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A SURVEY ON NOISE REMOVAL USING FUZZY FILTERS IN IMAGE PROCESSING

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ABSTRACT

Filters are one best technique in image processing for edge detection, image smoothing, sharpening and used for various other type of functions. One of the main disadvantages of image processing is noise. To remove the noise from an image, the fuzzy approach provides various fuzzy filters for efficient removal noise using fuzzy rules.[1]

KEYWORDS: Noise, impulse noise, median, Fuzzy filter, vector.

INTRODUCTION

It is one of the most important drawback, when we are dealing with the images. In images noises are unwanted pixels which are occurred while capturing the pictures. In order to remove the noise, we use different types of filter in image processing, they are linear filtering, averaging filter and median filter & adaptive filter etc.so to provide more accuracy in removing the noise, we use different types of non linear methods.[1]

According to recent progress, fuzzy logic provides new methods for removing the noise through Non-linear methods.In this paper well discuss different types of fuzzy filters which are used for noise removal.[1]

PARAMETRES TO EVALUATE

To evaluate, that how the proposed fuzzy filters are working while removing the noise from images. for this purpose we use different type of parameters .they are mean average error (MAE), mean square error (MSE), Normalized mean square error (NMSE), Signal to noise

error ratio (SNR) and mean chromaticity error.[1] The evaluation is based on two real world images.

FUZZY FILTERS

Multipass Fuzyy Filter

It is one of the fuzzy filter used for removing the noise and it was introduced by fabrizio Russo.This filter consists of three cascading blocks and each block consists of fuzzy operator to remove noise without modifying the original structure of the image and this filter is continuously applied without increasing the blur. Each and every fuzzy operator which is used in fuzzy filter are developed using fuzzy rules.so, to eliminate the specific kind of noise, we use to select a fuzzy operation, when rule get satisfied.[1]

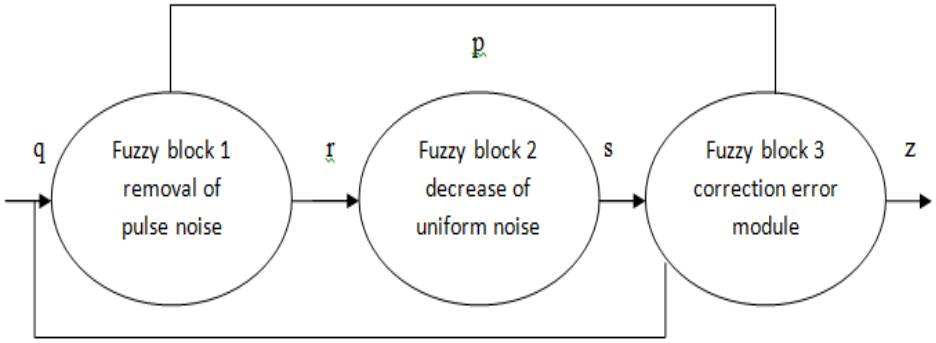

Figure 1: Structure of Multipass fuzzy filter.[1]

In the above structure, in the first block it remove noise from the input image pixel q(x,y) and output of first block is r(x,y) provide as input to second block to remove the noise uniformly and finally from the 3rd block we'll get the corrected image on removing the noise. This filter performs the removal of impulse noise by using 3*3 search windows. Each element in the search window is treated as a fuzzy input variable that is defined by.[1]

W_1	W_2	W_3
W_4	W_C	W_5
W_6	W_7	W_8

Fuzzy Multilevel Median Filter

To improve the impulse noise elimination from the images, we use another type of fuzzy filter i.e., fuzzy multilevel median filter. Here in order to eliminate the impulse noise ratio we use two types, they are r(x,y) and credibility function 'C'.[1][3]

To define the credibility function of the median of each sub-window, the difference between the median and each one of the pixels in each of the same sub-window are studied.[1][3]

Let med_i (x,y)) for i=1,2,3,4…. Be the median values of each sub- window, then two variables can be defined as

$$\mathrm{med}_{\max}(x,y) = \max_{i=1}^{4} \mathrm{med}_i(x,y), \text{ [1][3]}$$

$$\mathrm{med}_{\min}(x,y) = \min_{i=1}^{4} \mathrm{med}_i(x,y) \text{ [1][3]}$$

The output of this filter is

$$r(x,y) = \mathrm{med}(\mathrm{med}_{\max}(x,y), \mathrm{med}_{\min}(x,y), q(x,y)) \text{ [1][3]}$$

Figure 2: Before applying filter.[1]

Figure 3: After Applying filter.[1]

Histogram Adaptive Filter

This is one of the important fuzzy filter in image processing because in this technique , we do not completely remove the noise, in this we just hide the noise by adjusting the dark, medium, light parameters. This filter was introduced by Wang and Chu. This is the histogram based filter means by adjusting the histogram we can hide the noise.[1]

This function is implemented by three parameters they are d_j,m_j and b_j . these parameters determines the behavior of the member function.[1]

The fuzzy inference rules employed to define the membership of the greay level for each fuzyy set are given by

Rule 1:

$$\text{IF } q_i(x,y) \in D \; \forall \; i = 1,\ldots,9 \text{ THEN } r(x,y) \in D. \text{ [1]}$$

Rule 2:

$$\text{IF } q_i(x,y) \in M \; \forall \; i = 1,\ldots,9 \text{ THEN } r(x,y) \in M \text{ [1]}$$

Rule 3:

$$\text{IF } q_i(x,y) \in Li \; \forall \; i = 1,\ldots,9 \text{ THEN } r(x,y) \in Li \text{ [1]}$$

By adjusting all these parameters we can get a noise free histogram.

Fuzzy Vector Rational Median Filter

It is another type of fuzzy filter and it uses combination of rational and median functions.by using this type of fuzzy filter, we can preserve the image edges and chromaticity while removing the noise. And it is also called as multichannel filter and it was introduced by khriji & gabbouji.[1]

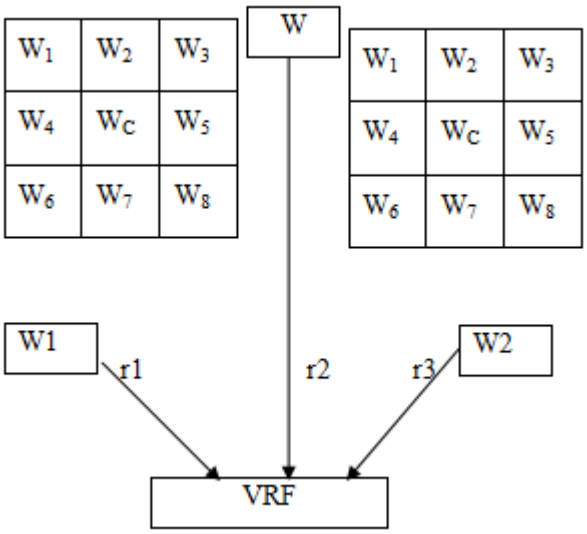

Figure 4: structure of fuzzy vector rational median filter.[1]

Here two windows W1 & W2 are used instead of original window and these are output's of fuzzy vector rank filter.[1]

CONCLUSION

In this paper we have discussed various types of fuzzy filters that are used to remove the impulse noise in the image. Some techniques are used to remove the uniform noise and some other techniques are used to preserve the edges and chromaticity of images. Each and every filter has its own significance and type of the filter is used based on our requirement.[1]

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