

CS-255 Computer Graphics Assignment

Date set: 6/2/2017;

Deadline: Wed 1st March 2017 at 11:00 submit via Blackboard;

Viva booking: <http://bit.ly/graphics2017vivas>

Guidance: A lot of guidance for this assignment will be given in the lectures.



Unfair Practice: Do not copy code from colleagues, internet or other sources. Do not post the code template on the internet in any form on any site. You may discuss approaches together, but all coding must be your own. Presenting work other than your own at a viva is plagiarism and a recipe for disaster.

Aims

Understand how an image is stored internally, and how to manipulate the image

Translate useful graphics algorithms into working code

Improve your programming skills

Task based learning – seek out information sources to carry out the assignment

Understand that graphics can be useful to users

Combine interaction with visual feedback

Practice presenting your work in a viva situation

Files:

The supporting framework is written in Java. You may build on this framework. If you wish to carry out the coursework in a different language you may do so, but there will be no provided framework. The assignment is to be demonstrated in a viva (you may do so on your own laptop). You will be required to demonstrate your working program to me or a post-graduate student in the week of the deadline at times to be arranged. You will require the following to start the exercise:

1. A copy of the Java template – downloadable from blackboard. This demonstrates how to display and manipulate images, and also functions and procedures which will help you with the exercise.

[Note: You must not redistribute this anywhere – you do not have permission to do that]

Exercise – Implement the following:

1. Gamma Correction:
 - a. Gamma correction algorithm.
 - b. An interface to provide the value to gamma correction.
 - c. A fast implementation of gamma correction (this will require some research and thought).
2. Contrast stretching
 - a. Contrast stretching algorithm.
 - b. An interface to provide the (r1, s1) and (r2, s2) points to the algorithm.
3. Histogram
 - a. Calculate the histogram(s) for the image.
 - b. Output the histogram(s).
 - c. Full marks are awarded to calculating and displaying histograms for red, green, blue and brightness.
 - d. Histogram equalisation carried out on the image.
4. Cross-correlation
 - a. Implement cross-correlation using the 5x5 Laplacian Matrix.

Requirements:

Also see later. You will demonstrate your program working to me or a post-graduate at times to be arranged in the week of the deadline. You therefore need to have a comment with your name and student number at the top of your java files along with the declaration that it is your own work (if you have several files, place them in a ZIP – **do not** include the image(s) used). The coursework is worth 30% of this module. There is only 1 coursework. It is an individual coursework – not a group coursework. At the viva you will log in to your university account, or bring your own laptop with your files on it.

Mark distribution:

See over for a breakdown. 50% will be awarded for the user interface and demonstration at the viva. You will get 0% if you do not submit anything. You will get 0% if you do not give a viva.

5x5 Laplacian Matrix:

```
-4  -1  0  -1  -4
-1   2   3   2  -1
 0   3   4   3   0
-1   2   3   2  -1
-4  -1  0  -1  -4
```

Submission Procedure:

Submit the assignment through blackboard before the deadline. Demonstrate/viva your assignment in the week of the deadline at times to be notified.

College policy for late assignments will be followed. The timestamp from Blackboard will be used. I will email students at their University account, so you must read this frequently during the term. You might not be able to demonstrate/viva if you submit late.

If you have extenuating circumstances (documentation must be provided), we will not have a problem with making alternative arrangements.

Java and Bytes

Java does not support the unsigned types (e.g. unsigned byte). Images store the red, green and blue values as unsigned bytes (0 to 255), therefore some problems can arise - e.g. a value of 255 can be interpreted as -1. In order to work around this problem, one needs to carry out a logical AND with a bit mask of 255 and correctly typecast the result to int. e.g. `int red = image_byte[index]&255;` Examples are contained in the code template.

Discrepancies:

If you find a discrepancy between any information you receive about this course, first please tell me, and then note that **Blackboard** should be regarded as being correct (since I will resolve the discrepancy by making sure Blackboard is correct, and creating a clarification announcement on Blackboard).

Feedback:

Feedback will be sent to university email addresses and home email addresses (make sure these are up-to-date). It will not be sent via blackboard since it is too fiddly.

Computer Graphics Assignment

Marking scheme [300 marks total]

Gamma Correction [70 marks]

1. Has gamma correction been implemented correctly? [12 marks]
2. Can a value for gamma be entered by some interface? [12 marks]
3. Has the fast version been implemented correctly (self-study, no hints)? [11 marks]
4. If the student has done at least 1 thing from above, does the student answer a suitable set of questions about their implementation and gamma correction? – e.g. What is the purpose of gamma correction, what is the equation for gamma correction, how is this implemented, how are the other parts implemented? [35 marks]. **Deduct marks** from 1-3 above if the student cannot or hesitantly describes their own code. Part 4 will be marked out of the total marks achieved in 1-3 (max 35 marks).

Contrast Stretching [70 marks]

1. Has contrast stretching been implemented correctly? [11 marks]
2. Can a values for (r1, s1) and (r2, s2) be entered by a simple interface (e.g. text box)? [11 marks]
3. Can a values for (r1, s1) and (r2, s2) be entered by a complex interface (e.g. via mouse, creating a line chart like Photoshop)? [13 marks]
4. If the student has done at least 1 thing from above, does the student answer a suitable set of questions about their implementation and contrast stretching? – e.g. What is the purpose of contrast stretching, what is the equation for contrast stretching, how is this implemented, how are the other parts implemented? [35 marks]. **Deduct marks** from 1-3 above if the student cannot or hesitantly describes their own code. Part 4 will be marked out of the total marks achieved in 1-3 (max 35 marks).

Histogram [80 marks]

1. Has histogram calculation been implemented correctly (do not copy my previous histogram code which you may find, and which does not answer this question)? [7 marks]
2. Can the histogram be displayed (e.g. text output – do not use my existing code which does not achieve the answer)? [7 marks]
3. Can this be done for each channel and brightness? [7 marks]
4. Can the histogram be displayed using a fancy interface (e.g. using a chart library in Java)? [9 marks]
5. Has histogram equalisation been implemented correctly? [10 marks]

If the student has done at least 1 thing from above, does the student answer a suitable set of questions about their implementation and histograms? – e.g. What is the purpose of histogram equalisation, what is the algorithm for histogram equalisation, how is this implemented, how are the other parts implemented? [40 marks]. **Deduct marks** from 1-5 above if the student cannot or hesitantly describes their own code. Part 4 will be marked out of the total marks achieved in 1-4 (max 40 marks). Be cautious about plagiarism.

Cross-correlation [80 marks]

Has cross-correlation been implemented correctly? Hard coding a 5x5 Laplacian is all that is needed for this assignment. Edges may be set to black. [40 marks]

If the student has done this, does the student answer a suitable set of questions about their implementation and cross-correlation? – e.g. What is the purpose of cross-correlation, what is the algorithm, how is this implemented, what are high pass and low pass filters, what does the Laplacian do? [40 marks]. **Deduct marks** if the student cannot or hesitantly describes their own code. This part will be marked out of the total marks achieved in the first part (max 40 marks).

Suggested Schedule:

- By 12/2/2017 Complete Gamma Correction question.
- By 19/2/2017 Complete Contrast Stretching question.
- By 24/2/2017 Complete Histogram question.
- By 1/3/2017 Complete assignment.

FAQ

When can I see you?

Usually I will be in my office at 0910 every day to answer questions. I am also fairly easy to speak to after lectures. You can also ask questions in the lectures. I don't make appointments – try my door – I'm usually in my office at least 50% of the day.

How do I submit through blackboard?

On blackboard, (probably) click on CS-255 Assignment, then click on "Assignment", then Attach local file - >Submit

I see the error: "Please enter a valid file"

Perhaps you have a space in the name. Please move your file to a top level directory (e.g. c:\) and try submitting. If you still get problems, please ask LIS.

Why won't you accept an emailed file?

I will delete all emailed submissions. I have many students enrolled on this course. Blackboard provides a simple to use interface for accessing files – in a few clicks I can have a directory with sub-directories of student numbers, with your submission file in each directory. We also have to store assignments for 2 years after you leave so having them all in Blackboard allows me to do this in a simple way. It also timestamps assignment submissions (and you receive a receipt). You can upload multiple assignment versions – so try one early on to verify you can submit correctly.

I'm not registered on blackboard for your course.

Send me your student number, I can add you.

I've submitted the wrong version.

Only the last submitted version will be marked and treated as your intended submission.

I cannot be available at the University on the days set aside for the viva.

Of course, we are fully sympathetic for extenuating circumstances (documentation must be provided). If you are absent for a trivial reason (e.g. holiday), firstly, you are expected to attend full-time at University, so this is not a good excuse, and secondly it demonstrates a lack of commitment to the course. Even in those circumstances, we will do the right thing, and allow you to demonstrate **before** you leave (but not after you get back as this is unfair on all the diligent students).

Feedback?

Feedback will be provided either at the demonstration/viva, or a few days later in an email to your University number mail account.

I haven't done any of the code, but I've read all the notes, book chapter, etc., so I am an expert in the various algorithms. Can I do the viva?

Computer science is not for you. You need to submit code through blackboard before you can participate in the viva. **If you do not do the viva you will get 0% (no matter whether you have submitted code or not).**