ACSE-5: Advanced Programming
Assignment Two

Implement an imaging filter that enhances or modifies a medical image in some way, preferably by enhancing some feature not immediately visible when looking at the original image. Your programme should be able to load a medical image, apply one or more filter, and output the filtered/modified image back to a file. Your design should contain an object called "Image" in which you store the image. You should create at least three classes. At least one of the classes should be inherited from another.

Do use methods that you have learned as part of this or previous courses. Try to incorporate programming techniques that you learned in class. Namely STL containers/iterators/algorithms, inheritance, polymorphism, functors, templates, and others. These are not mandatory, please do not feel that you must incorporate any/all of these into your project.

Feel free to use techniques that are more advanced than those covered in class (!). Document your code (explain in the code what the different blocks of code are supposed to do), and do not copy code from the internet or other sources.

Use any data you can find on the internet, but make sure to reference your sources, and always pick high-quality sources. A list of publicly available image can be found here:
https://www.ucl.ac.uk/child-health/support-services/library/resources-z/medical-image-repositories

Your code will be compiled and executed as part of your evaluation. We will mark the projects based on: code structure and style (30/100), implementing of loading/writing/filter (30/100), user experience, creativity and execution (20/100), code documentation/commenting (10/100), and one-page description (10/100). To submit, follow these steps:

Step 1>> Register your team (of one or two) in the GitHub classroom @
https://classroom.github.com/g/QrX-msjE

Step 2>> Gather the images you will be using to test your filter.

Step 3>> Choose or design the filter to be implemented. Your filter can be as simple as a threshold (setting all grey pixels of an image above a certain value to white or black, for example), an average (re-defining each pixel as the average of the neighbour pixels), a colouring filter, or any other simple, complex or creative filter you may think of.

Step 4>> Upload your code onto your GitHub classroom repository before **midnight of February 10th 2019**. This should include: one C++ MSVC 2017 project file, one main.cpp file, one or more .cpp and .h files containing your classes, two sample images, and any other additional header or source files you create. Make sure to upload all files required for your project to be compiled and executed.

Step 5>> Prepare a one-page description of your code (Word or PDF, single space 11pt). Provide a short explanation of the design of your code, its structure, input/output, and how to execute it. Briefly describe the strengths and/or weaknesses of your chosen design of methods and code structure. Make sure to include the name of your filter and programming team names in the document.

If you have additional questions email: apaluszn@imperial.ac.uk

Frequently Asked Questions

What type of medical image can I process? There are many medical imaging "modalities" they all create different types of images (X-ray, CT, MRI, PET-CT, ultrasound, etc). You can use an image from any of these modalities.

What file format should I load/write? You can read and write the medical image in any format you like (ppm, bmp, png, jpg are the most popular). Many images in the internet are in these formats. The format you read does <u>not</u> have to be the same format you write. DICOM is the standard medical imaging format, you can also implement reading/writing DICOM -with or without a library- if you want a challenge.

Can I use external libraries? Yes, you can use one or more external libraries to perform tasks (as long as they are C++ libraries). Note for advanced programmes: if you decide to support DICOM (and png, jpg, etc) you would -of course- need to use an external library to load the image.

Should I supply any images when I submit my code? Yes, please upload at least two test images.

Does my filter need to be a real life/existing medical filter? No, you can make one up.

Does my filter need to have a real medical application? No, you can create your own crazy filter. The idea is to learn a bit about medical images, and to write a piece of code that can modify an image.

I am an advanced programmer, can I please make this assignment more complex? Yes, you can consider supporting the DICOM image format, or you can consider offering several image format options for loading or writing, or you can consider offering several different filters.

Remember: the more you code, the better you will get at it! (sort of ☺)