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RESEARCH ARTICLE

Document Image Binarization Using Image Segmentation Algorithm in Parallel Environment

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Abstract: *- The Segmentation of text from poorly degraded document images is a very hard due to the high intravariation between the document background and the foreground text of different document images. The algorithms used for Image processing take more time for execution on a single core processor. Graphics Processing Unit (GPU) is becoming most popular due to their speed, programmability, less price and more integral execution cores in it .The main goal of this research work is to make binarization faster for recognition of a large number of degraded document images on GPU as well as on single core processor. In this system we provide new image segmentation algorithm that each pixel in the image has its own threshold proposed. We are doing parallel work on a window of m*n size and extract object pixel of text stroke of that window. The document text is further segmented by a local threshold that is estimated based on the intensities of detected text stroke edge pixels within a local window.*

Keyword: *Segmentation, Pixel classification, GPU, Parallelization, binarization.*

I. Introduction:

Binarization is an active research area in the field of Document Image Processing. Binarization converts grey image into binarized image. Document image binarization is the most important step in pre-processing of scanned documents to save all or maximum subcomponents such us text, background and image [1]. Binarization computes the threshold value that differentiate object and background pixels. Color and grey level image processing consumes lots of execution powers. But binarized images decrease the computational load and increase efficiency of the given systems [7] [10]. Binarization has many advantages such as medical image processing, document image analysis, face recognition etc. Binarization can be classified into two categories: global and adaptive. Global methods are based on the finding a single threshold value for the entire image, and adaptive methods are based on the local information obtained from the candidate pixel and is needed for the calculation of threshold value for every pixel. If clarification of input image is not similar (evenly illuminated), local methods might perform better. If image has equal illumination then global methods can work better. But global methods cannot handle any of the image degradation and not able to remove noise. Local methods are significantly more time-consuming and computationally expensive. Fast and accurate algorithms are necessary for Document Image Binarization Using Image Segmentation systems to perform operations on document images. To speed up the processing, parallel implementation of an algorithm can be done using Graphics Processing Unit (GPU) as general purpose computation hardware; programmability and low cost make it productive [1].

Document Image Binarization is performed in the preprocessing stage for document analysis and it aims to segment the foreground text from the background of document image. A quick and proper document image binarization technique is important for the ensuring document image processing tasks such as Document Image Binarization Using Image Segmentation Though document image Binarization has been studied for many years, the thresholding of degraded document images is still an unsolved problem due to the high inter/intravariation between the text stroke and the document background across different document images [6][7]. The handwritten text within the degraded documents often shows various types of problems in terms of the stroke brightness, stroke connection, stroke width, and document background. In addition, old documents are often degraded by the hemorrhage through where the ink of the other side seeps from end to end [7]. In addition, old documents are often degraded by different types of imaging artifacts. These different types of Document degradations are likely to induce the document thresholding error and make degraded document image binarization a big challenge to most state of the art techniques [7].

In classical threshold image segmentation an image is usually segmented and simply sorted to object and background by setting a threshold [2]. If there are two peaks in the histogram of an image, it is easy to get good result by threshold segmentation. But if there is complex formation in the image, the threshold algorithm is not suitable definitely [3] [11]. There have been several upgraded algorithms based on threshold segmentation which give the optimum threshold. It has a limitation that it gives only one threshold, which is difficult to extract all the useful information in the image. A new segmentation algorithm is proposed that each pixel in the image has its own threshold by calculating the statistical information of the gray scale values of its neighborhood pixels.

II. Methods:

2.1 Gray Scale Conversion: - The Main aim of the system is to have a clear binarized document image. For that we are going to first convert the image into the gray scale using serial and parallel approach. We are using the two approaches for calculating the time required for processing of the document image. We can simply calculate which approach required more time for getting the results.

Gray scale Algorithm:

I) Serial Approach

Algorithm:-Grayscale transformation in a CPU.
Input: ***I image vector***
Output: ***GI grayscale image***
1. for i = 0 to (*width(I) × height(I)) do*
2. *GI[i] = (I[i×3] + I[i×3+1] + I[i×3+2]) /3*
3. End for

II) Parallel Approach Algorithm:-

Grayscale transformation using CUDA in a GPU.

Input: ***I image vector***
Output: ***GSC grayscale image***
1. For each GPU task *i = blockIdx.x × (blockDim.x×blockDim.y) + blockDim.x × threadIdx.y + threadIdx.x;*
2. GSC[i] = (I[i×3] + I[i×3+1] + I [i×3+2]) /3
3. End for

After the conversion is done into the gray scale of the document image the next step will be the intensity calculation of the gray scale document image [1] [2].

2.2 Intensity Calculation: - For intensity calculation we will consider a window of the image and the sum will be calculated for the window pixel and the average value will be calculated of the window. After calculating the average value of the window the value will future consider for image segmentation calculation [9] [11].

2.3 Image Segmentation: - The segmentation algorithm uses edge stroke detection for dividing the image into segments. The old approach for image segmentation was canny edge detection which requires various parameter values for detecting the edges of the image in the proposed algorithm of image segmentation we required only one parameter value for the edge detection of the image [3] [7] [10].

Image Segmentation Algorithm:-

Input:

i. 'G' is Gray Scale image vector.
ii. Set threshold value 'th'.
iii. Set window size 'Ws'

Output: - 'BZ' for binarized image vector.

1. for each row 1 to height –Ws
2. for each column 1 to width –Ws
3. Curr_Pixel=G [row, column];
4. If (Curr_Pixel < avg – th)
5. LabelBZ [row, column]=0;
6. Else
7. LabelBZ [row, column]=1;
8. End;
9. End;
10. Return binarized image BZ;

III. System:

3.1 Existing system: - Many thresholding techniques have been reported for document image binarization. As many degraded documents do not have a clear bimodal pattern, global thresholding is usually not a suitable approach for the degraded document binarization. Adaptive thresholding, which estimates a local threshold for each document image pixel, is often a better approach to deal with different variations within degraded document images [8]. The local image contrast and the local image gradient are very useful features for segmenting the text from the background document image because the document text usually has certain image difference to the adjacent background document image. They are very efficient and being used in many document image binarization techniques. The Old system mainly uses serial approach for processing images. Due to this the processing time of image is high means to generate the output it takes more time. [3] The existing system is as shown below:

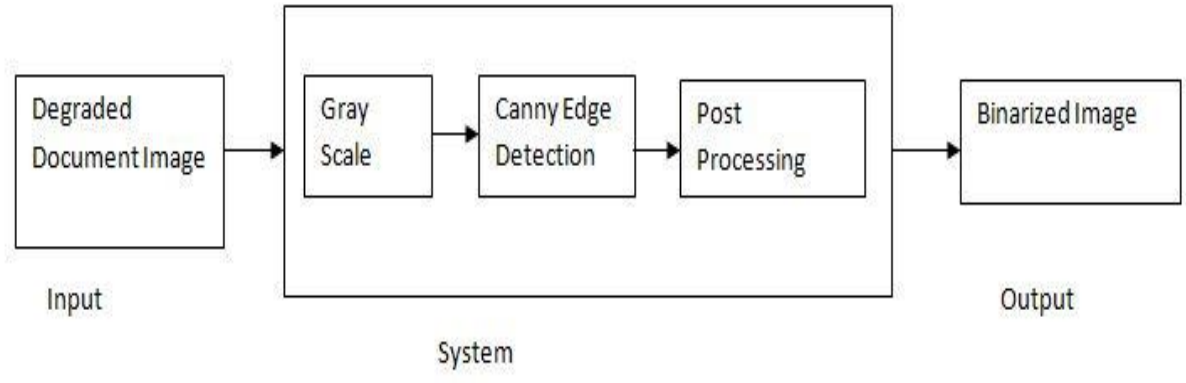

Fig: 3.1 existing system

3.2 The System: - Most of the work in image processing area is done serially. Means the approach used for clearing the image is serial approach due to that time required for getting clear image is much more. We proposed a system which uses a parallel approach in image processing area we will provide a degraded document image, which will then detect the text stroke edges through the combination of the Gray Scale Image and then we will calculate the intensity of window for each image and then applying New Image Segmentation algorithm which will generate Clear Binarized Image. But here is not the final output of the system after segmentation Is done we will apply post processing algorithm to detect stroke edges of the letters by post processing the stroke edges will be automatically detected if the letters are not properly written. The system is shown below.

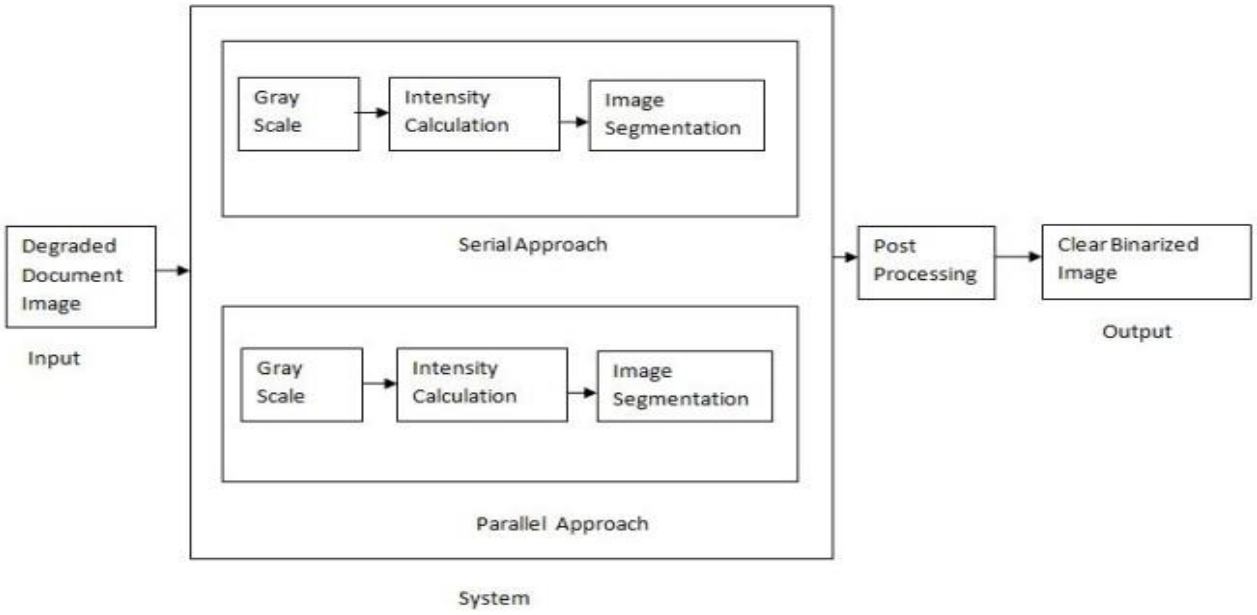

Fig 3.2 System

IV. System Result:

The proposed system uses various algorithms. The degraded document image will pass as the input to the system the image will be converted to gray scale first by using gray scale algorithm. Then the gray scale document image will be pass to calculate the intensity of the image then the image segmentation algorithm will be apply on the document image. The document image will be divided into various segments for generating output. Lastly the post processing algorithm will be apply to detect the stoke edges of the words automatically and the clear binarized document image will be generated.

4.1 Input to the System: - The input to the system will be the degraded document image. We can also provide the input to the system by passing various degraded images. For the input to the system we are using the data set provided by the DIBCO (2009) and DIBCO (2011). The DIBCO provides various data sets we are using the data sets as input to the system [4][5]. The example is shown below.

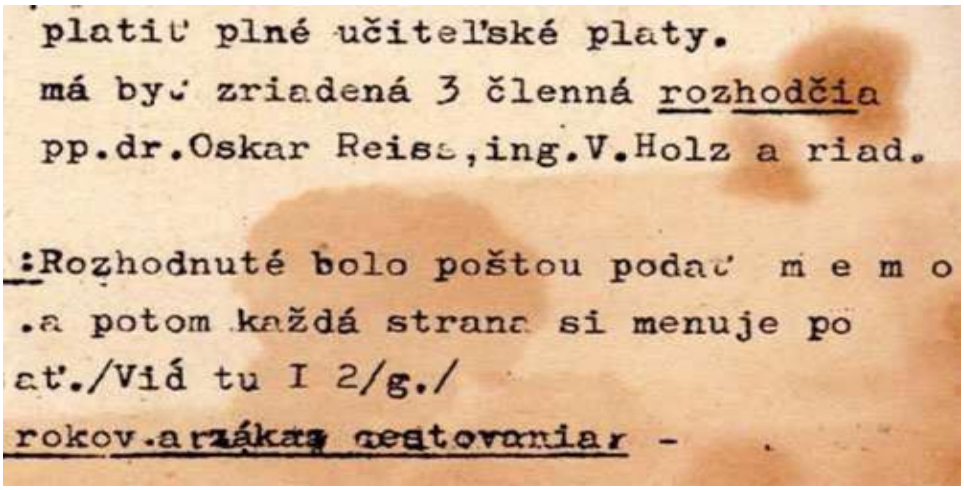

Fig 4.1 Example input to system as degraded document image.

4.2 Gray Scale Image: - Passing the degraded image to the for getting clear binarized image we will first convert the image into the gray scale form by using serial and parallel approach.

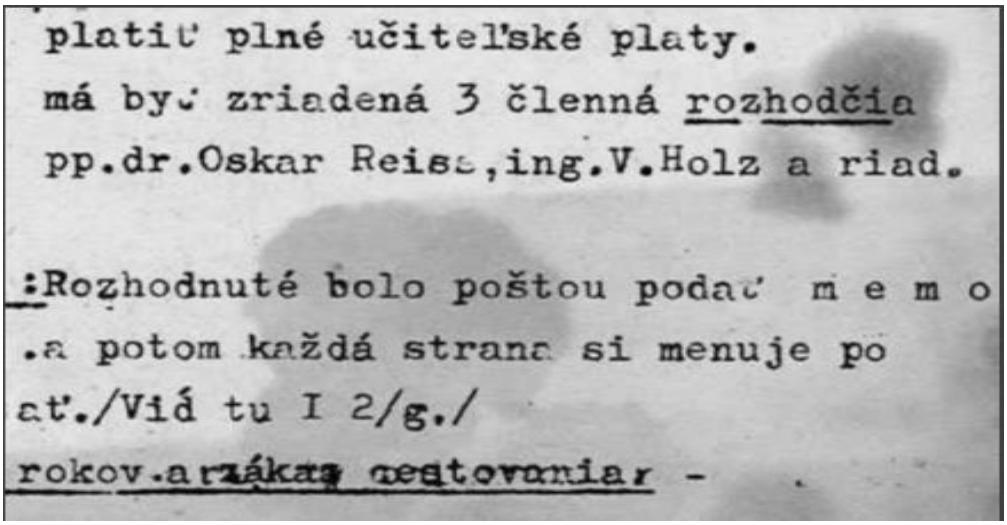

Fig 4.2 Example of Gray Scale Image

4.3 Output of the System: - The final output of the system will be clear binarized image. For that we will apply various algorithm first we will convert the image to the gray scale and then intensity calculation will be done of each window of the

image. After that we will apply the image segmentation algorithm for generating clear binarized image. The processing will be done in two approaches serial and parallel and the calculation will be done.

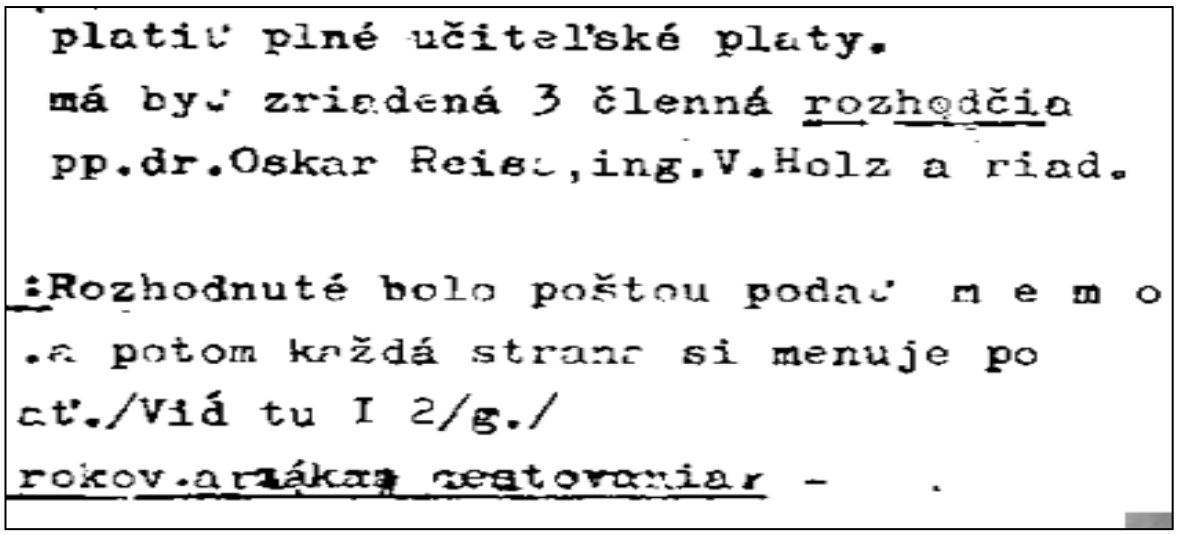

Fig 4.3 Clear Binarized Document image as output

V. Conclusion:

This paper presents a document image Binarization technique that is tolerant to different types of document degradation. The proposed technique is simple and robust, only few parameters are involved. We have presented an approach for document image processing using parallel computing using C# .Net And CUDA for running in a GPU. However, from the results we can conclude that CUDA obtained better results in most cases than OpenCV. We have Integrated CUDA in C# .net using Manage CUDA due to that we get simple platform to develop and easier to implement the system.

Thus we propose Parallel Approach for Document Image Binarization Using Image Segmentation Algorithm for generating clear document image from giving degraded document image.

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