Experiment Analysis of Different Texture Based Features of Image Using Simplified Gabor Gaussian Wavelet Transform

Rajni Rani, Kamaljit Kaur

Abstract-Textures feature are one of the important features in computer vision for many applications. Texture feature are mostly used for Gabor wavelet transform. It is used for edge detection. Edge detection plays a vital role in computer vision and image processing. Edge of the image is one of the most significant features which are mainly used for image analyzing process. An efficient algorithm for extracting the edge features of images using simplified version of Gabor Wavelet is real time application. Gabor Wavelet is widely used for edge detection. Edge detection finds the real and imaginary part of images of Gabor Wavelet. It is based on noisy and the filtered images using Gabor Wavelet. The performance of Gabor filter is also evaluated by segmentation of noisy, filtered and original images. These statistical metrics are also displayed graphically and they are compared for both the noisy and the filtered images. Simplified Gabor Gaussian Wavelet based approach is highly effective at detecting both the location and orientation of edges. This Proposed technique is used to increase the Peak signal of Noise Ratio (PSNR), and Mean Square Error (MSE) in the MATLAB Software.

Keywords: - Gabor Wavelet, Simplified Gabor Gaussian Wavelet Transform, Wavelet Transform.

I. INTRODUCTION

Satellite images are used in many applications such as geosciences studies, astronomy, and geographical information systems. One of the most important quality factors in images comes from its resolution. Interpolation in image processing is a well-known method to increase the resolution of a digital image. Interpolation has been widely used in many image-processing applications such as resolution enhancement. Many methods have been developed to increase the image resolution. Image-resolution enhancement in the wavelet domain is a Relatively Gabor wavelet transform have been proposed. Edge detection is a process which attempts to capture the significant properties of objects in the image. An edge is defined by a discontinuity in gray level values of an image. Edges are predominant features in images and their analysis and detection are an essential goal in computer vision and image processing. Edge detection is one of the key stages of image processing and objects recognition. An edge is the boundary between an object [2]. The shape of edges in images depends on many parameters: geometrical and optical properties of the object and noise level in the images.

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Edge detection is a very difficult task. When viewing an image, humans can easily determine the boundaries within that image without needing to do so consciously. Many edge detection methods have been proposed and implemented. Gabor Wavelets is proposed in this work, whose features can be computed efficiently and can achieve better performance for edge detection. The Proposed method for Gabor Gaussian wavelet Transform.

II. WAVELET TRANSFORM

Wavelet Transform is a representation of a square-integral (real or complex valued) function by a certain orthonormal series generated by a wavelet. It is the most popular method for the time-frequency-transformations. Wavelet transform is used to the dimensions to decompose the signal. Gabor functions form a complete but non-orthogonal basis set. Expanding a signal provides a localized frequency description. A class of self-similar functions referred to as Gabor wavelets, is now considered [1]. Their Gabor wavelet, then this self-similar filter dictionary can be obtained by appropriate dilations and rotations.

A. Need of Gabor Wavelet

Texture features are used on the various wavelet methods. Wavelet transformation is one of the most popular techniques used for the time-frequency-transformations. Wavelet transform is used on dimensions to decompose the signal. The wavelets transform decomposes an input signal into low and high frequency component using a filter. Daubechies, Haar wavelet, which characteristics the filter, has important properties of orthogonality, linearity, and completeness. Wavelets can be separated into different basis functions for image compression and recognition. the result of multi-resolution using Haar, Daubechies wavelets There are various problems of Gabor wavelet on texture feature but the Gabor used to different method but improve the efficiency of low and quality of different images in Gabor.

III. PROPOSED WORK

The computation required for Gabor Wavelet based feature extraction is very intensive. This is the problem for real time processing. An efficient method for extracting Gabor features is needed for many practical applications.

A. Simplified Gabor Gaussian Wavelet

It has been proposed that the imaginary part of a Gabor filter is an efficient means for edge detection. Edges can be detected by using this simplified Gabor Gaussian Wavelet.

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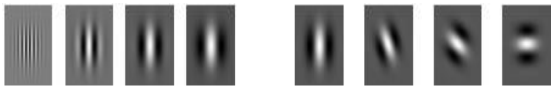
The Simplified Gabor Gaussian can be obtained by selecting different centre frequencies and orientations. These are used to extract features from an image. This method is known as Simplified Gabor Gaussian wavelet.

Gabor filters are directly related to Gabor wavelets, since they can be designed for number of dilations and rotations. Gabor filters have been used in many applications, such as texture segmentation, edge detection, retina identification, image coding and image representation [3].A Gabor filter can be viewed as a sinusoidal plane of particular frequency and orientation. The Gabor wavelet uses the imaginary part and real part of the Gabor function. These proposed methods combine to the all part of Gabor function and with the use for laplacian of Gaussian function [2]. A Gabor filter is a linear filter whose impulse response is defined by laplacian of Gaussian function. Gabor Wavelet Transform is follow:

$$G\,(X, Y, \lambda; \theta,\ \alpha,\ \sigma, \gamma)$$

(x) Use the row (y) use column, (λ) use center point of image and (θ) is real part, (α) imaginary part, (σ) absolute value, (γ) angle of images.



$\gamma = \{1/2, 3/2, 5/2, 7/2\}$

$\theta = \{ 0, \pi/6, \pi/3, \pi/2\}$

Fig 1 Example of Gabor Function [7]

Gabor function are used different values of original image to calculate the result , (x , y) is used to the row and columns value of image and λ is for centre point of image than θ is used to real part of image and α is the imaginary part of image. (σ , γ) is used to check direction of image.

- Wavelength (λ) of the cosine factor of the Gabor filter and the preferred wavelength of this filter. Its value is specified in pixels. Valid values are real numbers equal to or greater than 2.
- Orientation (θ) of the normal to the parallel stripes of a Gabor function. Its value is specified in degrees. Valid values are real numbers.
- The Phase offset (φ) in the argument of the cosine factor of the Gabor function is specified in degrees. Valid values are real numbers. The values correspond to center-symmetric 'center-on' and 'center-off' functions.
- Aspect ratio (γ) specifies the elasticity of the support of the Gabor function. For γ = 1, the support is circular. For γ < 1 the support is elongated in orientation of the parallel stripes of the function.

B. Simplified Gabor Gaussian Wavelet Transform

The Gabor Wavelet used to combine the both real and imaginary part of Gabor function and calculate the absolute value and magnitude of the original image and used to find the mean value of original image and use the combine Gabor function to find the best result of combine the Gabor Gaussian wavelet transform.

Gab out (size+x+1, size+y+1) =k*exp (-pi*S^2*(x*x + y*y))*.... (Exp (j*(2*pi*F*(x*cos (W) +y*sin (W)) +P))-exp (-pi*(F/S)^2+j*P));

To get the real part and the imaginary part of the complex filter output use real (gab out) and image (gab out). To get the magnitude and the phase of the complex filter output use abs (gab out) and angle (gab out), respectively.

IV. QUALITY METRICS

Digital image technique is examined with various metrics. The most important one is peak signal to noise ratio. This will express the quality. There exists another property which expresses the quality, which is MSE .PSNR is inversely proportional to MSE. The other important metrics is RMSE, SNR which express the amount of quality embedded in the technique [5].

<u>Mean Square Error (MSE)</u> It is refers to some of average or sum of square of the error between two images. MSE of Image can be calculated as:

$$MSE = I / MN \sum_{i-0}^{m-1} [I(i,j) - K(i,j)]^2$$

<u>Peak Signal To Noise Ratio (PSNR)</u> Peak Signal to noise ratio is defined as the ratio between signal variance and reconstruction error variance. Peak Signal to noise ratio are calculate from the following expressions. PSNR of Image can be calculated as:

$$PSNE = 10.\mathrm{Log}_{10}\,(\mathrm{Size}/MSE)$$

<u>Signal To Noise Ratio (SNR)</u> The mean square error is expressed in terms of a signal to noise ratio (SNR). Where $\sigma^2$is the variance of the desired image and σ^2_e is average variance. SNR of image can be calculated as:

$$SNR = 10 \log \sigma^2/\sigma^2_e$$

<u>Root Mean Square Error (RMSE)</u> The Root Mean Square Error is a frequently used measure of the difference between values predicted by a model and the values actually observed from the environment that is being modelled [5]. RMSE of Image can be calculated as:

$$RMSE = \mathrm{sqrt}\,(I / MN\ \sum_{i-0}^{m-1} [I(i,j) - K(i,j)]\,)$$

The different types of earth images are used to improve the image quality and different values are calculated the results in Gabor transform and laplacian of Gaussian function. Gabor transform calculate the absolute value of real, imaginary part. θ expresses the orthogonal direction to the Gabor function edges. The variation of θ changes the sensitivity to edge and texture orientations.

As shown in Fig 2.

Experiment Analysis of different Images Quality using simplified Gabor Gaussian wavelet transform. Gabor transform calculate the absolute value of real, imaginary part. θ expresses the orthogonal direction to the Gabor function edges. The variation of θ changes the sensitivity to edge and texture orientations.

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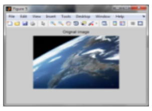
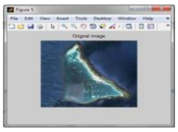
Earth images	**Parameters G (X , Y , λ ; θ , α , σ , γ)**	
Original images	θ =0.05, α =0.010	θ =0.15, α =0.020
 Earth Image Size 256*256		
 Round Image Size 512*512		
 Earth Image Size 256*256		

Fig 2 Comparative Analysis of different Earth Images of different sizes based Real and Imaginary part of different values.

The different types of earth images are used to improve the image quality and different values are calculated the results in Gabor transform and laplacian of Gaussian function. Gabor transform calculate the absolute value of real, imaginary part.

TABLE I

Experiment Analysis of Images Based on Different Quality Metrics using simplified Gabor Gaussian wavelet transforms.

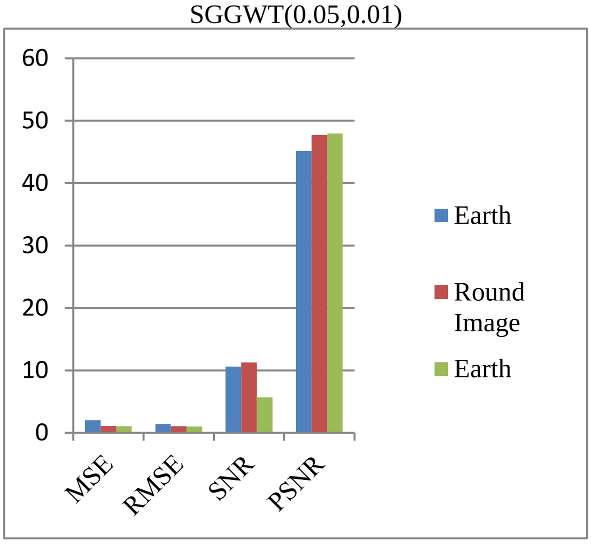
IMAGES	**SGGWT Parameters**	**MSE**	**RMSE**	**SNR**	**PSNR**
Earth 256*256	θ =0.05, α =0.010	2.0027	1.4152	10.618	45.1147
Earth Round 512*512	θ =0.05 α =0.010	1.0996	1.0486	11.266	47.7185
Earth 256*256	θ =0.05, α =0.010	1.0402	1.0199	5.6816	47.9594
IMAGES	**SGGWT Parameters**	**MSE**	**RMSE**	**SNR**	**PSNR**
Earth 256*256	θ =0.15, α =0.020	0.6085	0.7800	12.294	50.2884
Earth Round 512*512	θ =0.15, α =0.020	0.6743	0.8212	12.116	50.8421
Earth 256*256	θ =0.15, α =0.020	0.6155	0.7845	6.1374	50.2384

Table 1 Study of different quality parameters on Earth Images Using Simplified Gabor Gaussian Wavelet Parameters.

The parameters have been tested for all the standard test images and different size of images are used in Gabor used different parameters. The tables are representing to improve the image quality than use the peak signal to noise ratio.

GRAPH I

Graphical Representation of Images Based on Different Quality Metrics using simplified Gabor Gaussian wavelet Transform (SGGWT).



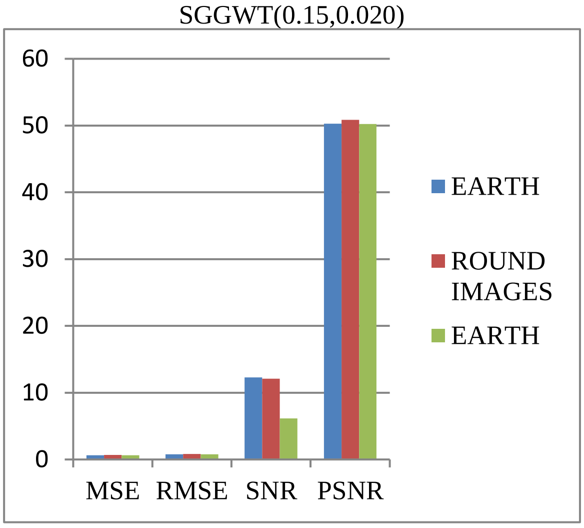


Fig 3 Graph representations of Earth Images Using

Simplified Gabor Gaussian Wavelet Transform (SGGWT).

Graph representations to improve the image quality measure after implement transform or any filter using (SGGW) and Laplacian of Gaussian function. The result may be measure to calculating MSE than RMSE and SNR than PSNR and total time consumed for transform.

V. CONCLUSION

These paper present evaluations of texture feature using Gabor wavelet transform. Gabor Wavelets are commonly used for extracting local features. Gabor functions use different frequencies and orientations. It is proposed that the real and imaginary part of a Gabor filter is efficient for edge detection.

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Combinations of Gabor wavelet and Laplacian of Gaussian function using noisy and distances earth images have been obtained to find the best values as per the analysis of those images on different quality metrics. The parameters which are evaluated using Gabor-filtered output images give best output values for all the quality metrics and also give the best results for the images. The analysis of different images shows that the results of Gabor wavelet and Laplacian of Gaussian function calculated using the absolute value of real and imaginary part of images. The variances values of orientation (0.03, 0.07, 0.08, and 0.09) and for some different scale values (0.01, 0.08, 0.014, and 0.015). Each image gives best response for some particular variances values and for some particular frequency scale values. The comparison of low resolution images and filtered images give the best result.

VI. FUTURE SCOPE

The application of Gabor wavelet transform has been growing at a very fast rate because of effect behaviour with respect to accuracy in parametric calculations and less time observer. Here our proposed algorithm simplified Gabor Gaussian wavelet transform can be used for image segmentation, weed image classification, Palm print recognition, Texture segmentation, for the illumination invariant recognition of colour texture, for an automatic inspection system for textile fabrics and many other types of data sets. the future work we can use various artificial intelligence techniques by using our proposed method like Radon neural network, Fuzzy, Adaptive, and Gradient Algorithm in order to attain the best output without performing calculations for each and every combination. This work can be done by using this technique will lead to more efficiency and less tedious work.

REFERENCES

[1] A.Ahmadian , A. Mostafa ," An Efficient Texture Classification Algorithm Using Gabor Wavelet" Department Of Biomedical Systems & Medical Physics, Tehran University Of Medical Science, Tehran, Iran, 0-7803-7789-3/03/ ©2003 IEEE.

[2] Bourkache.N, Laghrouche .M , And Oulebsir Boumghar.F, " Images Indexing Based On The Texture Parameters And Medical Information Content Retrieval"(2003).

[3] C.Sujatha And Dr. D. Selvathi , "An Optimal Solution For Image Edge Detection Problem Using Simplified Gabor Wavelet", International Journal Of Computer Science, Engineering And Information Technology (Ijcseit), Vol.2, No.3, June 2012).

[4] David Barina," Gabor Wavelets In Image Processing" Doctoral Degree Programme.Transactions On Pattern Alvalysls And Machine Intelligence, Vol. 18, No. 8, August 1996.

[5] K.purnima, TV sampath kumar, "Lossless Image Compression Using Traditional and Lifting Based Wavelet Transform" International Journal Of Innovative Research and Studies. ISSN 2319 -9725.

[6] http://en.wikipedia.org/wiki/Gabor_filter

[7] Moreno Plinio , Bernardino Alexandre, and Jose Santos, "Gabor Parameter Selection for Local Feature Detection "IBRIA -2nd lbpria conference on pattern recognition and image analysis ,estoril,Portugal,june 2005.

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