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Phase Based Binarization with Gaussian Summation Model for Ancient Documents

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Abstract: Image binarization is the main task in character segmentation. Here we are applying Gaussian sum model for image binarization concept. Here, we are calculating Gaussian sum distribution of image pixels that can estimate pixel changes effectively compared with state-of-art criteria like adaptive contrast map. In proposed criteria, we are applying prewitt edge detector and after wards we are applying independent component analysis based Gaussian sum model, so we are estimating text stroke edge pixels efficiently. We compare our methodology with state-of-art criteria like image binarization based on text stroke edge width estimation and contrast map construction. We prove that our methodology yields better results based on image metric values

KEYWORDS*:* image binariztion, Gaussian sum model, stroke edge pixels, contrast map construction

I.INTRODUCTION

Document image binarization (or thresholding) is the process that segments the grayscale or color document image into text and background by removing any existing degradations (such as bleed-through, large ink stains, non-uniform illumination and faint characters).To analyze the document, its image is binarized before processing it. It is nothing but segmenting the document background & the foreground text. For the confirmation of document image processing task an accurate document image binarization technique is a must.

Moreover, bleed through degradation is observed in historical documents by variety of imaging outputs. For most of the existing techniques many kinds of document degradations, it is still an unsolved problem of degraded document image binarization due to the document thresholding error. A document image binarization technique presented in this paper is an extended version of an existing local maximum minimum method.

Adaptive binarization methods play a central role in document image processing. In this work, an adaptive and parameter less generalization of Otsu's method is presented. The adaptiveness is obtained by combining grid-based modeling and the estimated background map. The parameter less behavior is achieved by automaticallyestimating the document parameters, such as the average stroke width and the average line height.

A document image analysis system includes several image-processing tasks, beginning with digitization of the document and ending with character recognition and natural language processing. The thresholding step can affect quite critically the performance of successive steps such as classification of the document into text objects, and the correctness of the optical character recognition OCR. Improperthresholding causes blotches, streaks, erasures on the document confounding segmentation, and recognition tasks. The merges, fractures, and other deformations in the character shapes as a consequence of incorrect thresholding are the main reasons of OCR performance deterioration. In NDT applications, the thresholding is again often the first critical step in a series of processing operations such as morphological filtering, measurement, and statistical assessment. In contrast to document images, NDT images can derive from various modalities, with differing application goals.

In degraded historical images, faint characters and bleed-through have quite similar characteristics. Thus, current methods are usually robust against oneof the aforementioned degradation. In we introduced a binarization method capable of achieving high performance in many different noise types. The main idea is to initially erase all the noisy components (false alarms) even if faint character parts are also removed. Then, perform binarization of high Recall such as Nib lack and perform combination at connected component level. In this way, noise is erased; the faint characters are completely detected, while the noise levels are very low. Compared with the image gradient, the image

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contrast evaluated by the localmaximum and minimum has a nice property that it is more tolerant to the uneven illumination and other types of document degradation such as smear.
The rest of this paper is organized as follows. Section II first reviews the current state-of-the-art binarizationtechniques.Our proposed document binarization technique is described in Section III. Then experimental results are reported in Section IV to demonstrate the superior performance of our framework. Finally, conclusions are presented in Section V.

II.EXISTING METHOD

Binarization is performed either globally or locally. For the global methods (global thresholding), asingle calculated threshold value is used to classify imagepixels into object or background classeswhile forthe local methods (adaptive thresholding), local area information guides the threshold value for each pixel. Most of the image binarization algorithms rely on statistical methods, without taking into account the special natureof document images. However, some document-directed binarization techniques have been developed. For document image binarization, global thresholding methods are not sufficient since document imagesusually are degraded and have poor quality includingshadows, non-uniform illumination, low contrast, largesignal-dependent noise, smear and strains. Concerning localmethods, a goal-directed performance evaluation of elevenpopular local thresholding algorithms has been performedfor map images. According to this evaluation, for aslowly changing background, local algorithms work well.However, with a complex background, it appeared that nonecan be tuned up with a set of operating parameters good forall images. Furthermore, local algorithms were dependenton stroke width.Given a historical document image, the proposed technique first constructs a contrast image and then detects the high contrast image pixels which usually lie around the text stroke boundary. The document text is then segmented by using local thresholds that are estimated from the detected high contrast pixels within a local neighborhood window.
The thresholding of document images is still an unsolved problem due to different types of document degradations, such as uneven illumination, image contrast variation, bleeding-through, and smear. The latest Document Image Binarization Contest (DIBCO) held under the frame-work of the International Conference on Document Analysis and Recognition (ICDAR) 2009 and Handwritten Document Image Binarization Competition(H-DIBCO)2010 held under the framework of International Conference on Frontiers in Handwriting Recognition (ICFHR)2010 also shows recent efforts on this issue.
In this criterion, canny edge detector was applied and after wards phase congruency covariance & Local weighted mean phase angle are calculated.So text stroke edge pixels efficiently (estimate minute edge difference also which can improve accuracy) re- estimated. Inpreprocessing phase median filter was applied for noisy image which works better for noise ratio up to 80- 90 percent. A criterion for calculating mean phase angle and phase congruency variance (which helps in estimate of angular changes of pixel with neighborhood) this can estimate pixel changes effectively compared with adaptive contrast map. Here binary connected components are estimated based on that we are taking maximum values, then based on gray threshold of binary connected image, we are estimating binarised output. But the text will not be accurate and it will not work for different styles, complexity is very high.

III. PROPOSED MITIGATION SCHEME

In the proposed framework we used the Hough transform to isolate features of a particular shape within an image. Because it requires that the desired features be specified in some parametric form, the classical Hough transform is most commonly used for the detection of regular curves such as lines, circles, ellipses, *etc. A* generalized Hough transform can be employed in applications where a simple analytic description of a feature(s) is not possible. Due to the computational complexity of the generalized Hough algorithm, we restrict the main focus to the classical Hough transform. Despite its domain restrictions, the classical Hough transform (hereafter referred to without the *classical* prefix) retains many applications; as most manufactured parts (and many anatomical parts investigated in medical imagery) contain feature boundaries which can be described by regular curves.
The main advantage of the Hough transform technique is that it is tolerant of gaps in feature boundary descriptions and is relatively unaffected by image noise. In proposed criteria, we are applying prewitt operator and after wards we are calculating phase congruency covariance & Local weighted mean phase angle so we are estimating text stroke edge pixels efficiently(we can estimate minute edge difference also which can improve accuracy)The Prewitt operator is

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used in imageprocessing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function.
At each point in the image, the result of the Prewitt operator is either the corresponding gradient vector or the norm of this vector. The Prewitt operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical directions and is therefore relatively inexpensive in terms of computations. On the other hand, the gradient approximation which it produces is relatively crude, in particular for high frequency variations in the image. Examplesofdynamicallyevolvingtextare chatlinediscussionsornewsgroupdocuments.Thedynamicaltextstreamcanbeseenasatimeseries, andmethodsoftimeseriesprocessingmaybeusedtoextracttheunderlyingcharacteristics.Asapreprocessingstep, the textstreamissplitinto shortwindows,andfrom eachwindowaT-dimensional vectorisformed,whereTis thesizeofthevocabulary;T Is typically several thousands of terms. The i-th element of the vector indicates (some function of) the frequency of the i-th vocabulary term in the window.The high dimensionality of the data is reduced by singular value decomposition, as is often done before applying ICA-type algorithms on the data.Automatically image processing means image segmentation (i.e. dividing an image intodifferent types of regions or classes), recognizing of objects and detecting of edges, etc.by machine. All of these can be done after segmentation of a picture. So image segmentation is the most important image problems. In addition noise removing and noisereduction of pictures always are important in classical image problems. In this paper, we do both segmentation and noise reduction with a probabilistic approach. There are many mathematical and statistical methods for image problems, but this paperargues about GMM as a general Gaussian distribution. The metrics which are calculated is given below

RMSE:
Root mean square error is difference of squares of output an input. Let say x is a 1xN input and y is a 1xN output. Square error is like (y(i) - x(i))^2. Mean square error is 1/N(square error). And its obvious RMSE=sqrt(MSE).
DRD (Distance reciprocal distortion metric):
This measure is based on the reciprocal of distance that is straightforward to calculate distortion measure matches well to subjective evaluation by human visual perception
NRM:
Negative rate metric is based on pixel-wise mismatches between ground truth and prediction. It combines false negative rate and false positive rate into one combine measure.
MPM: Misclassification penalty metric:
The Misclassification penalty metric MPM evaluates the prediction against the Ground Truth (GT) on an object-by object basis. Misclassification pixels are penalized by their distance from the ground truth object's border.
PSNR:
PSNR is most commonly used to measure the quality of reconstruction of lossy compression codec's. The signal in this case is the original data, and the noise is the error introduced by compression. When comparing compression codec's, PSNR is an approximation to human perception of reconstruction quality.

Here we taking degraded document image as test image and then we are applying Hough transform to detect lines in an image .Then we are calculating independent components of an image using ICA methodology.

We are computing Gaussian sum model for an image based on Gaussian distribution of image pixels based on Gaussian sum model we are estimating text stroke edge pixel width and we are segmenting text stroke edges and converting in to binarized image based on text stroke edge width values.

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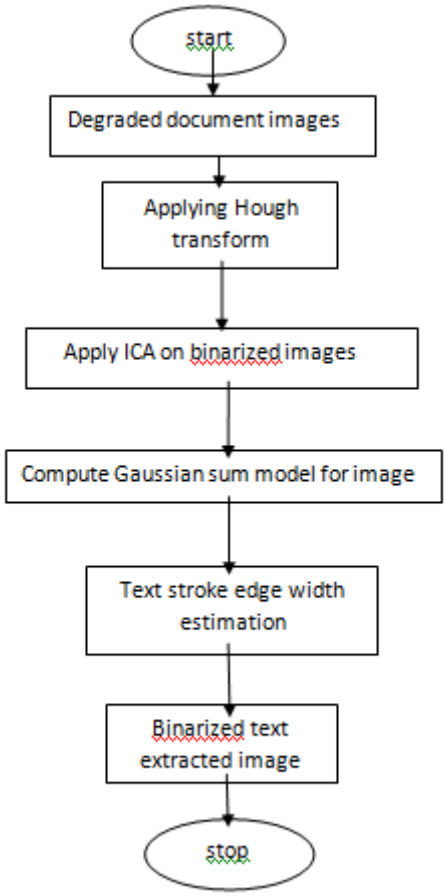

Fig: Flowchart of the proposed system

Recently it has been found out thatICA is a powerful tool for analyzing text document data as well, if the textdocuments are presented in a suitable numerical form.Independent component analysis (ICA) was originally developed for signal processing applications.Recently it has been found out thatICA is a powerful tool for analyzing text document data as well, if the textdocuments are presented in a suitable numerical form.This opens up new possibilities for automatic Analysis of Large textual Data bases: finding the topics of documents and grouping them accordingly.

First approachesof using ICA in thecontext of text dataconsidered the datastatic.In our recent study we concentrated on textdatawhosetopicchanges over time.

One of the powerful attributes of the GSM is its ability to form smoothapproximations to arbitrarily shaped densities. The classical unimodal Gaussian model represents feature distributions bya position (mean vector) and a elliptic shape (covariance matrix) and a vector quantizer (VQ) or nearest neighbor modelrepresents a distribution by a discrete set of characteristic templates.

Then the experimental results shows that the proposed method is very robust and the computational cost is very less compared with the state-of –art of criteria.

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IV.RESULTS

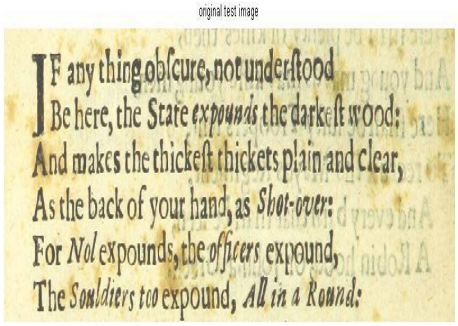

FIG.1: Original input image

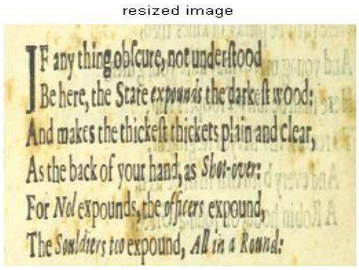

FIG.2: Resized image

FIG.3: Histogram equalized image

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FIG.4: Clahe image

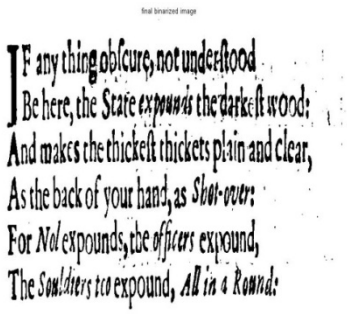

FIG.5: Final image

Proposed	Acc.	nrm	mpm	snr	drd	psnr	rmse
Hand_13	94.29	3.88	2.65	17.86	5.85	16.06	40.11
Hand_12	95.73	2.87	2.56	13.25	4.56	17.86	38.14
Scan_13	97.57	1.75	1.84	16.67	3.89	19.28	35.75
Scan_11	96.85	2.77	2.78	17.87	3.33	20.76	34.75
Extension	Acc.	nrm	mpm	snr	drd	psnr	rmse
Hand_13	95.22	3.89	2.65	9.92	5.58	16.06	40.12
Hand_12	97.83	2.88	2.22	12.25	4.34	18.98	35.23
Scan_13	96.87	1.82	1.32	11.76	3.25	20.05	32.28
Scan_11	97.95	2.89	1.75	10.76	3.21	22.81	33.75

Table: Comparison of metric values for different methods

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V.CONCLUSIONS

This paper presentsa document image binarization technique that is tolerant to variety of document degradation such as uneven illuminationand document smear. The proposed technique is easy &robust;we are calculating Gaussian sum distribution of image pixels that can estimate pixel changes effectively so that only few parameters are involved. Here we used the prewitt edge detector which detects the edges very sharply and ICA which is based on Gaussian sum model. It works for different kinds of degraded document images. It makes use of the local image contrast that is evaluated based on the local maximum and minimum. Theproposed method has been tested on the various datasets. Experiments show that the proposed method outperforms most reported document binarization methods in term of the F-measure, pseudo F-measure, PSNR, NRM, MPM and DRD

REFERNCES

[1]B. Gatos, K. Ntirogiannis, and I. Pratikakis, "ICDAR 2009 document image binarization contest (DIBCO 2009)," in Proc. Int. Conf. Document Anal. Recognit., Jul. 2009, pp. 1375–1382.
[2].I. Pratikakis, B. Gatos, and K.Ntirogiannis,"ICDAR 2011 document image binarization contest (DIBCO 2011)," in Proc. Int. Conf. Document Anal. Recognit., Sep. 2011, pp. 1506–1510.
[3].I. Pratikakis, B. Gatos, and K. Ntirogiannis, "H
-DIBCO 2010 handwritten document image
binarization competition," in Proc. Int. Conf.Frontiers
Handwrit. Recognit., Nov. 2010, pp. 727–732.
[4].S. Lu, B. Su, and C. L. Tan, "Document image
binarization using background estimation and stroke
edges," Int. J. Document Anal. Recognit., vol. 13, no. 4, pp. 303–314, Dec. 2010.
[5].B. Su, S. Lu, and C. L. Tan, "Binarization of
historical handwritten document images using local maximum and minimum filter," in Proc. Int.
Workshop Document Anal. Syst., Jun. 2010, pp. 159–166.
[6]Sezgin and B. Sankur, "Survey over image thresholdingtechniques and quantitative performance evaluation,"Journalof Electronic Imagingvol. 13, no. 1, pp. 146–165, 2004.
[7] N. Otsu, "A threshold selection method from gray levelhistogram,"IEEE Transactions on System, Man, Cybernetics,vol. 19, no. 1, pp. 62–66, January 1978.
[8] Y. Solihin and C. Leedham, "Integral ratio: A new class ofglobal thresholding techniques for handwriting images,"IEEETransactions on Pattern Analysis and Machine Intelligence,vol. 21, no. 8, pp. 761–768, August 1999.
[9] B. Gatos, I. Pratikakis, and S. J. Perantonis, "Adaptive degraded document image binarization,"Pattern Recognitionvol. 39, no. 3, pp. 317–327, March 2006.
[10] I. K. Kim, D. W. Jung, and R. H. Park, "Document imagebinarization based on topographic analysis using a water flowmodel,"Pattern Recognition vol. 35, pp. 141–150, 2002
[11]J. Kittler andJ. Illingworth, ÒOn threshold selection using clustering criteria,Ó IEEE Trans. Syst., Man, Cybern., vol. 15,no. 5.pp. 652Ð655, Sep.ÐOct. 1985.
[12]N. Otsu, ÒA threshold selection method from gray level histogram,Ó IEEETrans. Syst., Man, Cybern., vol. 19, no. 1, pp. 62Ð66, Jan. 1979.
[13]N. Papamarkos and B. Gatos,"A new approach for multithresholdselection," Comput. Vis. Graph. Image Process., vol. 56, no. 5,pp. 357370, 1994.
[14] J. Bernsen, "Dynamic thresholding of gray-level images," in Proc. Int.Conf. Pattern Recognit. Oct. 1986, pp. 1251–1255
[15] L. Eikvil, T. Taxt, and K. Moen, "A fast method for binarizationof document images," in Proc. Int. Conf. Document Anal. Recognit.Sep. 1991, pp. 435–443.
[16] I.-K. Kim, D.-W. Jung, and R.-H. Park, "Document image binarizationbased on topographic analysis using a water flow model," PatternRecognit. vol. 35, no. 1, pp. 265–277, 2002.
[17] J. Parker, C. Jennings, and A. Salkauskas, "Thresholding using anillumination model," in Proc. Int. Conf. Doc. Anal. Recognit.Oct. 1993,pp. 270-273.
[18] J. Sauvola and M. Pietikainen, "Adaptive document image binarization,"Pattern Recognit., vol. 33, no. 2, pp. 225–236, 2000.
[19] W. Niblack, An Introduction toDigital Image ProcessingEnglewoodCliffs, NJ: Prentice-Hall, 1986
[20] J.-D. Yang, Y.-S.Chen, and W.-H. Hsu, "Adaptive thresholding algorithmand its hardwareimplementation," Pattern Recognit. Lett. vol. 15, no. 2, pp. 141–150, 1994.
[21] Y. Liu and S. Srihari, "Document image binarization based on texture features," IEEE Trans. Pattern Anal. Mach. Intell., vol. 19, no. 5,pp. 540
–544, May 1997.
[22] M. Cheriet, J. N. Said, and C. Y. Suen, "A recursive thresholding technique for image segmentation," in Proc. IEEE Trans. Image Process.
, Jun. 1998, pp. 918–921.
[23] B. Gatos, I. Pratikakis, and S. Perantonis, "Adaptive degraded document image binarization," Pattern Recognit., vol. 39, no. 3, pp. 317–327, 2006.
[24] P. Kovesi, "Phase preserving denoising of images," in Proc. Int. Conf.Digital Image Comput., Techn. Appl., 1999.
[25] J. Canny, "A computational approach to edge detection," IEEE Trans.Pattern Anal. Mach. Intell., vol. 8, no. 6, pp. 679–698, Nov. 1986