【影像處理簡介】Lab 1

許木羽 / 111000177

1. **Reducing the Number of Intensity Levels in an Image**

   The maximum number of colors is 255, and let x be the number of Intensity level.

   - For every pixel, divide by 255 and multiply by x - 1. Therefore, the maximum value should be x and the scale between x and 255 is the same. Round the number.

     The reason for using x-1 instead of x is because the number 0 is included. Let's say intensity level is 4. We have 4 distinct colors to pick, and the result value of each pixel divided by 4 is in range 0 to 5, which we have 1 extra number. This case is true that there is extra 1 number for every possible case.
   - Multiply back by 255 and divide by x - 1 to get the actual color value representation.

2. **Zooming and Shrinking Images by Pixel Replication**

   - Get the size image by multiplying the original size with scale.
   - For every pixel image, get the row/col position and divide back to scale, and round the number. Those, we get the position to the original image and pick the pixel there.

   The formula of position row/column pixel is:

   - 1 + A * C = B for original Image in Row/Col

   A is the ratio we want to search, B is the current position, and C is the distance from first index, which the formula is Maximum of Row / Col – 1.

   So let say we are in the resized image in pixel(i , j), with the formula above, we can search the value of A as $A_{Row} = (i - 1) / (Max_{Row1} - 1)$, $A_{Col} = (j - 1) / (Max_{Col1} - 1)$

   Insert A to the formula back for the original Image, we got the position of the normal Image. If it's decimal, round it to nearest integer.

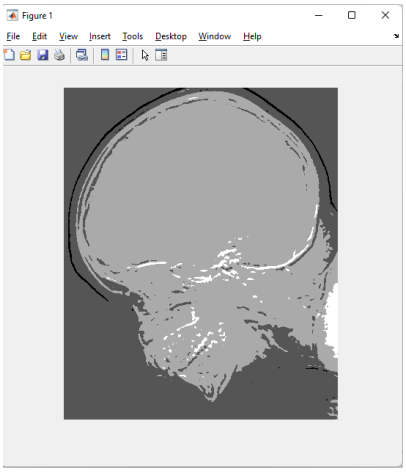
3. **Zooming and Shrinking Images by Bilinear Interpolation**

   The same concept with Pixel Replication, but once we get the original position, rather we round it, we use floor and ceiling function, which we will get 4 different pixel position, for up-left, up-right, down-left, and down right. We average the up part with the value of the pixel multiply by the distance from the original position. The same thing with down part and average both result by the distance also.

Question on Zoom then Shrinking Image towards the Image Quality

For Pixel Replication, in some cases we might replace the pixel by other pixel, that if we zoom and shrink it. As for bilinear, the pixel might be replaced by the average calculated pixel, and loosening pixel color. Both may be sound bad, but the result is not bad except you shrink it first.

Image of level 4 intensity



Scaling by 0.1 using KNN

Scaling by 3 using bilinear