Plot SVM margins using MATLAB and libsvm

I am using svmlib to classify linearly two dimensional non-separable data. I am able to train the svm and obtain w and b using svmlib. Using this information I can plot the decision boundary, along with the support vectors, but I am not sure about how to plot the margins, using the information that svmlib gives me.

Below is my code:

```
model = svmtrain(Y,X, '-s 0 -t 0 -c 100');

w = model.SVs' * model.sv_coef;
b = -model.rho;
if (model.Label(1) == -1)
    w = -w; b = -b;
end
y_hat = sign(w'*X' + b);

sv = full(model.SVs);

% plot support vectors
plot(sv(:,1),sv(:,2),'ko', 'MarkerSize', 10);

% plot decision boundary
plot_x = linspace(min(X(:,1)), max(X(:,1)), 30);
plot_y = (-1/w(2))*(w(1)*plot_x + b);
plot(plot_x, plot_y, 'k-', 'LineWidth', 1)
```

matlab machine-learning svm libsvm

asked Feb 17 '15 at 6:52

user115188
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The margin is the distance between the decision boundary and the support vectors. How would you like to plot it? – hbaderts Feb 17 '15 at 7:52

1 Answer

It depends on what you mean by "the margins". It also depends on what SVM version you are talking about (separable on non-separable), but since you mentioned libsvm I'll assume you mean the more general, non-separable version.

The term "margin" can refer to the Euclidean distance from the separating hyperplane to the hyperplane defined by `wx+b=1` (or `wx+b=-1`). This distance is given by `1/norm(w)`.

"Margin" can also refer to the margin of a specific sample `x`, which is the Euclidean distance of `x` from the separating hyperplane. It is given by

```
(wx+b)/norm(w)
```

note that this is a signed distance, that is it is negative/positive, depending on which side of the hyperplane the point `x` resides. You can draw it as a line from the point, perpendicular to the hyperplane.

Another interesting value is the slack variable `xi`, which is the "algebraic" distance (not Euclidean) of a support vector from the "hard" margin defined by `wx+b=+1` (or `-1`). It is positive only for support vectors, and if a point is not a support vector, its `xi` equals 0. More compactly:

```
xi = max(0, 1 - y*(w'*x+b))
```

where `y` is the label.

edited Feb 17 '15 at 19:22

answered Feb 17 '15 at 8:14

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I think I'm just not understanding the svm theory correctly. Given your equations, how do i know which support vector to use to obtain the margin? Would it be the correctly classified support vector that is farthest from the decision boundary? – user115188 Feb 17 '15 at 16:30

I'll edit my answer since it's not short enough for a comment – Itamar Katz Feb 17 '15 at 19:07