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Remove Noise and Reduce Blurry Effect From Degraded Document Images Using MATLAB Algorithm

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Abstract— Digital images are subjected to blurring due to many hardware limitations such as atmospheric disturbance, device noise and poor focus quality. In order to reveal the detailed information carried in the digital image, image de-blurring or restoration is necessary. Image de-blurring have wide applications, from consumer photography, e.g., remove motion blur due to camera shake, to radar imaging and tomography, e.g., remove the effect of imaging system response. This research is aimed to provide a basic knowledge of image degradation and restoration process. Offline handwriting recognition approaches proceed by segmenting characters into smaller pieces which are recognized separately. The recognition result of a word is then the composition of the individually recognized parts. Inspired by results in cognitive psychology, researchers have begun to focus on holistic word recognition approaches. Here we present a holistic word recognition approach for degraded documents, which is motivated by the fact that for severely degraded documents a segmentation of words into characters will produce very poor results. The quality of the original documents does not allow us to recognize them with high accuracy - our goal here is to produce transcriptions that will allow successful retrieval of images, which has been shown to be feasible even in such noisy environments. We believe that this is the first systematic approach to recognizing words in historical manuscripts with extensive experiments. Our experiment is to clear the degraded documents using some filter approach. We will use wiener filter for removing noise partials from different images using wiener filter algorithm.

Keywords— Degraded documents, noise, de-noising, Wiener filter algorithm, Mean Square Error, PSNR.

I. INTRODUCTION

FILTERS

There are a number of filters used in image processing for adding and removing noise from images like photographs, hand-written images, scanned images etc. Filters used in image processing are Prewitt, Sobel, Roberts, canny and wiener filter. We choose wiener filter to clear the de-graded documents scanned images, Wiener filter is itself an algorithm for clearing scanned documents, and rest all filters are used for edge detection.

WIENER FILTER

Wiener filters are a class of optimum linear filters which involve linear estimation of a desired signal sequence from another related sequence. In the statistical approach to the solution of the linear filtering problem, we assume the availability of certain statistical parameters (e.g. mean and correlation functions) of the useful signal and unwanted additive noise. The problem is to design a linear filter with the noisy data as input and the requirement of minimizing the effect of the noise at the filter output according to some statistical criterion. A useful approach to this filter-optimization problem is to minimize the mean-square value of the error signal that

is defined as the difference between some desired response and the actual filter output. For stationary inputs, the resulting solution is commonly known as the Weiner filter. Its main purpose is to reduce the amount of noise present in a signal by comparison with an estimation of the desired noiseless signal.

DEGRADED IMAGES

Degradation in scanned document images result from poor quality of paper, the printing process, ink blot and fading, document aging, extraneous marks, noise from scanning, etc. The goal of document restoration is to remove some of these artifacts and recover an image that is close to what one would obtain under ideal printing and imaging conditions. The ability to restore a degraded document image to its ideal condition would be highly useful in a variety of fields such as document recognition, search and retrieval, historic document analysis, law enforcement, etc. The emergence of large collections of scanned books in digital libraries has introduced an imminent need for such restorations that will aid their recognition or ability to search. Images with certain known noise models can be restored using traditional image restoration techniques such as Median filtering, Weiner filtering, etc.

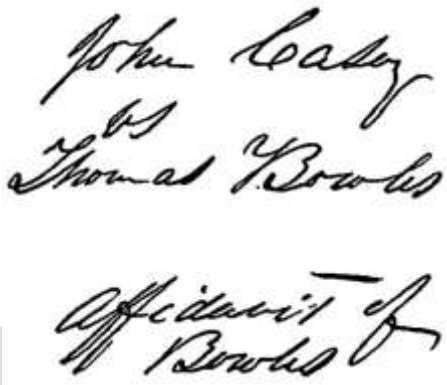


Figure 1: Degraded document (1)

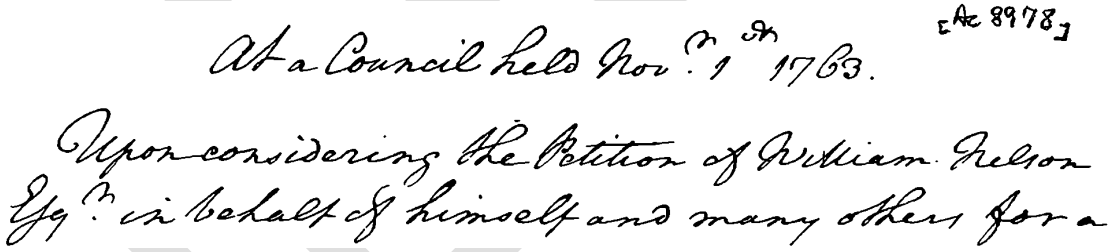


Figure 2: Degraded document (2)

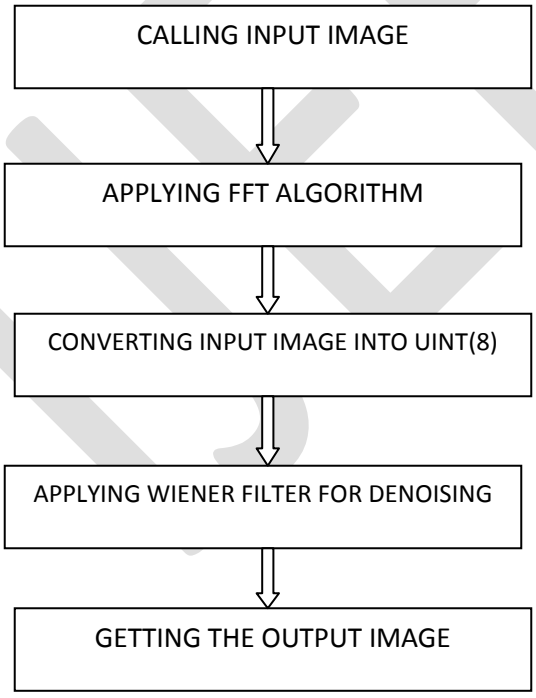
However, in practice, degradations arising from phenomena such as document aging or ink bleeding cannot be described using popular image noise models. Document processing algorithms improve upon the generic methods by incorporating document specific degradation models and text specific content models. Approaches that deal with highly degraded documents take a more focused approach by modeling specific types of degradations. For instance, ink-bleeding or backside reflection is one of the main reasons for degradation of historic handwritten documents. In this paper, we approach document restoration in a different way, and useful setting. We consider the problem of restoration of a degraded 'collection of documents' such as those from a single book. Such a collection of documents, arising from the same source, is often highly homogeneous in the script, font and other typesetting parameters. The availability of such a uniform collection of documents for learning allows us to:

- To reduce the noise from the scanned de-graded document images area by using wiener filter algorithm degraded images.
- To reduce Mean Square Error and calculate Peak Signal to Noise Ratio.
- To calculate execution time for our final implemented code.

II. RELATED WORK

Srinivasa G. Narasimhan and Shree K. Nayar [1] et. al. stated that the images of outdoor scenes captured in bad weather often suffer from poor contrast. Under bad weather conditions, the light reaching a camera is severely scattered by the atmosphere and the resulting decay in contrast varies across the scene and is exponential in the depths of scene points. Deepak, Vikas Mittal [2] designed speech recognition system using cross-correlation and FIR Wiener Filter. The algorithm is designed to ask users to record the words three times. The first and second recorded words are different words which will be used as the input signals. The third recorded word is the same word as one of the first two recorded words. The recorded signals corresponding to these words are then used by the program based on cross-correlation and FIR Wiener Filter to perform speech recognition. Bolan Su, Shijian Lu, and Chew Lim Tan [3] et. al. concluded that Segmentation of text from badly degraded document images in a very challenging task due to the high inter/intravariation between the document background and the foreground text of different document images. He proposes a novel document image binarization technique that addresses these issues by using adaptive image contrast. The adaptive image contrast is a combination of the local image contrast and the local image gradient that is tolerant to text and background variation which are caused by different types of document degradations. The proposed methodology for efficient filtering of historical and degraded document images is illustrated in Fig. 3. It consists of many different steps. At the first step, at the run time GUI will execute and preprocessing based on Wiener filtering is applied. At the next step, several binarization results are combined in order to produce a binary (b/w) image taking into account the agreement in the majority of binarization methodologies. The work related to our work done so far is as, Niranjan Damera-Venkata, Thomas D. Kite, Wilson S. Geisler, Brian L. Evans and Alan C. Bovik [4] proposed model a for degraded image as an original image that has been subject to linear frequency distortion and additive noise. he develop a distortion measure of the effect of frequency distortion, and a noise quality measure of the effect of additive noise. Mohammed M. Siddeq Dr. Sadar Pirkhider Yaba [5] et. al. stated an algorithm for image de-nosing based on two level discrete wavelet transform and Wiener filter. At first The DWT transform noisy image into sub-bands, consist of low-frequency and high-frequencies and then estimate noise power for each of the sub-band. The noise power is computed through two important computations, compute square of variance for each sub-band then compute the mean of the variance.

FLOW CHART



At the next step, the edge information of the grey level image is combined with the binary result of the previous step. From all edge pixels, only those are selected that probably belong to text areas according to a criterion, number of pixels in output image and input

image is calculated. Smoothing algorithm is then applied in order to fill text areas in the edge map. Finally, different parameters are calculated using different formulas.

EVALUATION MEASURES

I Size of I/O image. By calculating the row and column pixels, it is used to find the total size of original and restored image.

II MSE is **Mean Square Error**, f (i,j) is pixel value of output image, F(i,j) is pixel value of input image. Given by Formula:
MSE= ((no_pixels_in_output_image - no_pixels_in_input_image).^2)./((Size_Of_Image).^2)

III PSNR (peak signal to noise ratio) is used to measure the quality of restored image compared to the original image. Larger is the value, better will be the quality of image. It is calculated using equation as follow:
PSNR=20 log10(255 / MSE)

where MSE defined in II refers to mean square error.
The quality of the image is higher if the PSNR value of the image is high. Since PSNR is inversely proportional to MSE value of the image, the higher the PSNR value is, the lower the MSE value will be. Therefore the better the image quality is the lower the MSE value will be.

IV Time calculation: - To use MATLAB command CLOCK to calculate time for our code to be executed, CLOCK is inbuilt command to show the real time, we use this command twice to calculate time consuming parameter.

III. RESULTS AND DISCUSSION

In proposed algorithm, are used to provide more clarity than in previous work. In this, results of all the intermediate steps of the proposed methods are highlighted. Implementation is done on MATLAB Experimental results of intermediate steps show the efficiency of the proposed approach. Results includes following steps:

Figure 3: Degraded document

The input image for de-graded document is taken from IEEE data set. Wiener filter is applied on the input image to remove its blurry effects. The output of the wiener filter is shown below.

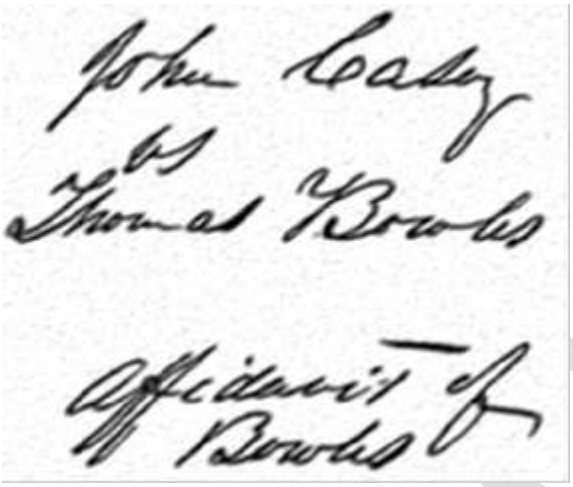


Figure 4: Restored image

The restored image after applying wiener filter is given above, wiener filter clears the input image by removing the homogenous noise.

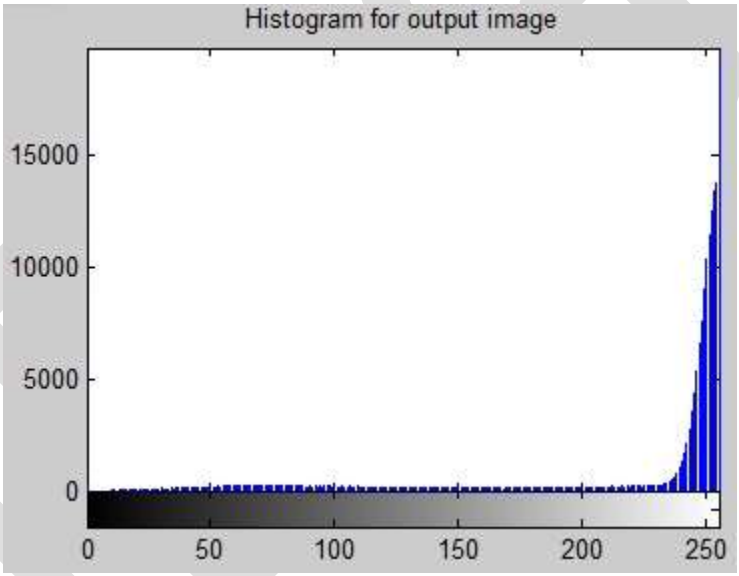


Figure 5: Histogram for input image

In the above figure graphical representation of input image is shown. A *histogram* is a display of statistical information that uses rectangles to show the frequency of data items in successive numerical intervals of equal size. In the most common form of *histogram*, the independent variable is plotted along the horizontal axis and the dependent variable is plotted along the vertical axis.

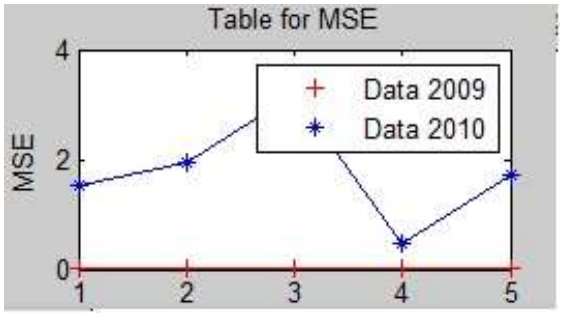


Figure 6: Graph for Mean Square Error

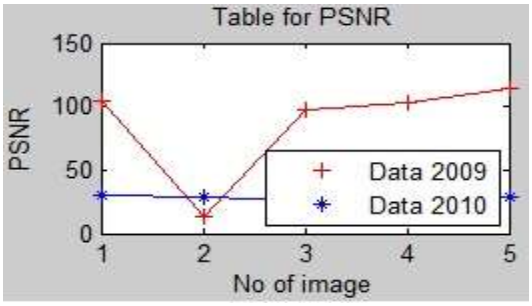


Figure 7: Graph for PSNR

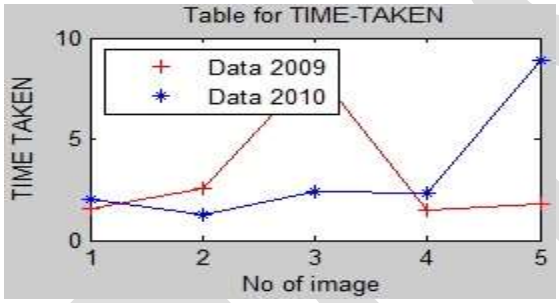


Figure 8: Graph for Time-Taken

Different graphs for various values calculated are shown above. MSE, PSNR and Time Taken are calculated and shown in the form of graphs.

S.NO.	NO.OF PIXELS OF I/P IMAGES	NO. OF PIXELS OF O/P IMAGES	SIZE OF I/O IMAGES	MSE	PSNR	TIME TAKEN(*10-3)
1	528721	560153	565820	0.0031	49.1715	1.919000
2	1283804	1317755	1320370	0.0066117	55.8623	2.964000
3	318176	332435	332478	0.0018	51.4189	1.373000
4	476790	501494	502095	0.0024	50.2258	1.747000
5	650976	673892	674866	0.0012	53.4470	2.028000

Table 1: Evaluation parameters

IV. CONCLUSION

This research work is based on removing noise from degraded images (handwritten documents). Our implemented algorithm is Wiener Filter Algorithm. This method includes histogram equalization and de-blurring. This paper develops a system which is used to clear the degraded documents. We formulate number of parameters for our output and input images. We used to reduce the noise in homogenous areas, implement wiener filter algorithm for removing the blurry effect from degraded images, Evaluating various parameters for studying percentage of improvement and calculate execution time for taking our final output from our code. We reduce the amount of computation by not including other filters to our algorithm from which the execution time for our code gets very small.

V. FUTURE SCOPE

To develop an image technique that will become efficient for de-noising degraded images, blur effects and other noisy images. In this research work we took number of images for our thesis work, we calculate various parameters like MSE, PSNR and Time to implement our design. One could use some other technique to implement same design with reduced time and could also calculate some other parameters and some improved GUI design.

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