SMO Implementation from Scratch & Application of SVM

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Problem-Statement

- Training of SVM algorithm is slow for large data-sets and it is complex to implementation .
- John C. Platt from Microsoft in 1998 invented a new fast algorithm for training support vector machines known as Sequential minimal optimization(SMO).
- In this project we are implementing Sequential minimal optimization (SMO) from scratch for training Support Vectors.
- Next, application of support vector machine on a good dataset using in-built libraries.
- For both implementations MINST dataset is used.
- At last accuracies are compared for various types of kernels.

Methods

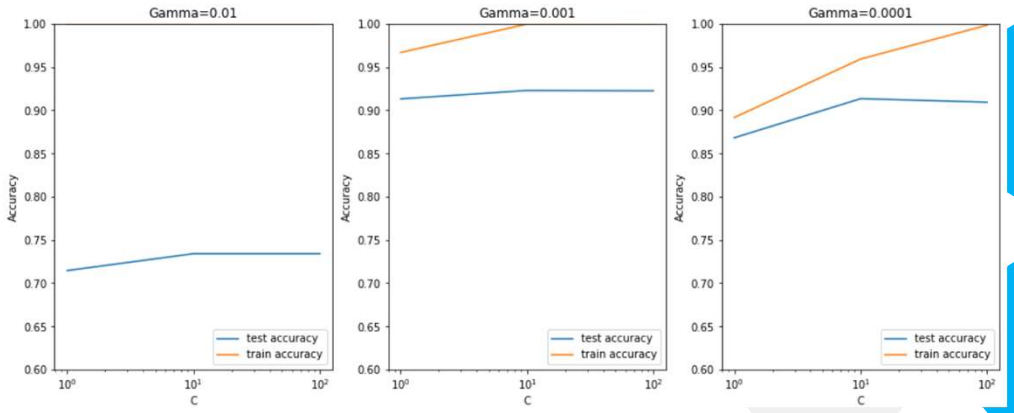
- We trained Support Vector Machines with new optimization algorithm Sequential Minimal Optimization.
- It quickly solve the SVM QP problem without any extra matrix storage and without using numerical QP optimization steps at all.
- Unlike the previous methods, SMO chooses to solve the smallest possible optimization problem at every step.
- In this project we implemented the SVM with SMO using different kernels like linear, gaussian and quadratic kernel. In application of SVM we use RBF kernel.

Results And Discussions

- Implementation of SMO

Kernel Type	Equation	Accuracy
Linear Kernel	$k(x, y) = x^T+y$	94.45%
Quadratic Kernel	$k(x, y) = (x^T+y)^2$	95.08%
Gaussian Kernel	$k(x, y) = \exp(\|\|x-y\|\|^2/2*\sigma^2)$	46.97%

- Application of SVM



- The best optimal parameters are C=1 and gamma=0.001.
- The final accuracy on test data is approx. 94%.

References

- Base Paper
- Dataset
- https://analyticsindiamag.com/understanding-the-basics-of-svm-with-example-and-python-implementation/
- http://crsouza.com/2010/03/17/kernel-functions-for-machine-learning-applications