ICT4Health Lab 9 -
Support Vector Machine

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In this lab, the same data for arrhythmia patients in Lab 3 is utilized to implement SVM classifier and then comparison is made between two types of SVM kernels, 'Linear' and 'Gaussian' kernel.

Data Preparation

```
clc;
% loading data matrix
load('arrhythmia.mat','arrhythmia');
% removing empty columns
s = sum(arrhythmia);
empty_col=find(s==0);
count = 0;
arrhythmia_old = arrhythmia;
arrhythmia(:,empty_col) = [];
% setting classfication value for patients having all different levels
 of
% arrhythmia to 2
arrhythmiaAll=arrhythmia;
iii=find(arrhythmia(:,end)>2);
arrhythmia(iii,end)=2;

rng('default')

y1 = arrhythmia(:,1:end-1);
c = arrhythmia(:,end);
[N,F] = size(y1);
ymean = mean(y1);
yvar = var(y1);
o = ones(N,1);
y = (y1-o*ymean)./sqrt(o*yvar);
```

'Linear' kernel SVM

```
% --- following code is for searching the optimum box constraint value
% bc = 0.5;
% for i=1:200
%     Mdl=fitcsvm(y,c,'BoxConstraint',bc,'KernelFunction','linear');
%     classhat=sign(y*Mdl.Beta+Mdl.Bias);
%
%     CVMdl = crossval(Mdl);
```

```matlab
%      classLoss = kfoldLoss(CVMdl)
%
%      cll(i) = {classLoss};
%      bc=bc+0.5
% end
% --- it is found that bc = 39 minimizes the classloss

%cll=cell2mat(cll);
%[m,id] = min(cll);
idx = 0.5:0.5:100;
figure
subplot(1,2,1)
plot(idx1,cl_p1) % loading previously saved classloss vector from
 workspace
xlabel('Box constraint value');
ylabel('Classloss');
title('0 < BC <= 10');
axis([0 10 0.2 0.38]);
subplot(1,2,2)
plot(idx,cll) % loading previously saved classloss vector from
 workspace
xlabel('Box constraint value');
ylabel('Classloss');
title('0 < BC <= 100');
axis([0 100 0.2 0.38]);
suptitle('Linear SVM:Classloss vs Box constraint');

bc = 39;
Mdl=fitcsvm(y,c,'BoxConstraint',bc,'KernelFunction','linear');
classhat=sign(y*Mdl.Beta+Mdl.Bias);
CVMdl = crossval(Mdl);
classLoss_linear = kfoldLoss(CVMdl); % classLoss = 0.2876
```

Linear SVM:Classloss vs Box constraint
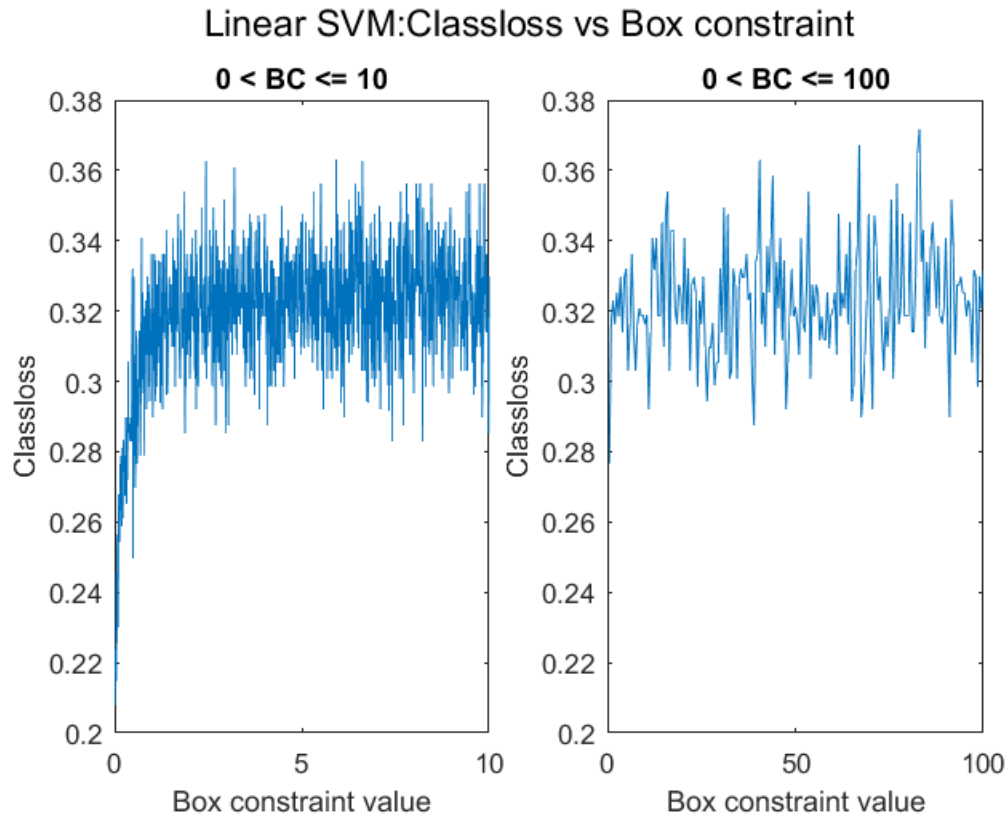
'Gaussian' kernel SVM

```
% bc = 0.5;
% for i=1:200
%
 SVMg=fitcsvm(y,c,'BoxConstraint',5,'KernelFunction','gaussian','KernelScale','aut
%     CVSVMg = crossval(SVMg);
%     classLoss = kfoldLoss(CVSVMg);
%     clg(i) = {classLoss};
%     bc=bc+0.5
% end
% --- it is found that bc = 33.5 minimizes the classloss

% clg=cell2mat(clg);
% [mg,idg] = min(clg);
figure
plot(idx,clg)
xlabel('Box constraint value');
ylabel('Classloss');
title('Gaussian SVM:Classloss vs Box constraint');
axis([0 100 0.2 0.38]);

bc = 33.5;
SVMg=fitcsvm(y,c,'BoxConstraint',5,'KernelFunction','gaussian','KernelScale','auto
CVSVMg = crossval(SVMg);
```
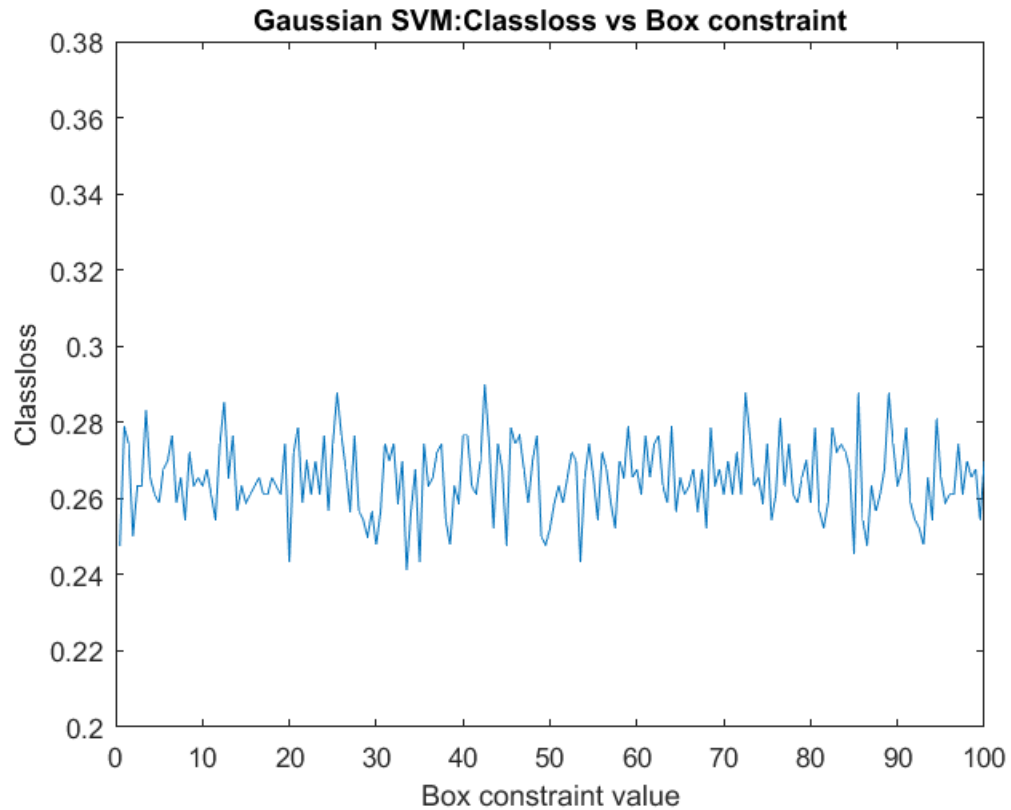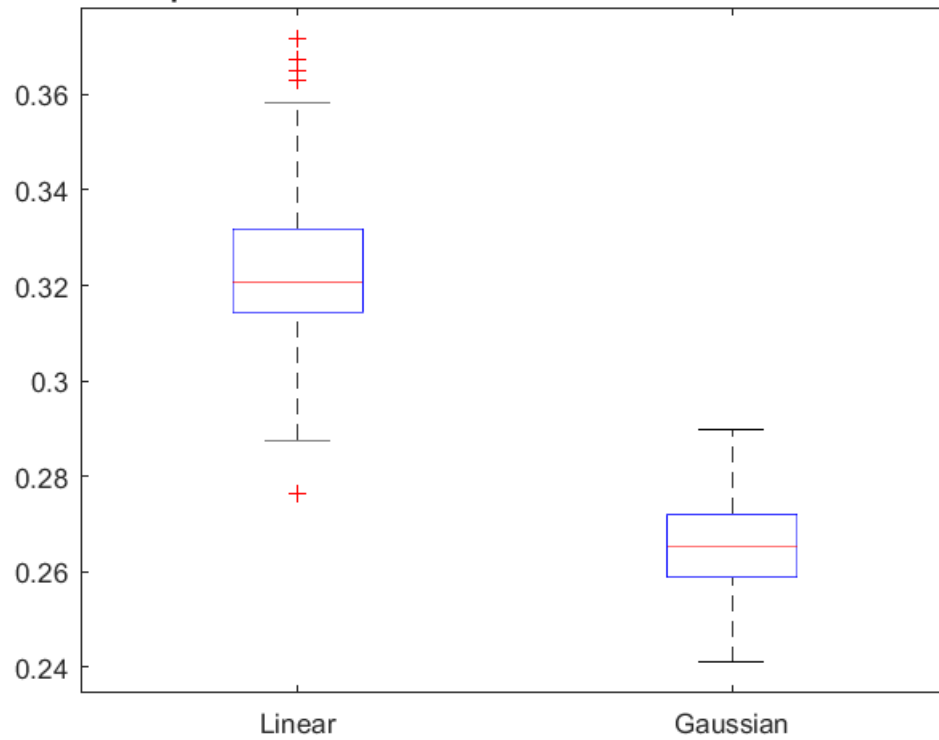
```
classLoss_gauss = kfoldLoss(CVSVMg); % classLoss = 0.2412

cl = [cl_p; clg];
figure
boxplot(cl','Labels',{'Linear','Gaussian'})
title('Statistical comparison of classloss values over box constraints
 in different SVM')
```

Statistical comparison of classloss values over box constraints in different SVM

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