ECGR 4105 Homework 4

Cole Bennett

801289645

October 25, 2025

GitHub Link

https://github.com/oopCole/ECGR4105/tree/main/HW4

Problem 1.

1. Optimum Number of Principal Components:

The optimum number of principal components that achieved the highest accuracy for various kernel tricks can be seen in the table below.

Kernel	K Value	Accuracy
Linear	8	0.9736842105263158
RBF	8	0.9912280701754386
Poly	4	0.9649122807017544

2. Accuracy, Precision, and Recall Plots:

Shown below are the accuracy, precision, and recall plots for the Linear Kernel.

Linear Kernel Accuracy Linear Kernel Precision Linear Kernel Recall 0.96 0.98 0.97 0.95 0.96 0.96 0.94 0.95 0.94 Accuracy 0.93 0.94 0.92 0.92 0.93 0.91 0.90 0.92 0.90 0.91 0.88 0.90 15 10 15 20 15 NPrincipal Component (K) Principal Component (K) Principal Component (K)

Figure 1: Plots for Linear Kernel

Shown below are the accuracy, precision, and recall plots for the RBF Kernel.

RBF Kernal Accuracy RBF Kernal Precision RBF Kernal Recall 0.98 1.00 0.98 0.98 0.96 0.96 0.96 Precision 0.94 Accuracy 6.0 Recall 86.0 0.92 0.90 0.92 0.88 0.90 0.90 0.86 0 10 15 20 30 0 10 15 20 30 10 15 20 30 25 0 NPrincipal Component (K) Principal Component (K) Principal Component (K)

Figure 2: Plots for RBF Kernel

Shown below are the accuracy, precision, and recall plots for the Poly Kernel.

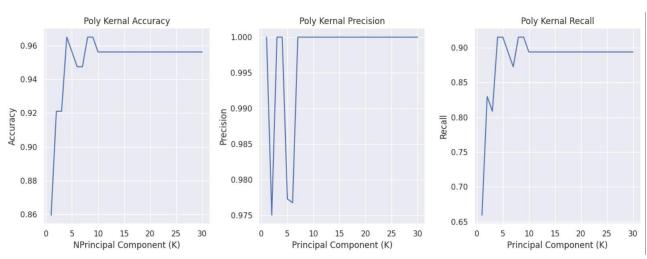


Figure 3: Plots for Poly Kernel

3. Comparing Kernel Accuracies:

Shown below are the kernel accuracy plots.

Linear Kernal Accuracy **RBF Kernal Accuracy** Poly Kernal Accuracy 0.97 0.96 0.98 0.96 0.94 0.96 0.95 Accuracy Accuracy 0.94 0.94 0.90 0.93 0.92 0.92 0.88 0.91 0.90 0.86 0.90 10 15 20 25 30 0 10 15 20 25 30 10 15 20 25 30 NPrincipal Component (K) Principal Component (K) Principal Component (K)

Figure 4: Comparing Accuracies with Various Kernels

4. Compare Results to Homework 3:

In Problem 4 of Homework 3, the optimal K value was found to be 11 principal components, compared to the 8 found in Problem 1 of this homework. The results can be seen in the table below:

Homework	K Value	Accuracy
Homework 4	8	0.9736842105263158
Homework 3	11	0.9649122807017544

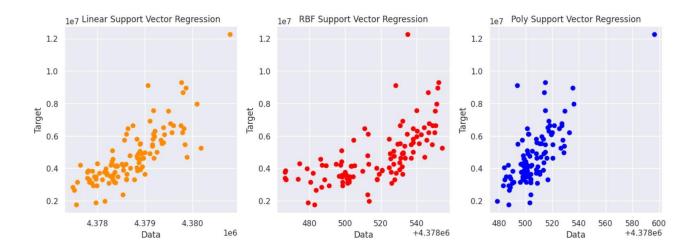
These results show that an SVM classifier is more accurate that a logistic regression classifier.

Problem 2.

1. SVR Regression Plots for Various Kernels:

The scatter plots for SVR regression for various kernels can be seen below:

Figure 5: Plots for SVR Regression



2. Compare Results to Homework 2:

The plot of mean-squared-error over the number of principal components looks similar to the shape of the linear regression plot from Problem 3 of Homework 2. However, SVR does not use linear regression, so this is why the curve is not as smooth as it is when it's plotted using linear regression.

3. Optimum Number of Principal Components:

The optimum number of principal components that achieved the highest accuracy for various kernel tricks can be seen in the table below.

Kernel	K Value	MSE
Linear	10	2035421831509.1892
RBF	1	3000141079406.065
Poly	1	2995778436314.8477

4. Comparing Kernel Accuracies:

The various kernel accuracies can be seen below:

Figure 6: Comparing Accuracies with Various Kernels

