

## INTRODUCTION TO IMAGE PROCESSING

2014-2015 – FALL

DUE : 29 December 2014

### HOMEWORK 3

Submit ONE SINGLE PDF FILE on DYS. Any material that is not in your PDF document will NOT be graded.

Label all axis for plots and bars. Put a descriptive title on plots, bars and images.

Include all the MATLAB code in your homework (in the PDF file).

Display the original and processed images in your homework. Put informative captions under the images.

Each homework should be done individually. You will suffer a significant GRADE REDUCTION if you submit very similar material.

### GLOBAL AND ADAPTIVE THRESHOLDING

Consider the image “document1.bmp”:

#### Brightness and Contrast Correction

Brightness and contrast enhancement automatically corrects document brightness and contrast to provide the best image quality. Manual adjustment is an option.

#### Adaptive Local Contrast Enhancement in Grayscale Documents

The function makes text and fine detail more legible by automatically increasing local contrast without affecting digital noise or introducing image artefacts. Two parameters are available to fine-tune the performance for different font sizes and background noise levels.

#### Cleaning Document Background

This feature automatically detects and removes distracting background elements such as texture, dots, lines, as well photocopying and scanning artefacts common in documents such as ID cards and passports, bank checks, tickets, and so on.

Cleaning background before processing the document with an OCR program can dramatically increase text recognition quality. As an example, there was an almost 50% increase in text recognition quality in a part of a security suite that was capturing passport information.

**Step 1:** Apply OTSU’s thresholding method to the image, using MATLAB functions “graythresh” and “im2bw”. Report the threshold returned by the “graythresh” function and display the thresholded image. Is it possible to extract all the characters from the resulting binary image?

**Step 2:** Try a couple of other threshold values on this image, and display the results. Can you find a global threshold that will make it possible to extract all the characters from the resulting binary image?

**Step 3:** Write a MATLAB program that calculates the local mean of NxN neighborhood of each pixel. In other words, you are going to calculate a matrix M:

$$M(i,j) = \text{mean}(\text{NxN window of the original image centered at pixel location } (i,j))$$

Display the resulting image M. You can replicate the border pixels using MATLAB's padarray function. Choose N as 7.

**Step 4:** Apply the following thresholding scheme to the original image I :

$$BW(i,j) = 1 \text{ if } I(i,j) > M(i,j)$$

$$BW(i,j) = 0 \text{ otherwise}$$

Display the resulting binary image BW. Comment on the result.

**Step 5:** This time, apply the following thresholding scheme to the original image I:

$$BW(i,j) = 1 \text{ if } I(i,j) > M(i,j) - 10$$

$$BW(i,j) = 0 \text{ otherwise}$$

Display the resulting binary image BW. Comment on the result.