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Detection and Dismissal of Rain or Snow in a Single Tone Image

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ABSTRACT: We propose a novel efficient methodology to get rid of rain or snow from a color image. In image processing, Image decomposition and dictionary learning are two widespread techniques used to decompose the image and extraction of the image. At first, a mix of rain and snow is detected and to decompose the input image to a complementary pair a guided filter is employed: 1) the low-frequency part that's freed from rain or snow almost fully and 2) the high-frequency part that contains not only the rain/snow part however several details of the image.
Then, we tend to target the extraction of image's details from the high-frequency part to the current end. We tend to style a 3-layer hierarchical scheme. In the initial layer, an over complete lexicon is trained and 3 classifications are distributed to classify the high-frequency part into rain/snow and non rain/ snow parts within which some common characteristics of rain/snow are used. The second layer is the next important layer for the combination of rain/snow detection and guided filtering which is worked out on the rain/snow part obtained within the initial layer. In the third layer, the sensitivity of variance across color channels is manipulated to reinforce the visual quality of rain/snow-removed image. The effectiveness of our methodology is verified through each subjective (the visual quality) and objective (through rendering rain/snow on some ground-truth images) approaches, that shows a superiority over many progressive works.

KEYWORDS: Rain, Snow, Image Decomposition, Dictionary Learning, Guided Filter, Sensitivity of Variance across Color Channels.

I.INTRODUCTION

It is well known that a bad weather, e.g., haze, rain, or snow, affects severely the quality of the captured images or videos, which consequently degrades the performance of many image processing and computer vision algorithms such as object detection, tracking, recognition, and surveillance.

Rain and snow belong to the dynamic weather they contain constituent particles of relatively large sizes so that they can be captured easily by cameras. On the other hand, haze belongs to the steady weather the particles are much smaller in size and can hardly be filmed. As a result, rain or snow leads to complex pixel variations and obscures the information that is conveyed in the image or video. Especially, the degradation on the involved algorithms performance would be severe if the algorithm is based on some features in the image or video. As compared to the haze problem where some excellent solutions have been achieved .e.g., removing of rain or snow is much more challenging. The common characteristics of rain and snow are used for rain and snow detection. Though belonging to the dynamic weather category, rain and snow still have some differences when appearing in the image or video.

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II.RELATED WORKS

Automatic Rain Streak Removal: The main idea of the work "Automatic Rain Streak Removal" is to develop a method that can separate rain streaks from the high-frequency part, a hybrid feature set, including a histogram of oriented gradients (HoGs), depth of field (DoF) and Eigen colour, is employed to further decompose the high frequency part. With the hybrid feature set applied, most rain streaks can be removed, while the non-rain component can be enhanced. The rain streaks in an image are usually more blurred than the focused subject, their visual effect is relatively weak and likely appears as fog. Therefore, properly employing the DoF feature is helpful for identifying the main subjects to be preserved in a rain image. The rain streaks usually reveal neutral colour in analysing the atoms of rain in the method. Hence colour information is also a key feature to be employed for rain removal, where the Eigen colour feature is used.

Removing Rain From A Single Image Via Discriminative Sparse Coding: The paper aims at developing an effective algorithm to remove visual effects of rain from a single rain image, i.e. separate the rain layer and the de-rained image layer from a rain image. Built upon a nonlinear generative model of rain image, namely screen blend model, we propose a dictionary learning based algorithm for single image deraining. The basic idea is to sparsely approximate the patches of two layers by very high discriminative codes over a learned dictionary with strong mutual exclusivity property. Such discriminative sparse codes lead to accurate separation of two layers from their non-linear composite. The experiments show that the proposed method outperforms the existing single image de-raining methods on tested rain images.

An Improved Guidance Image Based Method To Remove Rain And Snow: In A Single Image Rain and snow bring poor visibility to outdoor vision systems. The commonly used image processing methods may be not suitable for a degraded image. In this paper, a guidance image method is proposed to remove rain and snow in a single image. To removal rain and snow only using one image, a guidance image is derived from the imaging model of a raindrop or a snowflake when it is passing through an element on the CCD of the camera. Since only using this guidance image may lose some detailed information, in this paper, a refined guidance image is proposed. This refined guidance image has a similar contour with the un-degraded image and also maintains the detailed information which may be lost in the guidance image. Then a removal procedure is given by the use of the refined guidance image. Some comparison results are made between different methods using the guidance image and the refined guidance image. The refined guidance image can be used to get a better removal result. In this paper first, analyse the imaging model of rain and snow formation to find a guidance image. Second, propose a refined guidance image such that this novel image could keep detailed information and at the same time remove the linear edge caused by rain and snow. Thereby use filtering method to remove rain and snow from this guidance image.

III.METHODOLOGY

A. EXISTING METHOD:

As compared to the existing 2-step methods the novelty of our proposed approach is two-fold. In the first step, instead of applying a low-pass filtering simply, we combine rain/snow detection together with a guided filter. By doing this, we can achieve a much improved balance between removing rain/snow components and preserving image's details, the resulted low-frequency part becomes free of rain or snow almost completely and at the same time contains the image's details to a reasonable extent.

B. PROPOSED SYSTEM:

Our proposed rain/snow removal algorithm consists of two steps. In the first step, the input image is decomposed into the low frequency part and high-frequency part. Note that low frequency part is free of rain or snow almost completely but usually blurred, while high frequency part contains rain/snow components and some or even many details of the image. In the second step, we design a 3-layer hierarchy of extracting non dynamic components from high-frequency part. First, rain/snow detection is performed to produce a binary location map. Because the location map is binary,

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holes appear at the rain/snow locations. Then, we fill each hole with the mean value of its neighbouring non rain/snow pixels. At last, a guided filter is utilized to generate the low-frequency and high-frequency part. Finally to say simply, we detect raindrops on the windshield in a single image, and then we model the geometric shape of raindrops. After that we utilize the photometric property to construct a relationship between raindrop and the environment. Later on, some learning-based image decomposition methods will be proposed to remove rain in a single image. In the meantime, a guided filter based method is used by to remove rain or snow from a single image by designing a rain/snow free guidance image.

C. BLOCK DIAGRAM

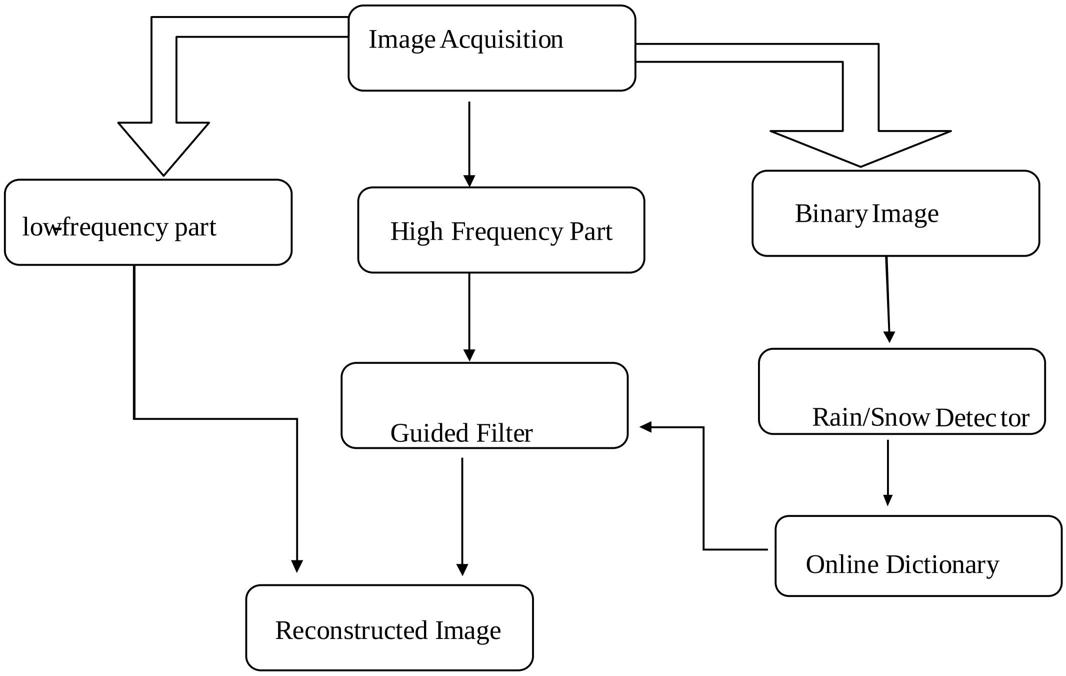

Fig.1: BLOCK DIAGRAM OF RAIN OR SNOW REMOVING

Image decomposition:
Since the location of rain/snow in the image is random it is difficult to accurately separate rain/snow with other non rain snow components by normal detection methods. Dictionary learning is an excellent image decomposition method, which can decompose an image into many components. Some are rain/snow components and the other is non rain/snow components. In this subsection, we try to represent IH by a sparse coding, we choose the on-line dictionary learning method to learn an over-complete dictionary for factorizing. This method addresses the factorization problem with a new on-line optimization algorithm that is based on stochastic approximation. We choose this method because it suits for both small and large data set, and can train adaptive over-complete dictionaries iteratively.

Dictionary learning:
The on-line dictionary learning method to learn an over-complete dictionary for factorizing IH. This method addresses the factorization problem with a new on-line optimization algorithm that is based on stochastic approximation. We choose this method because it suits for both small and large data set, and can train adaptive over-complete dictionaries iteratively. On the other hand, K-SVD can do a similar job but is slower in speed; whereas MCA utilizes a different transform to construct an over complete dictionary that is not adaptive. In the following, we introduce this on-line dictionary learning method briefly.

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Guided filtering:
This method addresses the factorization problem with a new on-line optimization algorithm that is based on stochastic approximation. We choose this method because it suits for both small and large data set, and can train adaptive over-complete dictionaries iteratively. On the other hand, K-VD can do a similar job but is slower in speed; whereas MCA utilizes a different transform to construct an over complete dictionary that is not adaptive.

IV.RESULTS AND DISCUSSIONS

The images which have been affected by rain or snow are cleared by using SVCC mapping and guided filter, and made suitable to view perfectly. The rain and snow has been removed successfully as shown in below figures.

Fig.2: Left: Image affected by snow; and Right: Snow removed image

Fig3: Left: Rain Image ; and Right: De-rained Image

V.CONCLUSION

This paper has attempted to solve the rain/snow removing problem from a single color image by utilizing the common characteristics of rain and snow. To this end, we defined the principal direction of an image patch (PDIP) and the sensitivity of variance of color channel (SVCC) to describe the difference of rain or snow from other image components. We acquired the low and high frequency parts by implementing rain snow detection and applying a guided filter. For the high frequency part, dictionary learning and three classifications of dictionary atoms are implemented to decompose it into non dynamic components and dynamic (rain or snow) components, where some common characteristics of rain snow defined earlier in our work are utilized. Moreover, we have designed two additional layers of extracting image details from the high frequency part, which are based on, respectively, the SVCC map and another combination of rain and snow detection and a guided filtering. Finally, we have presented a large set of results to show that our method can remove rain and snow from images effectively, leading to an enhanced visual quality in the rain and snow removed images.

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