# IMAGE PRACTICAL

## CS4302: PRACTICAL 3

### DEADLINE

This practical is due 20th November 2018 at 9pm. It is worth 35% of the coursework part of the grade.

### SUMMARY

This practical consists of writing a Matlab program to solve image processing tasks and writing a report to describe and discuss your methods and results.

### GOALS

The main goal of this practical is to provide practical experience with the processing of images in the spatial and spatial frequency domain. As a secondary goal you will gain more familiarity with Matlab, a very common programming environment for image and signal processing.

### REQUIREMENTS

You will prepare a report that reflects your solution to the tasks described below. Please relate the task number to the solution in the document. Include all your figures in your report.

The practical requires you to screenshot or capture three of your own image files:

- A photograph with lots of variation (which probably has a wide variety of spatial frequency content). You can use a photograph taken by you and scaled to the right size by using any raster image manipulation programs (e.g., Gimp), or download a picture free of copyright from wikimedia commons or a similar source. If the source of the image is a jpg, make sure that it is of high quality (non-observable artefacts), or that it is of very high resolution before you scale it. Make sure that your images are exactly 1024x768.
- A photograph with little variation, for example, a photograph of the desert or the sky. Same considerations as in the previous point apply.
- A rasterization of an SVG diagram created by yourself. The diagram can be created in any vector graphics program (e.g., Inkscape, Illustrator, CorelDraw, Open Office Draw), and contain at least a Bezier curve, a polygon and readable text with a word. Most vector software allows you to rasterize a vector image through some kind of "Export" command.

### TASKS

You will need to solve the following problems:

1. Show the three components Red, Green, Blue (RGB) components as monochrome images with a colorbar for all three image files. Label the figures so that it's clear which component you are showing. Describe what these show and why.
2. Convert the images into the YCbCr colour space and show the 3 components of this colour space as separate images. Describe what these show and why.

3. Reduce your sampling of the Cb and Cr (chromatic components) in the spatial domain by a factor of 8 in both dimensions. Create matrices which contain the reduced sample set, then create an image (of the original resolution) using the Y (intensity map) and combine with the reduced sample of the Cb and Cr components for each image (consider the new mapping you will need to do). How do the new images compare with the original images? Produce a difference image of the original image minus the changed image to show how they have changed and discuss the changes in terms of visual impact.
4. What is the spatial frequency components in these (original) images? Perform a 2D Discrete Cosine Transform (DCT) on the images and then discuss what these show and why they are the way they are.
5. What is the heart rate shown in the video file (heart_rate_vid.MOV - found in the practical directory on studres)? The file heart_rate_vid.MOV is a close up video of a person's finger recorded using a smartphone camera. As the person's heart beats the intensity of light goes up and down accordingly (as there's more and less blood through the skin), your task is to analyse the video stream to calculate the heart rate. Explain the steps you take, include figures of the steps you take, and explain the results you obtain.
6. Extensions: Be creative and experimental, show me something relevant to this practical. Options might be (not limited to): Are there any other methods you might implement? Implement one (or multiple) of these methods and/or describe them.

## DELIVERABLES

You will deliver through MMS the following elements, compressed in a zip with the same folder structure that you used to run them:

- A pdf with your answers to the tasks
- Your Matlab Script
- The image files that you used as input
- Any additional files (code or otherwise) that you used to complete the assignment.

The standard penalty for late submission applies (Scheme B: 1 mark per 8 hour period, or part thereof): http://info.cs.st-andrews.ac.uk/student-handbook/learning-teaching/assessment.html#lateness-penalties

Please note that the Good Academic Practice also applies: https://info.cs.st-andrews.ac.uk/student-handbook/academic/gap.html

This practical accounts for 35% of the coursework marks in the module.

The marking will conform to the mark descriptors from the student handbook: http://info.cs.st-andrews.ac.uk/student-handbook/learning-teaching/feedback.html#Mark_Descriptors

## GENERAL ADVICE

Try to relate what you are doing in the file to the content of the model lectures. Clarity in your answers is more likely to result in higher marks. Do comment your code for readability. Make sure your figures have axis labels (which are legible in the report) and you create figure captions in your report.