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# IMAGE BASED RAIN STREAKS REMOVAL VIA IMAGE DECOMPOSITION

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## Abstract

Video based rain or fog removal process is a challenging issue and it is studied extensively. The varying environmental conditions such as rainfall, snow and fog will affect the image features these conditions degrade the effectiveness of the different processes such as feature extraction, image registration, object tracking and image restoration etc., the proposed system is an image based rain streak process to obtain the vision enhancement. The rain streak has two characteristics. They are, it have the repetitive local structure which is scattered over different directions of the video and the chromatic properties of rain streak. We use a MCA (morphological Component Analysis) algorithm for the detection of rain droplets and other image parts. The photometric properties can be detached from the input to produce the vision enhanced image.

## CHAPTER 1: INTRODUCTION

Machine visualization technologies are practiced for various principles such as observation, tracking in additionto intelligent transport systems (ITS) ,etc., These vision of the system we have model a robust algorithm to perform the vision enhancement process. The dreadful climate conditions such as drizzle, haze and vapor will humiliate the recital of the outdoor vision system. The illustration of the rain component is as follows Rain is the collection of water droplets which is comes at elevated speeds. Every rain streaks can be represented as a sphere shaped mirror which refracts and reproduce light appears on the camera, it produces a sharp intensity patterns in videos. The rain drops have the significant effect of spatial and temporal variations which humiliate the recital of the outdoor visualization systems. With respect to the above analysis, we have proposed arain.

Fig.1: The Illustration of Rain.

(a) Rain Streaks due to the motion of individual rain drops.

(b) Water Droplets of Rain removal modeled that perform the decomposition morphological component analysis to eliminate/decrease the presence of drizzle effects without affecting the originality of image/picture. This model proposes the image composition and various analysis steps to identify the presence of rain droplets.

## CHAPTER 2: LITERATURE SURVEY

Weather conditions i.e. rain, snow, fog, mist and haze degrade the quality also performance of outdoor vision system. Rain is one of the type of weather condition as well as rain is the major component for the dynamic bad weather. Rain introduces sharp intensity variations in images, which degrade the quality or performance of outdoor vision systems. These intensity variations depend on various factors, such as the brightness of the scene, the properties of rain, and the camera parameters. Rain removal has many applications in the field of security surveillance, vision based navigation, video or movie editing and video indexing or retrieval. So, it is important to remove rain streaks from the images. In this paper we have discuss previously proposed methods for rain streaks removal from the video.

Decomposition of an image into multiple components has been an effective research topic for various image processing applications. In this paper, we propose self learning based image decomposition based on morphological component analysis (MCA). Instead of applying conventional image decomposition, we focuses on the learning the basic information from an input image and thus the rain streaks patterns present in it can be identified by performing dictionary learning and sparse coding. By using PCA and SVM classifiers on the learned dictionaries, our framework aims at automatically identifying the common rain patterns present in them and thus we can remove rain streaks as a high frequency components from the input image. Different from prior image processing works with sparse representation, our method does not need to collect training images or any other assumption. Our result confirms, the rain streaks can be successfully removed from the image without losing original image details.

Rain removal from a video is a challenging problem and has been recently investigated extensively. Nevertheless, the problem of rain removal from a single image was rarely studied in the literature, where no temporal information among successive images can be exploited, making the problem very challenging. In this paper, we propose a single- image-based rain removal framework via properly formulating rain removal as an image decomposition problem based on morphological component analysis. Instead of directly applying a conventional image decomposition technique, the proposed method first decomposes an image into the low- and high-frequency (HF) parts using a bilateral filter. The HF part is then decomposed into a "rain component" and a "no rain component" by performing dictionary learning and sparse coding. As a result, the rain component can be successfully removed from the image while preserving most original image details.

Experimental results demonstrate the efficacy of the proposed algorithm.

Removing rain streaks from the video is the challenging task and has been researched broadly. But finding the exact problem in removing the rain streaks in a single image is still unclear. In this paper for removing rain streaks from a single image, MCA algorithm is used. It is based on the structural component, which is directly applied conventional image decomposition method. Using bilateral filter the image is decomposed into low frequency and high frequency. Using MCA algorithm high frequency part is filtered into rain component and non rain component. The rain components from the image will be removed. Hence a clarity image will be given as output.

## CHAPTER 3: IMPLIMENTATION

## CHAPTER 3.1: BACKGROUND

- Rain streak properties

**1. Spatial-temporal properties:**

Rain streak is scattered randomly and falls to the earth at high speed. The spatial property states the rain streak features and the temporal property state the changing pixel values of the rain streak with respect to time enclosed by drizzle throughout the complete image.

**2. Color value properties:**

Rain is streaks righter when the light falls on it. The light energy penetrates through the rain drop, the luminance value is increased due to the reflective property which makes the rain drop clear than the environment. The raise in chrominance values is proportional to the background. The chromatic property takes the Red, Green, Blue values of the rain streak

**3. Photometric constraint:**

Determine he substantial characterestic's of the rain streak is described photometric constraint. There are three factors to the characteristics of raindrop. Firstly, the brightness of the rain streak, then the environment scene radiances and finally the camera resolution. It also assume that rain streak have almost the same size and velocity.

## CHAPTER 3.2: REALTED WORKS

Moreover, many image processing applications heavily depends on the mining of gradient information or directional information. It means the pixel intensity in x and y axis. The widely used feature extraction techniques that are dependent on the calculation of picture_gradients they are recognition of features techniques, shape or edge detection approaches, and image properties descriptions algorithms. The effectiveness of these picture gradients properties mining technique can be considerably reduced by drizzle visible in the image.

The dynamic properties are introduced by the drizzle with respect to varying times in the same direction. The correlation model [2] which extracts the properties of drizzle and a correlation modeled that describes the rain image properties. Visual attention techniques obtain the similarity map of image features programming for similarity at every local region on the image. A saliency map is an image that depicts each pixel's unique quality. The output produced by saliency map is the set of contours extracted from the image. The efficiency of the rain streak removal process is ruined if rain drops intermingled with the image region.

A no. of drizzle identification and elimination approaches based on adjusting

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parameters of the camera which is not applicable to the normal end-user cameras [6] and cannot be applied to existing captured picture/recorded data. To remove the drizzle from frames captured by a motion video capturing unit, the recital of the frames processing may be considerably decreased. Because the problem is the frame processing techniques typically execute the detection of drizzle, which is done by the interpolation of identified image features.

These interpolated pixels are exaggerated by drizzle sin every image sequence of dynamic environment because of camera movements and false motion assessment due to the influence of drizzle may reduce the recital of drizzle identification and removal process. The movement analyzing approaches can be its recital can also be decrease by drizzles or huge movement's activity. In the concept of stable properties of drizzle, it identifies the stable details from adjacent image sequences for reconstruction.

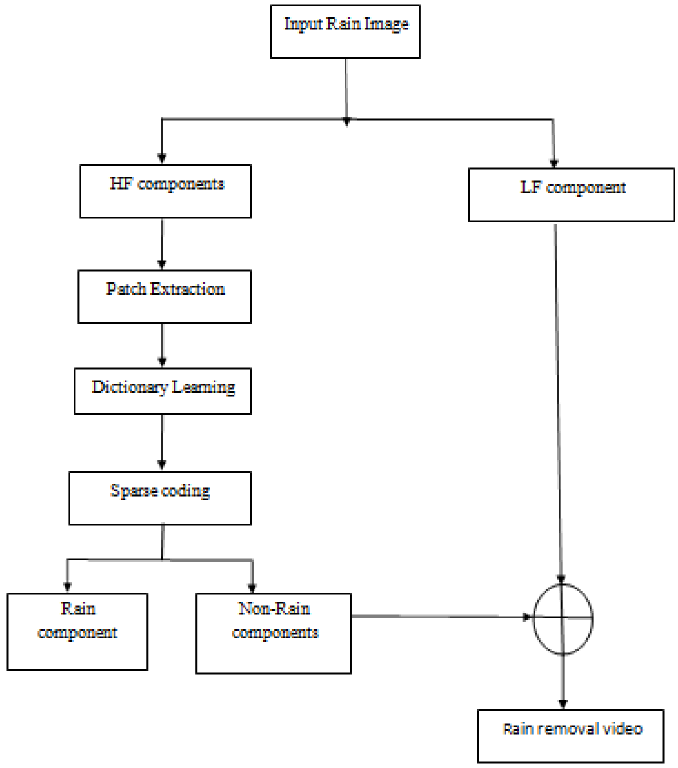


Fig 3: Block diagram explaining the detailed process

1) In the proposed system, the input image is first reprocessed for the quality improvement and decayed into the smooth end image parts (LF) and sharpened image part by the bilateral filtering process.
2) The sharpened image details are decayed into "rain component" and "non-rain component" by obtaining the morphological component analysis process.
3) The contributions are,
    a. Preserving the details of the video
    b. Decomposition of video to separate the video detail
    c. Automated process of rain streak removal.
4) The HF part is decomposed into a "rain component" and a "non-rain component" by performing dictionary

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training and sparse coding

5) Image-based rain streak removal, in which rain streak removal is formulated as an image decomposition problem.
6) In our method, the input rain image is first roughly decompose into the low-frequency (LF) part and the high-frequency (HF) part using the bilateral filter where the most basic information will be retained in the LF part while the rain streaks and the other edge/texture information will be included in the HF part of the image as illustrated in fig .
7) Then, we perform the proposed MCA-based image decomposition to the HF part that can be further decomposed into the rain component and the geometric (non-rain) component.
8) In the image decomposition step, a dictionary learned from the training exemplars extracted from the HF part of the image itself can be divided into two sub-dictionaries by performing HOG feature-based dictionary atom clustering. Then, we perform sparse coding based on the two sub- dictionaries to.

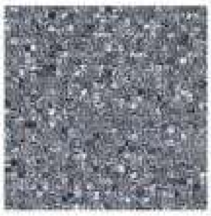
- **Preprocessing**

Step 1: In the preprocessing stage the input rain image is applied with the bilateral filter which preserves edge information of the input image. The bilateral filter is also called as smoothing filter and it act as a noise-removal filter. The output of this filter is the Low frequency such as basic information of the image and sharp edge image components, such as drizzle and the image related information.

Step-2: patch extraction & Dictionary learning

In the patch extraction step, the overlapping patches are extracted from the HF images parts. The rain streak and texture information of H

Fig 3: Patch extraction



part is divided into two learned dictionaries called as rain dictionaries and geometric sub-dictionaries. The image gradient is considered as the necessary feature for a rain component. From the rain HF part the feature descriptor obtains the rain component. The HOG descriptor separates the dictionary into rain dictionary and geometric dictionary of HF.

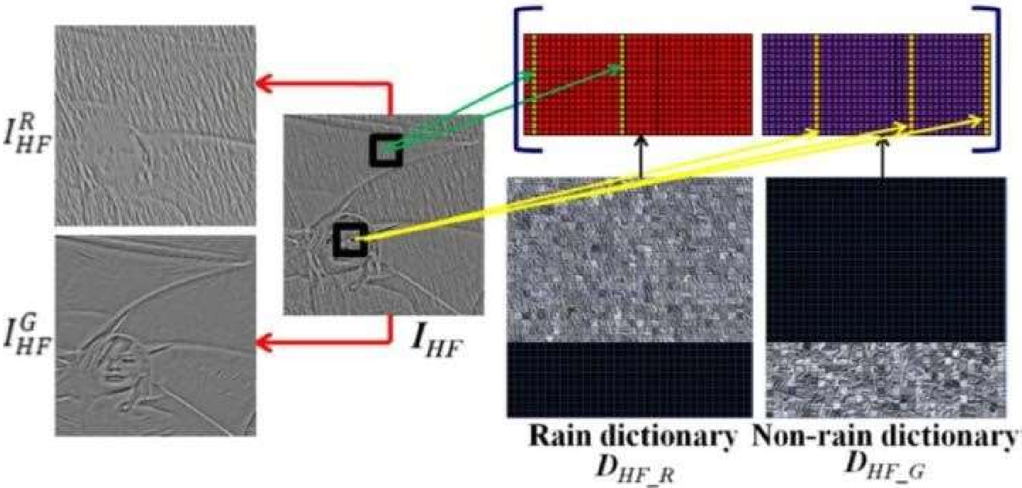


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Fig 4: Dictionary learning

Step-3: Sparse coding
Sparse coding is an approach to find the parse representation for a signal in image processing .Sparse coding is applied on the above two sub-dictionaries such as rain and texture to identify the sparse coefficients of the sharpened part of the picture. The sparse coding process results by separating rain component and image parts. Then the image parts are combined with the smooth part to produce the rain removed picture.

## CHAPTER 3.3: ALGORITHM

1. Input: Rain / Drizzle image.
2. Smoothening process: Smoothening filter process to produce low frequency image elements and high frequency images part.
3. Construct images patches: Obtain the images patches from high frequency components.
4. Perform sparse signaling representation and for each atoms extract HOG feature.
5. Use clustering algorithm k-means to classify the extracted features into two clusters.
6. Based on the classification result the clusters are determined as rain dictionary and non-rain dictionary.
7. OMP (Orthogonal Matching Pursuit) is applied for each patch in the rain dictionary.
8. Reconstruct the non- rain components.
9. Combine the non-rain component with the LF image components.
10. Output: Images after removal of rain streaks.

## CONCLUSION

The proposed system is an effective method for rain streak removal. This method includes an automatic decomposition technique called as MCA for the rain streak removal process. The patches are constructed and the dictionary is learned for the decomposing process of rain steaks from an image. The rain component can be detached from the video to produce the vision enhanced video. This system can be further enhanced by the implementation of CNN model for the effective removal of rain streaks. The dictionary learning process takes much time to compute the decomposition of drizzle and non-drizzle elements. So in the future system the learning process can be done in fast manner by the implementation of hidden layers.

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