B) Practical programming assignments:

B1) Compute a Histogram and CDF

Write code that reads a 2D image as input and returns a 1D array of the relative frequencies of occurrence of greylevels in your image. Provide a choice for quantizing a binning of the greylevels into *n* quantized bins between 0 and the maximum value (please remember that for an 8bit image, this is the range 0 … 255 for the range 0 … L-1).

- Calculate the histogram of an image of your choice, please note that a color image first needs to be converted into black-and-white.
- Normalize the histogram by the image size to present a probability density function (pdf), plot the pdf.
- Calculate the cumulative distribution function CDF from your pdf and plot the function.
- Creatively experiment with a second image that may show different structures.
- Write a short report that shows the original images, and the corresponding pdf and CDF plots. Provide a short discussion if the shape of the histograms that may reflect some of the visible properties of the image, and discuss differences between results from the two images.

B2) Histogram Equalization

Use the histogram code as developed above, and provide an additional function for histogram equalization.

- Follow instructions as in the book and course notes to calculate the histogram, pdf, CDF and then a binning of the frequency axis into *n* bins that determines the mapping of intensities to form a uniform distribution.
- Apply your histogram equalization code to the images used before. Calculate and plot the new histogram after equalization.
- Add an additional section to the report by showing images, pdf's and CDF's before/after equalization. Briefly discuss what you see in the histogram equalized images and the corresponding plots of pdf's and CDF's.

B3) Histogram Matching

Following the course notes, develop code that maps intensity values of a preferably bad image into intensity distribution of a good looking image.

- Select an image with somewhat poor contrast or visibility of structures. Select a second image which looks good.
- Calculate histograms, pdf's, CDF's of both images. Follow course instructions to map the intensity distributions of the first image into those of the second image (histogram matching).
- Add a section to the report that shows original images and plots of pdf's and CDF's. Then show the results of the adjusted first image, and its pdf and CDF's.
- Provide a short discussion of what you see and if the procedure resulted in the anticipated result.