

# Illumination Compensation for Document Images Using Local-Global Block Analysis

Mohd. Hafrizal Azmi, M. Iqbal Saripan, Raja Syamsul Azmir, and Raja Abdullah

Department of Computer & Communication Systems Engineering,  
Faculty of Engineering, Universiti Putra Malaysia  
43400, UPM Serdang, Selangor, Malaysia

**Abstract.** This paper presents the illumination compensation technique for document images using local-global block analysis. Imbalance illumination will affect the performance of classification and segmentation process because the darker regions conceal the information of the image. This method will split the image into non-overlapped blocks, and utilize the information within the local and global area of the image. The output images were binarized with simple global thresholding technique and the result shows that the output image is comparable in quality with the existed method. A comparative result will be presented with other document binarization methods.

**Keywords:** Illumination compensation, local-global block analysis, OCR.

## 1 Introduction

Document image analysis becomes very important nowadays since we are dealing with documents in almost every aspect in our life. With the rapid development of technology, people are starts to convert from using the traditional way in documentation to the new modern techniques. This includes the applications of image processing technique to enhance the image of cheque deposit and recognize the characters and numbers written on it. The modern techniques are mostly applied to the digital images because it is easier to be processed for specific purposes. That is why we can see that people are starting to employ the digital document instead of the traditional way. Since documents are being digitalized, efficient methods to manage them are required. There are two categories of document image analysis; one is textual processing while the other is graphical processing [1]. Textual processing focuses on the text components of the document while the later deals with non-textual figures in the document including the line and symbols [1]. The details about this concept can be read in [1] since it is out of this paper's direction.

Optical Character Recognition (OCR) is an important component in textual processing for document image analysis. The past decade has seen many algorithms were introduced either to enhance the existed method or implementing the new techniques. Despite its active developments, there are still no such algorithms that can perform perfectly for every condition [3]. There are limitations for different cases and researchers are concentrating on developing algorithm that could adapt for most conditions while still maintain the quality of output image and consider other important factors such as the time consumption.

The main problem that occurs before we proceed with the recognition process is the non-uniform illumination. Unless we can ensure that the capturing process will be held in a controlled environment with a very bright and balance lighting effect which is so troublesome, the variable illumination will cause some regions in the captured image looks darker or brighter. This situation will affect the process to distinguish the background and the foreground text which will leads to false segmentation and classification. In the field of OCR, the wrongly interpretation of the foreground text and background can leads to the out-of-shape character image. Besides, it will become worse if the algorithm will segment the wrong character which will give wrong information.

There are many algorithms introduced to solve the imbalance illumination occurs in document images including adaptive thresholding [5] and polynomial surface smoothing [4]. We have introduced one method for illumination compensation in [2] that will utilize the information within local area and global area of an image. But it focused on texture images. In texture image, there is assumption that the surface of an image could have many rapid changes of intensity which demonstrate the existence of texture information. For document image, we can say that the foreground text plays a role similar to the texture information. Based on this assumption, we believed that local-global block analysis method could be used for imbalance illumination correction for document image. This paper will focus on implementation of the local-global block analysis method for document images to observe the effectiveness of the method for future use in OCR. The results will be presented in a form of binary image comparative to other illumination compensation method for document images.

## 2 Related Work

There are many techniques that have been introduced to solve the variable illumination in OCR. The most popular approach is the adaptive thresholding which will divide the image into smaller windows and set the unique threshold value for each window. Niblack has proposed this kind of technique [6] and Sauvola made some improvements to the algorithm by imposing a new assumption that stated that the text pixels have near 0 grey values and non-text pixels have near 255 grey values [7]. Based on our literature on both works, it can be said that Sauvola's work performs better than Niblack's, but problem occurs when the assumption made is not agreed [5]. As for example, if the document images are captured within very low illumination with low contrast, the different value of the text and non-text pixels are insufficient for the algorithm to perform effectively.

Christian [8] has also proposed a technique to overcome the weakness of Sauvola's method which will normalize the contrast and the mean gray value to determine the threshold value. But Meng-Ling Feng in [5] has proved that his work outperforms Christian's method in an image which is affected by large variations of illumination. Meng-Ling Feng has proposed contrast adaptive binarization method which improved Christian's work to adapt the algorithm with large variation of illumination and low contrast problem. The technique suggested considering two types of windows which are primary and secondary. The primary local window is the area of interest while the secondary local window will provide extra information to be considered, but will not