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Separation of Printed and Non-Printed sections using Modified Global Threshold approach from Medical Prescription Document Image

Hema Gaikwad[1], Jatinderkumar R. Saini*[2],Gururaj Mukarambi[3]
[1,2]*Symbiosis Institute of Computer Studies & Research, Symbiosis International (Deemed University), Pune, India*
[3]*Department of Computer Science, Central University of Karnataka Kalaburagi, India*
[1]*hema.gaikwad@sicsr.ac.in*
[2]*saini_expert@yahoo.com*
[3]*gururaj.mukarambi@gmail.com*

Abstract

Global threshold method is proposed in this paper, for separation of printed and non-printed sections from real time medical prescription images. There is no ground truth database available in the literature, for testing the performance of the proposed method.Hence, we have collected real time medical prescriptions from various Dentists, Gynecologists, Orthopedic Doctors, Cardiologists, Physiotherapists,Cancer Specialists, ENT Specialists, Urologists and Chest physicians. For experimental purpose, we have considered a total of 80 distinct sample medical prescription images.Then global threshold method has been performed on sample images for separation of printed and non-printed sections using different threshold values such as 0.15, 0.35, 0.55, 0.85 and 0.95. The proposed method obtained the segmentation accuracy of 46%, 38%, 38%, 38% and 36% respectively.Clearly visible sample images were obtained when the threshold value was 0.85. Hence, we have fixed 0.85 as the optimum threshold values for the experimental setup.

Keywords-*Image Segmentation, Global Threshold, Information Retrieval*

1. INTRODUCTION

Automatic interpretation and information retrieval from offline handwritten is the popular research area from last few decades (Roy et al,2017; Wshah et al,2014).Storage, Retrieval and Analysis of complex document images can be performed by different segmentation and text extraction methods (Mukarambi et al, 2019).Medical prescription image consists of printed text and non-printed text. Non-printed text consists of Medicine names, patient name and their intake schedule is handwritten as an adviser for the patient. Whereas the printed part contains details of the doctor and etc. This handwritten prescription is used by the patient to take medicines;problem arises when patients are unable to read this handwritten document. Any misreading of prescription can lead to serious consequences for the patient's health(Roy et al,2017). This is the motivation for us to proposethe method for segmentation of printed and non-printed sections from medical prescription images. Handwriting recognition from non-printed text is challenging because of different writing styles (Roy et al,2017) of different writers.Handwriting for the same word may be completely different (Jon,2014). Huge vocabulary (Roy et al, 2017; Wshah et al,2014) and different font size make the recognition even more challenging (Roy et al,2017). The application of Handwriting recognition applies in many areas such as automatic address reading, bank cheque processing and recognitionof manually filled forms. (Roy et al, 2017). Medical prescription images are complex colour documents consist of text, graphics and millions of colours(Strouthopoulos et al, 2002).

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Fig 1. shows the sample medical prescription image.

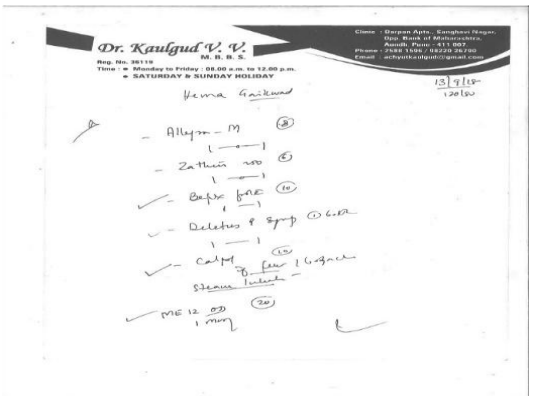

Fig1. Medical Prescription Image dataset

Automatic processing of medical prescription image consists of different phases such asnoise removal, segmentation and many more. Separation of Document Image is the foremost requirement for document analysing, document classification and for input to OCR system. (Deivalakshmi et al,2013) (Ibrahim et al,2008). The Document image segmentation means dividing the complete document into different blocks (Lin et al,2006). Connected component is the most popular method used for document image segmentation (Fisher et al,1990; Fan et al,1994; Lin et al,2006; Deivalakshmi et al,2013). It is used for homogenous region detection. Eight neighbours or four neighbours are used to create and find out the block (Fisher et al,1990; Lin et al, 2006). Document image scanning is started from top left and continued to bottom right by identifying its neighbours (either eight or four). Create the connected component block and label it. In case the block is not labelled, the procedure has to repeated for every block that belongs to the same group.Otherwise creating different groups and classifying them into space region, text region and graphicregion has to be done on the basis of Heuristic Rule. Criterion for measuring performance are, 96.43% is the rate of extraction of text region and 90.51 is for graphic region. Average rate of extraction of text and graphic region is around 94.03%.(Lin et al,2006). RBSC (Mitalet al,1995), Gabor filter (Strouthopoulos et al,1997), Global thresholding method (Ibrahim et al,2008) and Least absolute deviation fitting (Minaee et al,2015) are other segmentation methods.Two parameters Image brightness and character sharpness are considered for comparison of handwritten part of document image and obtained 75% accuracy by Global threshold and 25% accuracy by Otsu's threshold Likewise, for character sharpness 71% accuracy by Otsu's threshold and 29% accuracy by Global threshold method (Hema et al,2020). Text can be extracted from regions through different methods such as Run length smearing algorithm and statistics (Fisher et al,1990), Multichannel Gabor Filter (Jain et al,1992), Logical level techniques, Mask based subtraction technique (Kamel et al,1993),Run length smearing algorithm and stripe merging procedure(Fan et al,1994), Differential processing text extraction (DPTE)(Mital et al,1995),Extraction of features through DSE(Strouthopoulos et al,1997), ACR, PLA, NNBC, SOFM (Strouthopoulos et al,2002),Block matching, motion vector, text tracking(Jung et al,2004), GLCM (Lin et al,2006), Wavelet based GLCM(Deivalakshmi et al,2013),Contour based features, spatial and temporal features(Van Phan et al,2014).The wavelet based GLCM is better than GLCM because the results show that performance of wavelet based GLCM is better than GLCM features when classification need to be done.82.31% is the average rate of classification for GLCM and classification rate for COIFLET3 wavelet based GLCM, symlet8 wavelet based GLCM, HAAR wavelet based GLCM, db4 wavelet based GLCM, db25 wavelet based GLCM and COIFLET5 wavelet based GLCM are 95.65%, 91.74%, 92.66%, 90.82% and 89.92% respectively (Deivalakshmi et al,2013). The GLCM features are sum entropy (SEM), difference entropy (DEM), energy (ENR), Entropy(ENT) and standard deviation(STD) (Lin et al,2006).The Wavelet based GLCM features are homogeneity, sum entropy, contrast, energy, cluster shade correlation, difference entropy, cluster prominence and information measure of correlation one and two are calculated in eight different directions like 0 to 360 degree (Deivalakshmi et al,2013).

Following is the structure of the Paper-Section II contains dataset of medical prescription images. The overview of Global Threshold Method is discussed in Section III. The Algorithm is discussed in Section

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IV. The experimental results and discussion are presented in Section V. Graphical analysis is presented in Section VI and Conclusion is the subject matter of Section VII.

2.DATA SET

We have collected total 80 medical prescription images, with consent from doctors, from different states of India such as Delhi, Madhya Pradesh, Jammu and Maharashtra. Doctor's belongs to different cities like Delhi, Jabalpur, Jammu, Khamgaon, Akola and Pune. Their specializations are also varying such as Dentist, Gynaecologist, Orthopaedics, Cardiologist, Medicines, Physiotherapist, Paediatric Surgery, Cancer Specialist, ENT Specialist, Urologist, Chest physician & Allergist. All Medical Prescription Images were scanned through FUJITSU Scan Snap SV600 at 300 DPI and binarized using Global Threshold Method and store it in (.jpg) file format. A sample dataset of printed section and non-printed section are presented in Fig 2 and Fig 3 respectively.

Fig 2. Printed section of Medical Prescription Image.

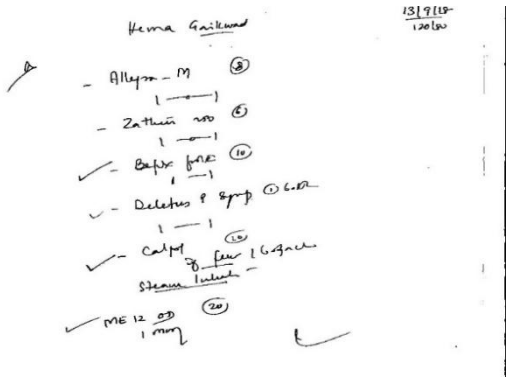

Fig 3. Non-printed section of Medical Prescription Image

3. GLOBAL THRESHOLD METHOD

Image can be segmented by using different methods such as Region approach, Cluster approach, Edge based approach and Threshold approach. Threshold can be Global threshold, Adaptive threshold and Histogram based threshold. Global threshold is the simple method. By thresholding, binary images are created from grey-level. It turns every pixel below some standard value to zero and every pixel above some standard value to unity.

Letg(x, y) be a threshold version of f(x, y) at any global threshold T, then

$$g(x,y) = \begin{cases} Unity & if\ f(x,y) > T \\ Zero & if\ f(x,y) \leq T \end{cases}$$

4. ALGORITHM

The algorithm for separation of printed and non-printed section from Medical Prescription Images are as follows—

Input: Colour Image(Original)

Output: separation of printed and non-printed section

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Start

Step 1 Convert original input image into Binary image using global threshold with optimum threshold value 0.85.

Step 2 Compute the length (L) of input binary image.

Step 3 Find out xmin and ymin coordinate values of binary image

Step 4 Set xmin=30(based on dataset observation) for cropping the handwritten section.

Step5 Compute average width of top and bottom section of all input binary images.

Step 6 Increment 1 for output of step 4.

Step 7 For cropping the printed section of input binary image using step 2, 3 and 4.

Step 8 For cropping the handwritten section of input binary image using step 2,4,5 and 6

Stop

5. EXPERIMENTAL RESULTS AND DISCUSSION

A sample data set of 80 MedicalPrescription Images were used for experimentation.Computing of average width of all images considered for both hand written and printed section, whenever we are going for analysing the real time medical prescription images with respect to printed and handwritten section. In case of normal practise of Doctor's, Medical Prescription Image contains printed section on the top and rest of the part contains hand written information. Hence, for experimental setup, there is a need to compute average width of all collected sample images for both the sections in the image (Printed and Handwritten text). For printed section, we computed average width in terms of first row and first column of an image till end of printed section. In case of handwritten section, we started computing average width in terms of after ending of printed section and one-line space before the handwritten part to till end of handwritten section.Segmentation was carried out for different threshold values such as 0.15,0.35,0.55,0.85and 0.95. Accuracy of segmented images on 0.15, 0.35,0.55, 0.85, and 0.95 are 46%, 38%, 38%, 38% and 36% respectively. The visibility of segmented image is readable on 0.85 as compared to other threshold values. Hence the threshold value 0.85 is optimum as per the experimental observations.

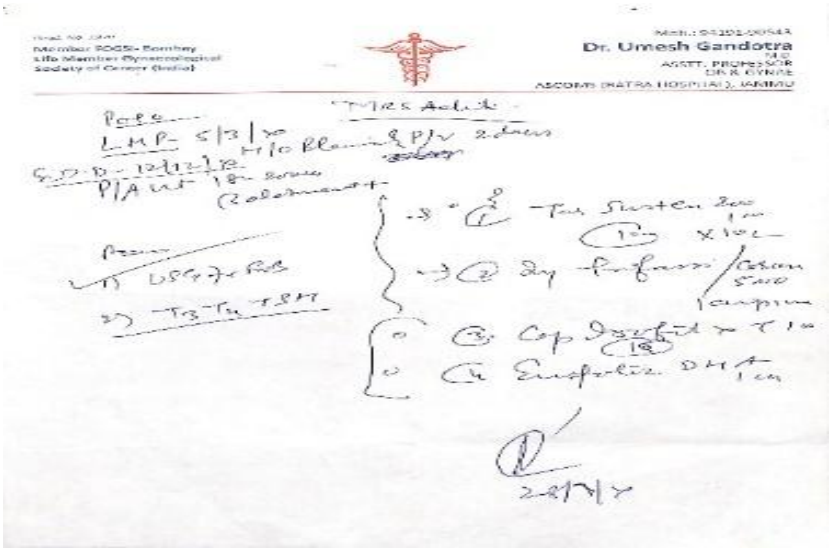

Fig 4.Medical Prescription Image.

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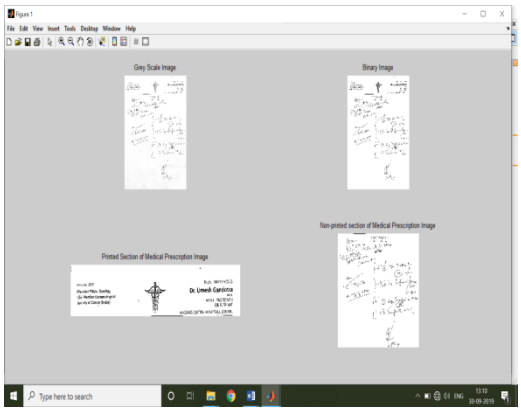

Fig 5. Working Pipeline process for Segmentation

6. GRAPHICAL ANALYSIS

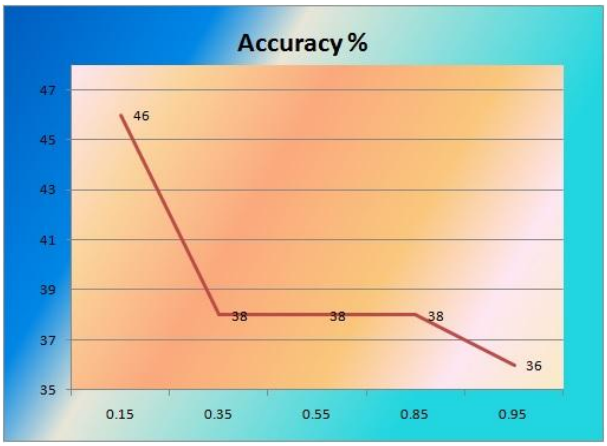

Fig 6. Graphical representation for accuracy of segmentation

Fig 5 shows the accuracy of segmentation. Segmentation was carried out for different threshold values such as 0.15,0.35,0.55,0.85,0.95 and accuracy of segmented images are 46%, 38%, 38%, 38% and 36% respectively.

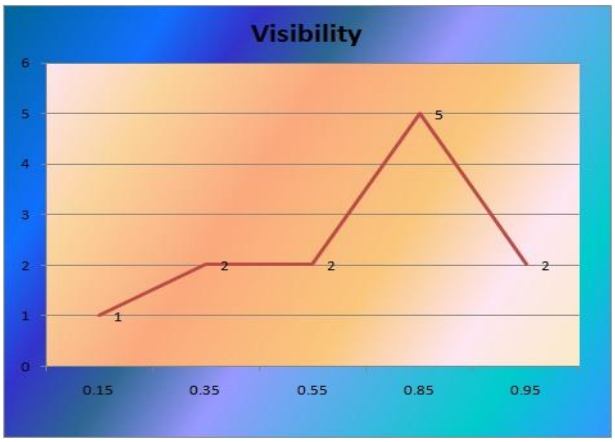

Fig 7. Graphical representation for visibility of Segmentation

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Fig 6 shows the visibility of segmentation. Segmentation was carried out for different threshold values such as 0.15,0.35,0.55,0.85,0.95 and the visibility of segmented image is readable on 0.85 as compared to other threshold values.

7. CONCLUSION

In this paper, modified global thresholding method is used for separation of Medical Prescription Images into printed and non-printed sections. We computed average width of all collected samples for printed and non-printed sections. For printed section, we start from first row and first column till the printed section ends and for non-printed section we started after ending of printed section and before start of the non-printed section of image till end of non-printed section. We obtained segmentation accuracy of 38% for medical prescription images on 0.85 threshold value and it is the optimum for the experiment.

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