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PREPROCESSING USING IMAGE FILTERING METHOD AND TECHNIQUES FOR MEDICAL IMAGE COMPRESSION TECHNIQUES

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Abstract

The computational analysis of images is trying as it more often than not includes assignments, for example, segmentation, extraction of delegate features, matching, alignment, tracking, motion analysis, deformation estimation, and 3D reconstruction. To do every one of these undertakings in a completely programmed, productive and powerful way is commonly demanding. The nature of the info images assumes an urgent job in the accomplishment of any image analysis task. The higher their quality, the simpler and less complex the undertakings are. Subsequently, reasonable techniques for image handling, for example, noise removal, geometric correction, edges and contrast enhancement or light correction are required. This paper investigates the different kinds of filtering techniques, to be specific, Linear Filter, Wiener Filter, Hybrid Filter, Median Filter and Average Filter too. Every technique result performs to better the method for filtering technique process.

Keywords:

Filtering, Accuracy, Robustness, Detection, Classification

1. INTRODUCTION

For many years, medical specialists have strived to create and improve the ways and means that would enable them to non-invasively view and analyze the inner parts of the human body. Medical imaging is the technique for devising the procedure of making visual portrayals of the inside aspects of a body for the purpose of medical analysis. Medical imaging looks to uncover the inward structures covered up by the skin and bones just as to distinguish and deal with illness. The noteworthy changes have been watched in view of development in quantum material science hypothesis, colossal increment in speed and limit of incorporated circuits. Advances in image have started a great deal of mechanical developments in the field of image preparing [5]-[7].

Modalities utilized for medical imaging delivered a rundown of current techniques for finding the data with respect to tissue arrangement, tissue detection, and analysis of tumor and so on. The particulars of medical image handling are: Medical image preparing techniques do not choose, they simply help us to choose whether information is uncommon and costly. Magnetic Resonance Imaging (MRI) is a test which utilizes magnetic field and beats of radio wave vitality to make images of organs and structures in the body. As a rule, MRI gives better data about structures in the body than can be seen with an ultrasound sweep or CT (computed tomography), X-beam examine. X-ray is an imaging technique utilized in radiology for envisioning the inside structure of tissues and organs in the body with detail, particularly for imaging delicate tissues MRI doesn't utilize any radiations [8] [9]. The magnet utilized in MRI may influence counterfeit appendages, pacemakers, and other medical gadgets that contain iron in any event, influencing a watch that is near it. In this way, patients with recreated heart valves, metallic ear inserts, chemotherapy, insulin siphons, shot sections and so forth ought no need to improve image quality for the brain, the muscles, the heart and dangerous tissues contrasted and other medical imaging techniques, for example, computed tomography (CT) or X-beams. Brain tumor is caused because of strange cell development inside the brain and is for the most part brought about by radiation to the head, hereditary hazard factor, HIV disease, cigarette smoking and likewise because of ecological poisons [10]-[13].

Serious issue in image segmentation is incorrect conclusion of the tumor district which gets limited essentially because of the contrast, obscure, noise, antiques, and contortion. Boisterous MR image counteracts precise detection of tumor. Indeed, even limited quantity of noise can change the classification. So the noise is diminished utilizing de-noising technique. For improving the nature of image, filters must be applied. There are various sorts of filters to de-noise the image like mean filter, median filter and wiener filter. Mean filter is a kind of linear spatial filter. Mean filter is fundamentally a convolution filter which comprises of cover or portion to deliver the smooth image. It is frequently used to diminish noise and additionally to lessen the measure of power variety starting with one pixel then onto the next. Median filtering is a nonlinear activity. It resembles the mean filter however is better in decreasing noise without obscuring edges of the image that is the safeguarding of sharp edges [14]-[16].

The median worth computed from the local pixels would not influence different pixels fundamentally. Its reaction depends on the median estimation of pixels contained in the image zone incorporated by the veil and then replaces the middle estimation of pixel with the determined median worth. Wiener filter performs noise decrease in an image by correlation with an estimation of the ideal noiseless sign which depends on a factual methodology.

2. LITERATURE SURVEY

Leavline and Singh [1] proposed the idea of bilateral filtering which is non-linear and smoothens an images (both dark scale and shading images) while safeguarding edges, it chip away at two parameters for example geometric closeness and their photometric likeness. In shading images, bilateral filtering results into no apparition hues along edges and decreases ghost hues where they show up in the first image.

Sharma et al. [2] broke down and looked at different noise removal strategies. Chiefly two sorts of de-noising techniques were broken down for example spatial domain filtering and change domain filtering. The outcomes demonstrated that the exhibition of the wavelet filter is superior to anything spatial domain filters. Spatial domain filters some of the time results into over smoothing and obscure image as it works by smoothing over a fixed window.

Kamboj and Rani [3] clarified different sorts of noise models and distinctive filtering techniques both linear just as non-linear alongside their points of interest and hindrances. Different execution analysis parameters (PSNR, MSE, BPP, SNR and so on.) were considered.

Deswal et al. [4] gave a wide description of different types of noise and clarified diverse bilateral filtering techniques, for example, adaptive bilateral filter, Modified double bilateral filter, switching bilateral filter and joint bilateral filter to expel noise based on various execution measurements, for example, Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE), Mean Absolute Error (MAE) and Time Complexity.

Matlab-9 was utilized for recreation and concluded that Joint Bilateral Filter (JBF) technique is the best for expelling Gaussian noise as its PSNR is higher than other bilateral filtering techniques. JBF uses Patch-Match Calculation Modified for finding matching bundles and likewise perform Non Local Means (NLM) which is utilized to average all pixels in an image. For drive noise, Double Bilateral Filter (MDBF) technique indicates great outcomes and Switching Bilateral Filter (SBF) technique function admirably for blended noise as observed from results. Kaur et al. [6] proposed an improved variant of adaptive Bilateral Filter to conquer the Gaussian noise from shading images. The technique was executed in Matlab-9. The execution of a technique was estimated through different existing parameters like Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE), Mean Absolute Error (MAE), and Normalized Color Difference (NCD).

3. CLASSIFICATIONS OF FILTER TECHNIQUES

De-noising is one of the standard procedures in image processing. The principle objective of image processing is to get clear data from the debased images. Modifying the pixels in an image, in view of some local pixels is filtering. Filtering is utilized to make the image better. Filters are utilized for expelling commotion, improving the image and furthermore to recognize the known example. Filtering has been grouped into different kinds.

3.1 MEDIAN FILTER

Median filter is one of the productive strategies, which is utilized to expel salt and pepper and drive commotion from images. It is one of the non-linear strategies. Filtering is completed by supplanting the image pixels from the areas where the pixels are of median worth. In Median filtering, the pixels that esteem in a window structure are requested dependent on power esteems. Median filtering is broadly utilized in image processing, since it saves or ensures the edges while expelling clamor. Median Filtering has an enormous clamor impact and less obscuring capacity when contrasted with different filters.

3.2 AVERAGE FILTER

It is one of the filtering used to lessen the noise in an image. Average filtering is a technique, were the images are smoothened and features the edges and debases the data about the image. Average filtering is otherwise called mean filter. It works by substituting every pixel by average of pixels in a square structure and by decreasing the force of an image between the pixels. The images get obscured in average filtering, when contrasted with different filters utilized.

3.3 LINEAR FILTER

Linear filtering works by reestablishing pixels of neighborhood in a liner mix way. It improves the image by honing the edges and redressing the enlightenment which make the image a standard one. Convolution is one of the significant factors in linear filtering, which is utilized for smoothing an image.

3.4 WIENER FILTER

Wiener filtering is utilized to decrease the noise that has corrupted an image and results the same as the first image. The objective is to have least measure of mean square blunder. Wiener filtering explores the earlier information about the noise in an image. It has the wide-running of rebuilding for finding the loud image.

3.5 HYBRID FILTER

The essential issue in image processing is the image enhancement and the rebuilding in the uproarious condition. In the event that we need to improve the nature of images, we can utilize different filtering techniques which are accessible in image processing. There are different filters which can expel the noise from images and protect image subtleties and upgrade the nature of image. Hybrid filters are utilized to expel either Gaussian or imprudent noise from the image. These incorporate the median filter and wiener filters. Blend or hybrid filters have been proposed to evacuate blended sort of noise during image processing from images. This hybrid filter is the blend of Median and wiener filter. At the point when we organize these filter in arrangement we get the ideal yield. First we expel the drive noise and afterward pass the outcome to the wiener filter. The wiener filter evacuates the blurredness and the added substance background noise in the image.

4. PROPOSED LAPLACIAN BASED FILTERING METHOD

We begin with the Partial Differential Equation:

$$\frac{\partial u}{\partial t} = -sign\left(\nabla^2 u\right) \times \left|\nabla u\right| \tag{1}$$

The shock filter depends on a standard adaptive in turnaround or forward differencing, to be express, “upwind derivatives”. If the sign of the Laplacian expression is certain:

$$\frac{\partial u}{\partial t} = -\left|\nabla u\right| \tag{2}$$

Filter applies erosion around minima, and if the sign of Laplacian term is negative:

$$\frac{\partial u}{\partial t} = \left|\nabla u\right| \tag{3}$$

This filter applies dilation around maxima. With these operations filter has an impact of sharpening on data image. Numerical expressions for dilation and disintegration operations are isolated and Eq.(4) to Eq.(8) give these numerical expressions:

$$\nabla u = \sqrt[2]{\left(u_x^2 + u_y^2\right)} \quad (4)$$

where,

$$u_{x^2} = \left\{\min\left(\frac{\left(u_{i,j} - u_{i,j-1}\right)}{h_x, 0}\right)\right\}^2 + \left\{\max\left(\frac{\left(u_{i,j+1} - u_{i,j}\right)}{h_x, 0}\right)\right\}^2 \quad (5)$$

$$u_{y^2} = \left\{\min\left(\frac{\left(u_{i,j} - u_{i,j-1}\right)}{h_y, 0}\right)\right\}^2 + \left\{\max\left(\frac{\left(u_{i,j+1} - u_{i,j}\right)}{h_y, 0}\right)\right\}^2 \quad (6)$$

The Eq.(6) applies if the sign of Laplacian term is negative (operation is dilation). If the operation is erosion, equations below is applied:

$$u_{x^2} = \left\{\max\left(\frac{\left(u_{i,j} - u_{i,j-1}\right)}{h_x, 0}\right)\right\}^2 + \left\{\min\left(\frac{\left(u_{i,j+1} - u_{i,j}\right)}{h_x, 0}\right)\right\}^2 \quad (7)$$

$$u_{y^2} = \left\{\max\left(\frac{\left(u_{i,j} - u_{i,j-1}\right)}{h_y, 0}\right)\right\}^2 + \left\{\min\left(\frac{\left(u_{i,j+1} - u_{i,j}\right)}{h_y, 0}\right)\right\}^2 \quad (8)$$

Discrete solution for the Laplacian expression is given in Eq.(9).

$$\nabla^2 u = \frac{\left\{u_{i+1,j} + u_{i-1,j} + u_{i,j+1} + u_{i,j-1} - 4 \times u_{i,j}\right\}}{h^2} \quad (9)$$

If we combine the majority of the equations above, and rewrite left-hand-side as:

$$\frac{\partial u}{\partial t} = \frac{\left(u_{i,j}^{k+1} - u_{i,j}^{k}\right)}{\nabla t} \quad (10)$$

We have an express arrangement discrete answer for the model of the "Shock Filter". The principle stunt in the execution of the code is altering referenced explicit direct with the computation of the upwind backups.

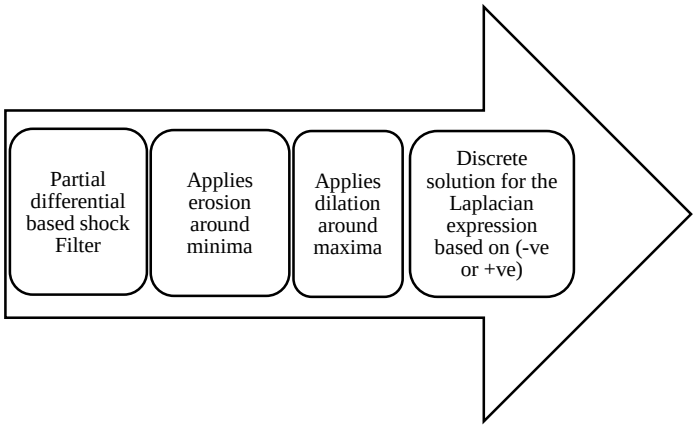

Fig.1. Workflow of proposed preprocessing filter in image compression

5. EXPERIMENTAL RESULTS ACCURACY RATIO

The Table.1 shows the accuracy ratio of the different values of wiener filter, median filter, average filter and hybrid filter. While comparing these 4 filter methods hybrid filter values are better than the other. Wiener filter values starts from 26.5 to 47, median filter values starts from 27.2 to 56.4, average values start from 32 to 61 and hybrid values starts from 36.4 to 76.

Table.1. Comparison Table of Accuracy Ratio

Images	Wiener Filter	Median Filter	Average Filter	Hybrid Filter
25	26.5	27.2	32	36.4
50	30.5	34.6	36	45.6
75	36.9	40.25	44	48.9
100	41.8	50.6	54	58.8
125	47	56.4	61	76

Table.2. Comparison Table of Intensity Ratio

Images	Wiener Filter	Median Filter	Average Filter	Hybrid Filter
25	29	30.5	34	37.2
50	35	34.1	42	45.5
75	39	41.8	53	55.7
100	46	49.9	66	69.8
125	59	64.8	70	75.2

The Table.2 shows the intensity ratio shows the different values of wiener filter, median filter, average filter and hybrid filter. While comparing these 4 filter methods hybrid filter values are better than the other. Wiener filter values starts from 29 to 59, median filter values starts from 30.5 to 64.8, average values start from 34 to 70 and hybrid values starts from 37.2 to 75.2.

Table.3. Robustness Ratio Comparison

Images	Wiener Filter	Median Filter	Average Filter	Hybrid Filter
25	28	30.4	35	25
50	35	34.9	43	27
75	43	45.6	54	32
100	47	49.8	67	35
125	57	64.8	71	40

The Table.3 of robustness ratio shows the different values of wiener filter, median filter, average filter and hybrid filter. While comparing these 4 filter methods hybrid filter values are better than the other. Wiener filter values starts from 28 to 57, median filter values starts from 30.4 to 64.8, average values start from 35 to 71 and hybrid values starts from 25 to 40.

6. CONCLUSION

Initially the imaging quality was bad and advancements to a great extent concentrated on the improvement of new materials, the advancement of high dimensional techniques, and top notch imaging techniques, like high field MRI, CT scanning and so on. This has made the new developments in image processing

increasingly significant. In the future, the significant objective of the therapeutic expert is to decipher the images better and determine more data. The days are not far; when a mirror at home may give, restorative admonition with respect to the adjustments in our face or an individual gets a caution on some genuine ailments, for example, seizures, contingent upon her/his strolling style which are caught utilizing imaging gadgets. This sort of flawless choice is conceivable when best in class image processing algorithms are set up.

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