A NOVEL APPROACH BASED ON KALMAN AND PARTICLE FILTER FOR VIDEO DERAINING AND DESNOWING

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Abstract
Elimination of rain and snow from video are difficult task in dynamic scene. Digital images and videos are used in many fields on different requirements. But the quality of the image or videos will be heavily degraded, while it affected by rain or snow effects. To clear the rain and snow effects from the images or frames of videos, this work proposed an algorithm using the kalman and particle filter method. In order to perform the video deraining and desnowing the signals will be initially preprocessed. In preprocessing the low frequency background noises and the reflection effects will be removed. The required portions of image can be masked, as per requirement. Kalman filter generates the approximation of the current state variables with their uncertainties. Based on the outcome of the next measurement, these estimates are revised by means of a weighted average, with more weight being given to estimates with higher certainty. Particle filtering utilizes a genetic based mutation- selection sampling method, to clear the rain streak particles in the image and will get the derained clear output image. By using the above mentioned experimental methods can demonstrate that the proposed algorithm outperforms conventional algorithms, by removing rain streaks efficiently and reconstructing scene contents faithfully.

Keywords: Deraining, Desnowing, Preprocessing, Kalman filter, Particle filter, SVM, Watershed transform.

1. Introduction
The stereo systems are widely used in outdoor vision applications and thus they can also suffer from bad weather conditions. A pair of stereo images, captured with snow streaks, which degrade the performance of stereo matching and result in a distorted disparity map. We observe severely distorted disparities around a thick snow streak in the middle of the frame. However, it is worth pointing out that stereo videos contain more information than monocular videos and that
the information can be exploited to remove rain streaks efficiently. In existing methods, a novel video deraining algorithm performed using temporal correlation and low-rank matrix completion. Assuming that adjacent frames, warped by the optical flows, are almost identical with a current frame except for rain streak regions, generate an initial rain map from the differences between the current frame and the warped adjacent frames. Then, the initial rain map using sparse basis vectors, which are dichotomized into rain streak ones and outliers using a support vector machine (SVM). By removing the outliers, the rain map and detect rain streaks.

Elimination of rain and snow from video are difficult task in dynamic scene. Digital images and videos are used in many fields on different requirements. But the quality of the image or videos will be heavily degraded, while it affected by rain or snow effects. To clear the rain and snow effects from the images or frames of videos, this work proposed an algorithm using the kalman and particle filter method. In order to perform the video deraining and desnowing the signals will be initially preprocessed.

In preprocessing the low frequency background noises and the reflection effects will be removed. The required portions of image can be masked, as per requirement. Thus the image preprocessing technique for enhancing the data images, prior to computational processing. Support Vector Machine (SVM) method used to convert the vectors into the valid one and outliers. Multiple vectorized images will be form a low rank matrix.

Kalman filter uses template, by using a series of measurements observed over time, containing statistical noise and other inaccuracies. Kalman filter generates the approximation of the current state variables with their uncertainties. Based on the outcome of the next measurement, these estimates are revised by means of a weighted average, with more weight being given to estimates with higher certainty. Particle filtering utilizes a genetic based mutation-selection sampling method, to clear the rain streak particles in the image and will get the derained clear output image.

2. Proposed System for Color Image Segmentation

Figure 1 illustrates the proposed system for video deraining and desnowing. In order to perform the video deraining and desnowing the signals will be initially preprocessed. In preprocessing the low frequency background noises and the reflection effects will be removed.

The required portions of image can be masked, as per requirement. Thus the image preprocessing technique for enhancing the data images, prior to computational processing. Multiple vectorized images will be form low rank matrix detection.
Kalman filter generates the approximation of the current state variables with their uncertainties. Based on the outcome of the next measurement, these estimates are revised by means of a weighted average, with more weight being given to estimates with higher certainty. Particle filtering utilizes a genetic based mutation-selection sampling method, to clear the rain streak particles in the image and will get the derained clear output image.

3. Experimental Result and Discussion

Figure 2 illustrates the input image, which had affected by rain. The objective of the work is to remove the rain effects from the image. Figure 3 illustrates the gray scale version of the given input image.

The gradient image and the Watershed transform which derived from the gradient image is shown in fig 4 and 5 respectively.

Figure 6 illustrates the opening (LO) and Figure 7 illustrates the opening by restoration.
Figure 6 shows the opening (LO) for the watershed transform of the image and figure 7 shows the opening the image by restoration for the input image.

Figure 8: Opening – closing (LO)  
Figure 9: Opening – closing by reconstruction

Figure 8 shows the Opening and closing (LO) for the given image and figure 9 shows the Opening and closing by reconstruction for Image.

Figure 10: Regional maxima of opening closing by reconstruction:  
Figure 11: Regional maxima of superimposed image

Figure 10 illustrates the regional maxima of opening closing by reconstruction for the image and figure 11 illustrates the regional maxima of superimposed image for image.

Figure 12: Modified regional maxima superimposed original image  
Figure 13: Thresholded opening and closing by reconstruction

Figure 12 illustrates the modified regional maxima superimposed original image and figure 13 illustrates the thresholded opening and closing by reconstruction for input image.

Figure 14: Watershed ridge lines  
Figure 15: Markers and object boundaries
Figure 14 shows the watershed ridge lines for input image and figure 15 depicts the markers and object boundaries superimposed original image for input image.

![Figure 16: Colored watershed label matrix](image1)

![Figure 17: superimposed transparently](image2)

Figure 16 shows the colored watershed label matrix for input image and figure 17 shows the LRGB superimposed transparently on original image for the input image.

![Figure 18: Noisy image](image3)

![Figure 19: Output image](image4)

Figure 18 illustrates the noise image obtained for the given input image and Figure 19 illustrates the derained output image obtained from the input image.

### 4. Conclusion

This paper described a novel approach based on kalman and particle filter for video deraining and desnowing. Elimination of rain and snow from video are difficult task in dynamic scene. To clear the rain and snow effects from the images or frames of videos, we proposed an algorithm using the kalman and particle filter method. In order to perform the video deraining and desnowing the signals will be initially preprocessed. In preprocessing the low frequency background noises and the reflection effects will be removed. Kalman filter generated the approximation of the current state variables with their uncertainties. Particle filtering methodology uses a genetic type mutation-selection sampling approach, to clear the rain streak particles in the image and will get the derained clear output image.

### 5. References


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