

A Review on Noise Filters For Digital Images

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Abstract - Impulse noise is a specific type of noise which causes alternation of the pixels in the images so that their gray values do not exhibit compatibility with their local neighbourhood. Usually images are degraded by impulse noise of short duration and high energy because of the errors caused by noisy sensors or transmission channels. In impulse noise (sparse light and dark disturbances), pixels in the image are very different in color or intensity from their surrounding pixels; the defining characteristic is that the value of a noisy pixel bears no relation to the color of surrounding pixels. Denoising can be done through filtering, which can be either linear filtering or non-linear filtering. Here we are discussing various noise filters such as median filter, adaptive switching median-based filter, center weighted median

Key Words: Impulse noise, De noising ,median filter, adaptive switching median-based filter, center weighted median filter.

1. INTRODUCTION

The term digital image processing refers to the manipulation of digital images by means of a digital computer. The different stages or functions of an image-processing system includes image acquisition, image enhancement, image restoration, color image processing, image storage, image compression, image segmentation, multi resolution processing, image representation and description, morphological processing, image display etc. Whenever an image is moved from one form to another form among those stages, many types of noise or noise like degradations can be present in that image. The term noise in digital images refers to any intensity value of an image which does not match the reality quite exactly. Image Denoising is the process to reconstruct or recover an image that has been degraded by the noise.

Median filter tends to preserve the sharpness of image edges while removing the noise. There are several variations of median filters such as weighted median filters, adaptive median filters, directional weighted median filters, centre-weighted filter, min-max filter, max-median filter, midpoint filter etc.

Switching median filters are another class of non-linear filter and they are very efficient than standard median filter. It consists of a noise detector and a standard median filter. It preserves the uncorrupted pixel from filtering, that is, the filtering is performed only if the detector finds the corrupted pixel. Adaptive switching filters are the extension of switching filters, whose behaviour changes based on the statistical characteristics of the image inside the filter region

defined by the rectangular filtering window. Adaptive filter performance is usually superior to non-adaptive type filters.

2. SURVEY ON VARIOUS FILTERS

Noise adaptive switching median-based filter for impulse noise removal from extremely corrupted images.

[A. Fabijan´ ska D. Sankowski, IEEE IET Image Process., 2011, Vol. 5, Iss. 5, pp. 472-480]

This is a type of switching median filter, which identifies the noisy pixels and then corrects them by using median filter. It searches the image for local intensity extrema in order to decide whether the pixel is corrupted or uncorrupted. The search is performed in areas determined by square window which passes through the image pixel by pixel. In each window local intensity minima and local intensity maxima are determined. Location of the local intensity extrema is marked by increasing the corresponding values on maps of local extrema.

Median filter

[R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Pearson Education Prentice-Hall-2009]

This is an order-static nonlinear spatial filter, whose response is based on ordering (ranking) the pixels contained in the image area encompassed by the filter, and then replacing the value of the center pixel with the value determined by the ranking result. It replace the value of a pixel by the median of the intensity values in the neighbourhood of that pixel original value of the pixel is included in the computation of the median. Median filters are popular for certain type of random noise because they provide excellent noise reduction capability with considerably less blurring than linear smoothing filters of similar size. Median filters are effective in the presence of impulse noise, because of it's appearance as white and black dots superimposed on an image.

Cognition and removal of impulse noise with uncertainty

[Zhe Zhou, IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 21, NO. 7, JULY 2012 pp 3157-3167]

Uncertainties are the major inherent feature of impulse noise. This fact makes image denoising a difficult task. Understanding the uncertainties can improve the performance of image denoising. This paper presents a novel adaptive detail-preserving filter based on the cloud model

(CM) to remove impulse noise. It is called the CMfilter. First, an uncertainty-based detector identifies the pixels corrupted by impulse noise. Then, a weighted fuzzy mean filter is applied to remove the noise candidates. The experimental results show that, compared with the traditional switching filters, the CM filter makes a great improvement in image denoising. Even at a noise level as high as 95%, the CM filter still can restore the image with good detail preservation.

3. CONCLUSIONS

Here a review of various noise filters such as median filter, adaptive switching median-based filter, center weighted median filter is done. New filters can be implemented by adding some functionalities to the existing ones or combing the features of the existing ones.

ACKNOWLEDGEMENT

First and foremost, I express my thanks to The Lord Almighty for guiding me in this endeavour and making it a success. I take this opportunity to express my heartfelt gratitude to all respected personalities who inspired and helped me in the completion of this review.

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