ECGR 5105 Homework 4: SVM and SVR Classification

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GitHub Link

Click here to view the code

Problem 1.

1. Optimum Number of Principal Components:

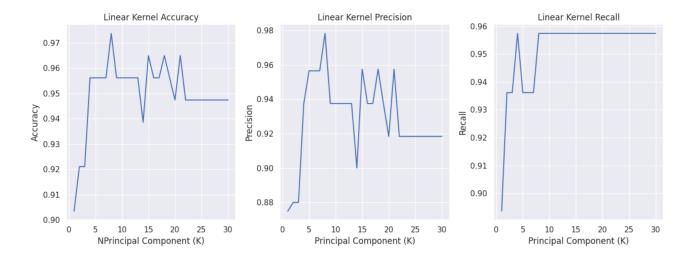
The optimum number of principal components that achieved the highest accuracy for various kernel tricks can be seen in the table below.

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

2. Accuracy, Precision, and Recall Plots:

The accuracy, precision, and recall plots for the Linear Kernel can be seen below:

Figure 1: Plots for Linear Kernel



The accuracy, precision, and recall plots for the RBF Kernel can be seen below:

RBF Kernal Precision RBF Kernal Recall RBF Kernal Accuracy 0.98 1.00 0.98 0.98 0.96 0.96 0.96 Precision 0.94 0.92 Accuracy 6.0 Recall 8 0.92 0.90 0.92 0.88 0.90 0.90 0.86 20 30 20 30 20 25 15 15 15

Principal Component (K)

Principal Component (K)

Figure 2: Plots for RBF Kernel

The accuracy, precision, and recall plots for the Poly Kernel can be seen below:

Poly Kernal Accuracy Poly Kernal Precision Poly Kernal Recall 1.000 0.96 0.90 0.995 0.94 0.85 0.990 0.985 Accuracy 0.9.0 Recall 08.0 0.90 0.75 0.980 0.88 0.70 0.86 0.975 0.65 0 15 30 0 20 25 30 NPrincipal Component (K) Principal Component (K) Principal Component (K)

Figure 3: Plots for Poly Kernel

3. Comparing Kernel Accuracies:

NPrincipal Component (K)

The various kernel accuracies can be seen below:

Linear Kernal Accuracy **RBF Kernal Accuracy** Poly Kernal Accuracy 0.96 0.97 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 0 10 15 20 30 0 10 15 20 30 0 10 15 20 25 30 Principal Component (K) Principal Component (K) NPrincipal Component (K)

Figure 4: Comparing Accuracies with Various Kernels

4. Comparing 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:

1e7 Linear Support Vector Regression **RBF Support Vector Regression** Poly Support Vector Regression 1.2 1.2 1.2 1.0 1.0 1.0 0.8 0.8 0.8 Target **Target** 0.6 0.6 0.6 0.4 4.379 4.380 480 520 540 600 4.378 500 540 480 500 520 580

Data

+4.378e6

+4.378e6

Data

Figure 5: Plots for SVR Regression

2. Comparing Results to Homework 2:

Data

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

