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A Novel Method for Noise Removal in Images Using Bit Planes Through Standard Mean Filter

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Abstract:

In this project, we proposed two Bit-plane (related to the beautiful design and construction of buildings, etc.)s to put into use the Mean functions to remove Salt and pepper, Gaussian noises. A Bit-plane consists of the bits going along with/matching up to the same significant level in all the elements. In the Mean function (related to the beautiful design and construction of buildings, etc.), three Bit-plane code look up tables are created based on the weight of the bit-plane and no of 1's in that bit-plane.

Binary addition of the three bit-plane codes gives a close guess of thed mean value for the given organized row of image elements. The experimental results show that the proposed (related to the beautiful design and construction of buildings, etc.)s are (doing as expected) equally well with the standard mean filters.

1. INTRODUCTION:

Noise can be in an organized way introduced into images during purchase/getting/learning and transmission. A basic problem of image processing is to effectively remove noise from an image while keeping its features unharmed and in one piece. The nature of the problem depends on the type of noise added to the image. In a lucky way, two noise models can well enough represent most of the noises added to images: (something added to food, or something else) Gaussian noise and sudden (unplanned) desire noise. (something added to food, or something else) Gaussian noise is seen as adding to each image pixel a value from a zero-mean Gaussian distribution. Such noise is usually introduced during image purchase/getting/learning.

The zero-mean property of the distribution allows such noise to be removed by locally averaging pixel values. In a perfect world, removing Gaussian noise would involve smoothing inside the clear/separate areas of an image without insulting the sharpness of their edges. Sudden (unplanned) desire noise is seen as replacing a part of/amount of an image's pixel values with random values, leaving the rest unchanged. Such noise can be introduced due to transmission errors. The most (able to be seen/worthy of attention) and least acceptable pixels in the noisy image are then those whose strengths/levels are much different from their neighbors. Image processing is a very important field within factory automation, and (in a more real and clear way), in the automated visual (careful examination of something).

The main challenge (usually/ in a common and regular way) is the needed thing of (happening or viewable immediately, without any delay) results. On the other hand, in many of these applications, the existence of uncontrolled noise and Gaussian noise in the gotten over time/purchased images is one of the most constant problems. Mean filter for the Gaussian noise. In this project we proposed two Bit plane (related to the beautiful design and construction of buildings, etc.)s to put into use the Mean filter and these (related to the beautiful design and construction of buildings, etc.)s are tested and can be used to put into use in FPGAs.

2. MEAN FUNCTION USING BIT-PLANES:

Linear filtering ways of doing things have been used in many image processing applications, and their (quality of being liked a lot or done a lot) mainly comes from/is

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caused by their mathematical simpleness and their (wasting very little while working or producing something) in the presence of (something added to food, or something else) Gaussian noise. (something added to food, or something else) Gaussian noise is seen as adding to each image pixel a value from a zero-mean Gaussian distribution. Such noise is usually introduced during image purchase/getting/learning. Such noise can be removed by locally averaging pixel values that are using Mean filters[1] and [11]. A mean filter is the best filter for Gaussian noise. The mean function is an important function used in the field of image processing. The most well-known/obvious example of the use of the mean function is the standard mean (SM) filtering, which is a common way of doing things used to hold back noise of a Gaussian nature. A mean filter acts on an image by smoothing it; that is, it reduces the strength difference/different version between (next to) pixels. The mean filter is nothing but a simple sliding window (related to space or existing in space) filter that replaces the center value in the window with the average of all the close-by pixel values including itself.

By doing this, it replaces pixels , that are unrepresentative of their surroundings. It is used with a convolution mask, which provides a result that is a weighted sum of the values of a pixel and its neighbors. It is also called a linear filter. The mask or kernel is a square. Often a 3Ã-- 3 square kernel is used. The mean or average filter works on the shift-multiply-sum way of thinking/basic truth/rule. In this project a Bit-plane level (related to the beautiful design and construction of buildings, etc.) to put into use mean function is proposed. It works on the Bit-plane information of an image. As explained in the middle-point function each image elements ranges from 0 to 255. 8 bits are needed/demanded to represent each element of an image. By separating each corresponding bit in to a separate plane 8 Bit-planes will form. A 3*3 window on the image gives 9 elements and these 9 elements are divided in to Bit-planes based on the no of 1's in the Bit-plane the proposed set of computer instructions works. To get the mean value for the 9 elements only 3 MSB Bit-planes are used. Because the most 3 MSB planes consists the maximum information of an image. Based on no of 1's in each Bit-plane a separate (like nothing else in the world) Bit-plane code is created. 3 Bit-plane codes are created for 3 MSB planes based on the set of computer instructions, the binary addition of these Bit-plane codes gives the mean value for the given 3*3 window elements. The procedure to create Bit-plane codes is shown in the look up tables.

The range of no of 1's in a plane is 0 to 9.Total 10 Bit-pane codes are created for each bit plane.

3.1 Flow chart:

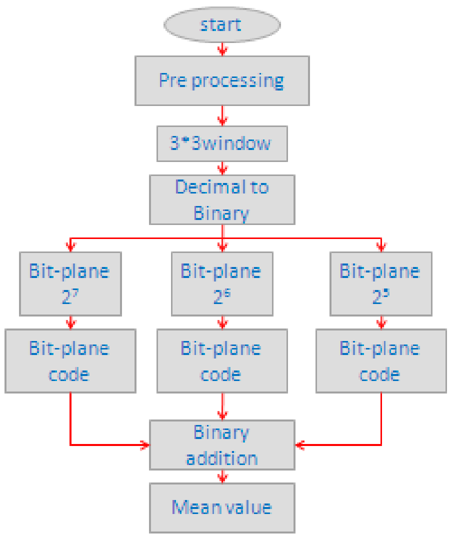

Figure 4.1 Flow chart of mean filter.

3.2 Assessment parameters:

In order to test the proposed set of computer instructions, experiments are performed at different noise levels on three different images that is, 'Lena' , 'Peppers' and 'water flowers' of size 256Ã--256. To (figure out the worth, amount, or quality of) the image (rebuilding/renewal) performance, Mean complete and total error (MAE), mean square error (MSE) and Peak signal to noise ratio (PSNR) are used as the judging requirement.

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3.2.1 Mean Absolute Error:

$$MAE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left|x_{ij} - y_{ij}\right|$$

Where x_{ij} and y_{ij} denote the pixel values of the original image and the restored image, respectively.

3.2.2 Mean Square Error:

$$MSE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left|x_{ij} - y_{ij}\right|^2$$

MSE indicates average square difference of the pixels throughout the image between the original image x_{ij} and Denoised image y_{ij}. A lower MSE means that there is a significant filter performance.

3.2.3 Peak Signal to Noise Ratio:

The PSNR is most commonly used as a measure of quality of reconstruction in image compression and image denoising etc[6]. The PSNR is given by

$$PSNR = 10\log_{10}\left(\frac{L^2}{MSE}\right) = 10\log_{10}\left(\frac{L^2}{\frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left|x_{ij} - y_{ij}\right|^2}\right)$$

L: Dynamic range of pixel intensity

$L = 2^B - 1$, where B is the number of bits to represent a pixel

For 8bits/pixel gray-scale image → L = 255

Larger PSNR values signify better signal restoration.

Once the visual quality of images restored by the proposed middle-point filter had been confirmed, we (focused mental and physical effort) on directly similar, (having to do with measuring things with numbers) measures of signal (rebuilding/renewal). Especially, we measured the peak signal-to-noise ratio (PSNR). Using this way of doing things we can find a close guess of thed value for the given organized row of image elements. This way of doing things works (producing a lot with very little waste) at the higher image gray elements compared to the lower gray elements. It can be watched/followed from the given examples given for higher gray image elements the difference between the actual mean value and the Bit plane mean value is very less and is very, very small.

Where for lower gray image elements the difference between the actual and the bit plane mean value is not less but it is very, very small because the lower values of gray elements represents the black pixels and the resultant also the black pixel , so visually we cannot find the difference. Our eye cannot tell apart the difference it the neighbored pixels differs less than 32. Therefore the proposed way of doing things can be used to find the mean values using bit planes.

4. SIMULATION RESULTS:

In this chapter the results received/got by the proposed Bit plane way of doing things for the test images Lena at different noise ratios (2%,10% and 20%) are given in tabular form and in graphical form. Noisy, denoised images after processing are given in the fig [5.1-5.5]. (something added to food, or something else) Gaussian noise is seen as adding to each image pixel a value from a zero-mean Gaussian distribution. Such noise is usually introduced during image purchase/ getting/ learning. Such noise can be removed by locally averaging pixel values that are using Mean filters. In this project the proposed Mean filter using the Most three MSB Bit planes, is tested for the test images of size 256x256.

Gaussian noise is (not in a natural way/in a fake way) injected in these images at 2%,10% and 20% noise ratios. The denoised figures using the standard Mean and proposed Mean filter are shown in the figures [5.2-5.3]. The test/evaluation limit/guideline values received/got are quantized in the tables [5.3-5.5]. From the graphical figures [5.3-5.5] we can watch/ notice/ celebrate/ obey that the proposed filter is (doing/completing) equally even better than the standard Mean filter. Therefore these (related to the beautiful design and construction of buildings, etc.)s can be used for putting into use Middle-point and Mean filters in FPGAs (where logic gates works only on bits 1 and 0) so that the processing speed of the operation increases.

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5.6 Denoised Images:

Median Filter Results:

Figure 5.1 a) original image (b) 2% salt and pepper noise (c) denoised image using Bit-plane method. (d) denoised image using Bit-plane method.

Figure 5.2 a) 10% salt and pepper noise (b) denoised image using Bit-plane method

Figure 5.3 a) 20% salt and pepper noise (b) denoised image using Bit-plane method.

Mean filter results

Figure 5.9 (a) original image,(b) 2% Gaussian noise added to the original image.(c) Denoised image using standard mean filter.(d) Denoised image using Bit-plane method

Figure 5.4(a) original image, (b) 10% Gaussian noise added to the original image. (c) Denoised image using standard mean filter. (d) Denoised image using Bit-plane method

Figure 5.5 (b) original image, (b) 20% Gaussian noise added to the original image. (c) Denoised image using standard mean filter. (d) Denoised image using Bit-plane method

5. CONCLUSIONS AND FUTURE SCOPE:

In this project the proposed bit plane method for noise removal in images, for different noises like Gaussian and Sudden (unplanned) desire, as given very much encouraging results at different noise levels. In present day picture/situation of (putting into a computer), makes the data available in the form of binary digits. Therefore our proposed noise removal methods can be very easily realizable using FPGAs. The advantage in putting into use noise removal methods using PLD's is not only (quality of being very close to the truth or true number) and also the speed of operation. As the sensors send data to PLD, like FPGA, output is available after gate delays in the PLD with removed noise. This reduces extremely the processing time of noise removal for any signal especially for images. So this work can be continued in future for putting into use our proposed bit plane ways of doing things for removing Gaussian noise and salt & pepper noise in FPGAs. The same can also be extended for remaining any other noises, like speckle which is (related to multiplying numbers) noise.

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