16385-HW4

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Q2.1

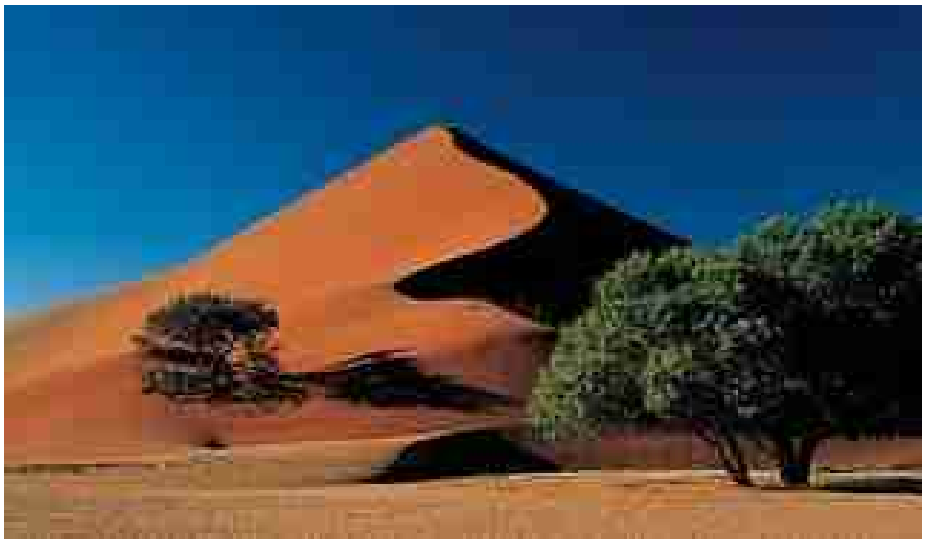

Figure 1: Original image

Figure 2: Filter response 1

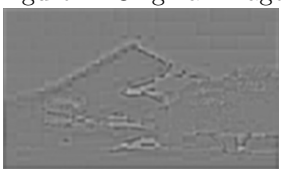

Figure 3: Filter response 2

Figure 4: Filter response 3

I observed that some of the filters make the image more blurry and different channels corresponded differently. CIE lab color space is designed to be perceptually uniform space, meaning the numerical color difference is close to human perception, which is the reason we choose it over other color space since

we could perserve more perceptual information. While L axis is for lightness, a axis is the color range from cyan to magenta, and b axis represent color range from blue to yellow.

Q3.3

I think it captured semantic meanings. For example, walls will be classifies as a color and other surroundings will be classified as other colors. In my opinions, harris dictionary perform better because it capture and classified visual words better, and has more detail compare to random dictionary.

Q4.3

NN:The result is actually surprising because in my random dictionary performs slightly better compare to harris dictionary. In terms of distance method, chi-square performs better. This is because chi-square works better in comparing distributions, which could perform better in terms of analyzing overall distribution of color. On the other hand, euclidean directly compare values for each pixel which is less tolerant to general differences.

kNN: I chose the random dictionary with chi2 distance since this combination has the highest accuracy among 4. In the graph, we can see that the peak occur at 11. If two indices have the same accuracy, I choose the smaller one. A higher k does not necessary mean higher accuracy. This is because, when we increase the k, the model will be less overfitting and consider the general pattern more. But if k gets too large, it will underfit the model and thus having a less accuracy.

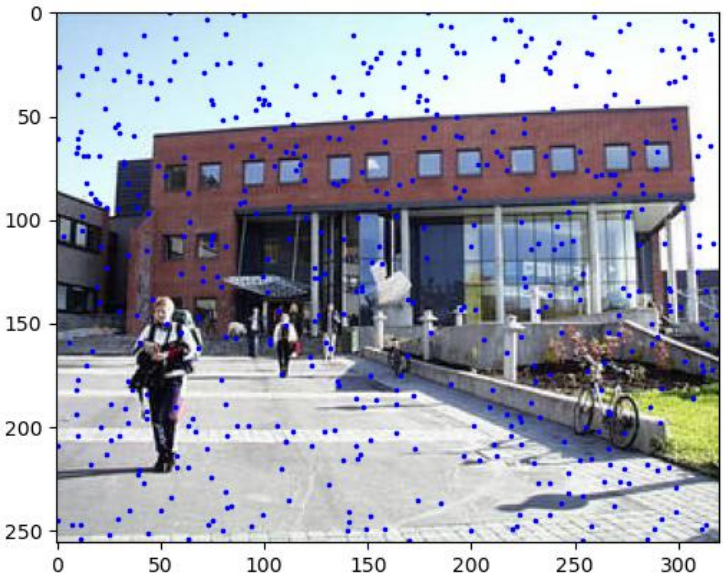

Figure 5: 2.2 Random points $\alpha = 500$

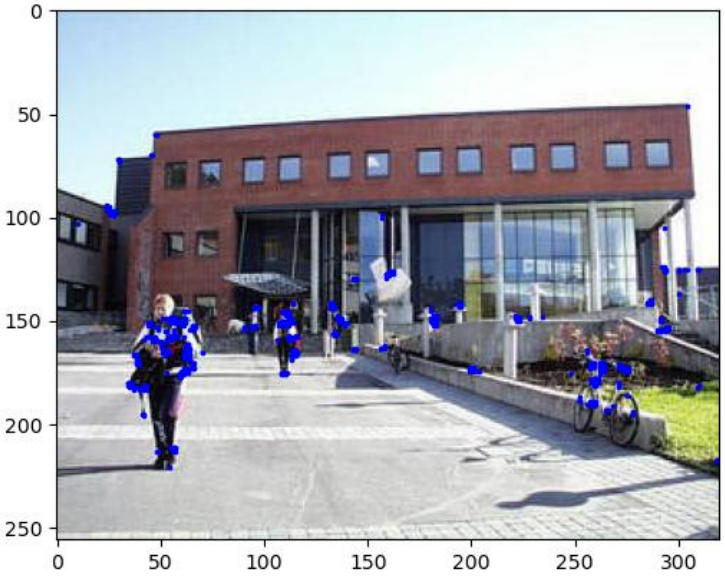

Figure 6: 2.2 Harris points $\alpha = 500, k = 0.05$

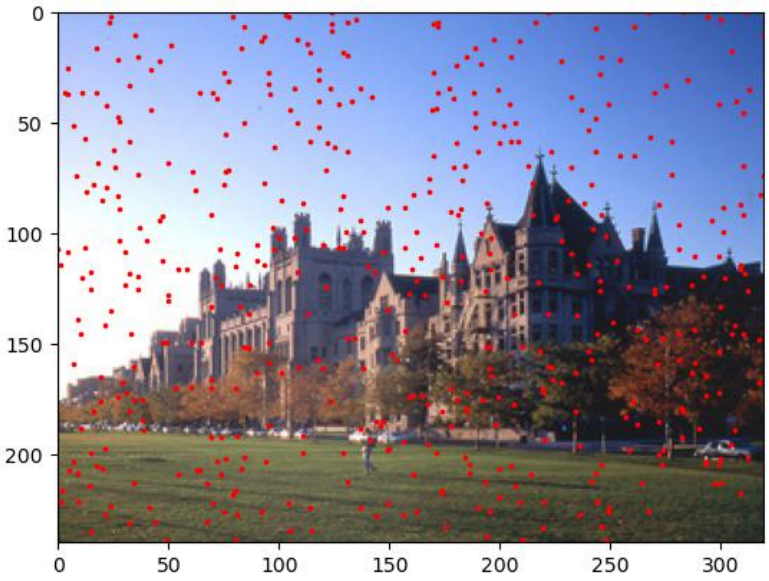

Figure 7: 2.2 Random points $\alpha = 500$

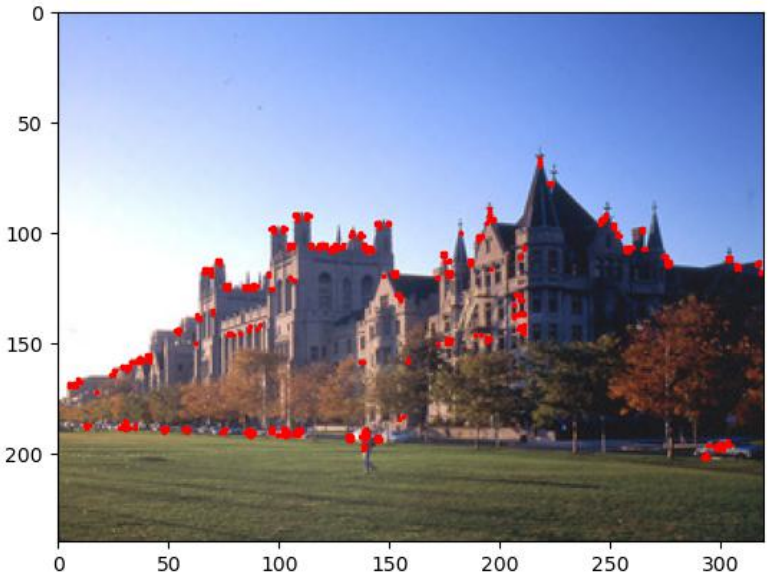

Figure 8: 2.2 Harris points $\alpha = 500, k = 0.05$

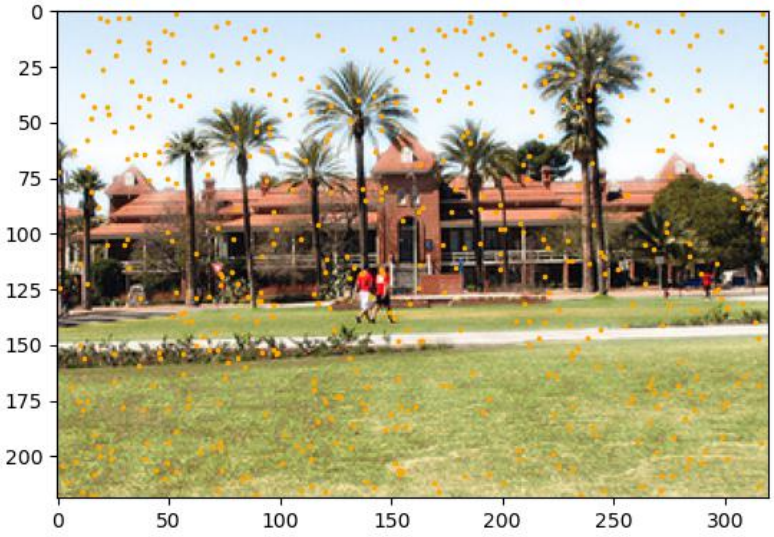

Figure 9: 2.2 Random points $\alpha = 500$

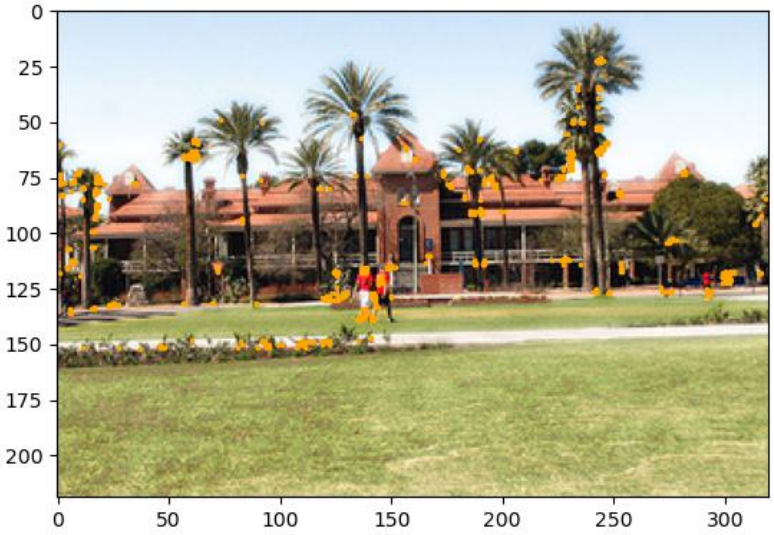

Figure 10: 2.2 Harris points $\alpha = 500, k = 0.05$

Figure 11: Airport original

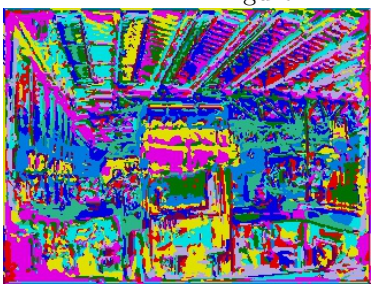

Figure 12: Harris1

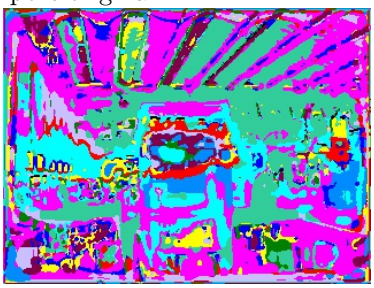

Figure 13: Random1

Figure 14: campus original

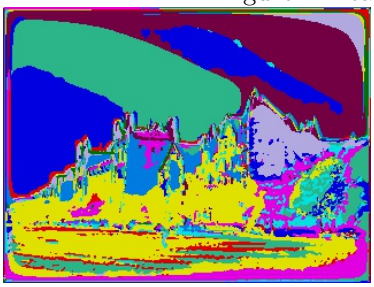

Figure 15: Harris

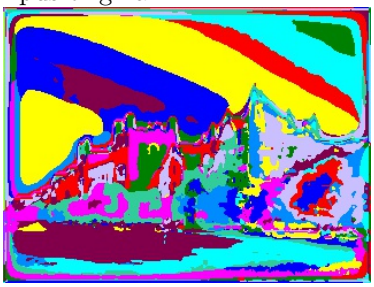

Figure 16: Random

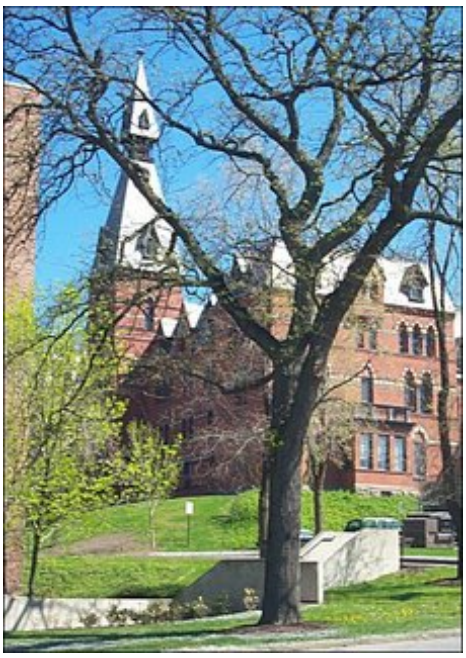

Figure 17: bedroom original

Figure 18: Harris

Figure 19: Random

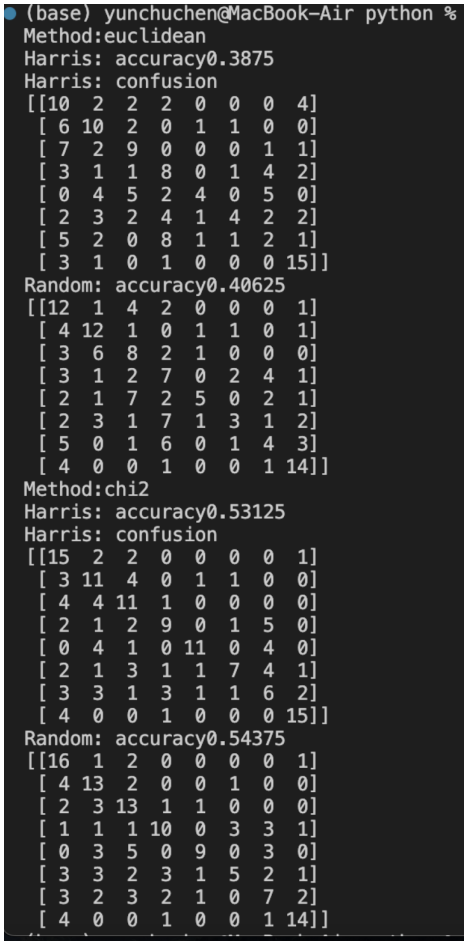

Figure 20: Accuracies and confusion matrices

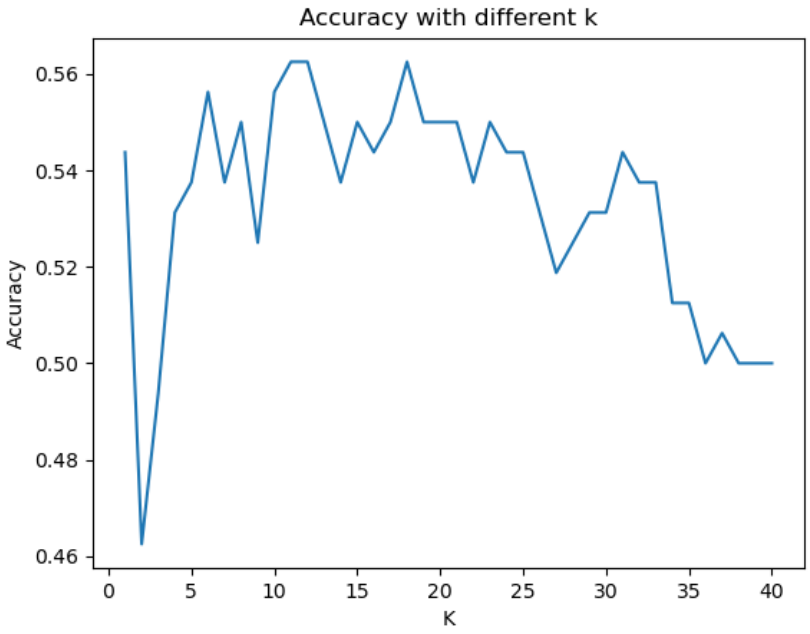

Figure 21: Accuracies in term of k

```
(base) yunchuchen@MacBook-Air python % python evaluateRecognitionSystem_kNN.py
[0.54375 0.4625  0.49375 0.53125 0.5375  0.55625 0.5375  0.55    0.525
 0.55625 0.5625  0.5625  0.55    0.5375  0.55    0.54375 0.55    0.5625
 0.55    0.55    0.55    0.5375  0.55    0.54375 0.54375 0.53125 0.51875
 0.525   0.53125 0.53125 0.54375 0.5375  0.5375  0.5125  0.5125  0.5
 0.50625 0.5     0.5     0.5    ]
Best Accuracy: 0.5625
Best k: 11
Best confusion:
[[14  2  2  0  0  0  0  2]
 [ 6 13  1  0  0  0  0  0]
 [ 5  3 12  0  0  0  0  0]
 [ 2  1  0 10  0  1  4  2]
 [ 0  4  4  0 11  0  1  0]
 [ 2  2  4  2  0  7  1  2]
 [ 4  1  3  2  2  2  5  1]
 [ 2  0  0  0  0  0  0 18]]
```

Figure 22: confusion matrix with best $k = 11$