A Review on different Image binarization Techniques for Degraded Documents

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Abstract: In current time digitization of various old written scripts digitization is taking place. This is because there cost of maintance is low as compared to manual documents. But the problem in the digitization of the documents is the degradation due to the noises in the documents. These degradation in due to various water marks, yellowish of the papers or even inking of the documents. Various researchers are putting their efforts to transform the degraded documents to denoised documents and successfully convert the paper document to the digital format. These documents can belongs to various types of Indian and Persian scripts. Each type of script documents are having different ways of writing and also has their own levels of complexities.

Keywords: Noises, Degraded, denoised.

I. INTRODUCTION

1.1 Noise in Images

In this section various types of noise corrupting an image signal are studied. The sources of noise are discussed and mathematical models for the different types of noise are presented.

1.2 Sources of Noise

During acquisition, transmission, storage and retrieval processes an image signal gets contaminated with noise. Acquisition noise is usually Additive White Gaussian Noise (AWGN) with very low variance. In many engineering applications, the acquisition noise is quite negligible. It is mainly due to very high quality sensors. In some applications like remote sensing, biomedical instrumentation, etc., the acquisition noise may be high enough. But in such a system, it is basically due to the fact that the image acquisition system itself comprises of a transmission channel.

1.3 Binarization Technique

There are various techniques that are followed for binarization of the image. Pre and Post processing on the Binarize image can be done there on.

1.3.1 Otsu's Method

This technique is based on a very simple idea that involves evaluating the threshold which minimizes the weighted variance within class. This results in maximization of the variance of between-class. It works directly on the grey level plot of histogram, so the method evaluates faster once the histogram is computed. Otsu's method is used to automatically perform image thresholding based on clustering. It reduces the gray-level picture to a binary picture. The algorithm assumes that the image to be threshold contains two types of pixels or bi-modal histogram (i.e. foreground and background) then evaluates the optimal threshold distinguishing those two classes so that their combined intra-class variance is minimal.

1.3.2 Niblack's Method

Niblack's method implements a sliding rectangular window over a grayscale image to calculate threshold for each pixel.[2] The threshold calculation involves evaluation of the local mean μ and the standard deviation of each of the pixel present inside the window and is determined by the following equation:

$$t_{niblack} = m + k * s$$

$$t_{niblack} = m + k\sqrt{\frac{1}{NP}\sum(p_i - m)^2} = m + k\sqrt{B} \qquad \text{(i)}$$

where NP denotes the number of pixels present in the grayscale image, m is the average value of the value of the pixels pi, k = −0.2 , by assumption. The benefit of Niblack is that it accurately identifies the text regions as foreground always but produces a huge amount of binarization noise in background regions which is the non-text region.

1.3.3 Thresholding

Thresholding is used to extract an object from its background by assigning an intensity value T(threshold) for each pixel such that each pixel is either classified as an object point or a background point In general, T = T[x, y, f(x, y), P(x, y)]

If T is a function of f(x,y) only then it is called global thresholding

If T is a function of both f(x,y) and local properties p(x,y),then it is called local thresholding

If T depends on the coordinates (x,y), it is said to have dynamic/adaptive thresholding Thresholds can be chosen in one of the following two ways:

1.3.4 Fixed Threshold

In fixed (or global) thresholding, the threshold value is held constant throughout the image. A single threshold value is determined and each pixel is treated individually. The binarization is done using following formula:

$b(x, y) = 0 f(x, y) < T$ (i)

$b(x, y) = 1 f(x, y) > T$ (ii)

It assumes that high-intensity pixels are of interest, and low intensity pixels are not of that much interest.

II. LITERATURE SURVEY

P. Thamilselvan et. al(2018): Digital images assume a vital part both in day by day life applications, for example, satellite TV, computed tomography, magnetic resonance imaging and additionally in ranges of research and innovation, for example, cosmology and geographical information systems. An expansive segment of computerized image preparing incorporates image restoration. Image restoration is a technique for removal or decrease of corruption that are caused amid the image catching. Corruption originates from obscuring as well as commotion due to the electronic and photometric sources. Obscuring is the type of data transfer capacity decrease of images caused by flawed image development process, for example, relative movement amongst camera and unique scene or by an optical framework that is out of core interest. Image Denoising is an important pre-processing task before further processing of the image like segmentation, feature extraction, texture analysis, etc. which removes the noise while retaining the edges and other detailed features as much as possible. This noise gets introduced during acquisition, transmission & reception and storage & retrieval processes. This paper presents a novel pre-processing algorithm which is named as Profuse Clustering Technique (PCT) based on the super pixel clustering. K-Means clustering, Simple Linear Iterative Clustering, Fusing Optimization algorithms are involved in this proposed Profuse Clustering Technique and is further used for denoising the Lung Cancer images to get the more accurate result in the decision making process.

Aravind B. N et. al(2015): Image is one of the most important part of multimedia that is used in several areas from simple photography to medical and satellite imaging. In each field its usage and requirements are very different. So, an image required to be clean and free from artifacts to convey better information. But, acquisition is always associated with some sort of degradation that may be due to atmospheric conditions, camera sensors and/or lighting conditions. In this paper they have considering the degradation only due to noise and in specific additive Gaussian noise. Here, we are proposing to use a dual step approach for denoising. In the first step it uses stationary wavelet based denoising and in continuation to second step, a spatial domain method, Non-local means, is used to remove the artifacts. The simulation is done on both real and synthetic images and it shows an improvement over existing methods. Image is one of the most important part of multi-media that is used in several areas from simple photography to medical and satellite imaging. In each field its usage and requirements are very different. So, an image required to be clean and free from artifacts to convey better information. But, acquisition is always associated with some sort of degradation that may be due to atmospheric conditions, camera sensors and/or lighting conditions. In this paper we are considering the degradation only due to noise and in specific additive Gaussian noise. Here to use a dual step approach for denoising. In the first step it uses stationary wavelet based denoising and in continuation to second step, a spatial domain method, Nonlocal means, is used to remove the artifacts. The simulation is done on both real and synthetic images and it shows an improvement over existing methods.

Xin Sun et. al(2017): In the process of denoising color images, it is very important to enhance the edge and texture information of the images. Image quality can usually be improved by eliminating noise and enhancing contrast. Based on the adaptive wavelet threshold shrinkage algorithm and considering structural characteristics on the basis of color image denoising, this paper describes a method that further enhances the edge and texture details of the image using guided filtering. The use of guided filtering allows edge details that cannot be discriminated in grayscale images to be preserved. The noisy image is decomposed into low-frequency and high frequency subbands using discrete wavelets, and the contraction function of threshold shrinkage is selected according to the energy in the vicinity of the wavelet coefficients. Finally, the edge and texture information of the denoised color image are enhanced by guided filtering. When the guiding image is the original noiseless image itself, the guided filter can be used as a smoothing operator for preserving edges, resulting in a better effect than bilateral filtering. The proposed method is compared with the adaptive wavelet threshold shrinkage denoising algorithm and the bilateral filtering algorithm. Experimental results show that the proposed method achieves superior color image denoising compared to these conventional techniques.

Yifeng Cheng et. al(016): with people's pursuit of high quality image, image denoising has always been a popular research. The traditional image Denoising method is based on wavelet transform threshold. The Denoising effect is good, but is prone to lose the image structure and texture information. Based on the deficiency of the traditional

Denoising method, this paper put forward a method that is based on morphological component analysis to decomposed an image into texture and structure. The part of texture uses all phase biorthogonal transform dictionary sparse representation to denoise. The part of the structure uses Block-Matching and 3-D Filtering algorithm to denoise. Finally, combined with the two parts to get the final Denoising image. Experimental result show that compared with traditional wavelet threshold Denoising, this paper's algorithm can better retain the image details and structure information, it can get better Denoising performance with PSNR.

Gabriela Ghimpe¸teanu et. al(2016): an image decomposition model that provides a novel framework for image denoising. The model computes the components of the image to be processed in a moving frame that encodes its local geometry (directions of gradients and level lines). Then, the strategy they develop is to denoise the components of the image in the moving frame in order to preserve its local geometry, which would have been more affected if processing the image directly. Experiments on a whole image database tested with several denoising methods show that this framework can provide better results than denoising the image directly, both in terms of Peak signal-to-noise ratio and Structural similarity index metrics.

III. COMPARATIVE ANALYSIS

AUTHOR,YEAR	TECHNIQUE	ADVANTAGES	DISADVANTAGES
P. Thamilselvan	Otsu's Based	In Otsu's based thresholding the optimum threshold is identified from the Binarize image	this technique is followed for single threshold based. So if there is noise in the image then it will not considers this technique
Aravind B. N	Niblack's Based	In Niblack based technique Niblack mask is prepared for identify the adaptive thresholding	White Gaussian noise identification will be difficult.
Xin Sun	Thresholding Based	it is based on identifying the single threshold value for whole image rather than the multiple thresholds	It is not suitable for those image which has noise in the image or background is having some fade color disturbances.
Yifeng cheng,zengli Liu	Fixed Threshold Based	this Fixed threshold is based on fixing the threshold value of the any type of the image.	this technique can be ok of those images which is of single time and having similar resolution.

IV. CONCLUSION

Form the above it is clear that various techniques has produced the results upto 90%. Various researchers has worked on English scripts documents having different levels of complexities. In proposed way there is a challenge for identification of type of noise and then while in preprocessing phase the noise has to be removed and the proper document which can be understandable to the computer can be generated. This way various binarization techniques had been already working. Each technique has their own set of complexities and problems. So there is large scope for further enhancing the work for further increasing the success rate of the binarization perspectives.

V. FUTURE WORK

Current researcher has put the researches on binarization of the degraded documents. These documents are belonging to various Indian and foreign scripts. Various type of techniques has their own set of success rate. In future the work can be done on Devanagari script documents using binarization technique based on Niblack.

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