2. Literature Review

In this section, we describe some selected binarization methods. Otsu‟s method [5] assumes the presence of two distributions (one for the text and another one for the background). It calculates a threshold value in such a way that it maximizes the variance between the two distributions.

Lu's et al [10][13] proposed a binarizatition method mainly based on background estimation. In first step, background of document was estimated via a one-dimensional iterative Gaussian smoothing procedure. After that for accurate binarization of strokes and sub-strokes, L1-norm gradient image was utilized. This method selected among 43 algorithms submitted to the DIBCO'09 competition.

Su et al [10] used local maximum and minimum to build a local contrast image. After that a sliding window was applied across the contrast image to determine local thresholds, where bright pixels shows foreground and dark pixels refer to background pixels. A version of this method ranked one of the two sharing _rst-rank winners among 17 algorithms participated in H-DIBCO'10 contest.

Farrahi Moghaddam et al [10] proposed a multi-scale binarization method in which input document was binarized several times using different scales. Then, these output images were combined to form the _nal output image. After that Historical Document Binarization Based on Phase Information of Images 3 this method has been extended to the Otsu's method with better results, which named as AdOtsu.

3. Phase Based Binarization Model

In this we are going to disscuss Phase based binarization model to improve the visual feature of the text of degraded document.
We have three types of documents Hand written, Machine printed and graphics. Degradation can classify into more categories depending on foreground and background. In foreground degradation can be text in nebulous and weak strokes or sub stroke. Where in background global bleed through, local bleed though, unwanted lines and pattern, alien ink and faded ink[11][13].

3.1 Phase Congruency-Based Feature Maps

Two features of phase congruency [5] are used to preprocess document images: i) the maximum moment of phase congruency covariance (MMPCC), and ii) the locally weighed mean phase angle (LWPMA). The MMPCC is a measure of edges strength which is used as an accurate edge detector. The LWMPA can be used to estimate the structure of foreground text.

3.2 Binarization Model

The final binarized output image is obtained by processing the input image in three steps: preprocessing, main binarization, and post processing. The binarization model is an extended version of the one proposed in our previous work [19]. We have added a diagnosed image, which is another phase-based feature to the binarization model, and achieved 5% improvement, on average.

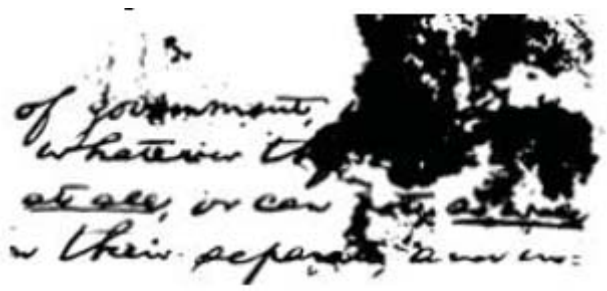

Figure 2: Input image

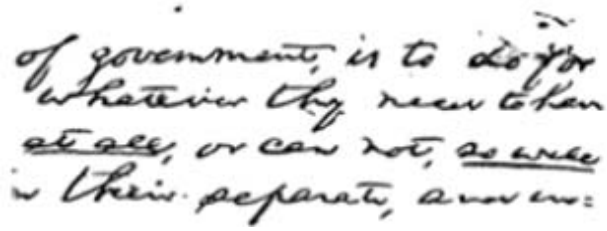

Figure 3: Binarized image

3.2.1 Preprocessing

In the preprocessing step, we use a denoised image instead of the original image to obtain a binarized image in rough form. The image denoising method discussed in section III is applied to preprocess the binarization output

3.2.2 Main Binarization

The next step is the main binarization, which is based on phase congruency features: i) the maximum moment of phase congruency covariance (IM); and ii) the locally weighted mean phase angle (IL). 1) IM: In this, IM is used to separate the background from potential foreground parts[11]. This step performs very well, even in badly degraded documents, where it can reject a majority of badly degraded background pixels by means of a noise modeling method. To achieve this, we set the number of two-dimensional log-Gabor filter scales ρ to 2, and use 10 orientations of two-dimensional log-Gabor filters r.

3.2.3 Post processing

In this step, we apply enhancement processes. First, a bleed through removal process is applied. Then, a Gaussian filter is used to further enhance the binarization output and to separate background from foreground, and an exclusion process is applied, based on a median filter and IM maps, to remove background noise and objects[12]. Finally, a further enhancement process is applied to the denoised image.

Figure 4: Binarization results of an Arabic historical document image: (a) Original image, (b) Otsu‟s, (c) Niblack‟s, (d) Sauvola‟s, (e) NICK and (f) Proposed method.

3.2.4Ground truth Generation tool

A ground truth binary image is produced using the proposed PhaseGT software. The PhaseGT is an application for historical document ground truthing. It uses phase congruency features [8] [9] and a priori knowledge about the characteristics of the input document image to preprocess input document image. Based on the provided information, the PhaseGT will generate a rough binarized image.GT generation is difficult and time consuming task. For this benchmark datasets are required i.e. PHIBD 2012, H-DIBCO 2012.

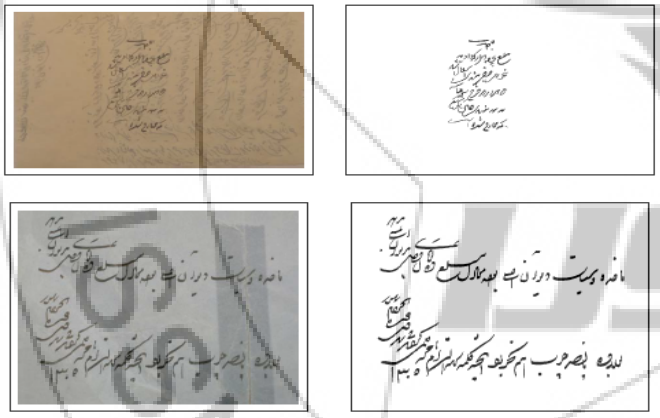

Figure 5: Sample original and ground truth image

4. Conclusion

In this, we have introduced an image binarization method that uses the phase information of the input image, and robust phase-based features extracted from that image are used to build a model for the binarization of ancient manuscripts. Phase-preserving denoising followed by morphological operations are used to preprocess the input image.

Then, two phase congruency features, the maximum moment of phase congruency covariance and the locally weighted mean phase angle, are used to perform the main binarization[1][7]. For post-processing, we have proposed a few steps to filter various types of degradation; in particular, a median filter has been used to reject noise, unwanted lines, and interfering patterns.

We have also proposed a rapid method to determine the type of document image been studied, which will be of great interest. The behavior of ancient handwritten document images and machine-printed images shows differences in terms of binarization. The strokes and sub-strokes of handwritten images require accurate binarization, and the binarization of the interior pixels of the text of machine-printed images needs to be performed with care. Although the proposed binarization method works well on both handwritten and machine-printed documents, better results for both types of documents are achieved, when a priori information about the type of input document is available.

Finally, an efficient ground truthing tool called PhaseGT has been provided for degraded documents [2]. This tool is designed to reduce the manual correction involved in ground truth generation.

In future work, we plan to expand the application of phase-derived features, which ensures the stable behavior of document images, to other cultural heritage fields, such as microfilm analysis and multispectral imaging.

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References

[1] H. Z. Nafchi, R. F. Moghaddam, and M. Cheriet, “Historical document binarization based on phase information of images,” in Proc. ACCV, 2012, pp. 1–12.

[2] K. Ntirogiannis, B. Gatos, and I. Pratikakis, “An objective evaluation methodology for handwritten image document binarization techniques,” in Proc. 18th IAPR Int. Workshop DAS, 2008, pp. 217–224.

[3] E. Saund, L. Jing, and P. Sarkar, “Pixlabeler: User interface for pixel- level labeling of elements in document images,” in Proc. 10th ICDAR, Jul. 2009, pp. 646–650.

[4] H. Z. Nafchi, S. M. Ayatollahi, R. F. Moghaddam, and M. Cheriet, “An efficient ground truthing tool for binarization of historical manuscripts,” in Proc. 12th ICDAR, Aug. 2013, pp. 807–811.

[5] R. F. Moghaddam and R.F.Nafchi, “Phase Based Binarization of Ancient document,” IEEE Trans. Image Process., vol. 23, no. 7, 2014.

[6] M. Valizadeh and E. Kabir, “Binarization of degraded document image based on feature space partitioning and classification,” Int. J. Document Anal. Recognit., vol. 15, no. 1, pp. 57–69, 2010.

[7] H. Z. Nafchi and H. R. Kanan, “A phase congruency based document binarization,” in Proc. IAPR Int. Conf. Image Signal Process., 2012, pp. 113–121.

[8] E. Zemouri, Y. Chibani, and Y. Brik, “Enhancement of Historical Document Images by Combining Global and Local Binarization Technique,” IJIEE, Vol. 4, No. 1, January 2014.

[9] J. Joy, J. Kuriakose, "Adaptive Contrast Binarization Using Standard Deviation for Degraded Document Images," (IJCST) – Volume 2 Issue 4, Jul-Aug 2014.
[10] S. Lu, B. Su, and C. Tan, "Document image binarization using back- ground estimation and stroke edges," Int. J. Document Anal. Recognit., vol. 13, no. 4, pp. 303–314, 2010
[11] N. Shobha Rani, Arun Gopi, "A Quad Tree Based Binarization Approach to Improve quality of Degraded Document Images," IJCSE, vol.4.
[12] J. Kaur, Dr. R. Mahajan, "A Review of Degraded Document Image Binarization Techniques," International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 5, May 2014.
[13] Pavlos Stathis, Ergina Kavallieratou, Nikos Papamarkos, "An Evaluation Technique for Binarization Algorithms," JUCS, vol. 14, no. 18 (2008).

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