

# challenge 5 report: Support Vector Machines (SVM)

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## 1 Theory

Challenge 5 covered using a Support Vector Machine (SVM) model for classifying points based on two features. The points were labeled either 1 or 0 based on the trained SVM model. For this challenge, four kernel functions were used. The graphs obtained for these kernels were compared, and the best decision regions was attached to this report. The best kernel function was that of *Radial Basis Function (rbf)* kernel. The *rbf* kernel was applied to the two features  $x_1, x_2$  using the following equation:

$$K(x_1, x_2) = \exp\left(\frac{\|x_1 - x_2\|^2}{2\sigma^2}\right)$$

All generated graphs ( eight in total) were uploaded to the course's GitHub page.

## 2 Results

training data using rbf kernel.png

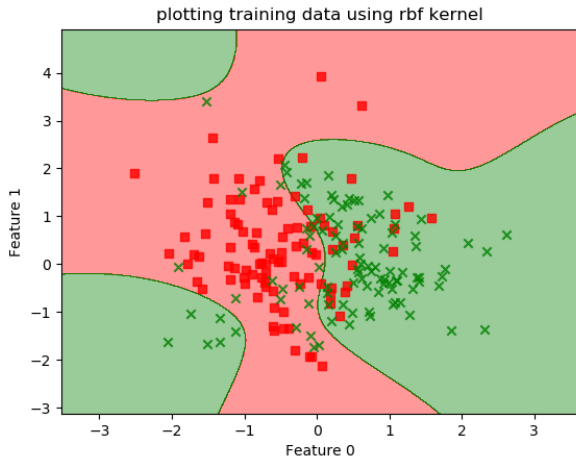


Figure 1: training data

test data using rbf kernel.png

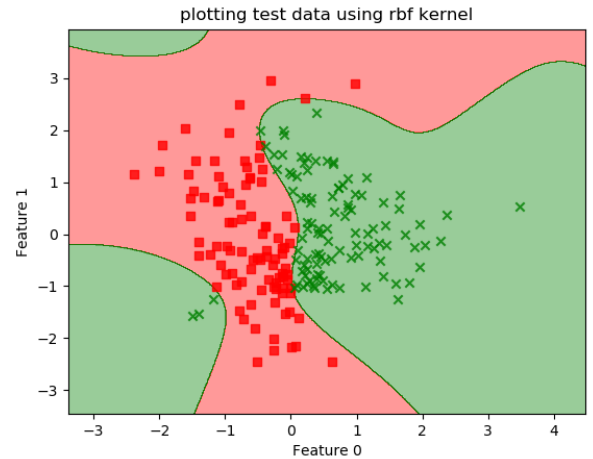


Figure 2: test data

The SVM model was ran for four different kernel functions. The four kernels were: linear, Sigmoid, Polynomial, and rbf. The rbf kernel was chosen in this report, since it produced the lowest empirical error out of the four kernels. In figure 1, the SVM model placed two decision regions, one red and one green, for classifying the training points. The decision regions were then used on the test data, as shown in figure 2. Since there were no base truth values for test points, the error rate could not be measured. For the training data, some samples crossed regions, hence, they contributed to an error percentage. The two classes were recorded to the test data file. All files were uploaded onto ECEN 689 GitHub page.