A Review paper on entropy maximization and background estimation based method is used for the rain removal

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Abstract—The rain removal from an image in the rainy season is also a required task to identify the object in it. It is a challenging problem and has been recently investigate extensively. In this paper the entropy maximization and background estimation based method is used for the rain removal. This method is based on single-image rain removal framework. The raindrops are greatly differing from the background, as the intensity of rain drops is higher the background. The entropy maximization is very much suitable for the rain removal. Experimental results express the efficacy of the rain removal by proposed algorithm is better than the method based on saturation and visibility features.

Keywords—single-image rain removal, entropy maximization, level of streak suppression

I. INTRODUCTION

The surveillance cameras are used in a range of circumstances, some of which are outdoors. The cameras are used to supply video streams of scenes such as parking lots, roads or restricted areas. A video camera which captures video in a rainy environment will produce artifacts in the resulting frames in form of streaks. The raindrop refracts and reflects light from its surroundings. This make them under some circumstances very visible to an observer. The resulting effect on the image appear discontinuous and places constraints on the algorithms used to detect and remove the streaks. The properties of rain may vary heavily from storm to storm. Factors such as wind, alter the direction of the streaks. In the case of snow the wind plays a bigger role as snow particles are lighter and may flow around in the scene with less clear of a direction than rain would. Precipitation is caused by the weather and have most impact on outdoor scenes. Therefore this report will mainly treat outdoor scenes.

The analysis is done in the context of surveillance cameras and real-time modification of the frames from a camera recording a scene with rain- or snowfall. The streaks produced by rain or snow can be disturbing for both human observers and image analysis algorithms which might be operating on the video stream from the surveillance camera. A surveillance camera does not want its motion detection to trigger on different weather phenomena. The streaks may also cause failure in face recognition algorithms when raindrops occlude parts of the face.

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. different weather conditions such as rain, snow, haze, or fog will cause complex visual effects of spatial or temporal domains in images or videos. Such effects may significantly degrade the performances of outdoor vision systems relying on image/video feature extraction or visual attention modeling, such as image registration, event detection, object detection, tracking, and recognition, scene analysis and classification, image indexing and retrieval, and image copy/near-duplicate detection. There are two types of bad weather conditions: steady and dynamic [4].
Removal of rain streaks has recently received much useful for object identification in rainy images. There are lots of topics that the researcher focuses that cover the field of image and signal processing. The field extends from

II. RELATED WORK
Accurate rain detection is important in order to preserve image quality. Too many false detections will lead to non-rain pixels being detected as rain and erroneously replaced. Depending on the replacement algorithm the consequences of this could either be that nothing happens or new artifacts being introduced to the images. Too many missed detections will lead to less rain or no rain being removed. When the pixels containing rain are detected, their current value will be replaced another value disguising the rain. Ideally the observer should not suspect that there had ever been a rain streak.

In [2] the properties of rain and snow in the frequency plane is analysed. It is found that the visual effect of rain in an image is consistent in the Fourier transform of the image. This can later be used to create a model of rain and snow which is used to remove frequencies similar to the rain or snow frequencies in an image. The model uses several parameters such as exposure time, focal length, droplet size, brightness and orientation of the rain. All these parameters need to be adjusted for the video and rain at hand, so that the model can be accurate. To improve the result, the temporal aspect of the video is utilized and pixels which are both rain like in the frequency space and are changing rapidly in the time domain are marked as rain. After the rain is detected, an alpha blending between the image containing rain and an estimated rain-free image is made in order to remove the rain. This rain-free estimate is made by using a median filter on the same image.

A camera has many different parameters and many of them can be adjusted. In [5] it is proposed that these parameters can be set so that the rain effects are minimized or removed. Exposure time and field of vision, among others, are used to lower the effects of rain.

The effect of rain on a pixel, as stated in the skewness, is that it makes the pixel brighter. This is explored in [6]. A raindrop acts as a lens refracting light from a wide range of the background. Garg and Nayar performed experiment with drops and concluded that a raindrop refracts light from a 165° angle behind it as seen in figure, seen from the camera. If compared to other noise, raindrops are much more dependent on the background from which they gain their intensity. They also find that if the background behind thee.
Chart -1: In the upper graph an example of two pixel intensity values over 19 frames can be seen. In the lower graph the distribution of the values of these two graphs are shown.

Fig -1: To the left there is an image with simulated rain. To the right there is the magnitude of the corresponding discrete two dimensional Fourier transform. Notice that the Fourier transform of the rain is a belt perpendicular to the actual rain.
Rain model
To get a perfect representation in frequency space one would need to apply the Fourier transform to all the streaks in a scene. This can be done by using

\[ \mathcal{F} \left\{ \sum_{d=1}^{N} g(x, y, \alpha_d, \beta_d, \theta_d, \mu_d) \right\} \]

III. OBJECTIVE
To remove/suppress the streaks from a video three things will have to be ascertained about the frames in the video stream.
1. Are there any rain streaks in the frame?
2. Which pixels are occupied by rain streaks?
3. What will the replacement value for these pixels be?

The first item in the list is included as a step if one would like to progress differently depending on the accuracy of the rain detection. It may be solved, or partly solved with item two. The second and third steps are two separate things which both have great effect on the result.

IV. IMPLEMENTATION
The proposed method finds the rain drops from the orientation filter and after the orientation filtering the entropy maximization based remaining rain drops are detected and the background is estimated for the rain removal. The step by step procedure is explained in the figure 2.

V. CONCLUSIONS
The purpose of our work has been to relieve the viewer or image processing algorithms from the specific noise the precipitation introduces. This hypothesis involved a subjective judgement of a video which could be difficult to objectively assess. We have watched a lot of videos with rain removed and under some circumstances the algorithms do suppress the rain effect satisfactorily, but this is not enough as an algorithm must work well in many cases, preferably in all cases. The false removal introduced by really aggressive rain removal algorithms could pose a problem if one attempts to analyze every detail in the image. If this is required then it is recommended that one should not remove the rain as aggressively by setting a higher threshold.
VI. FUTURE WORK
In this section improvements to the algorithm are projected. To find out if the algorithms are truly applicable in an actual camera further evaluation is required. In particular, the algorithm should be implemented and evaluated in a camera. Automatically determine what the optimal parameters used in our algorithms should be set to in real-time if no setting is found to be good enough all around. The intensity threshold could e.g. maybe depend on the average intensity in the scene. The algorithms are different and some are more in need of this than others. Optimal parameters are parameters that will enable the rain removal algorithm to remove a lot more rain without falsely removing anything.

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BIOGRAPHIES

I Anjolly pandey done my B.E[ECE] from chhattisgarh swamivivekanand technical university. Currently I am research scholar in MTECH [ECE] final year in the same university.