

# Morphological Gabor Wavelet Approach for The Encoding and Decoding of Image

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## Abstract

The field of a digital-image processing has experienced dramatic growth and increasingly widespread applicability in recent years. Fortunately, advances in computer technology have kept pace with the rapid growth in volume of image data in these and other applications. Digital-image processing has become economical in many fields of research and in industrial and military applications. While each application has requirements unique from the others, all are concerned with faster, cheaper, more accurate, and more extensive computation. Analysis of document images for information extraction has become very prominent in recent past. In this work the algorithm is proposed using various functions. This algorithm enhances image contrast very effectively so that the images can be encoded and decoded in efficient manner. If the observed data are disturbed by random noise then the Gabor operator should convert the probabilistic data into morphological data. All the implementation work has been done in MATLAB 7.1 image processing tool box.

## Keywords

RGB (Red, Green, Blue), Image enhancement, noise, MATLAB, Gabor filter etc.

## 1. Introduction

Image De-noising and Enhancement are the key research fields in Image Processing as they are useful in several applications such as Feature Detection, Medical Image Processing, Remote Sensing, Machine vision etc., which improves the image clarity and visual perception of human beings. They modifies images to improve them (enhancement, restoration), extract information (analysis, recognition), and change their structure. It improves the clarity of the Image for Human Perception.

Traditionally, if we talk about the text images our main form of transmission & storage for information has been by paper documents. These documents include many common types: business letters, forms, engineering drawing & maps, text books, technical manual, music notations & other symbolic data. Though paper was the exclusive medium in past, many documents now originate on the computers & often reside exclusively in electronic form. In spite of this it is unclear whether the computer has decreased/increased the amount of paper document produced, as these are printed out for reading, dissemination, markup predictions of paperless offices made so frequently during the early 1980 has given way to the realization that the objective is not elimination of paper but the ability to deal with the flow of electronic & paper document in effective & integrated way. Several good solutions exist for document processing and analysis, our paper tries to give general idea for document processing and the various steps/methods used for that. This will give an overview for processing, analysis and classification of document images and others.

On the other hand, image denoising from natural and unnatural images is still a challenging problem in image processing. Today's world is globe of Internet wherein information is needed to be exchanged across this globe, within fraction of second. This information may be composed of text, videos, or images. Images while transmissions over the communication media, are get corrupted due to insertion of noise. In order to recover the original image, the noise should be removed resulting as the concept of Image filtering. Following picture is an example of noisy picture and its denoised version after filtering.



Image affected by noise



Recovered image

## Different types of noises

There are several noises that may degrade the quality of an image

- Amplifier noise (Gaussian noise)
- Salt-and-pepper noise
- Poisson noise
- Quantization noise (uniform noise)

In one section of our proposed work we have considered the effect of various noise and we have proposed a method to denoise the noisy image using Gaussian filter. The proposed work also considers the enhancement of the image using other filtering methods. In the second section we have proposed a method for the text image enhancement.

## II. Document Image Analysis

The objective of Document Image analysis is to recognize the text & graphics components in image of documents & to extract intended information from them. Two categories of document image analysis can be defined.

### A. Text Processing

Deals with the textual components of a document image & its task are;

- Determining the skew (any tilt at which the document may have been scanned in the computer).
- Finding columns, paragraphs, textual lines, words, recognizing the text (Possibly its attributes such as size, font etc) by OCR

### B. Graphical processing

Deals with the non-textual elements (tables, lines, images, symbols, delimiters, company logo etc) Pictures are also included in this category; they are different from graphics in that they are often photographically or artistically generated.

## III. Related Work

[Golam Moktader Daiyan et al. (2012)] proposed a high performance decision based median filter is for removal of salt and pepper in image. This algorithm initially detects noise pixels iteratively through several phases and replaces the noisy pixels with median value. Detection of noise is done by expanding the mask until  $7 \times 7$  to maintain local information extraction. Moreover, the processing pixel is replaced by last processed pixel if the algorithm fails to detect noise free pixel at  $7 \times 7$ .

[Zhu Youlian et al. (2013)] proposed a new median filtering algorithm because the time complexity of the conventional median filtering algorithm was not desirable although it had good noise reducing effects. It is basically a combination of average filtering and median filtering algorithms. The algorithm uses the correlation of the image to process the features of the filtering mask over the image. It can adaptively resize the mask according to noise levels of the mask. The statistical histogram method was also introduced in the searching process of the median value. The complexity of the algorithm was decreased resulting in the effective noise reduction

[Vivek Chandra et al. (2013)] proposed an algorithm based on adaptive and unsymmetric trimmed median filter for restoration of gray-scale as well as color images which are highly corrupted by salt and pepper noise. The proposed algorithm replaces the noisy pixel by a value which is either a mean or a median of all other non-noisy pixels in the selected window. In this algorithm window size is selected.

## IV. Proposed Formulation

For the purposes of image analysis and pattern recognition there is always a need to transform an image into another better represented form. During the past five decades image-processing techniques have been developed tremendously and mathematical morphology in particular has been continuously developing because it is receiving a great deal of attention because it provides a quantitative description of geometric structure and shape and also a mathematical description of algebra, topology, probability, and integral geometry. It is mathematical in the sense that the analysis is based on set theory, topology, lattice algebra, function, and so on.

## A. Document Processing

Processing of document to extract their content in an automated fashion is essential task in all types of organizations for varied applications. Any document under processing is subjected to the following steps as:

- 1) The Pre-Processing Stage that enhances the quality of the input image & locate the data of interest.
- 2) The feature extraction stage that captures the distinctive characteristics of the document under processing.
- 3) The classification stage that identifies the document; groups the according to certain classes & helps in their efficient recognition.

## B. Pre-Processing

(Also known as Pixel-level processing or low-level processing) is done on the captured image to prepare it for further analysis. Such processing includes: Thresholding to reduce a grayscale or color image to a binary image, reduction of noise to reduce extraneous data, segmentation to separate various components in the image, and, finally, thinning or boundary detection to enable

easier subsequent detection of pertinent features and objects of interest.

## C. Image Acquisition

Acquire/obtain the image of document in color, gray level or binary format.

## D. Binarization

Converts the acquired image to binary format, the objective of binarization is to automatically choose a threshold that separates the foreground and background information. Selection of a good threshold is often a trial and error process. A grey level of 128 is set as threshold. This becomes particularly difficult in cases where the contrast between text pixels and background is low (for example, text printed on a gray background).

## E. Noise reduction

The data extraction procedure often requires binarizing the images, which discard most of the noise & replace the pixel in the image, character & the pixel in the background with binary 0 & 1 respectively. After binarization, document images are usually filtered to reduce noise. For documents, more specific filters can be designed to take advantage of the known characteristics of the text and graph components. A document to be scanned can itself be contaminated with dust or spots etc which constitute noise. Scanning itself can introduce some amount of noise. Noise is also due to the degeneration, ageing, photocopying or during data capture. In order to make it suitable for further processing, a scanned document image is to be freed from any existing noise. This can be achieved by a method known as image enhancement-this means improvement of the image being viewed by the machine or human. It includes contrast adjustment, noise suppression & many others. Smoothing operations in document images are used for blurring and for noise reduction. Blurring is used in preprocessing steps such as removal of small details from an image. In binary (black and white) document images, smoothing operations are used to reduce the noise or to straighten the edges of the characters, for example, to fill the small gaps or to remove the small bumps in the edges (contours) of the characters. Smoothing and noise removal can be done by filtering. Filtering is

a neighborhood operation, in which the value of any given pixel in the output image is determined by applying some algorithm to the values of the pixels in the neighborhood of the corresponding input pixel. Various methods are applied to reduce noise. The most important reason to reduce noise is to obtain easy way of recognition of documents.

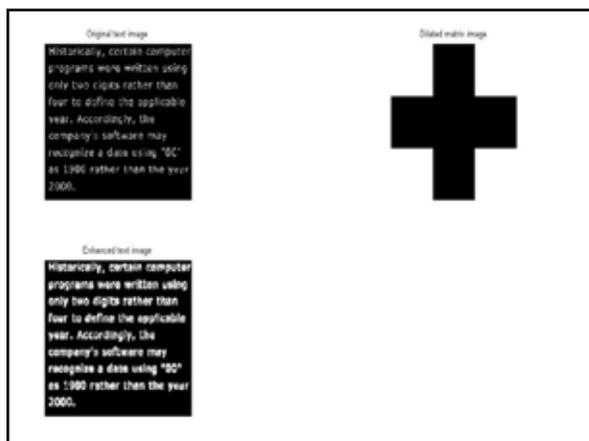
**V. Simulation Results**



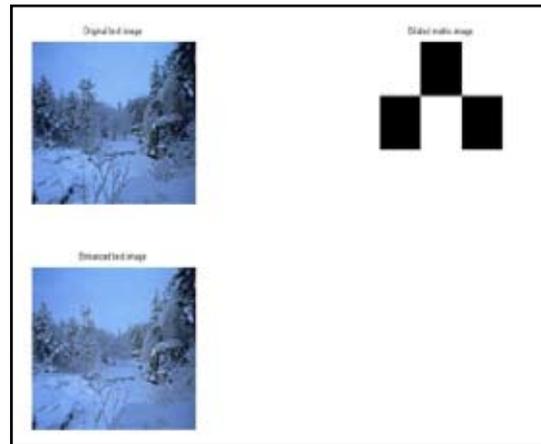
Image effected by noise



Filtered Image



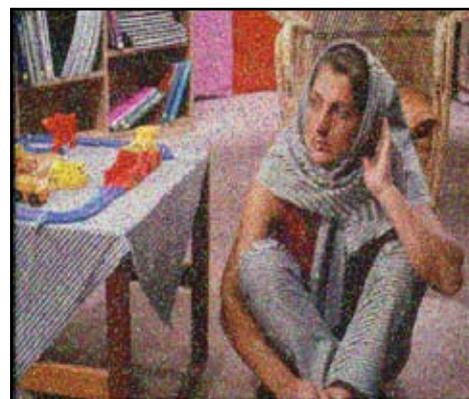
Enhancement of Text image using Dilated matrix method



Enhancement of Image using dilated matrix method



Original image



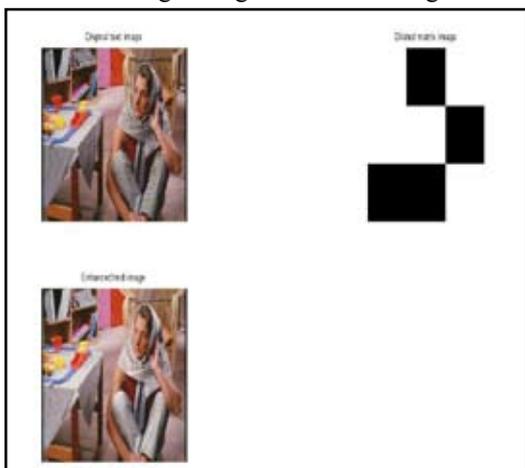
Noisy Image



Dull Image Quality because of noise



Enhanced Image using Bilateral filtering method



Enhancement of Image using dilated filtering matrix method

Table 1 : Encoded Simulation Time

Sr.No.	NAME	FORMAT	Processing time(in sec)
1.	Image1	PNG	32.71321
2	Image2	JPEG	22.4210
3	Image3	JPEG	45.5600
4	Image4	JPEG	18.3480
5	Image5	JPEG	25.7980
6	Image6	JPEG	41.3210
7	Image7	BMP	30.4350
8	Image8	JPEG	29.7711
9	Image9	JPEG	51.6340
10	Image10	JPEG	24.1287

**Conclusion And Future Scope**

Image filtering is the process of eliminating or reducing the noise from a noisy image with an aim to produce a filtered image that is closed to the original image i.e. the ground truth image. The processing of documents for the purpose of discovering knowledge from them in an automated fashion is a challenging task and hence an open issue for the research community. In this article we provide brief summary of basic building blocks that comprise of document image processing system which modifies pictures to improve them (enhancement, restoration), extract information

(analysis, recognition), and change their structure (composition, image editing). Today information technology has proved that there is a need to store, query, search and retrieve large amount of electronic information efficiently and accurately. So document image processing is very challenging field of research with the continuous growth of interest and increasing security requirements for the development of the modern society. Sequences of data preprocessing operations are normally applied to the images of the documents in order to put them in a suitable format ready for information extraction.

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