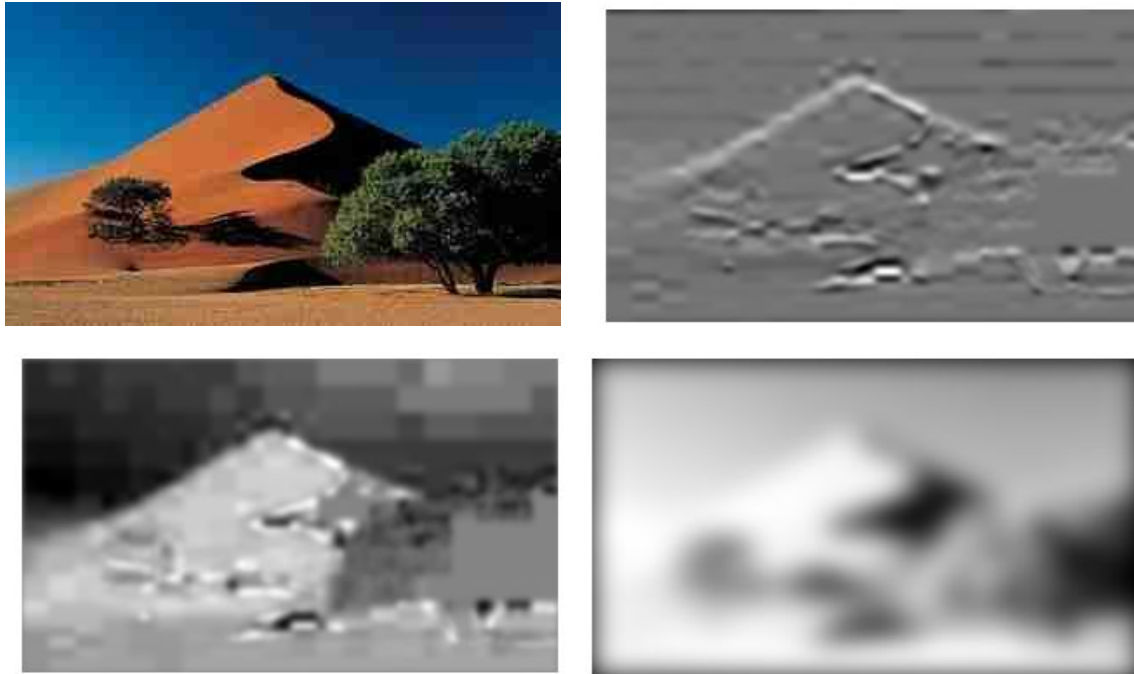# Q1.1

Artifacts:

Third image's right down corner(the tree) is blurred too hard, and lose too much information. Forth image's boundary becomes dark, while its unnecessary.

CIE Lab color space:

It expresses color as three values: L (for the lightness from black to white), a(from green to red), and b (from blue to yellow). CIELAB was designed so that the same amount of numerical change in these values corresponds to roughly the same amount of visually perceived change. Working with CIELAB has two major advantages in these works: (i) the colour space is designed for perceptual uniformity which makes it ideal for computer processing and (ii) these models only have to predict the a and b channels, as the L channel would be the grey-scale image.
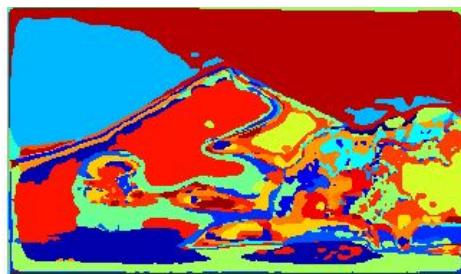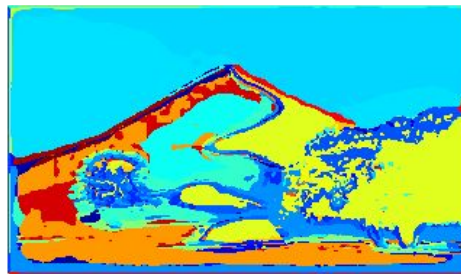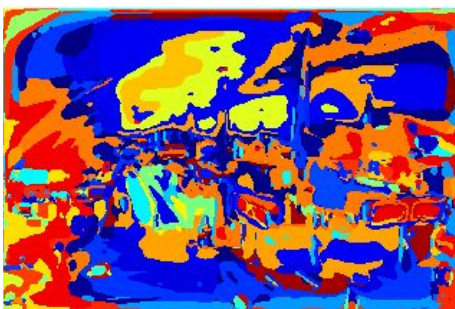
Q1.2
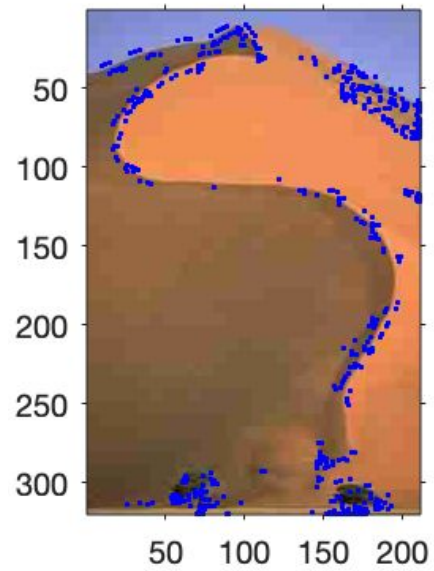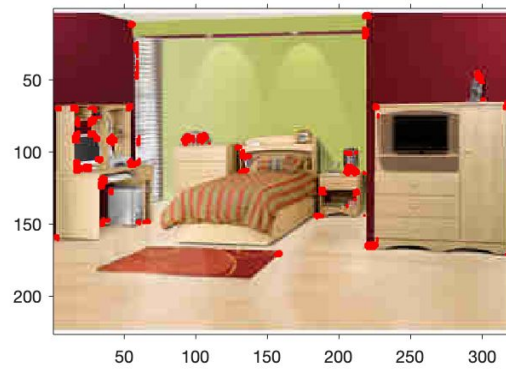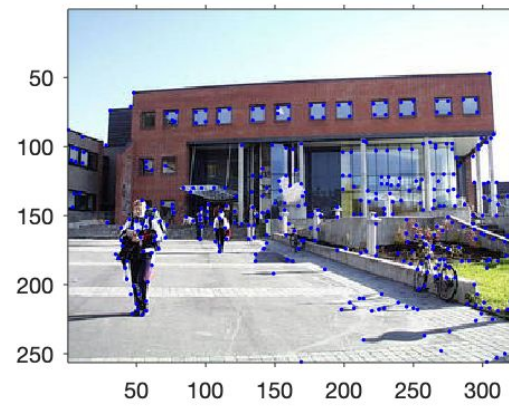
Q2.1

Origin
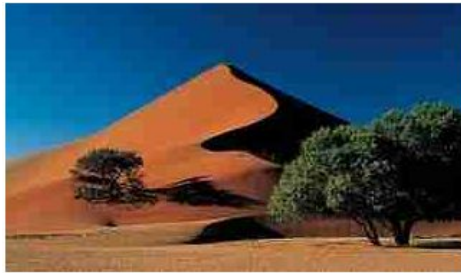
Random

Harris

Origin

Random

Harris
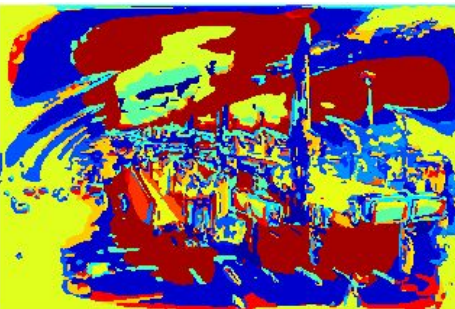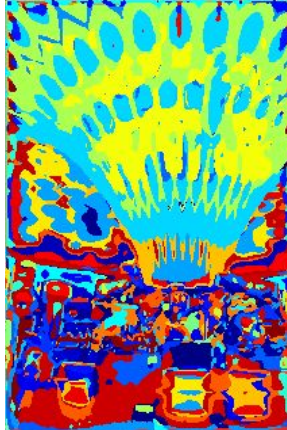
Origin	Ranom	Harris
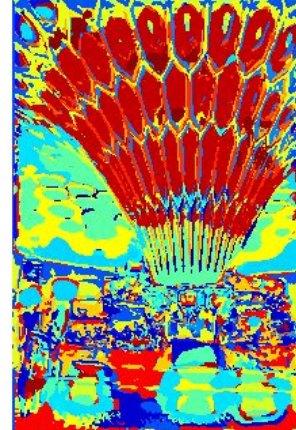
Are the visual words capturing semantic meanings?

Yes, those color(or dictionary label) describe the abstract meaning of some features of some place. Like, airport has more area in red and yellow, desert has more area in orange, dark red. The combination or distribution of these labels can imply how the scene looks like.

Which dictionary seems to be better in your opinion? Why?

I think Harris dictionary is better, it can accurately show the deges with different color than non-edge area. Compare with random dictionary, it has more color details, and clearly more types of color. Which makes classifier easier to classify and get higher accuracy. But, I can not directly predict which will get higher accuracy only depends on these sample image.

Q3.2

Harris - Euclidean (0.4625)

14	1	3	0	0	0	0	2
3	12	2	1	1	1	0	0
5	4	9	0	1	1	0	0
3	1	1	9	0	2	4	0
1	3	1	1	9	0	4	1
3	1	2	5	0	4	2	3
4	2	0	5	3	1	2	3
3	0	0	2	0	0	0	15

Harris - Chi2 (0.4938)

13	2	3	0	0	0	0	2
2	11	3	1	2	1	0	0
3	5	11	0	1	0	0	0
1	2	3	9	1	3	1	0
0	3	3	1	9	0	4	0
1	3	3	1	1	6	2	3
2	3	3	2	0	0	7	3
4	0	0	2	0	0	1	13

Random - Euclidean (0.4625)

11	2	2	3	0	0	0	2
5	11	3	0	1	0	0	0
9	5	4	0	2	0	0	0
2	1	1	11	0	1	0	4
0	3	1	1	13	0	2	0
3	3	2	3	0	5	1	3
3	1	1	5	1	2	5	2
2	0	1	3	0	0	0	14

Random - Chi2 (0.4875)

14	2	1	0	0	0	0	3
3	12	3	0	1	1	0	0
4	5	9	0	2	0	0	0
2	3	1	8	0	2	3	1
0	3	2	0	11	0	4	0
1	2	1	4	0	5	2	5
3	0	2	5	3	0	5	2
4	0	0	2	0	0	0	14

How do the performances of the two dictionaries compare? Is this surprising?

Harris has better performance than Random-dictionary. It is not surprising, because edges can always better describe the feature of a view.

How about the two distance metrics? Which performed better? Why do you think this is?

Chi-square distance metrics does better. The chi-squared distance is a nonlinear metric and is widely used to compare histograms. It has been shown that chi-squared distance has better behavior in describing distance between high dimensional distributions.
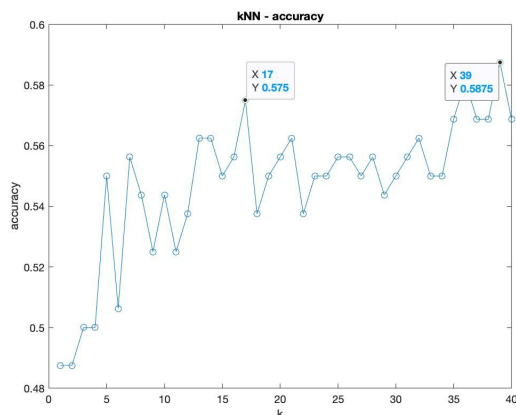
Large k may also reduce the performance of kNN, it depends on the model. A small value of k means that noise will have a higher influence on the result. If data is very noisy, I tend to choose larger k, which can tolerate more noise. In this case, I can just loop over some possible k value, and select the one with maximum accuracy. I think k=17 or k=39 are both good. Which achieved 59% accuracy.