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VIDEO DERAINING AND DESNOWING USING MORPHOLOGICAL ALGORITHM

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***Abstract*- This project based on a method adds color space with an generalised frame subtraction method to elliminate the rain streaks in color images using mathematical directional weighted median filter algorithm which involves Erosion and Dilation, based on the study of the existing rain removal method of using Color space and frame subtraction method. First analyzes the characteristics of HSV color images, comparing with the RGB images only V channel is greatly attacked by rain on a rainy video in HSV space, thus translate color image from RGB image into HSV image. Then deal the rain with the new five frame subtraction method on the V channel. Because of the same pixel on the two repeated frames may not be detected by the same rain .Then introduce the subtraction between average and median in five frame pixel as constraint condition to detect the rain. This algorithm can well detects and delete the raindrops on the image and the generalized speed is greatly improved compared with the frame subtraction method in RGB space.**

I. INTRODUCTION

The erosion of a greyscale image f by a matrix component s (denoted f*s) which gives a new grayscale image g = f*s with ones in all places (x,y) of a matrix element's origin at which that matrix element s fits the input image f, i.e. g(x,y) = 1 is s fits f and 0 otherwise, rotating for all image coordinates (x,y).

Erosion removes small-scale details from a greyscaleimage but repeatedly degrades the size of boundaries of interest, too. By subtracting the eroded image from the input image, boundaries of each edge region can be found: b = f − (f *s) where f is an image of the regions, s is a 3×3 matrix element, and b is an image of the region boundaries.

The dilation of an image f by a matrix component s (denoted f*s) produces a new greyscale image g = f,s with ones in all locations (x,y) of a matrix element's orogin at which that matrix element s hits the the input image f, i.e. g(x,y) = 1 if s hits f and 0 otherwise, repeating for all pixel coordinates (x,y). Dilation has the viceversa effect to erosion, it adds a edges of pixels to both the inner and outer boundaries of regions.

Morphological algorithm of a greyscale image is analyzed by considering compound operations like opening and closing as filters. They may act as noise reducer. For example, opening with a disc matrix element smooth's corners from the inside, and closing with a disc smooth corners from the outside. But also these operations can filter out from an image any details that are smaller in size than the

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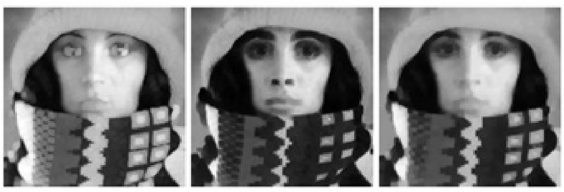
matrix element, e.g. opening is filtering the greyscale image at a scale defined by the size of the matrix element.

Only those parts of the image that fit the matrix element are passed by the filter; smaller structures are degraded from the output image

Fig 1 a) Erosion b) Dilation c) Smoothing



During the sudden growth of science and technology in now-a-days, all kinds of checking and control system is also growth in endlessly.Along with the growth of science and technology, higher components are used for the analysis of the monitoring system and the processing algorithms to bad weather. Rainy day is among the more common bad weather and also serious influence on surveillance video.Therefore,how to remove the rain of videos is a problem that cannot be ignored, also, it is a research hotspot nowadays.

II.EXISTING METHOD

Existing method combines color image with an improved frame differential method to remove the raindrops in color images using mathematical morphological algorithm which involves Erosion and Dilation,the rain removal image restoration method of using Color image and frame subtraction method. First analyzes the characteristics of HSV color image, comparing with the RGB image only V channel is affected by rain on a rainy day shooting video in HSV image, thus translate color image from RGB image into HSV image. Then deal the rain with the improved five frame subtraction method on the V channel. Because of the same pixel on the two repeated frames may not be covered by the same rain .Then introduce the subtraction between average and median in five frame pixel as constraint condition to detect the rain. This method can be well suitable for images with gray scale and not for RGB images and also only for snowy images

(a) (b)

(c)

Fig 2 a) input frame b) desnowing result c)rain map

Fig 3 Anoverviewoftheproposed algorithm: We obtain an initial rain map from an image frame, which is then refined based on sparse representation and classification. Christo Ananth et al. [9] proposed a system in which the cross-diamond search algorithm employs two diamond search patterns (a large and small) and a halfway-stop technique. It finds small motion vectors with fewer search points than the DS algorithm while maintaining similar or even better search quality. The

efficient Three Step Search (E3SS) algorithm requires less computation and performs better in terms of PSNR. Modified objected block-base vector search algorithm (MOBS) fully utilizes the correlations existing in motion vectors to reduce the computations. Fast Objected - Base Efficient (FOBE) Three Step Search algorithm combines E3SS and MOBS. By combining these two existing algorithms CDS and MOBS, a new algorithm is proposed with reduced computational complexity without degradation in quality.

III.PROPOSED METHOD

This project proposed a method which combines color image with an improved frame differential method to remove the raindrops in color images, based on the study of the existing rain removal image restoration method of using Color image and frame subtraction method.

First analyzes the characteristics of HSV color image, comparing with the RGB image only V channel is affected by rain on a rainy day shooting video in HSV image, thus translate color image from RGB image into HSV image. Then deal the rain with the improved five frame subtraction method on the V channel.

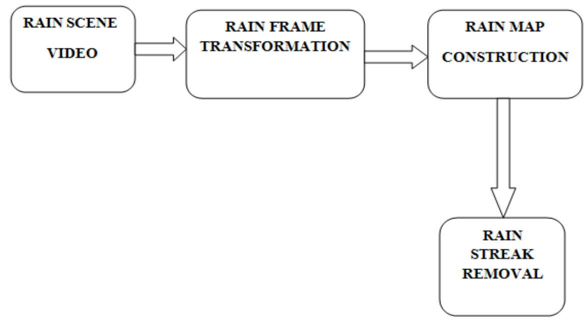


Fig 4 Block Diagram for the removal of rain streak

Because of the same pixel on the two repeated frames may not be covered by the same rain .Then introduce the subtraction between average and median in five frame pixel as constraint condition to detect the rain. Experiments show that this algorithm can well remove the raindrops on the image. And the processing speed is greatly improved compared with the frame differential method in RGB image and k-means in YCbCr.

- HSV represents the hue, saturation and brightness.
- As the human visual sensitivity to brightness is far stronger than the sensitivity of the color shade, in order to process and identify color, the human visual system often use the

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HSV color image, because it is better than the RGB color image consistent with human visual characteristics.

$$H = \left[\frac{3(G-B)}{(R-G)+(R-B)}\right]$$

$$S = 1 - \frac{\min(R,G,B)}{V}$$

$$V = \frac{R+G+B}{3}$$

HSL and **HSV** are the two most common coordinate representations of points in an RGB color model. The two representations rearrange the geometry of RGB in an attempt to be more intuitive and perceptually relevantthan the cartesian (cube) representation. HSL and HSV are used today in color pickers, in image editing software, and less commonly in image analysis and computer vision.

HSL stands for *hue*, *saturation*, and *lightness*, and is also often called **HLS**. HSV stands for *hue*, *saturation*, and *value*, and is also often called **HSB** (*B* for *brightness*). A third model, common in computer vision applications, is **HSI**, for *hue*, *saturation*, and *intensity*. However, while typically consistent, these definitions are not standardized, and any of these abbreviations might be used for any of these three or several other related cylindrical models.

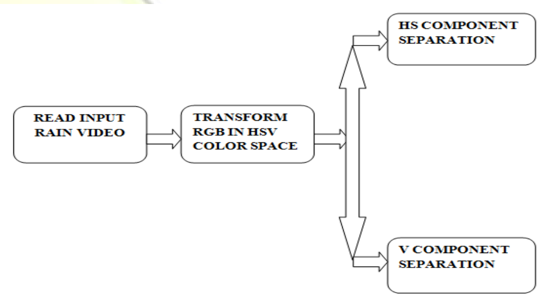

Fig 5Block Diagram for the separationof HS and V component

On the processing speed, the algorithm of this project is done in HSV image.

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Due to the rain, V component is greatly affected by rain streaks.

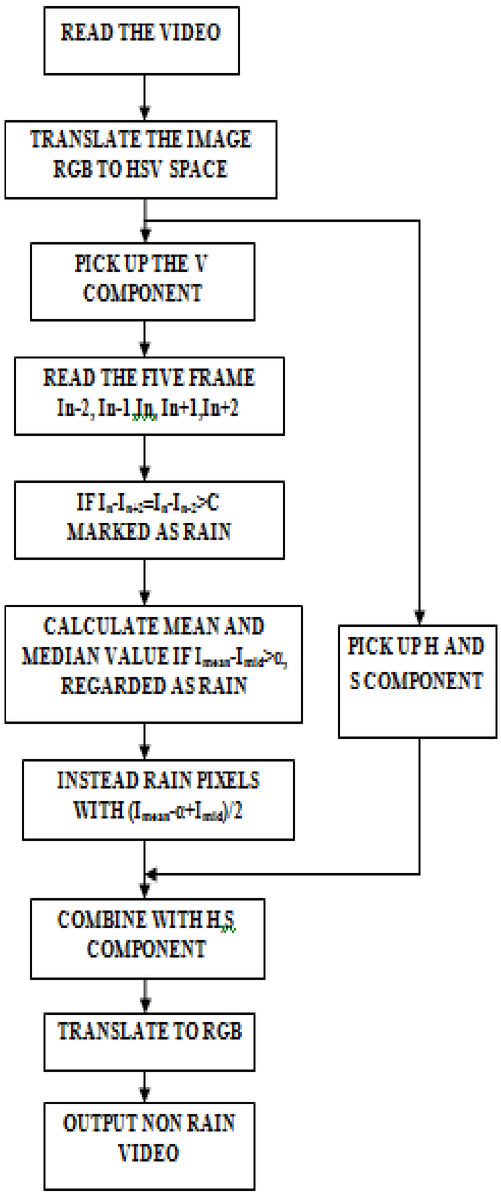

Fig 6 Flow diagram of the Proposed method

Raindrops detection with improved five frame subtraction method

Based on the optical model of raindrops, Garg and Nayar first put forward frame differential method to detect the raindrops.

The idea is that when the background pixels covered by raindrops brightness will up rush, as the rain has the faster falling speed, the same pixel point of adjacent frames are not covered by the same raindrops. Therefore consider n - 1, n, n + 1 frame pixel brightness I. Assume that the background is static, then the nth frame pixel brightness changes affected by rain, DI meet the conditions

$$\Delta \mathbf{I} = \mathbf{In} - \mathbf{In} - \mathbf{1} \geq \mathbf{C}$$

c is a threshold for determine whether there is rain, there. c = 1 ~ 3, denote the minimum intensity change caused by rain. Zhang Yingxiang and other people enlarged detection range from 3 frames to 5 frames. The constraint conditions is:

$$\Delta \mathbf{I} = \mathbf{In} - \mathbf{In} + \mathbf{2} = \mathbf{In} - \mathbf{In} - \mathbf{2} \geq \mathbf{c}$$

If they meet such conditions are judged for rains. And whether the raindrops can't be detected completely.

$$\Delta \mathbf{I} = \mathbf{In} - \mathbf{In} - \mathbf{1} = \mathbf{In} + \mathbf{1} - \mathbf{In} \geq \mathbf{c}$$

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$$\Delta \mathbf{I} = \mathbf{In} - \mathbf{In} + \mathbf{2} = \mathbf{In} - \mathbf{In} - \mathbf{2} \geq \mathbf{c}$$

Then calculate the median and the mean values of 5 frame pixel intensity in the same position. Because the pixels of two repeated frames in the same position will not be covered by the same raindrops, then the median value of 5 frame pixels' intensity is not changed. But brightness values of the mean will enlarged affected by the rain. However, if it is not affected by rain in the static background, the mean value Imean and median value Imid is almost the same.

The experiment is done under the hardware environment of Intel (R) Core (TM) 2 Duo CPU T5870 2.0 GHz processor and 1 GB RAM, and programming with MATLAB 2013a. Compared with and image frame differential method in RGB color image and the k-means algorithm in YCbCr color image in the standard video and Autodyne Video respectively.

SIMULATION RESULTS

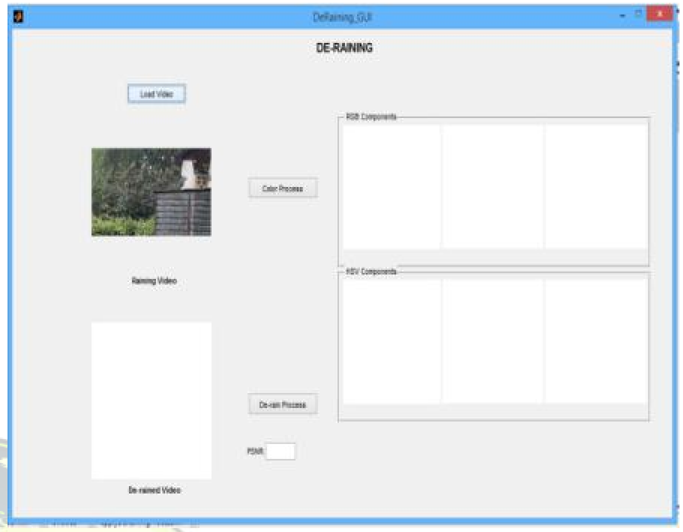

Fig 7 Load the rainy video

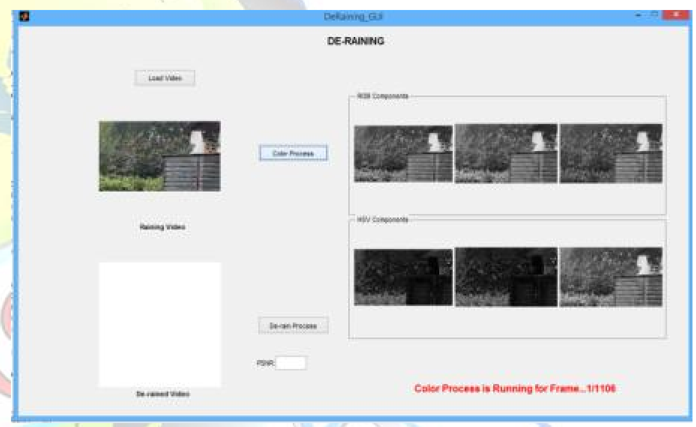

Fig 8Sepration of HSV components from the frame

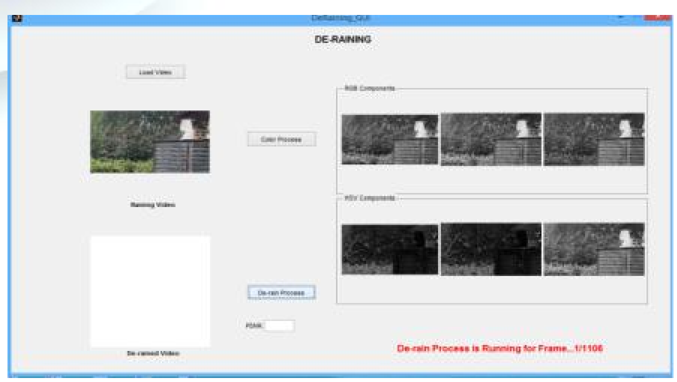

Fig 9 De-rain process running for frame

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Fig 10 De-rained image

CONCLUSION

On the generalising speed, the algorithm of this project is done in HSV image. Due to the rain it mainly affects the V component, thus greatly improves the speed of the algorithm. The YCbCr space algorithm has just deal with rain on the Y component, but the k-means grouping algorithm need to search each pixel which greatly raised the whole time of the algorithm. In this paper we used directional weighted median filter which involves the calculation of SNR and PSNR values. The obtained PSNR value is 50.

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