Support vector machines

Support vector machine is an efficient algorithm which can provide a decision boundary with **maximum gap** between the positive and negative samples. Eventhough Support vector machine is a non-linear classifier, it can be used as linear classifier also.

The main objective in SVM is minimizing the weight vector:

||w||^2/2

Such that y(i)[WT X(i) + b] >= 1

To obtain Non-linear Classification, Kernels are applied to SVM Linear Classification

The LibSVM is executed for the Promoters dataset and the following is the accuracy obtained :

Kernel 0

C:\libsvm-3.17\windows>svm-train.exe -t 0 training.train

....*....*

optimization finished, #iter = 579

nu = 0.017662

obj = -0.627017, rho = 1.172955

nSV = 40, nBSV = 0

Total nSV = 40

C:\libsvm-3.17\windows>svm-predict.exe validation.test training.train.model a.ou

t

Accuracy = 85.7143% (30/35) (classification)

Kernel 1

C:\libsvm-3.17\windows>svm-train.exe -t 1 training.train

.*.*

optimization finished, #iter = 162

nu = 0.022567

obj = -0.801149, rho = 0.404372

nSV = 57, nBSV = 0

Total nSV = 57

C:\libsvm-3.17\windows>svm-predict.exe validation.test training.train.model a.ou

t

Accuracy = 74.2857% (26/35) (classification)

Kernel 2

C:\libsvm-3.17\windows>svm-train.exe -t 2 training.train

.*

optimization finished, #iter = 99

nu = 0.801753

obj = -30.091940, rho = -0.076980

nSV = 71, nBSV = 22

Total nSV = 71

C:\libsvm-3.17\windows>svm-predict.exe validation.test training.train.model a.ou
t
Accuracy = 77.1429% (27/35) (classification)

Kernel 3

C:\libsvm-3.17\windows>svm-train.exe -t 3 training.train
*
optimization finished, #iter = 37
nu = 0.957746
obj = -65.367107, rho = -0.492870
nSV = 68, nBSV = 68
Total nSV = 68

C:\libsvm-3.17\windows>svm-predict.exe validation.test training.train.model a.ou
t

Accuracy = 45.7143% (16/35) (classification)

Kernel 0 : (linear Kernel)

Accuracy = 85.7143% (30/35) (classification)

Kernel 1:

Accuracy = 74.2857% (26/35) (classification)

Kernel 2:

Accuracy = 77.1429% (27/35) (classification)

Kernel 3:

Accuracy = 45.7143% (16/35) (classification)

By Running Perceptron for the Promoters dataset, the accuracy obtained is

The overall accuracy of linear perceptron ranges from 69 to 85 %

Inference from the Accuracy between Kernel SVM and Perceptron

Positive Samples -1

Negative Samples - 0

Perceptron is a linear classifier which tries to fit a decision boundary between positive and negative samples. The possibility that the decision boundary has maximum gap between the sample is when the accuracy is 85%.

If the accuracy of perceptron is 69% then the decision boundary doesn't have a maximum gap between the samples. And if there are any new unseen sample is processed and it is close to decision boundary then there is high probability that the sample can be predicted wrongly.

The linear Kernel has an accuracy of 85% which shows that it has a best decision boundary which can identify the unseen samples perfectly. Mostly, the decision boundary could lie between the positive and negative samples.

Kernel - 1, 2, 3:

For polynomial kernels K =1,2,3 the accuracy is very low compared to the linear kernel. This is due to the representation of samples in higher dimensions and classifying it.