



ELEC 546 Assignment #7 Image Classification

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1 Bag of Features Classification with SIFT Descriptors

- For sift part, I traverse all classes and use vl_sift in vlfeat library. I followed the steps on assignment.

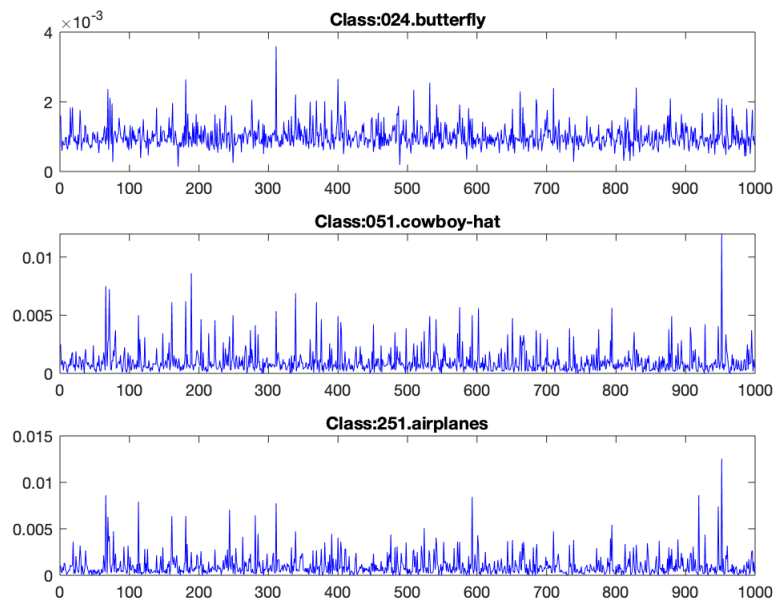


Figure 1: Distribution

- possible improvement This algorithm runs slow on large dataset.

- Confusion matrix
testResult =

```
0.4000 0.3000 0.3000
1.0000 0.0000 0.0000
0.0625 0.1250 0.8125
```



Figure 2: Histogram

2 Can you fix it? Yes you can!

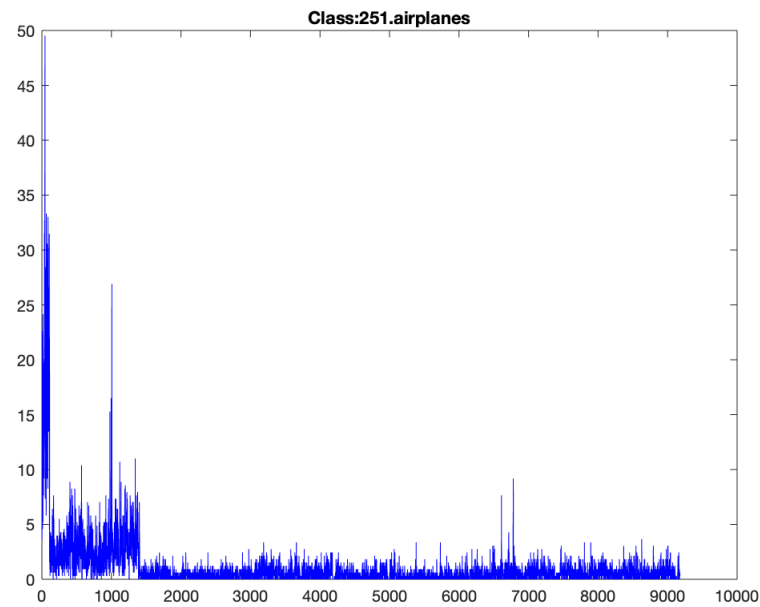


Figure 3: Airplane

- Salient features of improved classification framework.
I used vocabulary tree clustering to speed up cluster algorithm.
- confusion matrix

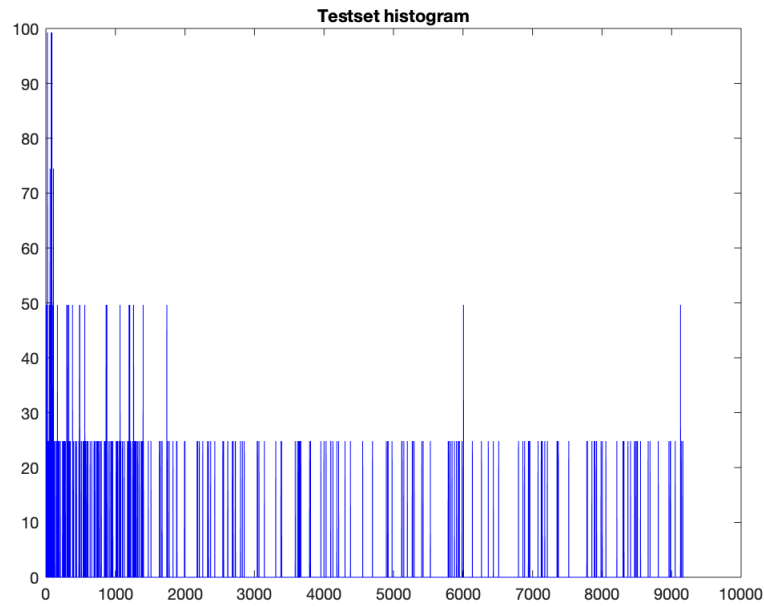


Figure 4: Confusion matrix

Columns 1 through 11										
25.0000	8.3300	16.6700	8.3300	0	8.3300	8.3300	0	0	0	0
0	14.2900	7.1400	0	7.1400	14.2900	14.2900	0	0	0	0
0	0	20.0000	10.0000	0	10.0000	0	10.0000	0	0	0
0	0	10.0000	50.0000	0	0	0	0	0	0	0
0	7.1400	7.1400	14.2900	35.7100	0	14.2900	7.1400	0	0	0
0	10.0000	0	0	0	70.0000	0	0	0	0	0
0	0	0	0	0	10.0000	60.0000	0	0	0	0
0	0	0	10.0000	0	10.0000	10.0000	30.0000	0	0	0
0	0	0	20.0000	0	0	0	20.0000	0	0	0
0	0	0	0	20.0000	0	6.6700	0	0	0	0
0	7.1400	0	14.2900	0	7.1400	7.1400	14.2900	0	0	0
0	0	0	14.2900	0	7.1400	0	0	21.4300	0	0
0	0	0	20.0000	0	0	0	0	0	0	0
0	0	0	10.0000	10.0000	0	40.0000	10.0000	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	10.0000	0	10.0000	0	0	10.0000	0	0	0	0
0	0	0	20.0000	0	0	20.0000	10.0000	0	0	0

						0	0	0
10.0000	10.0000	0	0	0	0	0	0	0
					0	10.0000	0	0
0	23.0800	0	0	0	23.0800	0	0	0
0	0	0	0	0	0	0	0	0
0	0	20.0000	10.0000	0	10.0000	10.0000	0	0
0	0	18.7500	18.7500	0	10.0000	10.0000	0	0
0	0	0	10.0000	0	0	6.2500	0	0
0	0	14.2900	35.7100	0	10.0000	0	0	0
0	0	6.2500	0	0	0	0	18.7500	0
					0	0	0	0
Columns 12 through 22								
0	0	0	0	0	0	0	0	0
0	7.1400	0	0	7.1400	0	0	8.3300	0
0	0	0	0	0	0	14.2900	7.1400	0
0	10.0000	0	0	0	0	10.0000	0	0
0	0	0	0	0	0	20.0000	0	0
0	0	0	0	0	7.1400	0	0	0
10.0000	0	0	0	0	0	7.1400	0	0
0	0	0	0	10.0000	10.0000	0	0	0
0	0	0	0	0	10.0000	10.0000	0	0
0	0	0	0	0	10.0000	20.0000	10.0000	0
13.3300	0	0	6.6700	6.6700	0	0	10.0000	0
7.1400	0	7.1400	0	0	6.6700	13.3300	0	0
42.8600	0	0	14.2900	7.1400	7.1400	7.1400	0	0
0	20.0000	10.0000	0	0	0	0	0	0
0	0	10.0000	0	0	10.0000	0	10.0000	0
0	10.0000	0	40.0000	0	10.0000	0	10.0000	0
0	0	0	0	30.0000	20.0000	0	0	0
0	0	0	0	0	0	10.0000	0	0
0	10.0000	0	10.0000	0	0	30.0000	0	0
0	0	0	0	0	0	0	10.0000	0
0	0	0	0	0	0	0	46.1500	0
0	0	0	0	0	0	0	7.6900	0
0	0	0	0	10.0000	60.0000	0	0	0
0	6.2500	0	6.2500	0	10.0000	0	0	0
0	0	0	0	0	6.2500	0	12.5000	0
0	0	0	0	0	10.0000	10.0000	0	0

					10.0000	0	0
0	7.1400	0	0	14.2900	0	7.1400	0
					7.1400	0	0
0	18.7500	0	6.2500	0	0	0	0
					0	0	12.5000
Columns 23 through 25							
8.3300	0	8.3300					
0	0	0					
10.0000	10.0000	0					
10.0000	10.0000	10.0000					
0	0	0					
0	0	0					
0	0	0					
0	0	0					
0	0	10.0000					
13.3300	0	6.6700					
0	0	0					
0	0	0					
10.0000	0	10.0000					
0	0	0					
0	0	0					
30.0000	0	0					
10.0000	10.0000	10.0000					
0	0	10.0000					
0	0	0					
20.0000	0	0					
0	0	0					
6.2500	18.7500	0					
40.0000	0	10.0000					
7.1400	7.1400	0					
0	0	37.5000					

3 Grad Credits: Support Vector Machines for Image Classification

- Reading

SVM is a classification method that can classify dataset which is linear separable. If the dataset is not linear separable, we need to use kernel method to create a kernel and make dataset linear separable. There are hard-margin and soft-margin SVM which is categorized by how to derive hyperplane. KNN is highly dependent on how k is chosen which has low generalization. However in SVM, if we add penalty term, it will prevent from overfitting.

- Train SVM on 3 class dataset Training loss is:

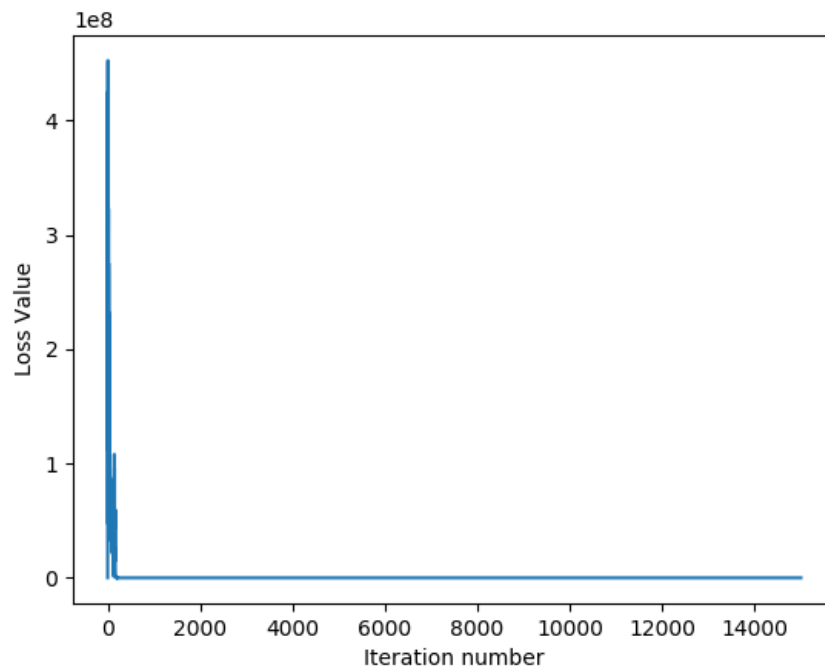


Figure 5: Training loss

- Train SVM on 3 class dataset
Confusion matrix is

```
[[0.3, 0.7, 0],
 [0.5, 0.4, 0.1],
 [0, 0, 1]]
```

- Competition

```
training accuracy: 1.0
Test accuracy: 0.6388888888888888
```

Figure 6: Train and test accuracy

Training accuracy: 1.0
Testing accuracy: 0.6389