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Hybrid Method for Analysis of Texture Features and Wavelet Analysis of Natural Images

Nikhil Debbarma
Department of Computer Science and Engineering
National Institute Of Technology
Agartala, India

Parthasarathi De
Department of Computer Science and Engineering
National Institute Of Technology
Agartala, India

Tamal Biswas
Department of Computer Science and Engineering
National Institute Of Technology
Agartala, India

Debasish Deb
Department of Computer Science and Engineering
National Institute Of Technology
Agartala, India

***Abstract*—This paper is based on extracting texture features that are embedded in images and also extracting those text from images and wavelet analysis is also done to check the performance measure of text that are embedded in the images. We studied texture features and successfully retrieve the texture features that are embedded in images. We also analyzed the wavelet characteristic and performance issues in the images. For our experiment we used images dataset from International Conference on Document Analysis (ICDAR). Different methodologies have been used for texture feature extraction. Our proposed method gives more accuracy and efficiency towards extract texture features analysis as compared with other previous studies. Wavelet analysis and performance measure is completely new in this paper.**

***Keywords*— Wavelet; Threshold; Morphology;**

I. INTRODUCTION

Text extraction is always a challenging problem in the field of digital image processing techniques and research works. Lots of research works have already been done and some research works are still going on this field. We are extending our previous works in the same field; we are working on the research of wavelet analysis, which is completely new in this paper as compared with our previous published paper [1]. Our methodology provides a good result as it is shown in this paper. We practically applied various methodologies that are essential for extracting the text that are embedded in the images. Our experiment is divided into number of modules, such as detection of edge-based, connected component based, wavelet based along with some other methods such as application of Otsu method, filtering operations, Morphological Operation, Segmentation technique, Wavelet transformation techniques. This paper is based on extracting texture features that are embedded in images and also extracting those text from images and wavelet analysis is also done to check the performance measure of text that are embedded in the images. We studied texture features and successfully retrieve the texture features that are embedded in images. We also compared the wavelet characteristic and performance issues in the images using Daubechies db1 at level1 and Haar wavelet transformation. Wavelet analysis and performance measure is completely new in this paper. In terms of mathematical term of wavelet, it can be considered as a tool that is useful in digital image processing. Wavelet analysis is mostly used in the study of compression and de-noising. We measured the performance issues that are necessary in digital image processing techniques. Study of wavelet is important; we compare the performance issues of wavelet at different level. Haar wavelet is actually a sequence of rescaled square shaped functions that together form a wavelet family. In discrete wavelet transformation the wavelets are sampled in discrete manner. For our experiment we have taken images dataset from International Conference on Document Analysis (ICDAR), some images are collected from magazines, some are taken from digital camera. Different methodologies have been proposed for texture feature extraction. Our proposed method gives more accuracy and efficiency towards extract texture features analysis as compared with other previous studies.

II. LITERATURE SURVEY

In the field of research area, text extraction plays an important role. Several proposed works and papers have been published. Text embedded in any image sometimes plays important role as it gives semantic information regarding texture features analysis. It is always important to extract text from images as on the magazine and book covers are mostly embedded with pictures. Semantic and useful information [1] may be collected from images, so we need to separate text strings from images. Text in an image contain varies properties such as color, edge, size [3]. In text extraction we also have to consider the various degradations such as low resolution, blurriness, or uneven lightening, make it difficult to extract text from images having noise. Texture feature analysis, text extraction and detection in images are difficult problem in the field of digital image processing research area [4]. We have worked on these fields to get a better result. Canny edged detector is basically used to get possible text regions but Sobel edge detector cannot detect possible text regions and the connected component analysis is applied to get the candidate text regions. If image contain background complexity then possibly non text regions also get collected

[5]. Euclidian distance provides good results that represent color difference measure [6]. Text recognition was mentioned by a text segmentation step which was followed by OCR algorithm, statistics and language modeling. Sunil Kumar et al. [7] proposed a clustering-based technique for estimating globally matched wavelet filters using a collection of ground truth images. Fisher classifiers have been used for classification. S.Audithan and RM. Chandrasekaran [10] proposed that Haar discrete wavelet transform operation was fastest among all wavelets. 1 or -1 represents Haar coefficients. The choice of wavelet function is crucial for performance in image compression. There are a number of basis that decides the choice of wavelet for image compression.[3]Detection of edges, line feature vector graph was generated based on the edge map and the stroke information was extracted. DWT now becomes a standard tool in image compression applications because of their data reduction capabilities. DWT can provide higher compression ratios with better image quality due to higher de-correlation property.[3] Hence, DWT has potentiality for good representation of image with fewer coefficients.

III. PROPOSED METHODOLOGY

Our proposed work is divided into several modules. We worked separately on different modules. Figure below depicts the basic procedure of our module and working principle of hybrid method for analysis of texture features and wavelet analysis of natural images.

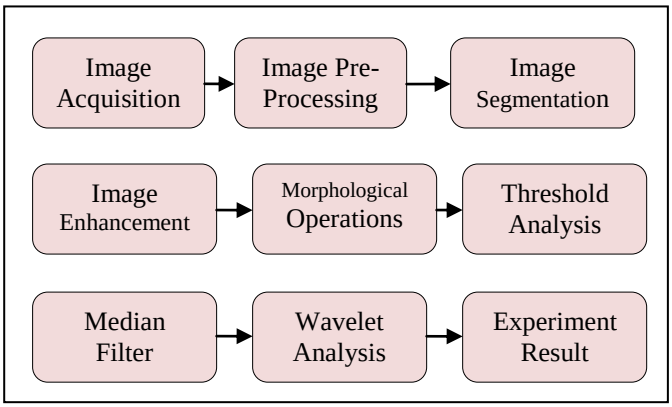


Fig. 1 Basic procedure of texture features analysis

The project work is implemented on MATLAB 2013, with basic software requirements in addition of jre, jdk, and Microsoft dotnet framework 4.5 for installation of real time windows application run. The project work is implemented on MATLAB2013a version. For experiment purpose we used image database from ICDAR dataset, and some images are collected from digital camera. Different approaches are used to extract text embedded in images. Firstly the image is taken from dataset and then it is pre-processed, after that it undergoes different degradation like high or low resolutions, image blurriness, image lightening etc. Pre-processing is a technique that involves in removing low-frequency background noise, adjusting size of images, normalizing the intensity of the individual particles images, removing reflections, and masking portions of images[1]. We need this preprocessing technique to enhance images prior to computational processing. Our next step is to convert the original images that are RGB to its gray-scale images. We also compared the edge detection techniques such as Sobel and Canny edge detection technique to get the edges of text area regions. We have found that it is always better to apply Canny edge detection technique rather than Sobel edge detection technique. Image enhancement is the process that adjusts digital images so that the results are more suitable for display or further image analysis. Median Filtering is used to remove noises; Gradient Difference is used to get text regions of high contrast. Histogram equalization technique gives contrast of image that can be enhanced. In histogram equalization, distributes pixel values throughout a range, thus, equalizing and making the histogram more "normal" shaped. Next we applied Daubechies DWT that gives characteristics of textured image, Otsu Method used to remove non-text regions. We also compared Daubechies DWT and Haar wavelet transformation in the images and calculated the performance measures of images in terms of wavelet analysis.

IV. EXPERIMNT AND RESULT

For our experiment we have taken some images and performed some basic operations like preprocessing, converting the image to gray scale image and also experiment on those images. Figure below shows the basic performance of canny as well as sobel edge detection procedure.

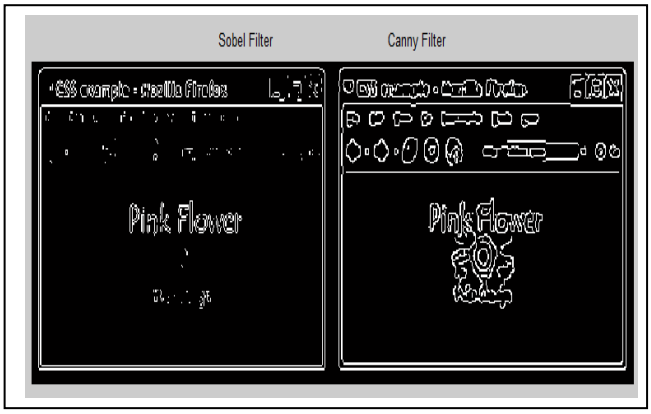


Fig. 2 Comparison of edge detection

In our experiment we analyzed the edge detection techniques on various images that are collected from ICDAR database and some are collected from local news paper, internet, and magazines. We have checked that it is always good to use sobel edge detection techniques rather than canny edge detection techniques because sobel is used to give proper edges of text that are embedded in the images whereas canny edge detection techniques gives all the text and nontext region edges, since we are interested only on text embedded in the images. We performed morphological operation to get the boundary of text in the images. In Matlab software there are some important functions that are basically used to get boundary regions of the images, such as bwtraceboundary and bwboundaries; In this bwtraceboundary function returns the row and column coordinates of all pixels on the border of text in an image. It is important to specify the location of border pixel on any object as a starting point for the trace. In this paper and our experiment we used two dimensional arrays, that corresponding to the indexed image representations. It is also available when using image conversions which are represented by m by n arrays of data type of unit8. Haar wavelet is actually a sequence of rescaled square shaped

functions that together form a wavelet family. In discrete wavelet transformation the wavelets are sampled in discrete manner. Wavelet analysis is mostly used in the study of compression and de-noising. We measured the performance issues that are necessary in digital image processing techniques. In figure below we are going through the features of two dimensional discrete wavelet analyses. 2D discrete wavelet analysis.2D discrete wavelet analysis helps in the analysis of image.

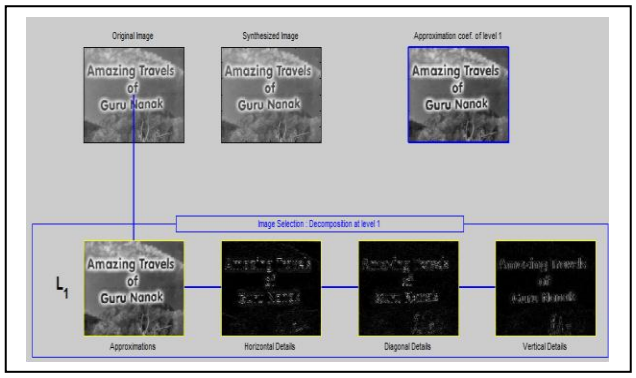


Fig. 3 Indexed 2D wavelet Analysis

We have experimented on the histogram, histogram creates plot of the given image. The histogram function is used for automatic binning algorithm. It returns bins with a uniform width chosen to cover the range of elements in the image and also revels the underlying shape of distribution[17]. Here height of each rectangle indicates the number of elements in the bin.

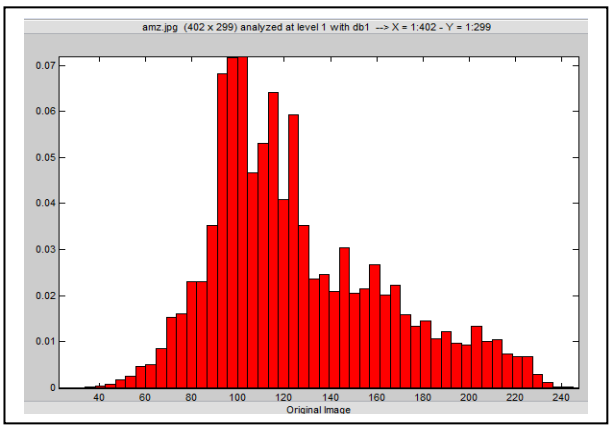


Fig 4 Histogram for 2D DWT Wavelet transforms

MATLAB Image processing toolbox is a powerful tool that helps in building and analysis of image processing. After loading the image , we performed wavelet analysis as shown in the figure below. Using wavelet and level menu we can determine wavelet family, type of wavelet and number of levels that are needed to be used for image analysis. There are many analysis that are needed in image analysis in terms of wavelet analysis. A Haar wavelet is the simplest type of wavelet[2]. In discrete form, Haar wavelets are related to a mathematical operation called the Haar transform. The Haar transform serves as a prototype for all other wavelet transforms. Like all wavelet transforms, the Haar transform decomposes a discrete signal into two subsignals of half its length. One subsignal is a running average or trend; the other subsignal is a running difference or fluctuation.The Daubechies wavelet transforms are defined in the same way as the Haar wavelet transform by computing the running averages and differences via scalar products with scaling signals and wavelets the only difference between them consists in how these scaling signals and wavelets are defined [2].

A. Decomposition and Analysis functions

- Maximum wavelet decomposition level
- Decomposition at single-level
- Simple Decomposition

B. Analysis of Compression and De-Noising

- Threshold for wavelet 1-D or 2-D de-noising
- Techniques for threshold incase of 2-D

For experimental purpose we have chosen an image and it has undergone various wavelet analyses. Result of Compression and Threshold information of 2D Discrete wavelet transformation analysis is shown below.

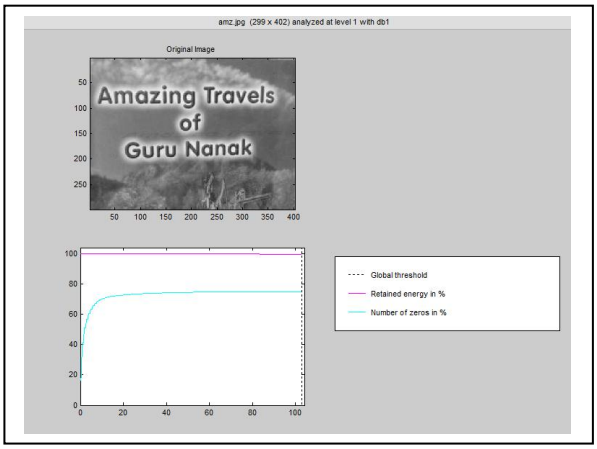


Fig. 5 Indexed 2D wavelet Analysis

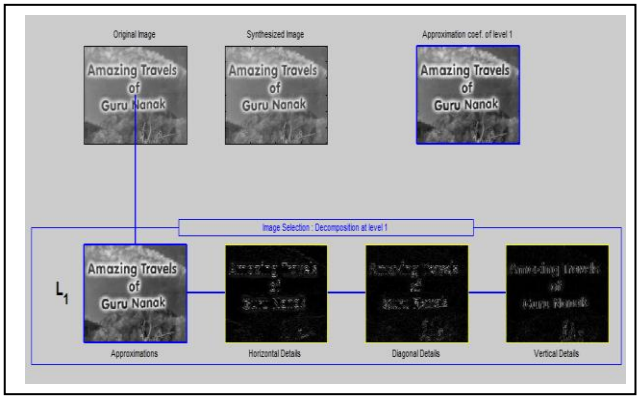
In the above picture dotted line indicates the threshold value of the gray level image; pink line indicate the retained energy level of the image and blue line indicate the number of zeros in the image. From the figure we analyzed the following as shown in the table

TABLE I. RESULT OF COMPRESSION AND THRESHOLD INFORMATION OF 2D DISCRETE WAVELET TRANSFORMATION

Image Name	**Result of Compression and Threshold information of 2D Discrete wavelet transformation analysis**		
	Data (in size)	***Name /Type***	***Wavelet Type***
amz	299 X 402	jpg	2D
Wavelet db Type		db 1	Level 1
Global Threshold value		103	Gray Level
Retained Energy		99.71 %	Level 1

Image Name	Result of Compression and Threshold information of 2D Discrete wavelet transformation analysis		
	Data (in size)	*Name /Type*	*Wavelet Type*
Number of zeros		75.00 %	Level 1

Haar wavelet is actually a sequence of rescaled square shaped functions that together form a wavelet family. Figure below depicts the analysis of haar wavelet at level 1. Haar discrete wavelet transform operation was fastest among all wavelets.



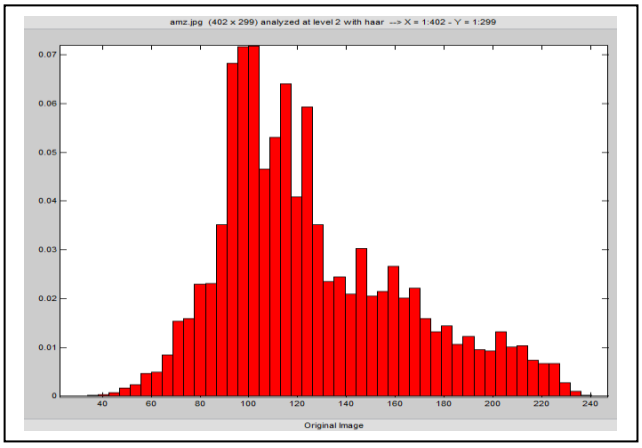


Fig 7. Histogram for Haar Wavelet transforms

Experiment result shows the compression and threshold information of Haar wavelet transformation. In the below picture dotted line indicates the threshold value of the RGB level image; pink line indicate the retained energy level of the image and blue line indicate the number of zeros in the image. From the figure we analyzed the following as shown in the table

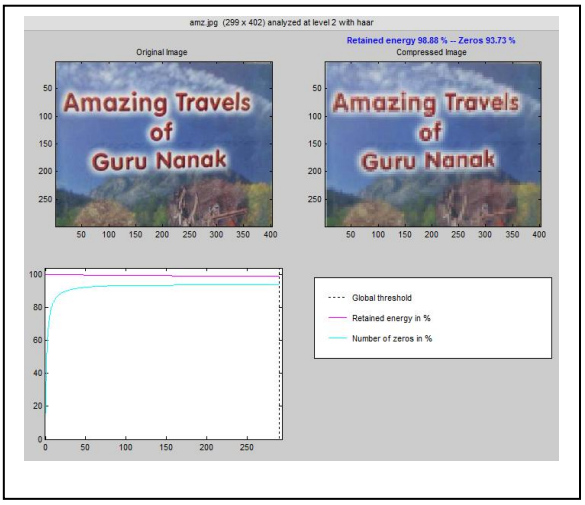


Fig. 8. Compression information of haar wavelet transform

TABLE II. RESULT OF COMPRESSION AND THRESHOLD INFORMATION OF HAAR WAVELET TRANSFORMATION

Result of Compression and Threshold information of haar wavelet transformation

Image Name	Result of Compression and Threshold information of 2D Discrete wavelet transformation analysis		
	Data (in size)	*Name /Type*	*Wavelet Type*
amz	299 X 402	jpg	haar
Wavelet db Type		haar	Level 1
Global Threshold value		103	RGB
Retained Energy		98.88 %	Level 1
Number of zeros		93.73 %	Level 1

In the above picture dotted line indicates the threshold value of the gray level image; pink line indicate the retained energy level of the image and blue line indicate the number of zeros in the image. From the figure we analyzed the following as shown in the table . We also performed de-noising of images to remove noises.

De-noising is important in analyzing image processing.

- Remove noise by adaptive filtering experiments on filtering wiener2 performs more smoothing
- The adaptive filter is more selective than a comparable linear filter
- Preserves edges and other high-frequency parts of an image.

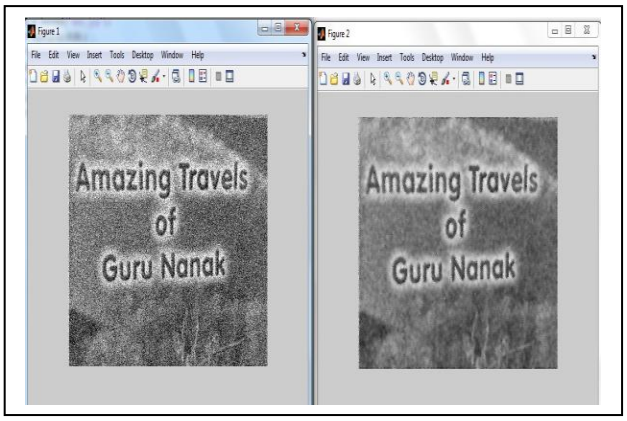


Figure 9. Adaptive median filter

CONCLUSION

This paper is based on extracting texture features that are embedded in images and also extracting those text from images and wavelet analysis is also done to check the performance measure of text that are embedded in the images. We studied texture features and successfully retrieve the texture features that are embedded in images. We also analyzed the wavelet characteristic and performance issues in the images. For our experiment we used images dataset from International Conference on Document Analysis (ICDAR). Different methodologies have been used for texture feature extraction. Our proposed method gives more accuracy and efficiency towards extract texture features analysis as compared with other previous studies.

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