

Assignment #3

Machine Learning, Fall 2016

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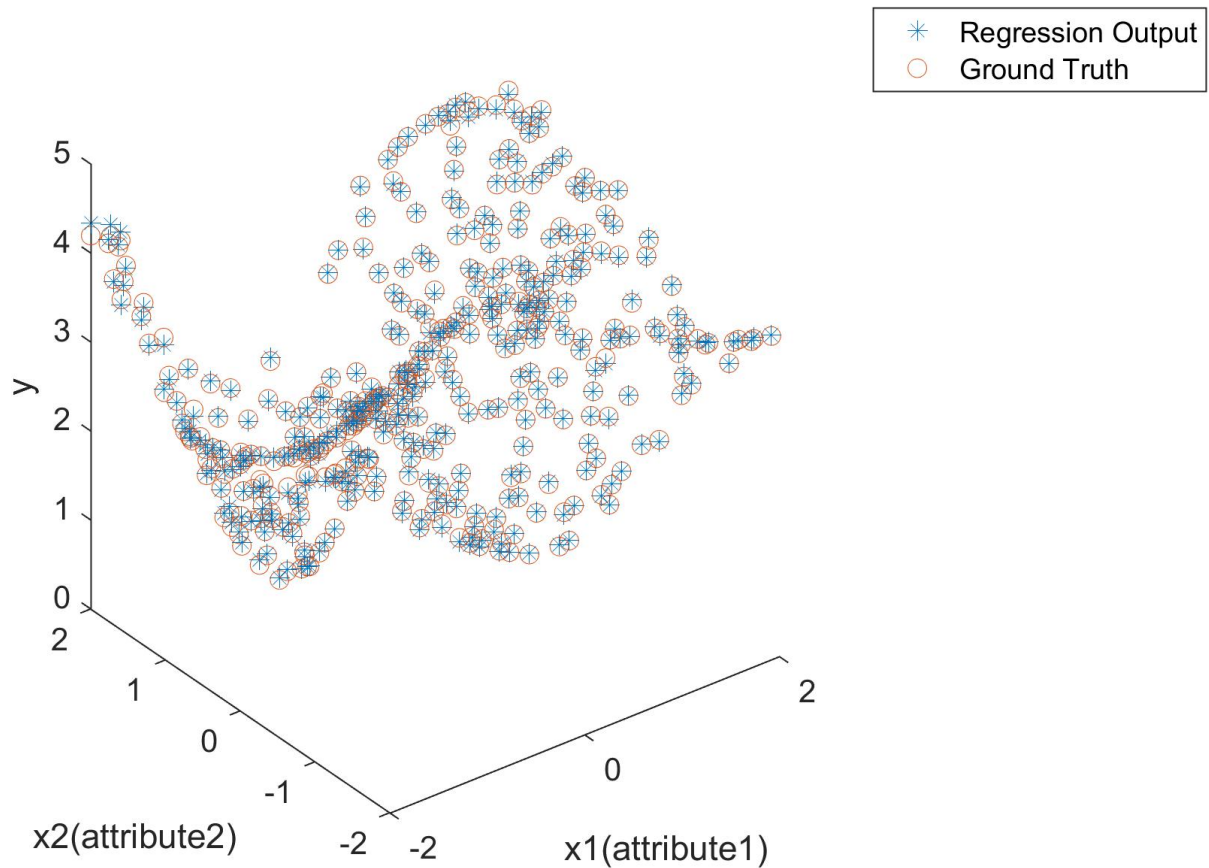
Jan. 2017

Methodology

1 Gaussian Process

1.1 Question a

$E(rms) = 0.0387.$



1.2 Question b

Training Accuracy	Test Accuracy	Time Consuming (s)
0.7455	0.7306	92.476891

2 Support Vector Machine

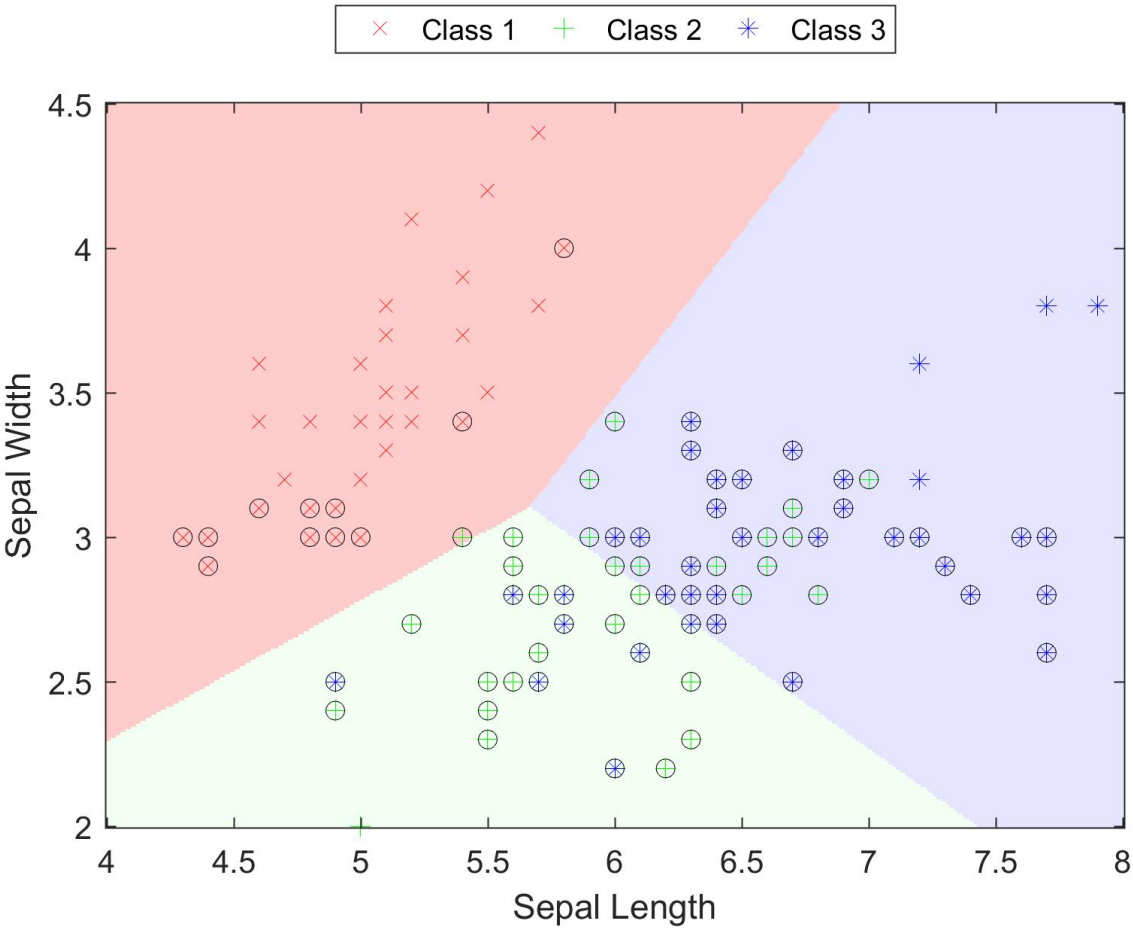
2.1 Question a

Decision approach: One-versus-the-rest.

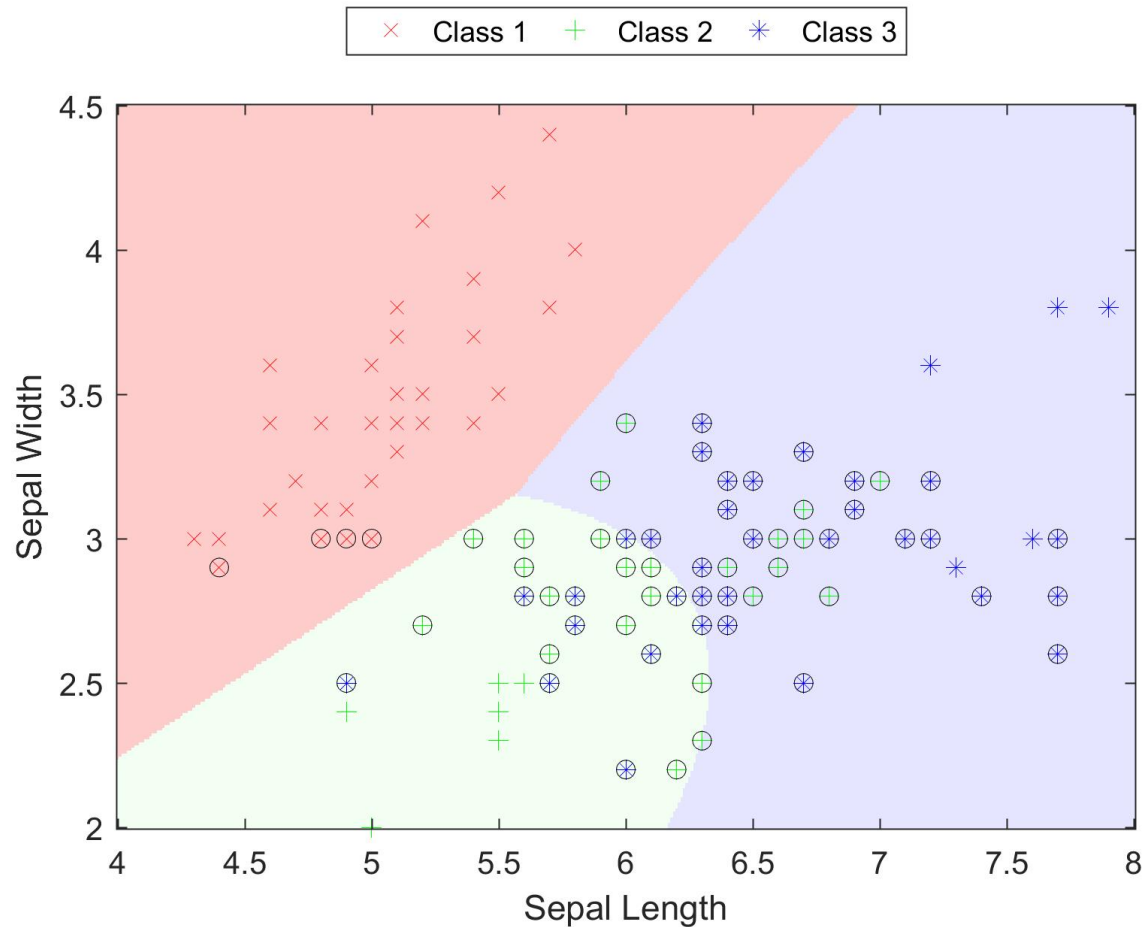
Kernel	Training Accuracy	Test Accuracy	Time Consuming (s)
Linear Kernel	0.7833	0.8333	0.366924
Polynomial Kernel of Degree 2	0.7583	0.8667	41.106797

2.2 Question b

Linear Kernel:



Polynomial Kernel:



2.3 Question c

The implementation of two types of SVM-Kernels are displayed above. The linear kernel is what we would expect, a linear model and the polynomial kernel of degree 2 is useful in this case because the datapoints are not linearly separable.

The kernel we choose defines the function class we are working with. The linear kernel allows us to use linear functions, which are really impoverished, but it is faster to train in comparison with non-linear kernel. In addition, linear SVM is less prone to overfitting than non-linear. In this case, the time consuming is just 0.37s with good test accuracy 0.8333. This work focuses on the degree-2 polynomial mapping. The above discussion shows only the efficiency of training degree-2 mappings under fixed parameters. Parameter selection is important because if we have the best setting for degree-2 expansions, the performance may be more accurate. The polynomial kernel works with 0.8667 test accuracy which is 0.0334 higher than linear functions. However it costs much longer time.