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A RESOURCEFUL FILTERING TECHNIQUE FOR TEXTURE SEGMENTATION AND ENHANCEMENT IN REMOTE SENSING IMAGES USING MORPHOLOGICAL OPERATIONS

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ABSTARCT:

Images are replications of real-world objects. Image enhancement is the method of applying certain changes to an input image. The changes require feedback from a human evaluator of the output resulting image. The target of image enhancement is to improve the quality of the image so that the resultant image is better than the original image. In this paper remote sensing images has been used. Traditional salt and pepper noise is added and removed using median filter. Morphological operations have been implemented in remote sensing images so as to enhance the quality of the image. Enhancement technique is done. Texture segmentation is also implemented using texture filters. Local range and local standard deviation of the images are found using texture filters. Standard deviation filtering of the image gives best result when compared to range filtering.

Keywords: *Texture Segmentation, Range Filtering, Local Standard Deviation Filtering.*

1. INTRODUCTION

Remote sensing can be defined as gaining information about an object but without making physical contact with it [3]. The activities such as recording, observing, perceiving objects or events at faraway places can be done using remote sensing images. Even it helps us to collect data on dangerous or inaccessible areas also [3].The two types of remote sensing are passive remote sensing and active remote sensing. Passive sensor spots the natural emissions which are reflected by the object or by the areas around. Sunlight reflection is the most common source of rays that is measured by passive sensors [2].

On the other hand active collection emits energy in order to examine objects and areas whereupon a sensor then detects and measures the rays that is reflected or backscattered from the target. RADAR and LiDAR are best examples of active remote sensing [2]. Generally a noise can be attached to any kind of images. Here the noise can be described as any disturbance that changes the real or original image [1]. Basically, there are various ways to introduce noise into an image. As the same, there are various types of filters such as adaptive filter, median filter and linear filter to reduce the noise [5]. Among all those filters, the median filtering [6] is a simple and powerful non-linear filter.

2. METHODOLOGY

One of the essential techniques in image processing is filtering of noise [1]. Noise removal is otherwise known as noise decreasing in which the fluctuations of pixels values are enhanced. The system architecture of our proposed work is shown in the Fig.1

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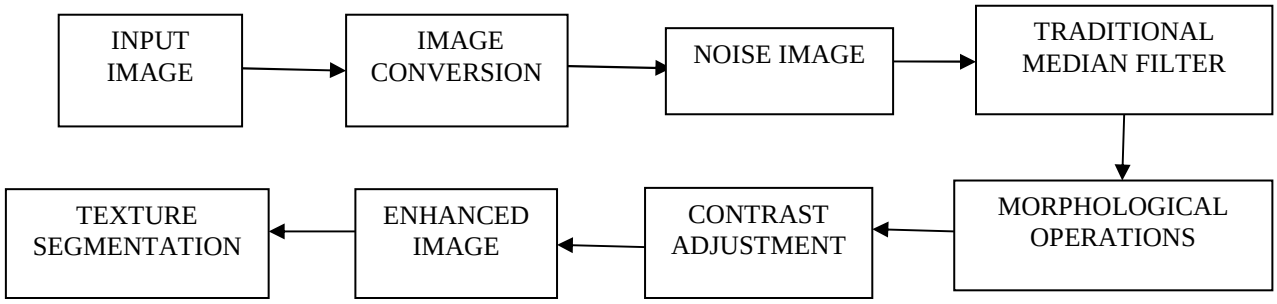

Fig1. System Architecture

2.1. *Noise*

Noise is an interruption which causes fluctuations in the pixel values. Hence the pixel values show random difference and this cannot be avoided. Noise can be seen in several ways. It can be divided based on the distribution of disturbances, correlation, nature and source [1]. There are many types of noises such as periodic noise, salt-and-pepper noise, Poisson noise, and Gaussian noise.

2.2. *Salt & Pepper Noise*

In this paper salt and pepper noise is added to the image [7]. Sensors and memory problems due to the transfer of wrong maximum values of pixels is the main reason for this noise.

$$P(x) = \begin{cases} P1, & x = A \\ P2, & x = b \\ 0, & otherwise \end{cases} \qquad \text{Equ. (1)}$$

Where P1, P2 are the probabilities density function (PDF). P(x) is distribution of salt and pepper noise in image and A, B are the array size image.

2.3. *Median Filter:*

Median filtering is a nonlinear operation. It is often used to reduce "salt and pepper" noise in image processing. It is more effective than other noises because it reduces noise and also preserves edges. Normally a noise can be added to any variety of images. Here the noise can be described as any interruption that modifies the actual image.

There are several ways to add noise into an image. There are many types of filters to condense the noise such as linear filtering, adaptive filtering and median filtering. Median filtering is a simple and powerful non-linear filter while compared to all other filter and it is very easy to implement. Median filtering is the best noise removal technique for removal of salt and pepper noise.

Median filtering is a common image enhancement technique. It removes the disturbance from salt and pepper noise very effectively. When compared to linear techniques this filtering is less sensitive. It removes salt and pepper noise without reducing the sharpness of an image.

3. MORPHOLOGICAL OPERATIONS

Image morphology plays a very vital role in processing the images. It is an important tool in image processing [8]. Morphology can be defined as processing of images based on shapes using a set of image processing operations. Morphological operations create an output image of same size by applying a

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structuring element to an input image. This operation produces an output where the value of each pixel in the output image is based on the evaluation of the corresponding pixel in the input image with its neighbors [8].

3.*1 Erosion Process*

The important morphological operations are dilation and erosion. Dilation method is used to add pixels to the boundaries of an image and erosion method is used to remove pixels from the boundaries of an image [8]. In this paper, the erosion method is used. The erosion method is another important operation of mathematical morphology. The output of the erosion operation is

$$g(x_0, y_0) = \begin{cases} 1 \; for \; z = k \\ 0 \; for \; z < k \end{cases} \qquad \text{Equ. (2)}$$

4. IMAGE ENHANCEMENT

Image enhancement alters the input image for further processing so as to improve the value of the image. The aim of image enhancement is to produce an image with a better quality. It also improves the interpretability or insight of information in images for human viewers [9]. It provides a `better' input for other computerized image processing techniques. The image enhancement starts with the concept of image betterment. There are many factors which are responsible to improve the quality of an image. Few necessary factors are contrast, brightness, spatial resolution and noise [9].

5. TEXTURE SEGMENTATION

Texture segmentation is used to segment the texture content in an image. The texture content in the region of the image can be characterized using texture analysis. Texture analysis identifies the behavior described by the silk, rough, or bumpy in the context of an image. Each behavior refers to the variations in gray levels. Mostly commonly used texture measures are derived from the Grey Level Co-occurrence Matrix (GLCM).

5.1 *Range Filter*

Local range of the image can be found by a function called rangefilt.

Image2=rangefilt(Image1)

It uses the morphological functions to determine the maximum and minimum values in the specified neighborhood. Accordingly, rangefilt uses the padding behavior of these morphological functions. It is also used to specify neighborhoods of various shapes such as disk, ball etc. Range filtering highlights the edges and surfaces.

5.2 Standard Deviation Filter

Local standard deviation of the image can be found by a function called stdfilt.

Image2=stdfilt(Image1)

It is also used to specify neighborhoods of various shapes such as disk, ball etc. The function called strel is used to create a structuring element object and it also uses a method for extracting the neighborhood from the structuring element object. For pixels on borders of image, stdfilt uses symmetric padding.

6. PERFORMANCE MEASURES

6.1 Mean

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The mean is the arithmetic average and is defined as the sum of all brightness value observations divided by the number of observations. The mean can be calculated using the formula

$$\text{Mean}=\frac{1}{N}\sum_{i=0}^{N} f_{k(i)} \qquad \text{Equ. (3)}$$

Where N is the total number of features and K is the constant value.

6.2 Standard Deviation

The Standard Deviation shows how much variation or dispersion from the average exists. A low standard deviation shows that the data points tend to be very close to the mean (also called expected value); a high standard deviation indicates that the data points are spread out over a large range of values. The Standard Deviation can be calculated using the formula

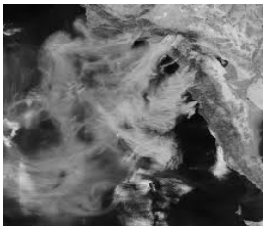
$$SD=\sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(f_{k(i)-mean})^2} \qquad \text{Equ. (4)}$$

Where N is the total number and K is the constant value.

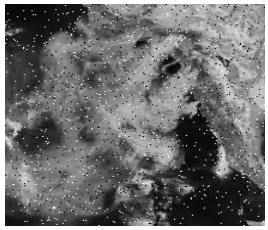
7. RESULT

The following figure shows the experimental results of the proposed work. The Remote Sensing image is taken as the input image. This proposed work is done using MATLAB.2010 version.

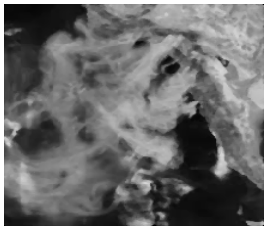
(A) ORIGINAL IMAGE 1



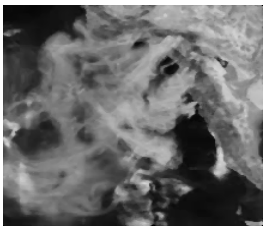
(B) GRAY-SCALE IMAGE



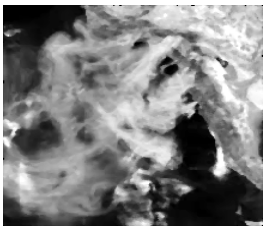
(C) NOISE IMAGE



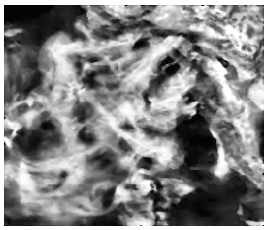
(D) FILTERED IMAGE



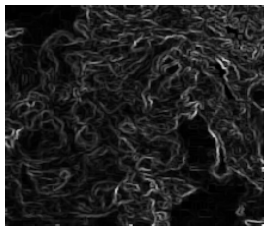
(E)ERODED IMAGE



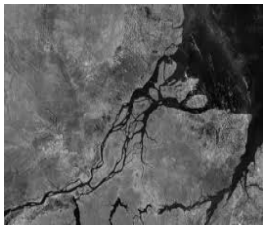
(F) ADJUSTED IMAGE

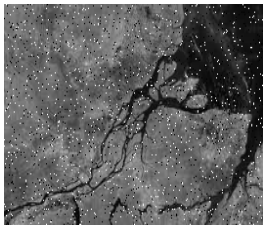


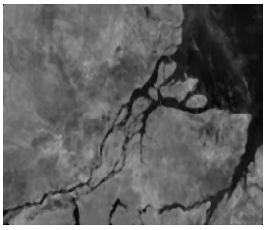
(G) ENHANCED IMAGE



(F) SEGMENTED IMAGE







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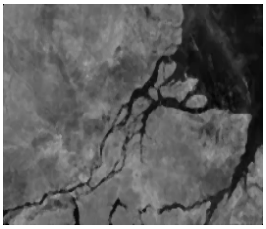
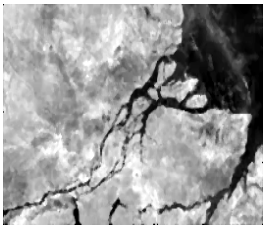
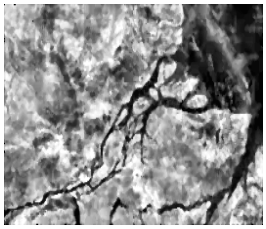
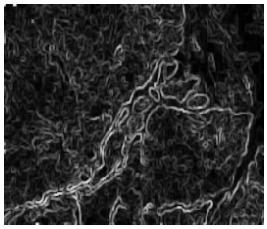
(A) ORIGINAL IMAGE 2 (B) GRAY-SCALE IMAGE (C) NOISE IMAGE (D) FILTERED IMAGE

(E) ERODED IMAGE (F) ADJUSTED IMAGE (G) ENHANCED IMAGE (H) SEGMENTED IMAGE

TABLE1: IMAGE NOISE = 0.04

INPUT IMAGE	STANDARD DEVIATION FILTER			RANGE FILTER		
	MEAN	MEDIAN	STD. DEVIATION	MEAN	MEDIAN	STD. DEVIATION
IMAGE1	9.68	6.89	9.7	27.12	20	26.5
IMAGE2	12.73	8.34	13.69	35.55	23	36.25

TABLE 2: IMAGE NOISE = 0.08

INPUT IMAGE	STANDARD DEVIATION FILTER			RANGE FILTER		
	MEAN	MEDIAN	STD. DEVIATION	MEAN	MEDIAN	STD. DEVIATION
IMAGE1	9.79	7	10	27.49	20	27.61
IMAGE2	13.05	8.51	14	36.5	25	37.36

8. CONCLUSION

In this paper various Remote sensing images has been used to get better quality of images. Traditionally conversion is one of the important processes where the respective methods are used for image modifications. Median filter is used to reduce the noise from the images. Morphological operation has improved the betterment

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of the images. Texture segmentation has been implemented. Finally as derived from above it is concluded that standard deviation filtering of the image gives best result while comparing with range filtering of the image.

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