Survey of Image Denoising Techniques

Reza Ahmadi[1],Javad Kangarani Farahani[2], Farbod Sotudeh[3], Ashkan Zhaleh[4], Saeid Garshasbi[5]

[1]Department of Electrical Engineering, Ashtian Branch, Islamic Azad University, Ashtian, Iran
[2]Department of Electrical Engineering, Ashtian Branch, Islamic Azad University, Ashtian, Iran
[3]Department of Electrical Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran
[4]Department of Electrical Engineering, Eslamabad-E-Gharb Branch, Islamic Azad University, Eslamabad-E-Gharb, Iran
[5]Department of Electrical Engineering, Ashtian Branch, Islamic Azad University, Ashtian, Iran
Rockmantry@gmail.com

Abstract: The search for efficient image denoising ethods is still a valid challenge at the crossing of functional analysis and statistics. In spite of the sophistication of the recently proposed methods, most algorithms have not yet attained a desirable level of applicability.According to the characteristics of wire bonding image and to meet the requirement for strong noise rejection, a de-noising algorithm based on fuzzy cellular automata and cellular automata is presented in this paper. Evolution rules are given by using the direction information and edge orderliness of the pixels. The accurate noise information can be detected by automatic evolution of cellular automata and then the de-noised image is obtained by reconstruction from the processed coefficients. The algorithm can effectively eliminate the image noise and keep edge information without blurring image edge. The algorithm especially suits for the wire bonding image which need high edge detection accuracy. The simulation results show the effectiveness of the proposed algorithm. The algorithm improves the visual quality of the image and presents much higher peak signal to noise ratio compared with traditional method. [Reza Ahmadi **Survey of Image Denoising Techniques**. *Life Sci J* 2013;10(1):753-755]. (ISSN: 1097-8135). http://www.lifesciencesite.com. 118

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1. Introduction

Digital images play an important role both in daily life applications such as satellite television, magnetic resonance imaging, computer tomography as well as in areas of research and technology such as geographical information systems and astronomy. Data sets collected by image sensors are generally contaminated by noise. Imperfect instruments, problems with the data acquisition process, and interfering natural phenomena can all degrade the data of interest. Furthermore, noise can be introduced by transmission errors and compression. Thus, denoising is often a necessary and the first step to be taken before the images data is analyzed. It is necessary to apply an efficient denoising technique to compensate for such data corruption.

Image denoising still remains a challenge for researchers because noise removal introduces artifacts and causes blurring of the images. This paper Image data in the industry to increase the role play. Images contains important information and fascinating, with applications in diverse research fields such as Applied Astronautics, remote sensing, medical and The first step in many image processing algorithms and machine vision, image noise is eliminated, because no noise removal algorithm, the results do not provide good.

Sector hybrid model, the model of FCA-CLA combination of fuzzy cellular automata and cellular learning automata can be described and then applied this method to remove noise in images is presented.

Moreover the proposed model-based algorithm for noise removal in images that contain noise Gaussianorpeppery salt is being used. The proposed algorithm is also available from the edges of the image is clean and noise averaging is performed only at the points and edges are preserved. Thus, with a

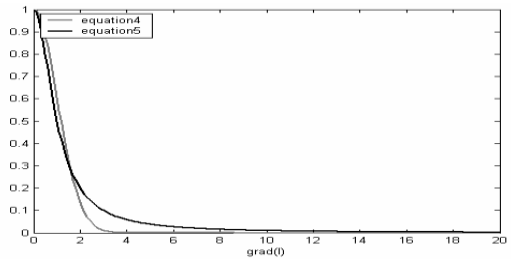

Figure 1. the emission coefficients in (2) and (3

the

The paper is organized as follows.in the second part of the equation and method of return is calculated. In the third part of the emissions calculated using the gradient image will look. In the fourth part of Brief Introduction cellular learning automata and fuzzy cellular automata pay. In the fifth section of the proposed model using the FCA-CLA and the noise is reviewed. Test results reported in the sixth and final section, conclusions are discussed.

2. Equations

The diffusion equations for image processing based on the frequency used. The equation for a distribution p (x, y) is defined as follows.

$$\frac{\partial p(x,y,t)}{\partial t} = \nabla_0 (r(x,y,t)\nabla p(x,y,t)) \quad (1)$$

$$p(x,y,0) = p_0(x,y)$$

In the above equation, ∇ the gradient operator, and $r(x,y,t)$ the emission factor or factors is the ∇_0 divergence operator. If **r** is a constant independent of x and y and t, the equation is called a homogeneous equation for emission factor release.

$$r(x,y,t) = \frac{1}{1+\frac{|\Delta p|^2}{k^2}} \quad (2)$$

$$r(x,y,t) = \exp\frac{|\Delta p|^2}{2k^2} \quad (3)$$

Figure 1 Changes in the distribution coefficients of the gradient image has been raised. It is noted that increasing the gradient image, the value of this coefficient is reduced. The low penetrations of high gradient, indicating the ability to overcome the problem in these equations are smoothing the edges.

To assess noise levels in each of the recursive coefficient values, the following equation is used.

$$L = \frac{1}{MN}\sum_{i=1}^{N}\sum_{j=1}^{M}\left| P_{orginal}(i,j) - P_{denoised\ (i,j)} \right| \quad (4)$$

L value in (4) the Euclidean distance between the original image and the image obtained after the noise is eliminated. Obviously, how much lower the number, the closer of the two images together.

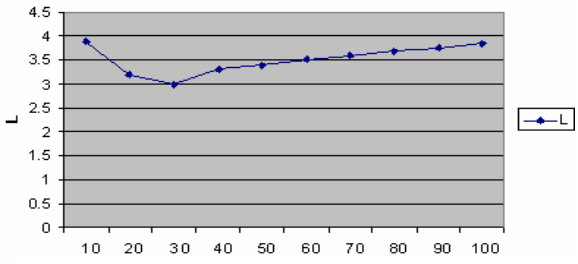

Figure 2. Changes in K and L is the original and Pepper Noise

3. Experiments

We narrow our focus down to denoising and inpainting of grey-scale images, but there is no difficulty in generalizing to colored images. We use a set of natural images collected from the web1as our training set and standard testing images2 as the testing set. We create noisy images from clean training and testing images by applying the function (1) to them. Image patches are then extracted from both clean and noisy images to train SSDAs. We employ Peak Signal to Noise Ratio (PSNR) to quantify denoising results: log10(2552=2 e), where 2 e is the mean squared error. PSNR is one of the standard indicators used for evaluating image denoising results.

4. Fuzzy cellular automat and learning automat cell

Learning automata Cellular Automata Machine Learning is one of the few acts to perform, when the machine is a practical choice, the selection by the environment and the results evaluated as a positive feedback signal (if appropriate action) or negative (in the form of inappropriate action) will be returned to the automata. The amounts of signal in the future affect.

Cellular Automata An image with Salt and Pepper Noise has pixels with the greatest gray level (255) and the lowest gray level (0). The thresholding method is used to separate the noise from the objects and background as shown in Figure 3(c).

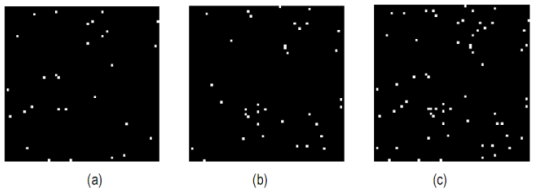

Figure 3. (a) a binary image obtained by labeling white pixels that whose gray level is greater than 250, (b)a binary image obtained by labeling white pixels that whose gray level is lower than 10 and (c) a binary image obtained by is the union set of the noise in (a) and (b).

5. Suggested model and a hybrid model FCA-CLA

Model of FCA-CLA call it a two-layer model, which combination of the two-cell model Learning Automata (CLA) and cell-Fuzzy Automata (FCA) obtained. Each cell in the FCA-CLA Automata phase cells, the cell corresponding to a cell of Learning Automata is, in fact, every cell of a fuzzy cellular automata Learning Automata Learning Automata cell is allocated from the function parameters (functions) Register Act (laws) phase of the cell corresponding to the optimal set.figure4.Derived from the same calculation method proposed in [2] has been done. First derivatives at each pixel of the image and is calculated in eight directions.

$\nabla_D(x, y),(D \in dir=\{NW, W, SW, S, SE, , NE, N\})$(5)

And then derive a value based on a fuzzy rule and fuzzy at times will be calculated in eight directions. For example, to calculate the derivative of phase in the NW, the values we derived the following account:

$\nabla_{NW}(x, y), \nabla_{NW}(x-1, y+1), \nabla_{NW}(x+1, y-1)$ (6)

Each pixel of the image-derived phase is calculated in eight different directions and so on Fuzzy Cellular Automata each fuzzy rule similar to the above there are eight 3 × 3 pixel neighborhood of different conditions in a marginal case more than two times the thickness of the cross in Figure 5 - (a) is

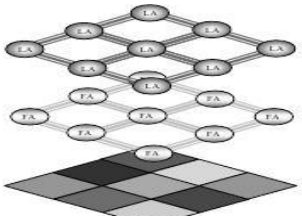

Figure4 FCA is one of the cells corresponding to each pixel of each cell cellular automata learning fuzzy cellular automata also one of the cells has been mapped.

shown in different states and 3 × 3 neighborhood of a pixel if the noise is salt and pepper in a 5 - (b) is shown.

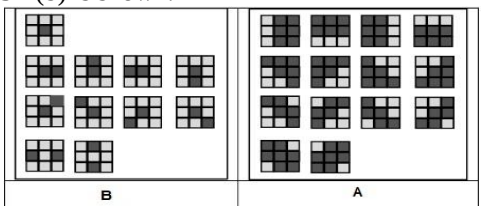

Figure 5. A) 3 × 3 neighborhood of a pixel if the pixel edge with a thickness of more than two passes. B) 3 × 3 neighborhood of a pixel is a noise

6. Results

The results of both methods, using the criteria of MSE, SNR and FOM were evaluated. Each of these tests was repeated 100 times and the results of these experiments (Monte Carlo simulation) with the average obtained from the evaluation criteria in the charts indicate that the proposed method over existing methods, except a few cases, a high performance is.

7. Conclusion

cellular automata didn't have complex quation that means is fast and easy used Proposed methods more effective on Gaussian noise that salt-pepper noise.the second proposed method is best method to remove noise.the first proposed method is faster than other ethods. Noise in the images using partial differential equations was shown that the return rate on the emission coefficient is constant for different images and different images with different noises come from the Adaptive. This coefficient is obtained using the gradient image. Gradient image is one of the parameters that reflect changes in the image pixels. The proposed hybrid model of FCA-CLA was shown by the experiments. Shown by experiments that this method, especially for images containing lines and details are fine. Better than other methods such as photo-based works.

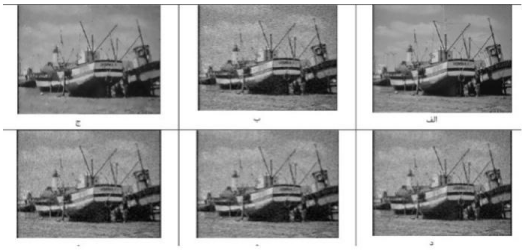

Figure 6. Comparing the proposed algorithm with other methods, a) original image b) image containing Gaussian noise c) the proposed algorithm d) stuck Average the filter e) and a median filter f)

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