IMAGE ENHANCEMENT BY DETECTING AND REMOVING RAIN IN DIGITAL IMAGES

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The report is submitted in partial fulfilment of the requirement for the

Bachelor of Computer Science (Software Development)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITY TEKNIKAL MALAYSIA MELAKA

2015

DECLARATION

I hereby declare that this project report entitled

IMAGE ENHANCEMENT BY DETECTING AND REMOVING RAIN IN DIGITAL IMAGES

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged.

STUDENT : _____ DATE: _____

(VINOAD GANESAN)

SUPERVISOR : _____ DATE: _____

(Ms. INTAN ERMAHANI A. JALIL)

DEDICATION

This report is dedicated to my parents, Mr. Ganesan Vaderavel
and Mrs. Telagam Ganesan for their fully support on completing this project.

To my supervisor, Ms. INTAN ERMAHANI A.JALIL and all my friends, for making it all worthwhile and have provided encouragement and guidance all the way during the completion of the project.

ACKNOWLEDGEMENTS

I would like to express gratitude and sincere thanks to my supervisor Ms INTAN ERMAHANI A.JALIL, for her invaluable guidance and constant support in making this project possible. Her kindness has always made me feel free from ant vulnerable of doubts during the progress. Her encouragement, supervision and tremendous help are truly appreciated.

Apart from that, I would like to thank my parents for their moral support and undying love because without it, I do not think I would have been able to accomplish anything.

Not forgotten to all my friends that helping and give me a moral support. Finally, to all individuals where involved in this project which I have not mentions their name. Without all of you, this report will not be finished successfully. Thank you.

ABTRACT

Different climate conditions, for example, rain, snow, or cloudiness will result in intricate visual impacts on spatial or fleeting spaces in images or videos. Such effects may significantly degrade the performances of outdoor vision systems. Poor perceivability debases perceptual quality of image and execution of the machine vision calculations, for example, surveillance, detection, recognition tracking, and navigation. The raindrops debase the execution of open air vision framework, and it brings troubles for items discovery and examination in a solitary picture. Identification and removal of rain in an image is a troublesome and critical issue because of the unpredictability of rain and its negative consequences for image. Removal of rain from images as a pre-processing builds the correctness of these computer vision calculations. A peculiarity point locator can fizzle if pictures have low perceivability. On the off chance that rain is removed and picture is improved, then investment point recognition can work with higher exactness. In this thesis, the bilateral filter and Guided filter have been applied for rain removal and image enhancement. The rain drops in digital images successfully detected by using Hough transform. The detected rain drops removed and the image enhance by using guided filter. The similar procedures done with the bilinear filter in order for comparison. As expected, the resulting images of bilateral filtering show little details and still contain rain. The Guided filter performed marginally better than the bilateral filter. More rain drops was removed by this method. The results from the guided filter shows no rain drops and smooth edges. Guided filter able to remove the rain and enhance the removed image to perform the best quality image.

ABSTRAK

Keadaan iklim yang berbeza, seperti hujan, salji, atau keadaan mendung akan menyebabkan kesan visual rumit pada ruang spatial di dalam imej atau video. Iklim yang teruk, akan mengurangkan kejelasan suatu gambar. kekaburan dalam gambar mengurangkan kualiti dan persepsi terhadap imej dan justeru ia menganggu pelaksanaan pengiraan visual komputer, sebagai contoh, pengawasan, pengesanan, pengiktirafan pengesanan, dan navigasi. Titik-titik hujan menghalang pelaksanaan rangka kerja yang luas, dan ia membawa masalah untuk item penemuan dan pemeriksaan di gambar bersendirian. Pengenalan dan penyingkiran hujan dalam imej adalah isu yang mencabarkan dan kritikal kerana ketidaktentuan hujan dan kesan negatif bagi imej. Pemecatan hujan dari imej sebagai pra pemproses yang membina betulnya ini pengiraan visual komputer. Pencari titik Keanehan boleh semakin pudar jika gambar mempunyai perceivability rendah. Pada kesempatan off bahawa hujan dikeluarkan dan gambar bertambah baik, maka pengiktirafan titik pelaburan boleh bekerja dengan ketepatan yang lebih tinggi. Dalam tesis ini, penapis dua hala (bilinear) dan penapis berpandu (guided filter) telah digunakan untuk penyingkiran hujan dan peningkatan imej. Hujan di dalam imej digital berjaya dikesan dengan menggunakan 'Hough Transform'. Hujan yang dikesan, dikeluarkan dan meningkatkan kualiti imej dengan menggunakan penapis petunjuk. Prosedur yang sama dilakukan dengan penapis dua hala dalam usaha untuk perbandingan. Seperti yang dijangka, imej yang terhasil daripada penapisan dua hala menunjukkan butir-butir tidak dalam dan masih mengandungi hujan. Penapis Berpandukan dilakukan sedikit lebih baik daripada penapis dua hala. Lebih titisan hujan telah dibuang dengan kaedah ini. Keputusan daripada penapis yang mendapat petunjuk tidak menunjukkan titisan hujan dan tepinnya licin. Penapis Berpandukan dapat menghapuskan hujan dan meningkatkan kualiti imej untuk melaksanakan imej kualiti yang terbaik.

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CHAPTER I

INTRODUCTION

1.1 Project Background

Various climates of environment surrounding, like snow, sunny, or haze will issue in complex visual effects on the spatial or transient spacing in pictures or maybe features by Garg and Nayar. Dreadful atmospheres can be attached to reductions barometrical detectable quality. Poor detectable quality spoils perceptual nature of picture and execution of the machine vision counts, for identification, acknowledgment following, reconnaissance, and route by Huan. 2012.

The main of the present methodologies by Garg and Nayar is looking around the discovery and rain removal from video. In recent of time, (Kang et al., 2012) proposed a new methodology that one-image rain evacuation that proposed the rain evacuation procedure as the picture decay issue focus on Morphological Component Analysis (MCA).

As opposed applying conventional picture deterioration methods, utilizing bilateral filter to low and high-recurrence parts of rain contained picture. The strategies recommended high-repeat picture deterioration into a set of "rain segments". As the function of “K” is grouping where “K = 2” "non-rain parts” are deterioration on the co-cooperated with possible utilization of preparing information.

Where to a great degree ensuring result were represented isolating picture iotas into two unique social occasions does not guarantee exact closeness in the

middle of between rain and non-rain designs by (Kang, 2012). Moreover, many generous systems are needed for upcoming upgrade execution. There have many other systems join in the rain removing from a single picture. We have contrasted with the rain elimination filters between guided and bilateral, as result suggesting guided filtering as a future method for rain elimination from one image.

1.1.1 Image Quality Improvement

Image quality improvement perform to upgrade the interpretability or the acknowledgment of information towards the picture to provide a excellent incorporate to other computerized picture taking care of ways the picture picked up from the basic background with high element degree fuses for faint and splendid districts. (Nancy & Sumandeep, 2013), picture upgrade is a normal strategy to improve the way of photos to the extent person visual perception. Advance systems may apportion into two classes to be particular:

- Transform domain strategic.
- Spatial domain strategic

To enhance a photo, spatial domain strategy is used and particularly is dealing with the force esteem regard in a picture. Methodology of change space procedures that include a change over the photo force data into a specific region by using schedules, for instance, DFT and the picture is enhanced by changing the repeat substance of a photo.

Enhancement of an image is associated in every field where pictures have to be analysed and comprehended. When rain expelled from an image by utilizing both filters guided and bilateral, it will eliminate noises in the pictures and in this way the quality of the images will reduce consequently. A new algorithm will be used as a way to raise quality of the picture. At the point when a conversion of picture from image “f” to image “g” and use as “T” is called image improvement. The image of “T” is the transformation. The “r” and “s” is shown as the pixel quality for image “f”

and “g”, independently. The eventual outcomes of this change are mapped into scale propelled pictures.

1.2 PROBLEM STATEMENT

Along these lines, the work with removing rain from a picture was found in the past written. The most part based on feature that approach transient correspondence in different dynamic edges. In light of current circumstances, when only a picture is open, for instance, capturing pictures utilizing an advanced smartphones and digital camera or downloaded from internet, a single-picture contained rain elimination methods.

Besides, Garg & Nayar have focus on rain removal in video methodologies that focus around parameters changing of camera. Camcorder buyer can’t be joined with existing picked up picture or video information since changing parameter of camera is not suitable to the camcorders. In other hand, (Zhang et al., 2007) for rain drop expelling from video, the shows of existing component based approaches may in a general sense corrupted.

Moreover, Garg & Nayar has mentioned some digital camera deployment systems estimation of camera movements could be connected to the movement. The rain streak or far reaching moving activity of execution may be moreover degrading. Additionally, as a sample, predictable effects of rain, e.g. rain a cross over numerous progressive edges that may be affected the pixel.

Various images based demand, like a convenient visual request, object recognize, picture selection, astounding, and picture sewing area seriously rely on upon extraction of point based contrivances that are rotate and scale invariant as mention by (Kang et al., 2012).

However, the display of the model for similar procurement might be same tainted if the rain lines particularly realte with the intrigued concentrate in a photo. Once by using guided filter or bilateral filter rain will be eliminate from an image. In

the image will lose clamours/noises and the picture actual quality will reduce consequently. To enhance the image quality is a necessary by using a new algorithm to enhance and recover the quality of picture.

1.3 OBJECTIVES

1. To detect the rain drops in the image by utilizing Hough Transform method.

2. To create a graphical user inteface to eliminate the noise and rain drops in the images via applying guided filter and bilateral filter.

3. To improve quality of images that has been rain removed by utilizing both filters guided and bilateral to achieve clear and glossy image.

4. To show the quality of rain removed image comparison using histogram to determine the effective method.

1.4 SCOPE

This project will be using Hough Transform method to spot the rain drops. Furthermore, bilateral and guided filter is namely clamour/noise removal filters. In order to eliminate the noise and rain drop in the digital pictures the both filters is been utilized. The guided and bilateral filters also used to enhance the rain removed images quality and also to show image comparison using histogram. MATLAB will be used to develop the graphical user interface and digital images to done the framework.

1.5 Project Significance

1. To help detect rain or noise in digital images by circle on noise the image
2. Can eliminate the noise or rain in on the digital images
3. Enhance the Image quality once done with noise removal
4. Quality of original image and enhance image comparison will show in histogram

1.6 Expected Output

The image enhancement by detecting and removing rain in digital images is relied by utilizing Hough transform to recognize rain drops in computerize images. The identified rain drops in the digital images will be evacuated and the picture will upgrade by utilizing guided filter and for comparative methods used the bilateral filter for comparison with guided filter and to show the quality of the enhance image comparison in histogram.

1.7 Conclusion

To tackle the problem of rain drops the guided filter is been utilized for digitals images. The outcomes from the guided filters has been compared with bilateral filter to detect faultlessly by eliminate the rain drop on the picture.

CHAPTER II

LITERATURE REVIEW

2.1 CONTEXT-CONSTRAINED IMAGE SEGMENTATION AND CATEGORIZATION

The context-constrained image separation and procedure technique was invented for images excellent-resoluteness purposes by Yang at el. (2011). In rain removal structure by author, first of all they applied the method to a rain images and split the images into unlike context categories of patches.

Each categorization can be sorted into different group align to their textual structure by affinity proliferation (AP) methods, which gathers the data by recognizing which is unconfirmed clustering methods of each clusters in one group. The AP is the major advantage, that not similar other clustering methods, e.g., K-indicate, no need the number of bunches K as previous knowledge. The use of AP is to permit us automatically arrange the picture segment into different way context classification and no tuning parameter or client interaction is needed.

2.2 MORPHOLOGICAL COMPONENT ANALYSIS (MCA) IMAGE BASED DECOMPOSITION

Instruct analysis is requested with assistance of word reference for spare coding and learning strategies using decomposition of picture on how morphological part dissection (MCA) Fadili et al. 2010. A morphological division, Imagine that a photo superposition is I of N pixels layers of S, its link together by $I = \sum_s^s = 1\ I_s$,, whereas I_s demonstrates the textural portion of and s-th part of *I*. *I* into $\{I_s\}_S^S$=, MCA is used to decompose the image iteratively diminishes and at the same time indicate function of effectiveness Huan 2012.

MCA Calculation

Equation 1

$E(\{I_s\}_S^S = 1, \{\theta_s\}_S^S = 1) = \frac{1}{2}\ ||I - \sum_{s=1}^{s} i_s||_2^2$+r$\sum_{s=1}^{s} E_s\left(I_{s,\theta_s}\right)$,

Where E_s is the snap pictorial according to the sort of D_s, $\theta_s$indicates uncommon coefficients between I_s to word reference D_s, and τ is a setting limit in general or close-by word reference. There are two stages in MCA calculation that have been explains, first settle minimal perform coding to θ_s else $\{\theta_s^p\}_{P=1}^N$, while θ_s^p alerts the unbalance coefficients of the recondition b_s^p isolated after I_s, to lessen E_s (I_s, θ_s) at the same time as determinant I_s; and second is to improve I_s else $\{b_s^p\}_{P=1}^N$ by (Huan 2012).

Mathematical statement

Equation 2

$\min_{D_{s,\theta_p}} \sum_{p=1}^{p}(\frac{1}{2}\left||y^p - D_s\theta^p\right||\frac{2}{2} + \lambda\left||\theta^p||_1\right)$,

Mathematical explanation may be adequately find out by performing in calculation based on dictionary learning, e.g. (Mairal et al., 2010), where the code act as an ordinarily masterly by method for orthogonal matching pursuit (OMP) Where θ^psignifies as the coefficients of y^p estimation to D_s and λ is a standardization parameter.

To fulfilled, decomposition of the images, MCA have been used to handle I_s in time fixing D_s and calculation to learning in the dictionary is D_s in time fixing I_st till organized.

Single image rain elimination is a coordination of deterioration and taking towards procedures oneself in order to grow a system and approach written by Kang et al. (2012). Connection of schema joins in disintegration image by MCA to recognize consequently the design of rain through principle component analysis (PCA) and support vector machines (SVM) from the picture.

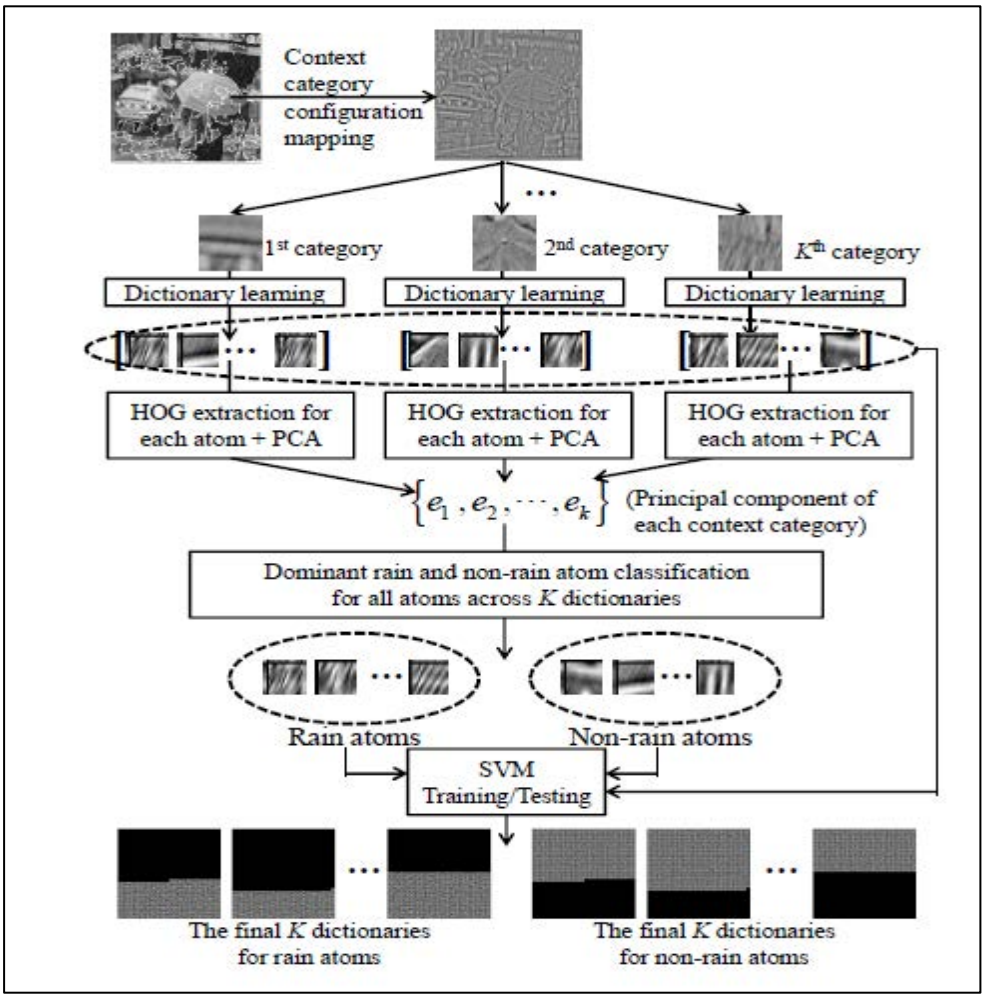

Figure 2.1: Show a block diagram that proposed context-aware dictionary learning for pattern identification rain and non-rain adapted from (Kang et al. 2012)

2.3 DICTIONARY LEARNING AND SPARSE CODING

Sparse coding is a functionally in a row a across a sparse illustration with a minimum number of discriminating coefficients or nonzero or recognition for a pointer with the particles in a statement by (Olshausen & Field, 1996). A coding is a procedure that is a enough to note down three property that attempting into a calculation to find meagre straight code to restricted, and organized in creating complete group that was indicated by (Olshausen & Field, 1996).

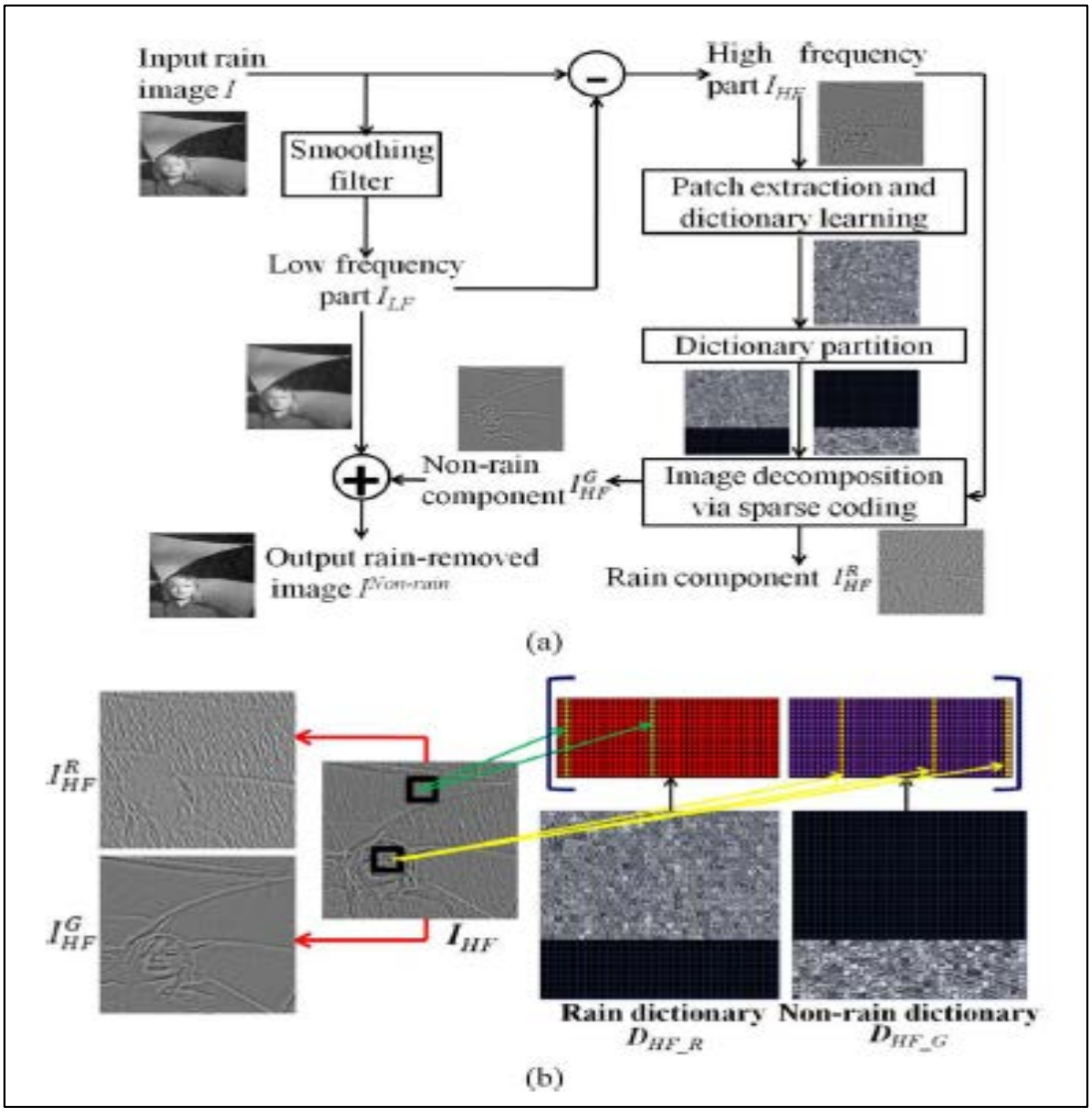

Figure 2.2: Show a block diagram of proposed rain streak elimination steps and illustration based on two learned local dictionaries adapted from (Kang et al. 2012)

As mention earlier, dictionary D_{ls} is an obliged to build and holding the neighbourhood structures that one patch b_s^k derived from textural portion I_s of image I of surfaces for sparsely speaking. Based on certain requirement, we might use a part of available models of the the expelled patches in the section that want to decompound, $y^k \in R^n, k = 1, \dots, P$ (Kang et al., 2012):

Comparison

Equation 3

$$\min_{Dls \in R^{nXm}{}_{s,\theta^k \in R^{ms}}} \sum_{k=1}^{P} \left(\frac{1}{2\left|\left|y^k - D_{ls}\theta^k\right|\right|_2^2} + \lambda \left| |\theta^k| \right| 1 \right)$$

The θ^k is a coefficients that denotes to sparse of y^k to D_{ls}, and λ is a regularization parameter. Picture disintegration by iteratively accomplished by performing the MCA methods to handle the calculation from dictionary learning is to study while editing before merge. The merging of MCA picture by (Peyre et al., 2007) has been demonstrated the disintegration calculations.

Proposed elimination of rain construction using dictionaries that acquired from patches that have been prepare to remove from the rain pictures from single deteriorate a rain pictures into its rain particular and geometric of no rain portion to avoid using of any worldwide word reference. The main reasons include:

- In a sunny time the geometric part is basically more mixed with the rain streaks and in few area rain photo, nearby fixes separating the photo would be less difficult to focus the rain fixed that essentially and taking towards drizzle particles.