MODIFIED HYBRID MEDIAN FILTER FOR REMOVAL OF LOW DENSITY RANDOM-VALUED IMPULSE NOISE IN IMAGES

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Contents

1. Letter of Report Submission iii
2. Letter of Offer (Research Grant) iv
3. Acknowledgements vi
4. Enhanced Research Title and Objectives vii
5. Report .
   5.1 Proposed Executive Summary
   5.2 Enhanced Executive Summary 2
   5.3 Introduction 3
   5.4 Brief Literature Review 4
   5.5 Methodology 6
   5.6 Results and Discussion 12
   5.7 Conclusion and Recommendation 18
   5.8 References/Bibliography 20
6. Research Outcomes 21
7. Appendix 22

1. Letter of Report Submission

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PENERIMAAN BORANG TAMAT PROJEK PENYELIDIKAN (FRGS)
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Dengan segala hormatnya perkara di atas adalah dirujuk.

2. Adalah dimaklumkan, Pusat Pengurusan Penyelidikan (RMC) telah menerima satu (1) salinan asal borang tamat projek bertajuk seperti di atas daripada pihak puan. Pihak RMC mengucapkan setinggi-tinggi tahniah. Sehubungan itu, projek penyelidikan pihak puan telah didaftarkan sebagai **TAMAT**.

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5.2 Enhanced Executive Summary

Digital images are prone to corruption during their acquisition, storage, or transmission in noise environment. Without being restored, any useful information that can be acquired from the image would be inadequate or inaccurate as the image is corrupted by the noise. A specific type of noise which is the random-valued impulse noise (RVIN) corrupts digital images by replacing most the image's original pixels with two random values within the grey level intensity. RVIN is a variation of fixed-valued impulse noise (FIN) which is similar to RVIN with the exception of the pixel values replacing the image's original pixels are fixed at grey level 0 (black) and 255 (white), resulting in FIN also being known as 'salt-and-pepper' noise. The standard median filter (MED) is commonly used in the removal of impulse noise due to it's effectiveness and high computational efficiency but it's reliability sharply declines at high noise densities. MED also filters each and every pixels present in an image regardless of whether it is noisy or noise-free, resulting in the image reproduced being blurry and less-sharper than the original image. This paper introduces a new method of RVIN filtering of digital images. This approach is based on two phase of operation which is first the detection phase, followed by the filtering phase. Both of these phase works in a sequence to remove RVIN from corrupted digital images. The quality of noise removal and image reproduction is assessed by comparing the original image with the filtered image both qualitatively in terms of the image detail preservation and quantitatively in terms of mean-squared error (MSE) and peak signal-to-noise ratio (PSNR). Results obtained shows that this method is able to produce a significantly better results than MED in impulse noise removal by only targeting the noise pixels. This method can filter the RVIN from the corrupted image while preserving the original image detail quite reliably.

5.3 Introduction

Random-valued impulse noise (RVIN) is a randomly distributed noise of two significant pixel values that degrades the quality of digital images during acquisition, processing, and storage. It is a variation of the salt-and-pepper or fixed-valued impulse noise (FIN) which instead of the black and white pixel, the noisy pixel value can be anywhere in the range of the grey level pixel.

Typically, this degradation is the result of two phenomena; the deterministic and random. The deterministic degradation is related to the image acquisition manner while the random degradation is corresponding to the noise coming from any signal transmission or signal storage. Without their being restored, little useful information can be acquired from the corrupted image. Consequently, it will severely impede subsequent image processing tasks, such as image segmentation, edge detection or object recognition. Therefore, it is absolutely necessary to restore the original image from the corrupted image.

During the past decade, numerous and diverse de-noising methods have been proposed to remove the two common types of noise distributions; additive Gaussian noise and impulse noise. The median filter (MED) is the most popular choice for removing the impulse noise from images because of its effectiveness and high computational efficiency. However, the drawback of this filter is it efficiency drops at high noise densities resulting the appearance of patches and unpreserved image. A lot of solutions have been proposed to overcome these problems by introducing some other filters (e.g. multistate median filter and center weighted median filter). However, these filters being implemented uniformly across the image without considering whether the current pixel is a "noise-free pixels" or not. As a result, this would inevitably alter the intensities and remove the image details contributed from uncorrupted pixels, and cause image quality degradation.

Recently, there are many IN removal methods based on two stages/phase idea (noise detector at the first phase and restoration scheme at the second phase) have been reported, such as progressive switching median (PSM) filter, adaptive weighted median filter and center-weighted median (CWM) filter. However, in some cases, the efficiency of these filters is limited by the accuracy of the noise detector in the first phase or the capability of the restoration scheme at the second phase. RVIN makes the filtering job worst as it is kind of unpredicted noise where the noise can occur at