

Machine Learning Assignment 3 Report

Topic: Support Vector Machines

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About the Support Vector Classifier

The SVM Package used is from the scikit-learn library. In this package, support vector classifier is or SVC is implemented as a function that can be directly used in conjunction with various kernels.

Typically, the SVC uses a one-versus-one approach for classification, which means that even if multiple classes are provided, the classifier makes pairs of classes and tries to differentiate between those. So, if there are n -classes, the total number of classifications made are $nC2$. However, in keeping with the traditional norm of multi-class classification, SVC has an integrated “decision_function_shape” function that allows for monotonic transformation of the results of the “one-vs-one” form of classification to “one-vs-all”.

The Linear Kernel: When the data is linearly separable, this kernel often gives the best results.

The Polynomial Kernel: In this kernel, the degree of the polynomial function can be varied and this is useful when the data isn't linearly separable (eg: XOR).

RBF Kernel: The radial basis function kernel or the RBF kernel uses a combination of C and another hyperparameter γ in order to find the best possible function. C determines how much error is tolerable whereas γ determines the amount of curvature that the curve has. In conjunction, these two hyperparameters are crucial

in preventing overfitting/underfitting and the best way to find a balance between the two is by using GridSearch.

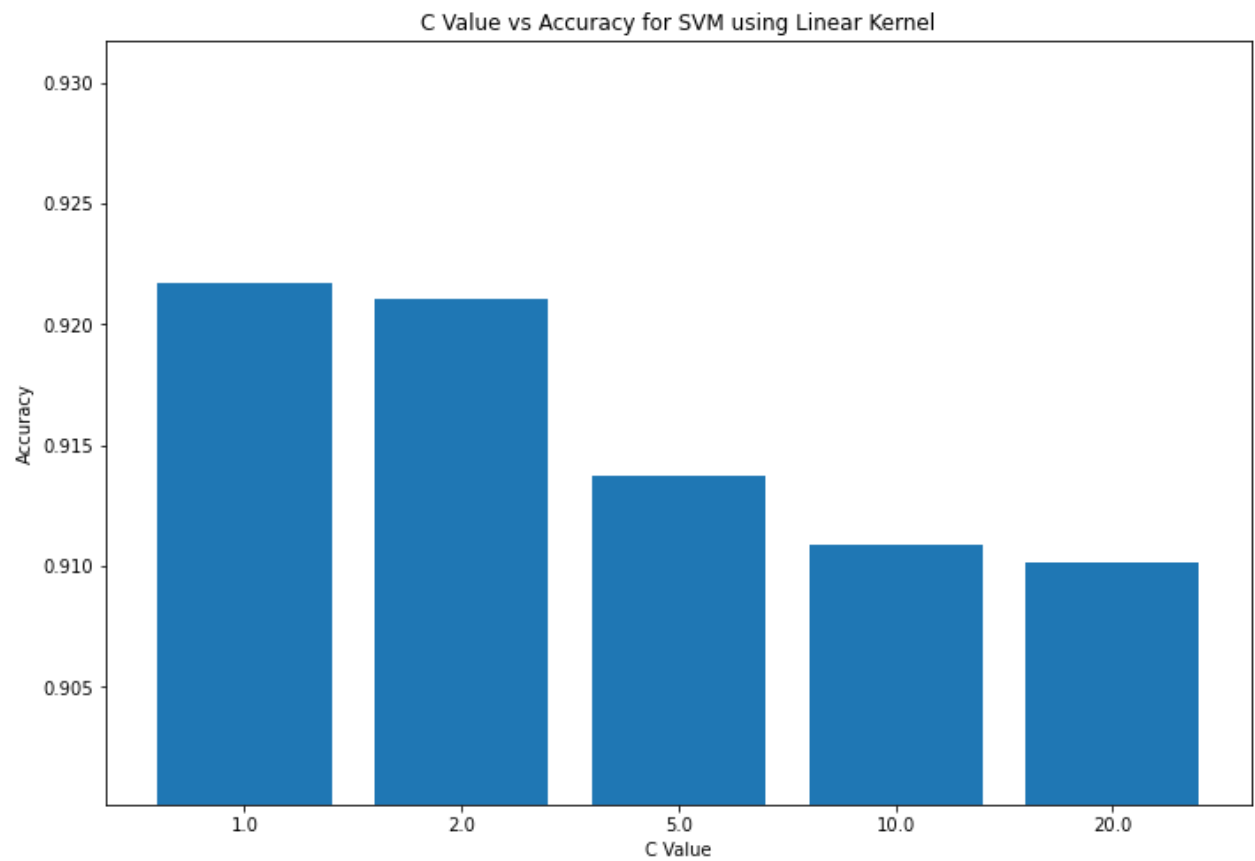
Test Results

For each kernel and C-Value, the test set results are given below: -

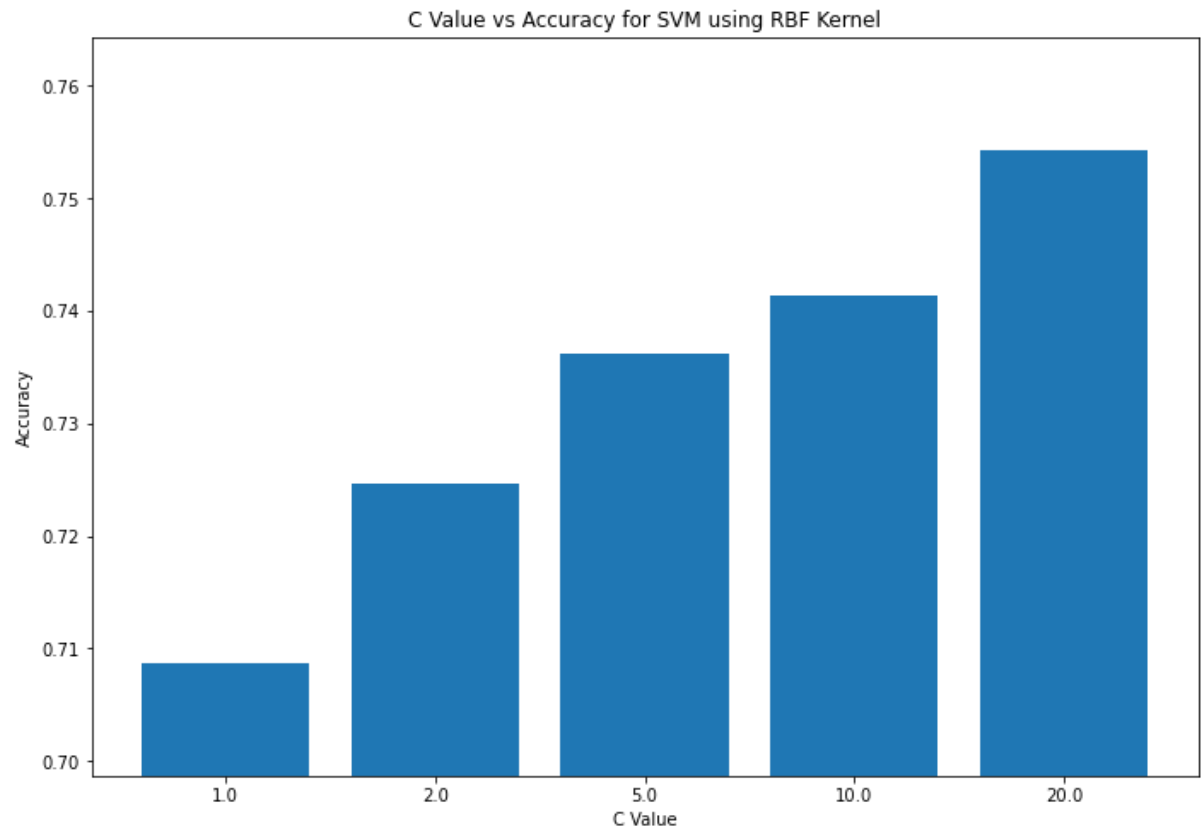
C-Value	Linear Kernel	Quadratic Kernel	RBF Kernel
1.0	0.9217391304347826	0.7086956521739131	0.6521739130434783
2.0	0.9210144927536232	0.7246376811594203	0.6528985507246376
5.0	0.913768115942029	0.736231884057971	0.6579710144927536
10.0	0.9108695652173913	0.741304347826087	0.6601449275362319
20.0	0.9101449275362319	0.7543478260869565	0.6652173913043479

Graphs

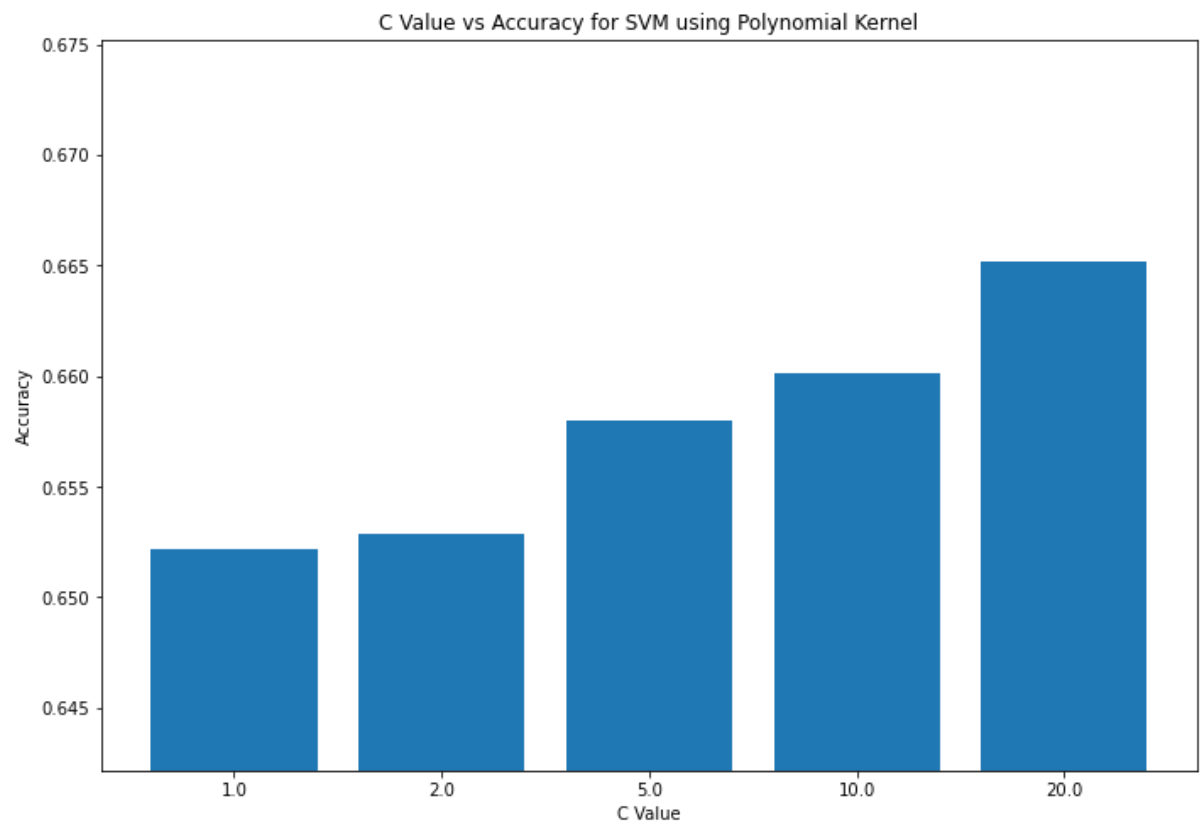
Linear Kernel C-Value vs Accuracy Graph



RBF Kernel C-Value vs Accuracy Graph



Polynomial Kernel C-Value vs Accuracy Graph



Thus, we can see,

- For Linear Kernel, lowest C-value gives best accuracy.
- For RBF Kernel, highest C-values gives best accuracy.
- For Polynomial Kernel, highest C-values gives best accuracy.