

Support Vector Machines Analysis

1. Use the scikit implementation of support vector machines to train a classifier to distinguish 3's from 8's. (Use the MNIST data from the KNN homework.)

Ans: Please check svm.py for this part.

2. Try at least five values of the regularization parameter C and at least two kernels.

Ans:

```
#Accuracy: 96.8122 #Kernel: linear #Regularization Parameter_C: 1.0
#Accuracy: 96.6650 #Kernel: linear #Regularization Parameter_C: 1.5
#Accuracy: 96.6160 #Kernel: linear #Regularization Parameter_C: 2.0
#Accuracy: 96.4689 #Kernel: linear #Regularization Parameter_C: 5.0
#Accuracy: 96.3708 #Kernel: linear #Regularization Parameter_C: 10.0
#Accuracy: 96.0765 #Kernel: linear #Regularization Parameter_C: 15.0
#Accuracy: 96.9103 #Kernel: rbf #Regularization Parameter_C: 1.0
#Accuracy: 97.0083 #Kernel: rbf #Regularization Parameter_C: 1.5
#Accuracy: 97.2536 #Kernel: rbf #Regularization Parameter_C: 2.0
#Accuracy: 97.8911 #Kernel: rbf #Regularization Parameter_C: 5.0
#Accuracy: 98.1363 #Kernel: rbf #Regularization Parameter_C: 10.0
#Accuracy: 98.1854 #Kernel: rbf #Regularization Parameter_C: 15.0
```

Figure 1: The analysis was done with ..
regularization parameters $C=\{1, 1.5, 2, 5, 10, 15\}$
kernel = {linear, rbf}

This little experiment shows that accuracy went down by increasing regularization parameter for linear kernel. For rbf kernel, accuracy went up by increasing regularization parameter. In conclusion, regularization parameter behavior depends on kernel type.

3. Give examples of support vectors with a linear kernel.

Ans:

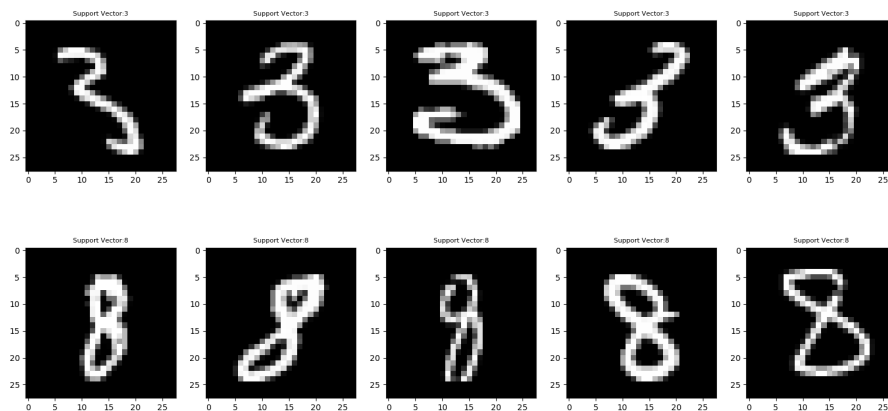


Figure 2: The top 5 support vectors for with linear kernel and regularization parameter=1