1. Follow the specified repository structure.
2. src will contain the Jupyter notebooks used for the assignment.
3. images will contain images used for the questions.
4. Follow this directory structure for all assignments in this course.
5. Make sure you run your Jupyter notebook before committing, to save all outputs.
6. Make sure you commit and push your work regularly.
7. Allowed libraries: numpy, matplotlib, opencv (only basic functions like imread, imshow, cvtColor).
8. Make an effort to vectorise your code as it carries $20\%$ weight.

## 1 Oppenheimer's Poster [10]

You are trying to make a poster for the Oppenheimer movie. You've got Oppenheimer's image on a green screen, and the goal is to insert a simulated explosion background. Blend these elements to craft a dynamic and eye-catching poster for the Oppenheimer movie.

1. Generate the poster using the images provided in `Images` folder.
2. Download images from the internet and make some more creative posters.
3. How many images of size 720 x 480 can be stored if cloud of size 2 GB is available. Show your calculations in markdown.

(a) explosion

(b) oppenheimer

Figure 1: Images for matting

## 2 Quantized Explosion [20]

In this section we will apply bit quantization to the explosion image. How can you use this technique to represent the explosive scene with limited bits while maintaining its visual essence?

1. Write a function bitQuantizeImage which takes an 8-bit image im and k, the number of bits to which the image needs to be quantized to and returns the k-bit quantized image.
2. Apply this function to the explosion image and plot all the results.
3. Plot all the bit planes using bit plane slicing of the explosion image and write down your observations for the question above using markdown.

## 3 Colour Corrected Barbie [20]

Unveil the hidden allure of the new Barbie movie image using only basic OpenCV functions! Apply contrast stretching to revive the faded details and vibrant colors, transforming this image.

1. Write a function `linContrastStretching` which takes any image im, integers a and b that enhance the contrast such that the resulting intensity range is `[a, b]`.
2. Apply this function to the `barbie_flat.png` image and plot the results, for various a,b.
3. Plot the colorbars (a strip containing k most frequently occurring colors) before and after applying contrast stretching and write down your observations using markdown.

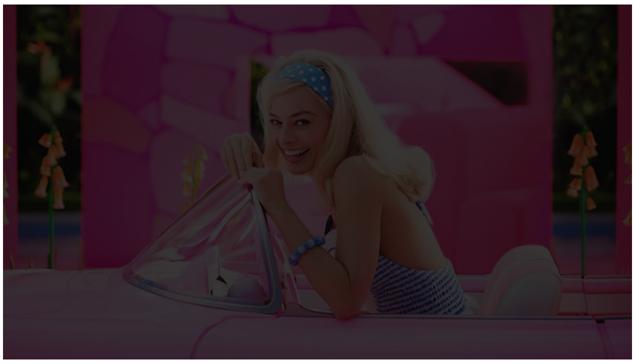


Figure 2: Barbie needs contrast

## 4 Histogram Equalisation [10]

Imagine you're working on restoring an image damaged by radiation, causing loss of contrast. Apply histogram equalization to bring back clarity, enhance features, and make the image reveal its true story.

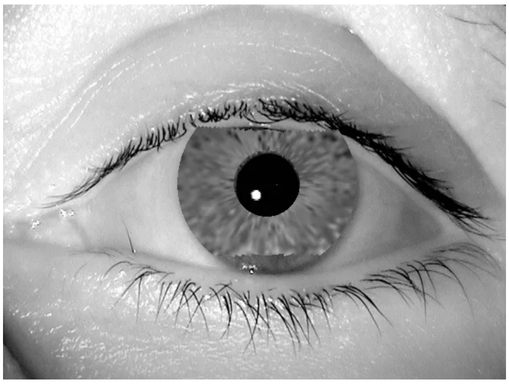
1. Write a function `histEqualization` which takes a grayscale image `img`, and applies histogram equalization on the entire image.
2. Apply this function to the `low.png` image and plot the results.

Figure 3: Low Contrast Image

# 5 Explosion Effects [10]

Grandmother Obaasan saw the blast of atomic bomb from a radius of 10 kms , since then see is facing some problem with her vision , help Obaasan diagnose her eye and climb up stairs using piecewise linear transform.

1. Perform piece wise linear transform in `Images` folder, according to the function below.
2. You will be given 2 vectors A and B which has pair of values, A vector is the x-coordinate point pair , the intensity range to map . In the B vector the first coordinate is m(slope) and 2nd-coordinate c(intercept) of the line for the corresponding range.
   (a) Image iris1.png :
   A=[(0.0,0.2),(0.2,0.3),(0.3,0.4),(0.4,1)] B=[(0.0,0.0),(-1,0.7),(0.0,0.0),(1.0,-0.1)]
   (b) Image stairs2.png:
   A=[(0.0,0.2),(0.2,0.4),(0.4,0.6),(0.6,0.8),(0.8,1.0)] B=[(0.0,0.0),(0.0,0.2),(0.0,0.4),(0.0,0.6),(0.0,0.8)]
3. plot the images after transformation and also plot a graph for each image showing the mapping of intensity values for the transformation (x axis-original intensity, y axis -transformed intensity).



(a) iris1

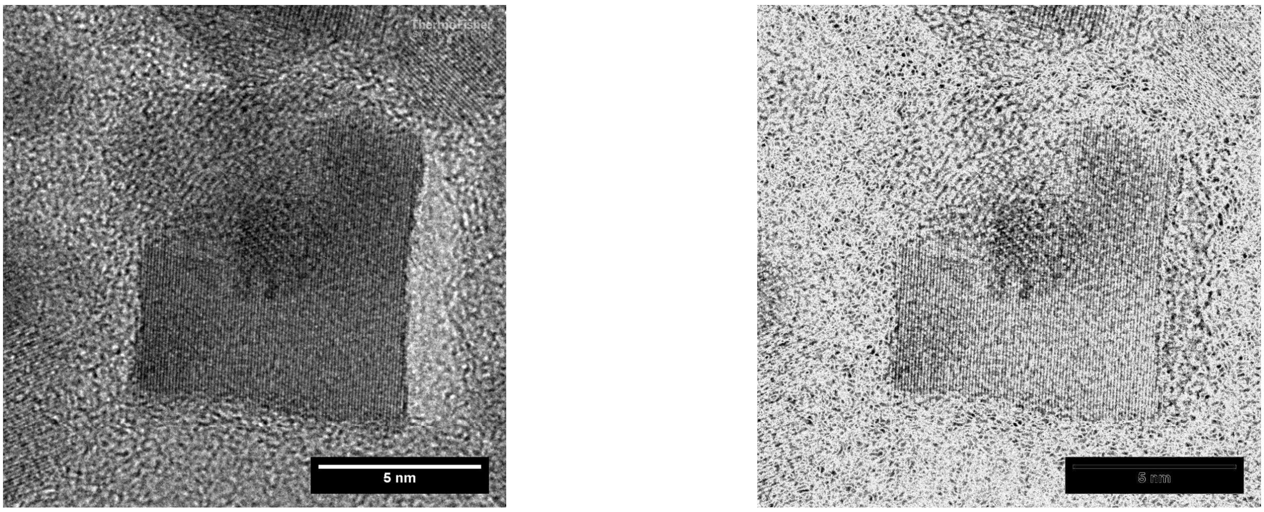
(b) stairs2

Figure 4: Images for piecewise linear transform

# 6 Oppie's Filter [30]

In a secret laboratory located deep in the New Mexico desert, a group of talented 3rd-year undergraduate students have been selected to assist the renowned physicist Dr. Oppenheimer in a top-secret project. The team's task is to analyze images of various atomic structures using piecewise transformations. One particular image they've obtained shows a distinct pattern of brightness levels that can only be obtained by enhancing crucial values in the range $[0, 255]$.

1. Use the function you wrote earlier to figure out what piecewise transformations were used to get the transformed image `Transformed.jpg` from the original `micro.jpg`.
2. plot the graph of the transform function that you estimated.
3. Apply the same transformation to 3 more images of your choice and plot the transformations side by side.




(a) Original (b) transformed

Figure 5: Images for piecewise linear transform