University of Lincoln Assessment Framework
Assessment Briefing 2022-2023

Module Code & Title: CMP3108M/9055M Image Processing

Contribution to Final Module Mark: 100% for Level 3; 80% for MComp Level 4

Description of Assessment Task and Purpose:

Requirements:

This assessment is an **individual** assignment and comprises five assessed tasks, as detailed below.

1. Pre-processing. Weight: 20%
2. Edge detection. Weight: 10%
3. Simple swan segmentation. Weight: 20%
4. Swan recognition. Weight: 30%
5. Performance evaluation. Weight: 20%

Tasks:

Download and unzip the file 'Assignment_Input.zip' from Blackboard. You should obtain:

- A dataset of 16 images containing a white swan logo;
- Two MATLAB script m-files named 'Task1to3.m' to 'Task4to5.m'.

Complete the MATLAB m-files to perform the corresponding tasks described below. As a guide, a few command lines for performing the Tasks have already been added to the script. You need to add the command lines to implement the other steps. Ensure you add appropriate comments to your code to briefly explain what each section is doing. You CAN use any built-in function but not any custom functions written by others (e.g. from Matlab File Exchange).

Task1 – Pre-processing

Add code to the MATLAB script Task1to3.m to load the image 'IMG_01.jpg' and convert it to greyscale. Then reduce the image size from its original size to half by bilinear interpolation. With the resized image, produce its histogram. Based on the histogram, discuss and justify in your report what value would be a good threshold for binarising the image so that the swan logo can be detected. Then generate the binarised image. Display the re-sized image, histogram and binary image in your report.

Task2 – Edge Detection

Continue to write your code in the MATLAB script Task1to3.m to apply edge detection techniques (both Sobel and Canny) to the grey-scale image you produced in Task 1. Display the detected results and add one close-up (zoomed-in section) to you report where the difference between the two edge sections of the swan is clear. Discuss the differences you notice between the two techniques.

Task3 - Simple Swan Segmentation

Complete the MATLAB script Task1to3.m to automatically segment the swan using either the binary image obtained in Task1 or edge image obtained from Task 2 or both. Write down the

steps you took in the report and include the resulted image(s). Note the segmented image should be binary and only contain the complete white swan (as accurate as possible) on a black background (as little noise as possible). (Hint: use connected component analysis)

Task4 – Swan Recognition

You will likely find that the script you've written so far does not work if you change 'IMG_01.jpg' to another image from the provided dataset. Complete the MATLAB script Task4to5.m to recognise and segment the swan through a series of image processing techniques you choose, generate a binary image where zero means no swan detected and a non-zero value means that the pixel belongs to the swan logo as shown in the figure below.

Fig. (a) Original Image

Fig. (b) Swan Segmentation

For this task, your target is to write an automatic and robust method that is able to accurately detect the swan logo from all provided images. Tip: you could try applying colour thresholding; connected component analysis; use region and shape features or any other advanced segmentation techniques to recognise the segments that belongs to a swan.

Your solution must minimise the amount of hard thresholds in order to make the algorithm as robust as you can. It should NOT involve any training (i.e. a machine learning based approach).

In your report, explain the steps you have taken and why you have used it. Select one particular image other than 'IMG_01.jpg', and illustrate the outcome of each processing stage by adding example figure(s) to your report.

For Task4, you can optionally save all the resulted images when running the algorithm on the entire dataset in a file called 'output'. This output file can be zipped up together with your source code and submitted through 'supporting material upload'.

Task5 – Performance Evaluation

For this task, we have provided you with the ground truth images (contained in the Assignment_GT.zip file). The ground truth images are of the same size as the dataset image, so make sure you apply appropriate resizing before making comparison to your segmented output. They are basically greyscale images correspond to images in the input dataset with only two labelling values. The swan is labelled with 255, and background value 0. Make sure you convert the labels to appropriate values to make comparison to your output images. The final task would be to evaluate your method by reporting its performance on the entire dataset against the provided ground truth using Dice Score (DS). Continue to write your code for this task in script Task4to5.m, write down the formula you used to calculate Dice Score in the report,

output your evaluation results to the screen and record it in report as well (i.e. present in a table DS per image, then provide mean and standard deviation).

Please see the Criterion Reference Grid for details of how the presentation will be graded.

Learning Outcomes Assessed:

- [LO1] critique the theoretical knowledge of image processing, including how to process and extract quantifiable information from images.
- [LO2] apply image processing techniques to solve practical problems.

Knowledge & Skills Assessed:

Subject Specific Knowledge, Skills and Understanding: academic report writing, literature searching, referencing, mathematics, algorithm development, project planning, designing and management, image processing techniques including image formation, intensity transformation, spatial filtering, morphological operations, image segmentation, feature representation and description and recognition evaluation, etc.

Professional Graduate Skills: independence and personal responsibility, adaptability, verbal communication, written communication, creativity, critical thinking, IT skills, problem solving, research skills, effective time management, working under pressure to meet deadlines.

Emotional Intelligence: self-awareness, self-management, motivation, resilience, self-confidence.

Career-focused Skills: An understanding of the range of skills and attributes required by employers from computer vision field, a range of strategies to present skills and attributes to employers.

Assessment Submission Instructions:

The deadline for submission of this work is included in the School Submission dates on Blackboard.

You must make an electronic submission of your work in **pdf** format (a concise report) through the assessment (TurnItIn) link on Blackboard for this component, together with a **zip** file (not in any other format, e.g. 7z, rar) containing all source code files (i.e. two m-files which produce the desired results and display the outputs) by using the supplementary documents upload link on Blackboard for this component.

Make sure the MATLAB scripts are correct and functional and do not display any error message. Put all the files (excluding the provided images and compress the folder into a zip file for submission. Name your zip file and PDF report using this format: LastName_ FirstName_StudentNo. You must attend the lectures for further details, guidance and clarifications regarding these instructions.

Please **note** that, in the report, you also need to include the main source code in the appendix. The maximum page limit of the report for this assessment is 4 pages (including all figures but not the cover page, references and the appendix).

Date for Return of Feedback:

Please see the school assessment dates spreadsheet.

Format for Assessment:

See CRG. Marks allocation for each task is distributed as below:

Task 1 (20%), Task 2 (10%), Task 3 (20%), Task 4 (30%), and Task 5 (20%).

Feedback Format:

Written feedback via blackboard. Oral feedback can be given upon request from student.

Additional Information for Completion of Assessment:

This assessment is an individually assessed component. Your work must be presented according to the Lincoln School of Computer Science guidelines for the presentation of assessed written work. Please make sure you have a clear understanding of the grading principles for this component as detailed in the accompanying Criterion Reference Grid. If you are unsure about any aspect of this assessment component, please seek the advice of a member of the delivery team.

Assessment Support Information:

Assessment support will be provided during the workshop sessions. The team won't be able to provide direct solutions but can help you understand all concepts related. Please consult the delivery team for any questions regarding this assessment.

Important Information on Dishonesty & Plagiarism:

University of Lincoln Regulations define plagiarism as 'the passing off of another person's thoughts, ideas, writings or images as one's own...Examples of plagiarism include the unacknowledged use of another person's material whether in original or summary form. Plagiarism also includes the copying of another student's work'.

Plagiarism is a serious offence and is treated by the University as a form of academic dishonesty. Students are directed to the University Regulations for details of the procedures and penalties involved.

For further information, see www.plagiarism.org