design a 3-layer hierarchical scheme. In the first layer, an overcomplete dictionary is trained and three classifications are carried out to classify the high-frequency part into rain/snow and non-rain/snow components in which some common characteristics of rain/snow have been utilized. In the second layer, another combination of rain/snow detection and guided filtering is performed on the rain/snow component obtained in the first layer. In the third layer, the sensitivity of variance across color channels is computed to enhance the visual quality of rain/snow-removed image. The effectiveness of our algorithm is verified through both subjective (the visual quality) and objective (through rendering rain/snow on some ground-truth images) approaches, which shows a superiority over several state-of-the-art works.