Conversion of Images to Monochrome

Akhilesh Ravi

9 September 2018

This aim of this program is to convert a greyscale image to a monochrome image and make it appear as if it is a greyscale image having various pixel intensities using various methods. This happens because our eye averages the region around a pixel.
f, f1, g, g1, g2, g3, g4, g5, g6 - It should be greyscale image (2D matrix)
This should be the format for the functions.
In the main program, main.m, the input image can be a colour image. It should be of .jpg type (other than campus.png)

g1 = threshold_161100007(f)

Thresholding the greyscale image
This function directly thresholds the greyscale image and converts it into a monochrome image (threshold, T = 127)

[f1, g2] = noiser_16110007(f)

Random Noise Binarization
Random noise in the range [-128 128] and then, the threshold is introduced for binarization.

[g3, g4, g5] = halftone_16110007(f)

Halftoning using dither matrices
This function halftones the input image by using a dither matrix of a given size.

Output Arguments
g3 - Output image (input image halftoned by 2x2 dither matrix)
g4 - Output image (input image halftoned by 4x4 dither matrix)
g5 - Output image (input image halftoned by 8x8 dither matrix)

g6 = error_diffusion_16110007(f)

Error Diffusion
We go pixel by pixel and binarize it using the threshold (T = 127). We check the error of the pixel after thresholding with respect to the original image. We scale this error and add it to neighbouring pixels using a scaling matrix.

[a1, a2, a3, a4, a5, a6] = fidelity_16110007(f, g)

Fidelity Metrics
Function to find out the fidelity of an image (monochrome) with respect to the original image using various metrics. Here we compare how close the two images appear to be.

Input Argument
f - Input Reference Image
g - Input Image

Output Arguments
a1 - Mean of deviation
a2 - Mean of absolute deviation
a3, a4 - Mean of Absolute Deviation after transforming using gamma
a5, a6 - Mean of Absolute Deviation after applying gamma transformation and then applying a Low Pass Filter

0.1 Image 1 -campus.png

Here are the fidelity metrics for g1 to g6 for campus.png.

Image	α_1	α_2	α_3	α_4	α_5	α_6
g1	46.3979	92.3566	60.4193	132.1008	92.3442	150.6884
g2	-23.9031	109.5145	113.3679	112.5216	60.9789	51.7983
g3	-0.0470	113.5935	104.9654	125.8948	50.7676	42.0606
g4	-0.0312	113.6792	104.9083	125.9855	51.4734	42.9971
g5	-0.1135	113.7009	104.9682	125.9658	51.5393	43.0042
g6	-0.1027	112.7252	104.0663	125.2739	48.3253	43.6722

0.2 Image 2 - river.jpg

Here are the fidelity metrics for g1 to g6 for river.jpg.

Image	α_1	α_2	α_3	α_4	α_5	α_6
g1	-13.5698	62.0080	70.7546	73.9204	58.2157	93.5345
g2	-38.5389	72.0513	91.1677	71.1090	56.3350	52.1181
g3	2.5874	78.1590	76.7970	92.7154	37.3632	58.8553
g4	-0.1661	80.7990	80.3811	93.8599	41.3750	50.1979
g5	-0.0326	80.8659	80.4206	93.9592	41.3386	50.4855
g6	-0.2120	80.7819	80.4082	93.8266	40.2956	49.8636

0.3 Image 3 - snow.jpg

Here are the fidelity metrics for g1 to g6 for snow.jpg.

Image	α_1	α_2	α_3	α_4	α_5	α_6
g1	-48.6838	78.3545	115.1636	64.4758	69.4783	61.4689
g2	-63.9201	85.0736	128.1811	63.0224	64.7452	34.0008
g3	-7.6008	102.3028	116.4125	99.3492	43.6477	35.6458
g4	0.1139	105.1468	115.3899	104.6612	41.2715	36.8203
g5	0.0755	105.1235	115.3979	104.6218	41.2930	36.9635
g6	-0.1358	104.9559	115.3536	104.4018	40.9746	35.5377

0.4 Observations

- In general, we observe that g5 and g6 have the lowest values of α_1, α_5 and α_6 and g1 or g2 have the lowest values of α_2, α_3 and α_4.
- Sometimes, g1, g2, g5 and g6 have similar values for certain metrics.

- In general, we observe that g5 or g6 seems to best represent the original image for the human eyes.
- In some cases, g2 is also appears to be close to the original image.

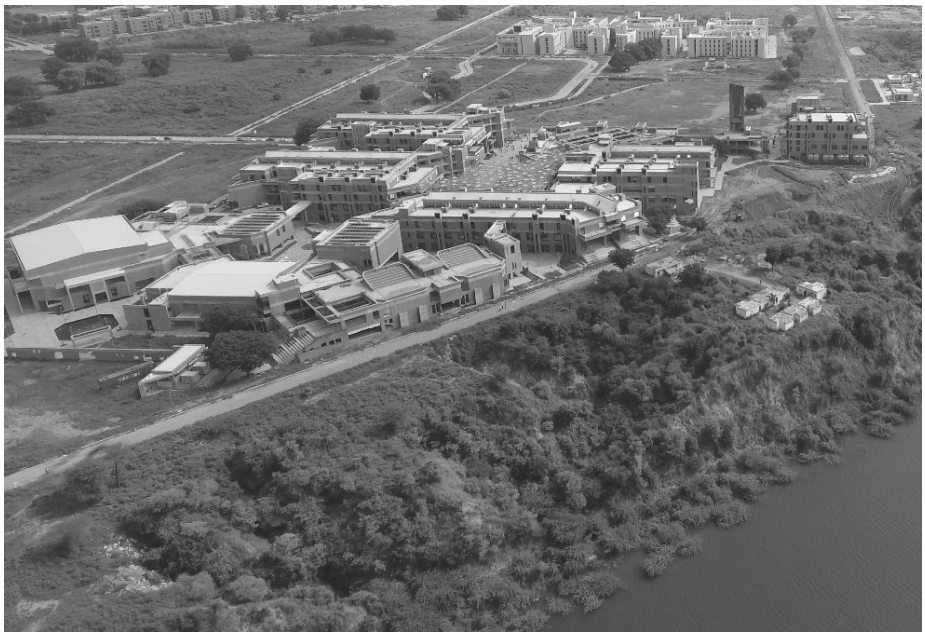

Figure 1: campus.png

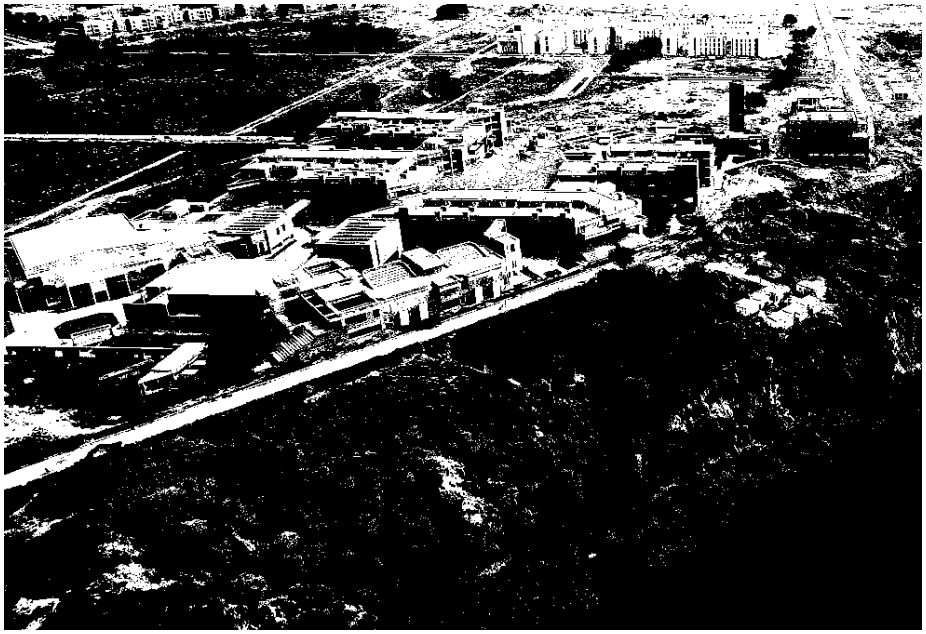

Figure 2: g1 for campus.png

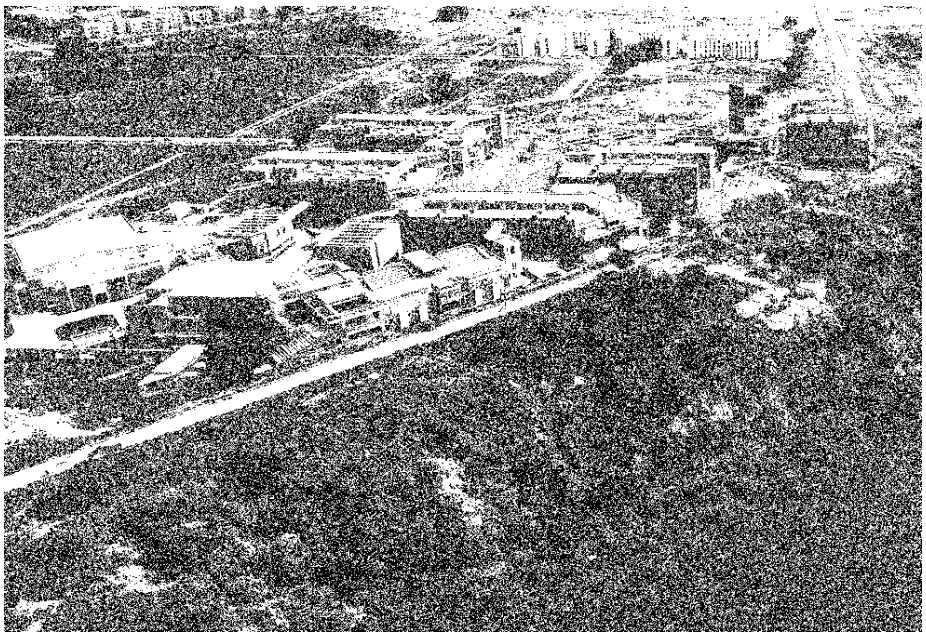

Figure 3: g2 for campus.png

Figure 4: g3 for campus.png

Figure 5: g4 for campus.png

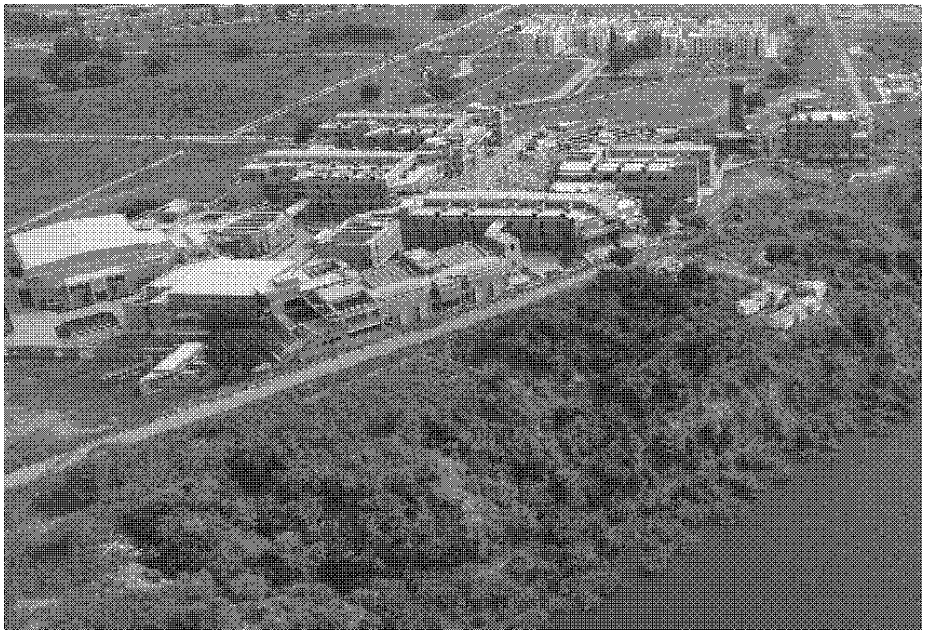

Figure 6: g5 for campus.png

Figure 7: g6 for campus.png

Figure 8: river.jpg

Figure 10: g1 for river.jpg

Figure 11: g2 for river.jpg

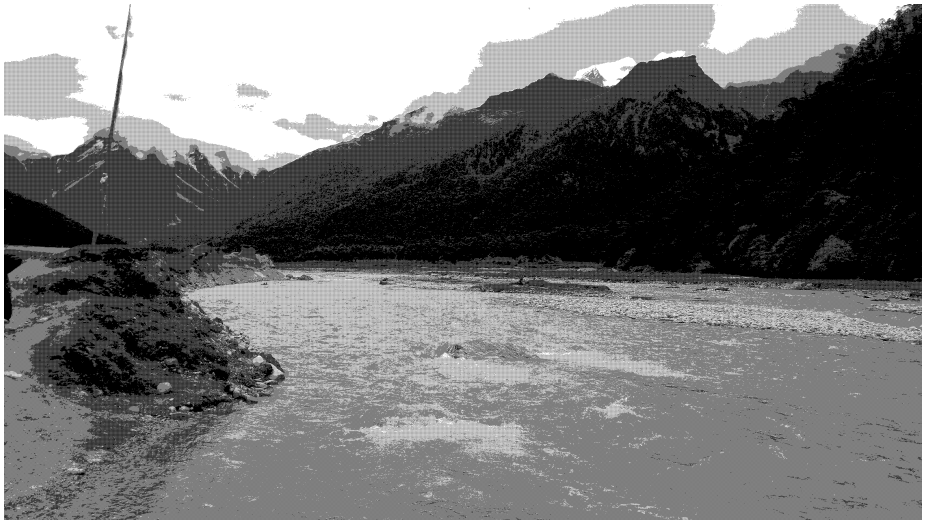

Figure 12: g3 for river.jpg

Figure 13: g4 for river.jpg

Figure 14: g5 for river.jpg

Figure 15: g6 for river.jpg

Figure 16: snow.jpg

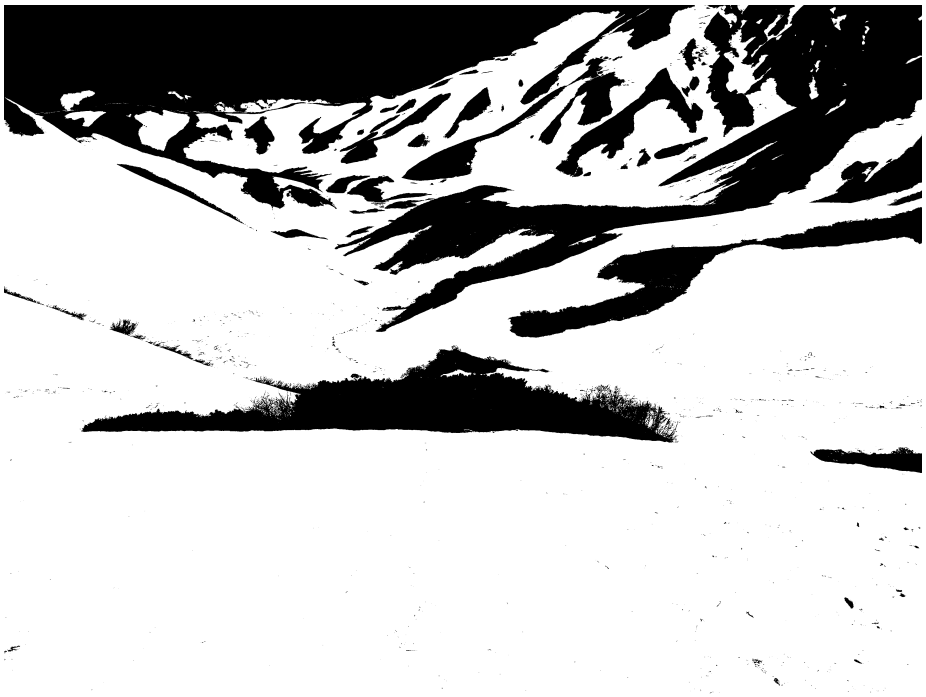

Figure 18: g1 for snow.jpg

Figure 19: g2 for snow.jpg

Figure 20: g3 for snow.jpg

Figure 21: g4 for snow.jpg

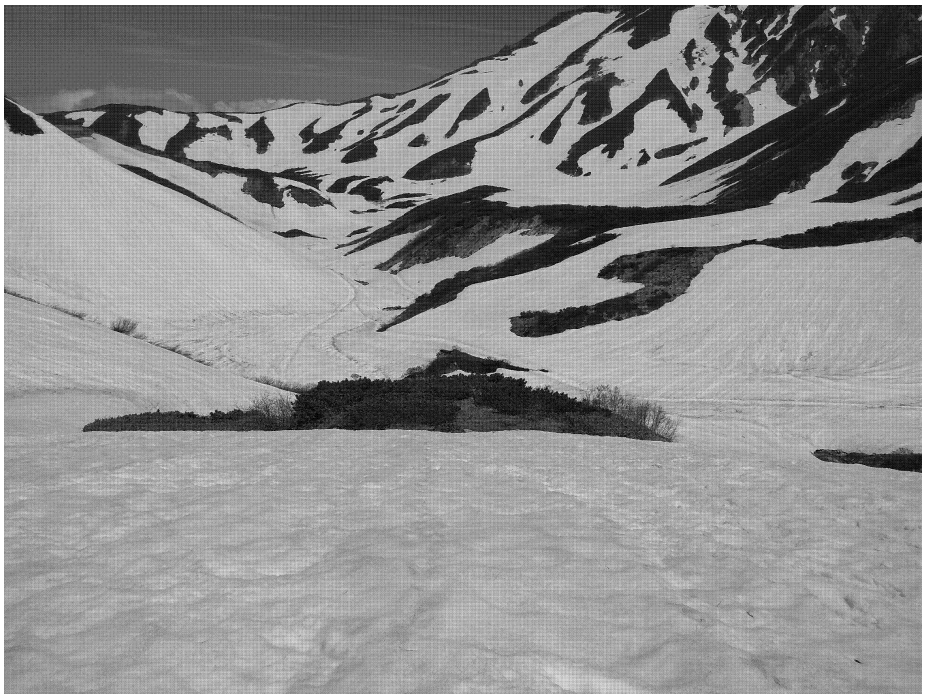

Figure 22: g5 for snow.jpg

Figure 23: g6 for snow.jpg