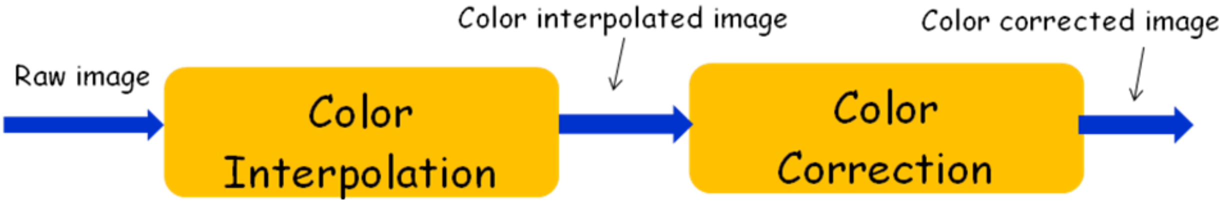
CSCI366 Multimedia Computing

Assignment Two (15%)

Due Date: (please check with Dr Loo)

Tasks

You are required to develop a C/C++ program that implements the color image processing chain converting raw image data captured by a CMOS image sensor into true color RGB images. The chain consists of two components: **color interpolation (demosaic)** and **color correction**.



You are provided with two `bmp` files `test1.bmp` and `test2.bmp`, which contain the raw image (Bayer Pattern Color Filter Array data) directly captured by a CMOS image sensor. The images have resolution 640x480 pixels. The Bayer pattern used in the CMOS sensor is shown below:

🟩	🟥	🟩	🟥	…
🟦	🟩	🟦	🟩	…
🟩	🟥	🟩	🟥	
🟦	🟩	🟦	🟩	
				…

Color Interpolation - You can use any color interpolation algorithms such as Nearest Neighbor or Bilinear. The requirement is that it must produce an RGB image with the same width and height as the input raw image. Therefore, you need to take into account boundary conditions, as pixels around the image boundary may not have neighboring pixels on one or two sides. Try to find the most efficient and simple solution to interpolate boundary pixels.

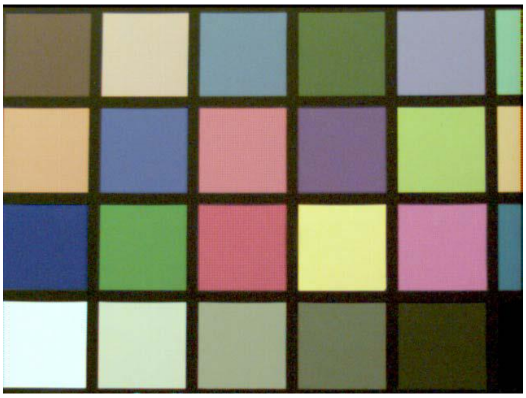
Color Correction - Color Correction is a matrix operation. You should use the following matrix that was optimized for this CMOS image sensor:

$$\begin{bmatrix} R' \\ G' \\ B' \end{bmatrix} \begin{bmatrix} 1.18 & -0.05 & -0.13 \\ -0.24 & 1.29 & -0.05 \\ -0.18 & -0.44 & 1.71 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

Matrix multiplication may result in output values less than 0 or greater than 255. Thus, you need to check the values and clip them to 0 or 255 if needed.

The program should be able to display the raw image (data), the image produced by the interpolation and the image after color correction based on the user input. When the raw image is displayed, all missing RGB values should be simply set to zero.

For `test1.bmp`, the image after color interpolation should be similar to the image shown below



Requirements

1. The program should be named as "**colorChain**" and shall take a BMP image as the input image.
2. The window size is fixed at 640 x 480 (width x height) pixels. At default, the raw image should be displayed in the window.
3. Users should be able to switch the display through the following keys:

Key 'r' or 'R' :	raw image
Key 'i' or 'I':	image after color interpolation
Key 'c' or 'C':	image after color correction
Key 'q' or 'Q':	the program exits

4. You MUST supply a *Makefile* together with your source code to compile to link your program.
5. No other third-party libraries should be used in the program except SDL. The code has to be in C/C++.

Marking Scheme

1. Zero marks may be graded if your code is not compliable using the supplied *Makefile*.
2. Program structure, comments and usability (2%)
3. Display of the raw image (3%)
4. Generation and display of the color interpolated image (5%)
5. Generation and display of the color corrected image (5%)

Submission

Zip all source files and the comparison report to ***your_login_name*.zip** and submit the zip file.

IMPORTANT: ***DO NOT*** *include and submit any object files and images in the zip file. Your submission may not be accepted if you do so.*