Project 1 Report

Kautuk R Desai – 50247648

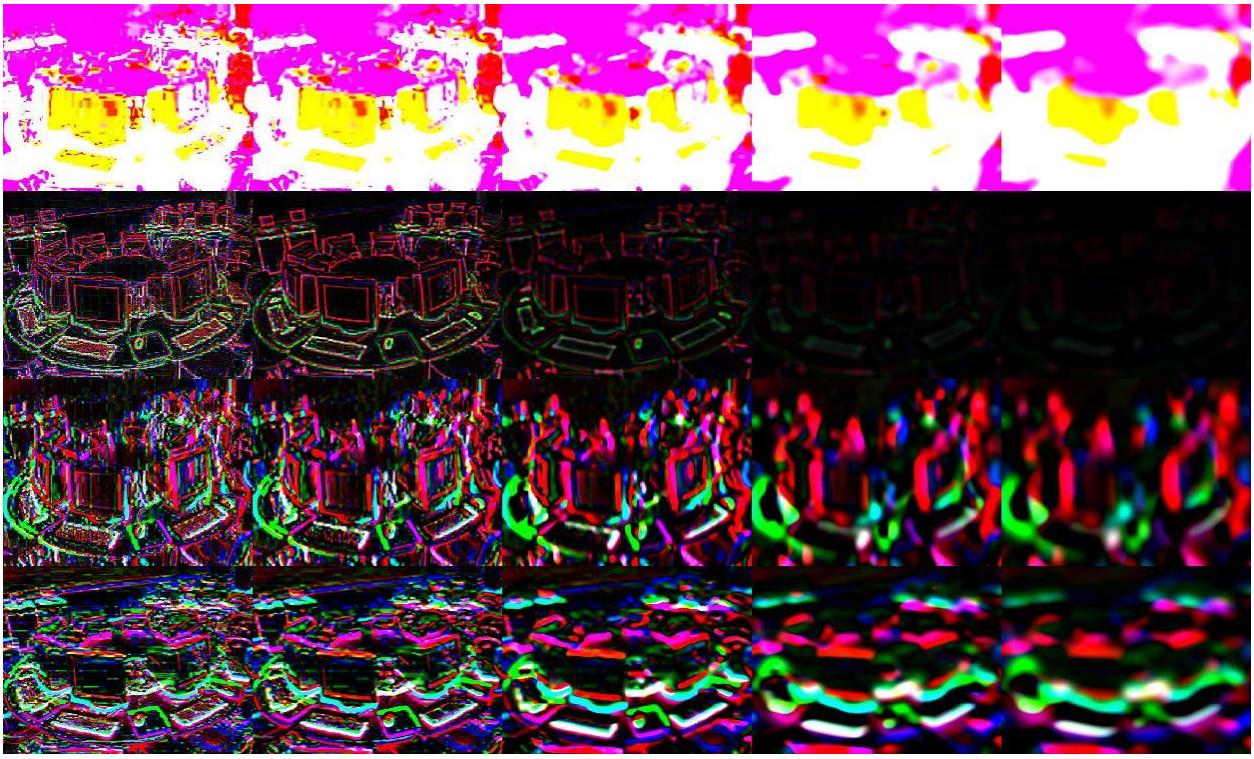
Q1.0

➔ The create filter bank script contains 4 types of filters,

1. Gaussian Filter: A Gaussian filter gives less weight to pixels further from the center of window. It removes high-frequency components from the image, so it basically acts like a low-pass filter.
   Using Gaussian filter, the nearest neighboring pixels have the most influence on the output. It means that, the output of this filter on each pixel is the value of the pixel along with the values of the neighboring pixels.
2. LoG filter (Laplacian of Gaussian): The Laplacian of an image highlights regions of rapid intensity change and it is 2^{nd} spatial derivative (2^{nd} order) of an image. It is mainly used to highlight edges in an image. This filter is often used after the image is smoothed by Gaussian filter.
3. Derivative of Gaussian filter (dx & dy): The derivative filters are 1^{st} derivative (1^{st} order) filter and they are mainly used to detect changes in image along the x and y directions. These filters can identify changes across a pixel. Dx is the derivative for horizontal edges whereas dy is for vertical edges.

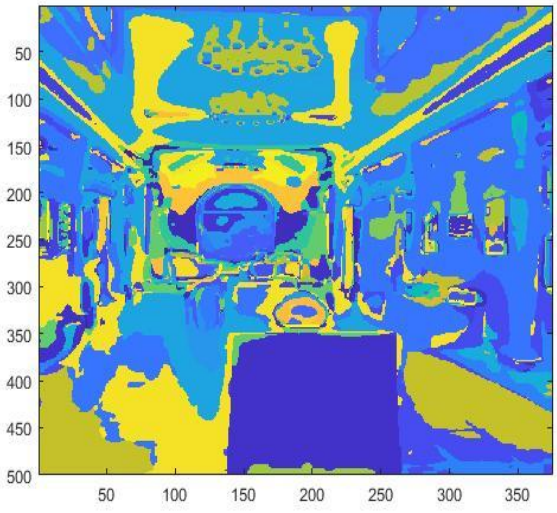
Q1.1)

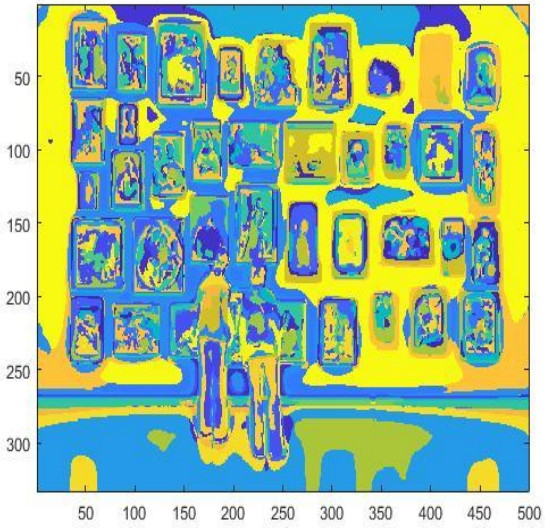
➔ Montage of an image, 'data/computer_room/sun_aagspgyvjmoiytfb.jpg'

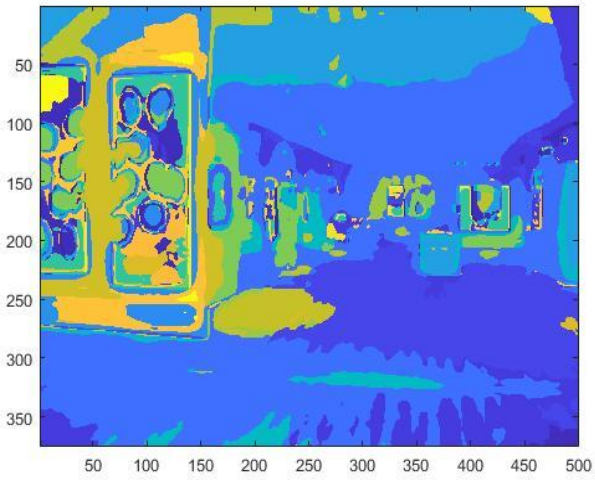


Q1.3)

➔ Images and their respective wordmaps. First three images and their respective wordmap was selected from ‘data\art_gallery’

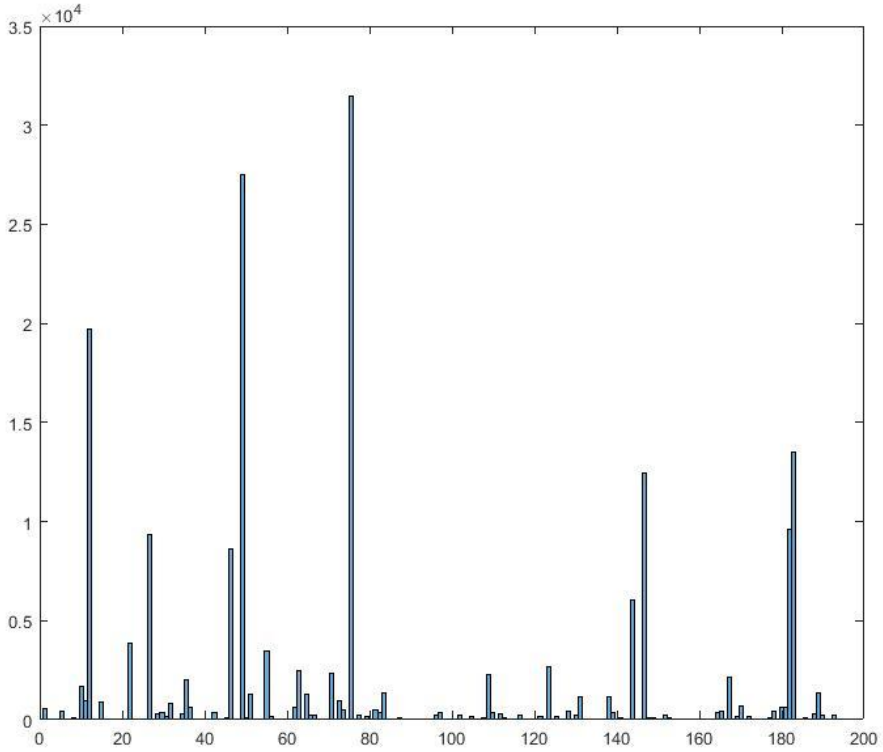






Q2.1)

- ➔ To verify that histogram works, the following code was written
  >> load('../data/art_gallery/sun_aaaxsldstlpzwrbe.mat', 'wordMap');
  >> histogram (wordMap, 200)
- ➔ Below is the histogram plot of the word map.



➔ Both histogram and histcounts function have the capability of automatic binning and normalization. But histcounts is the primary calculation used to get bin counts for histogram.

Q2.3)

➔ In order to test the function the vectors, wordHist and Histogram, we given test case values and the output of the function was matched with manually calculated output.

➔ wordHist = [1; 2; 3]
Histograms = [4, 5, 6; 7, 8, 9; 2, 4, 6]

Expected output (sum): [5, 6, 6]
Function output matched with the expected output.

Q2.5)
The following alpha and K-cluster values were used for testing

Alpha α	K-cluster	Accuracy (%)
200	200	47.5
150	200	39.375
150	150	51.25
150	100	51.25
100	100	47.5

For K = 150, α = 150 the accuracy is maximum, the confusion matrix obtained is given below

	Art Gallery	Computer Room	Garden	Ice Skating	Library	Mountain	Ocean	Tennis Court
Art Gallery	4	4	0	5	5	0	1	1
Computer Room	3	7	0	3	5	0	1	1
Garden	1	0	15	0	2	1	1	0
Ice Skating	1	2	1	13	1	1	0	1
Library	5	2	0	3	10	0	0	0
Mountain	1	0	2	1	0	10	6	0
Ocean	0	0	0	0	0	0	20	0
Tennis Court	2	3	2	6	0	1	3	3

Q2.6)
From the confusion matrix for the best accuracy (51.25 %), we can infer that Ocean's accuracy is higher than all others:
Number of Ocean images: 20
Number of images that were classified correctly = 20

Number of images that we incorrectly classified as Ocean:
Mountain classified as ocean = 6
Computer room = 1
Art Gallery = 1
Tennis Court = 3

The lowest accuracy (15%) was for classifying Tennis Court which has only 3 correctly classified out of the total 20. 6 out the 20 Tennis Court images were classified as Ice Skating, this may be because both the scene are Indoor and might have the same lighting. Also, the edges could be same for Tennis Court and Ice Skating might. Similarity in color could also possible lead to the incorrect classification.
On the other hand, the scene which has very minimum similarity in color, brightness and edges are never confused. For example: mountain and library.