Detailed Guidance for the Coursework Submission

ACS61012 "Machine Vision"

A Well-written Report Contains:

- **A title page**, including your ID number, course name, etc., followed by a content page.
- **The main part**: description of the tasks and how they are performed, including results from all subtasks. For instance: "This report presents results on reading and writing images in MATLAB. Next, the study of different edge detection algorithms is presented and their sensitivity to different parameters…" You are requested to present in Appendices the MATLAB code that you have written to obtain these results. A very important part of your report is the analysis of the results. For instance, what does the image histogram tell you? How can you characterise the results? Are they accurate? Is there a lot of noise?
- **Conclusions** describe briefly what has been done, with a summary of the main results.
- **Appendix**: **Present and describe briefly in an Appendix the code only for tasks 2-4. Add comments to your code to make it approachable and easy to understand.**
- Cite all references and materials used. Write with own style and words to minimise and avoid similarities.

Report Submission

There are two submission links on Blackboard: 1) for your **course work report** in a pdf format and 2) for the requested **code** in a zipped file

The advisable maximum number of words is 4000.

Submission Deadline: **Week 9** of the spring semester, Sunday midnight

REQUIRED FOR EACH SUBTASK

Task 1: Introduction to machine vision

For the report from Task 1, you need to present results with:

For Lab session 1 – Part I

- The Red, Green, Blue (RGB) image histogram of your own picture and analysis the histogram. The original picture should be shown as well. Discuss the results. For instance, what is the differences between the histograms? Is it possible to decide according to the histograms, which image contains only one colour and which contains two colours?

For Lab session 1 – Part II

- Results with different edge detection algorithms, e.g. Sobel, Prewitt and comment on their accuracy with different parameters (threshold, and different types of noise especially). Include the visualisation and your conclusions about static objects segmentation using edge detection (steps 9-11 with Sobel, Canny and {Prewitt operators)) in your report. Visualise the results and draw conclusions.

Task 2: Optical flow estimation algorithm
For the report, you need to:
- Visualise the track on the last frame and the ground truth track of 'Red Square' tasks.
- Compute and visualise the root mean square error of the estimated track by the optical flow algorithm in comparison with the groundtruth values (the red square). Use the exact coordinates given in the file called groundtruth. You need to include the results only with one corner. Analyse the results
- Present results for the 'Gingerbread Man', visualise and analyse the results
- Make the conclusion about the accuracy of the method.

Task 3: Automatic detection of moving objects in a sequence of video frames
Part I: with the frame differencing approach
For the report, you need to present:
- Image results of the accomplished tasks
- Analyse the algorithms performance when you vary the detection threshold.

Part II: with the Gaussian mixture approach
For the report, you need to present:
- Results for the algorithm performance when you vary parameters such as number of Gaussian components, initialisation parameters and the threshold for decision making
- Detection results of the moving objects, show snapshots of images.
- Analyse all results

Task 4: Treasure hunting
For the report, you need to present results with:
- The three different images (easy, medium and difficult showing the path of finding "the treasure". Note that in the "medium" image, the "green" object is not a "treasure", only the blue fish is. In the "hard image", there are two treasures – the clove and the sun.
- Include the results of the binarisation of the images and the value of the threshold that you found, in your report.
- Explain your solution, present your algorithm and the related MATLAB code.
- Include the brief description of main idea of your functions in your report and the actual code of the functions in an Appendix of your report.

In the guidance for the labs, one possible solution is discussed, but others are available. Creativity is welcome in this task.

Task 5. Study and compare capsule Convolutional Neural Networks (CNNs) with the Siamese CNNs and YOLO CNN with respect to: their architecture, principle of operation, advantages, disadvantages and applications – with respect to tasks such as detection, classification and segmentation.