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Research Article

Document Image Binarization using Sliding Image based Segmentation

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Abstract

*Segmentation of text from badly degraded document images is a very challenging task due to the high inter/Intra variation between the document background and the foreground text of different document images. Image processing and pattern recognition algorithms take more time for execution on a single-core processor. Graphics Processing Unit (GPU) is more popular nowadays due to its speed, programmability, low cost and more inbuilt 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. In this system, we provide a 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.*

Keywords: *Pixel classification, GPU, Parallelization, Binarization*

Introduction

DOCUMENT Image Binarization is performed in the pre- processing stage for document analysis and it aims to segment the foreground text from the document background. A fast and accurate document image binarization technique is important for the ensuing document image processing tasks such as optical character recognition (OCR). 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/Intra variation between the text stroke and the document background across different document images. As illustrated in Fig. 1, the handwritten text within the degraded documents often shows a certain amount of variation in terms of the stroke width, stroke brightness, stroke connection, and document background. In addition, historical documents are often degraded by the bleed-through as illustrated in Fig. 1(a) and (c) where the ink of the other side seeps through to the front. In addition, historical documents are often degraded by different types of imaging artifacts as illustrated in Fig. 1(e). These different types of document degradations tend to induce the document thresholding error and make degraded document image binarization a big challenge to most state-of-the-art techniques.

Algorithms

- Grayscale Conversion
- Image Segmentation
- Post Processing

Literature Survey

A. 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. The local image contrast and the local image gradient are very useful features for segmenting the text from the document background because the document text usually has certain image contrast to the neighbouring document background. They are very effective and have been used in many document image binarization techniques. The Old system mainly uses a serial approach for processing images. Due to this the processing time of an image is high means to generate the output it takes more time. Image processing, a subdomain of computer vision, is a field that deals with the conversion of an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is an image, like video frame or photograph and output, may be image or characteristics associated with that image. Usually, an

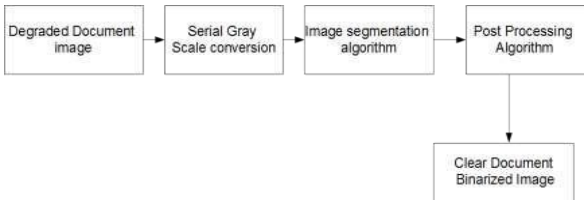
image processing system includes treating images as two-dimensional signals while applying already set signal processing methods to them. The purpose of image processing can be basically divided into 5 groups, namely:

1. Visualization: Observe the objects that are not visible.
2. Image sharpening and restoration: to create a better image.
3. Image retrieval: seek for the image of interest.
4. Measurement of pattern: measures various objects in an image.
5.Image recognition: distinguish the objects in an image.

Proposed Methodology

Digital image processing has become an applied research area that goes from professional photography to several different fields such as astronomy, meteorology, computer vision, medical imaging, among others. The aim of digital image processing is to improve the pictorial information in order to perform subsequently other tasks such as image-based classification, feature extraction or pattern recognition. Image processing is usually an expensive and time-consuming task. The use of a GPU to parallelize tasks started several years ago, in 2004 proposed a new architecture using multiple GPUs for image processing and computer vision; they obtained significant speed up over a CPU implementation. Fast algorithms are important for efficient image processing systems for handling a large set of calculations. To speed up the processing, parallel implementation of an algorithm can be done using the Graphics Processing Unit (GPU). GPU isgeneral-purpose computation hardware; programmability and low cost make it productive. Binarization is a widely used technique in image analysis and recognition applications. In this paper, we investigate the accuracy and performance characteristics of GPUs on well-known global binarization.

A. Architecture



As the system starts, we give degraded document images as the input to the system. Then the image is converted to grayscale format after that the image segmentation algorithm is applied to get the clear binarized image as output. The postprocessing algorithm is applied to get character and image clearer and more readable. Some key features of the system are as follow:

- Processing image using parallel computing.
- To generate Clear output from Degraded Images.
- Text Stroke Identification.
- Parallel Image Segmentation

B. Algorithms

1. Algorithm for Gray Scale Image
Algorithm: Grayscale transformation in a serial approach.
Input: I image vector
Output: GI gray scale 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

Algorithm :- Grayscale transformation
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

2. Algorithm for Image segmentation
Image Segmentation Algorithm 1) Input:
I. G is Gray Scale image vector. Ii. Set threashold value th. Iii.Set window size Ws
Iv. BZ for binarized image vector.

2) For each row 1 to height -Ws
For each column 1 to width -Ws
Currpixel=G[row, column];
If
(currpixel < avg - th) label BZ [row, column]=0;
Else
Label BZ [row, column]=1;
End;
End;
Return binarized image BZ;

3. Algorithm for Post Processing Post Processing Algorithm:
Input: The Input Document Image I , Initial Binary Result B and Corresponding Binary Text Stroke Edge Image Edge
Output: The Final Binary Result BF

1: Find out all the connect components of the stroke edge pixels in Edg.
2: Remove those pixels that do not connect with other pixels.
3: for Each remaining edge pixels (i, j): do
4: Get its neighborhood pairs: (i − 1, j) and (i + 1, j);(i, j − 1) and (i, j + 1)
5: if The pixels in the same pairs belong to the same class (both text or background) then
6: Assign the pixel with lower intensity to foreground class (text), and the other to background class.

7: end if
8: end for
9: Remove single-pixel artifacts along the text stroke boundaries after the document thresholding.
10: Store the new binary result to BF.

C. Important modules

The various modules to be made are enlisted as follows:

- *Gray Scale Module*

As we are giving degraded document images as the input to the system. After passing the degraded document to the system the document will first converted into gray. For converting the document into grayscale, we are applying a serial approach as well as a parallel approach so that we can calculate the time for both approaches to generate the result. From that, we come to know which approach is fast.

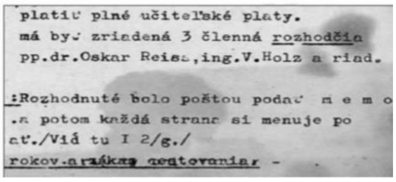

platiť plné učiteľské platy.
má byť zriadená 3 členná rozhodčia
pp.dr.Oskar Reis.,ing.V.Holz a riad.

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Fig . 1: Example: Gray Scale image

- *Window intensity calculation*

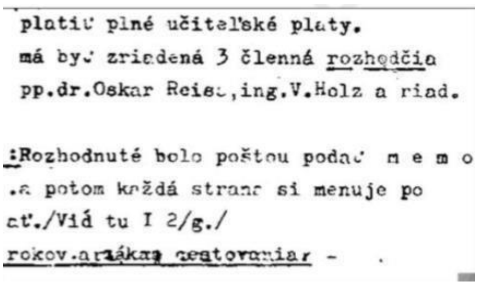
After converting the document into grayscale, we are calculating the intensity of each window for the document image in parallel approach and at the same time, we are mapping the edge for each window in serial approach by canny edge detection for each window of the document image.

- *Image segmentation*

The window intensity calculation in done then we are applying the Image segmentation algorithm. We are dividing an image into segments and calculating the threshold value for each segment in the parallel approach. by applying the segmentation algorithm, we will get the accurate threshold value for each segment of the document image.

- *Post Processing*

We are applying the post-processing Algorithm in the last step to recognizing the letters in the document image. If the letters are type halfly then by postprocessing Algorithm the letters can be recognized automatically by the post-processing algorithm.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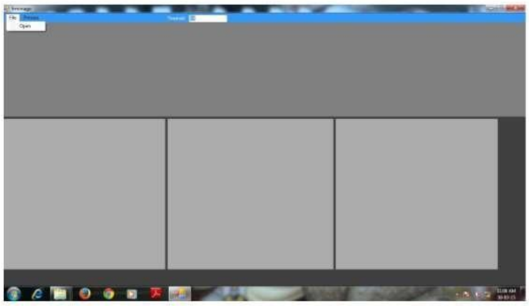
Result and Discussions

1 Results (Snap shots of the results)

A. Following figure represent the GUI of the System



B. Following figure represent the input of the system how to open file from the folder.

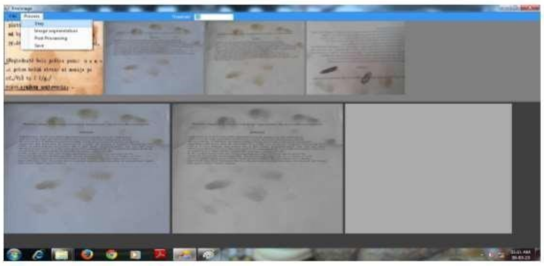


Figure 5: Input to the system

C. Following figure represent the gray scale conversion of the input image provided to the system.

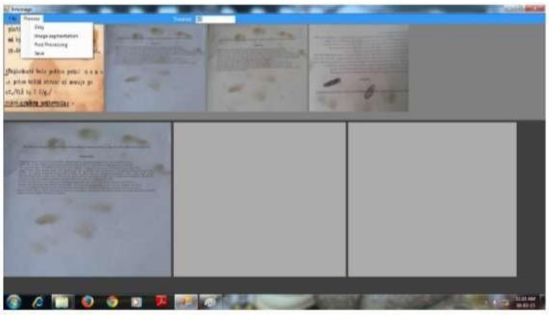


Figure 6: Gray scale conversion module

D. Following figure represent the clear binarized output of the input file done after image segmentation process.

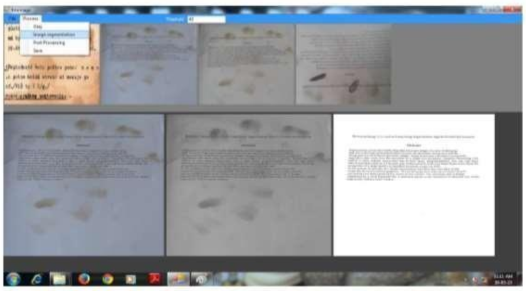


Figure 7: Binarized image after image segmentation

E. Following figure represent the output of the degraded image after post processing algorithm.

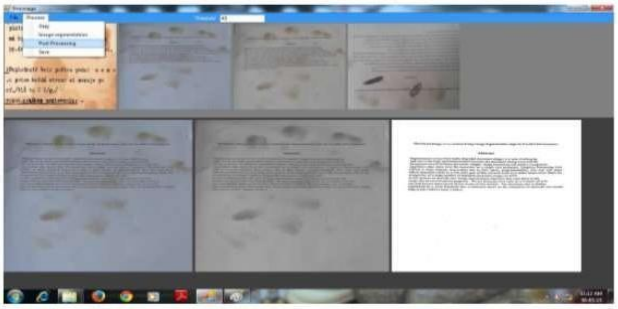
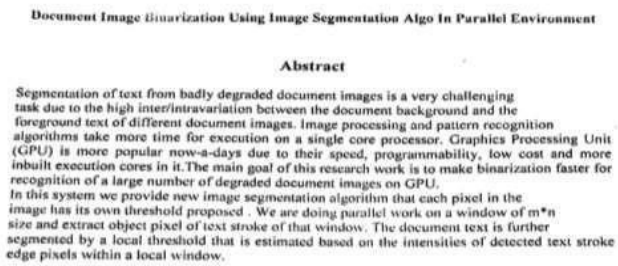


Figure 8: clear output after post processing algorithm

F. Following figure represents the final clear binarized output of the degraded document image.



Document Image Binarization Using Image Segmentation Algo In Parallel Environment

Abstract

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Figure 9: Clear binarized ouput of the document image

Conclusions

The system provides document image Binarization technique that is tolerant of different types of document degradation. The proposed technique is simple and robust, only a few parameters are involved. We have presented an approach for document image processing using parallel computing using C# .Net. The gain in parallel maybe not very significant. However, from the results, we can conclude that obtained better results in most cases than OpenCV.

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

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