ANKARA UNIVERSITY
Computer Engineering
COM466/4504 – Digital Image Processing
Practical Coursework 2*

May 1, 2021

* This coursework will be considered as the second half of the midterm grade, which means it will contribute 15% to your course grade.

In this coursework, you will develop the code for some image processing tasks described below using OpenCV library and the programming language you prefer.

You will be submitting a pdf report, output images for Tasks 1, 2, and 3, and your source code until **May 22, Saturday, 23:59.**

There are four tasks below. For each one, you will be including the result(s) in your pdf report. For Tasks 1-3, also submit the output images as separate files, for Task 4, only show them in your pdf. The report MUST contain for each task, an <u>explanation about how you completed the task (explanation of your source code/algorithm)</u> and the results you obtained. **If you only put the result for a task without sufficient explanation, that answer will not be graded.**

You can of course discuss the problems with other students but your code and report MUST be your own work. Plagiarism will NOT be tolerated. <u>If you are seeing someone else's code or sharing yours, what you are doing is unethical!</u>

You are given two color image files together with this document, golbasiCampus.jpg and golbasiCampus-Degraded.jpg. The first one is the original image and the second one is obtained by degrading the first with some simple operations. When you look at the images, it is not difficult to see that the contrast is reduced and there is some noise added. For Tasks 1, 2, and 3, you will process <u>color</u> input images and produce <u>color</u> image results.

1. **[25 points]** Your first task is to work on the degraded image and apply image restoration (noise removal) techniques to remove noise. You are free to try any method we discussed in the course and choose the ones that you think work best. You can combine multiple methods if you want. Remember, you are processing a color image input to produce again color image output. Include your output image both in the report for the discussion and as an additional image file in your submission.

2. **[25 points]** As we said above, the degraded image also has a reduced contrast. In Task 2, you are expected to enhance the output from Task 1 in terms of contrast. Remember again that you are processing a color image input to produce a color image output. When improving contrast in a color image, one must pay attention to not changing colors at a perceivable level. The original image is actually the ideal output at the end of this stage. Of course, you cannot get exactly the same image but if your output after Tasks 1 and 2 is similar to the original image, you are doing well. Include your output image both in the report for the discussion and as an additional image file in your submission.

3. **[15 points]** The third task is about enhancing the output from Task 2 even further. If you are unable to complete Tasks 1 and 2, you can directly work on the original image from golbasiCampus.jpg file to attempt this task. Analyze the image you have (directly by viewing it, by looking at different channels, histograms, and/or colors), think about the methods we discussed in the course, and find out if you can enhance this image for visual appeal. You can attempt any method we have discussed under the image enhancement or color chapters, or combine multiple methods. The important point for the output is that does it look like a better photograph. Include your output image both in the report for the discussion and as an additional image file in your submission.

4. **[25 points]** For this task, take the output from Task 3 (or take the output from Task 2 if you couldn't do 3, output of Task 1 if you also couldn't do 2, or the original image if you couldn't do any of the previous tasks) and first, convert it to grayscale. Then, apply thresholding to produce a binary image. Choose any acceptable threshold value that produces both black and white pixels in the output binary image. Using the average intensity as the threshold value is one acceptable choice. Include this binary image in the report only, do not add it as a separate file. Then, apply dilation, erosion, closing, and opening morphological operations on the binary image. Show the result for each of them in the report, do not add them as separate files.

- The remaining **10 points** are for the quality of your pdf report. To get these points you should have good organization, sufficient explanation and present your results in nice and easy-to-understand ways.

Below is a checklist of what you are expected to submit:
  - o Report (pdf)
  - o Source code (zip)
  - o Task 1 output (jpeg)
  - o Task 2 output (jpeg)
  - o Task 3 output (jpeg)