4. Kernels-II

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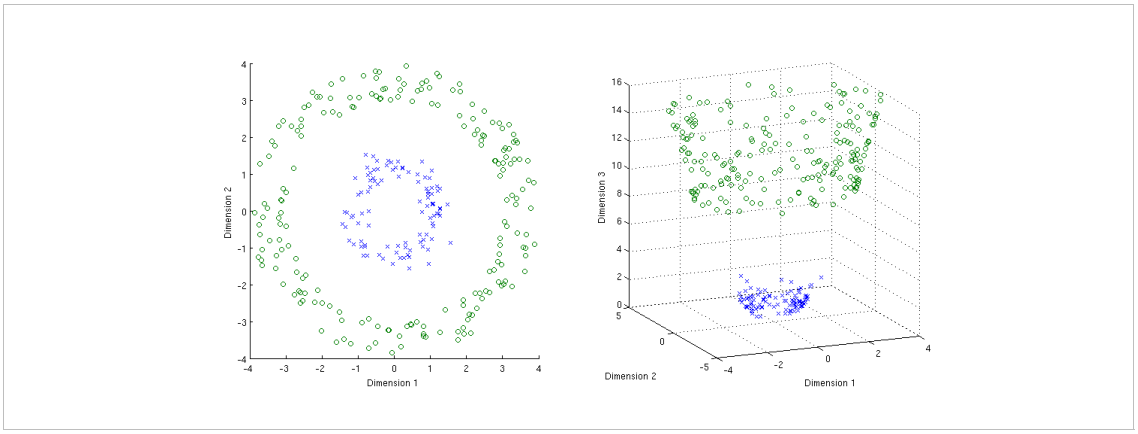
Homework due Mar 8, 2023 08:59 -03 Completed

In this question, we will practice some specific kernel methods.

4. (a)

2/2 points (graded)

In the figure below, a set of points in 2-D is shown on the left. On the right, the same points are shown mapped to a 3-D space via some transform $\phi(x)$, where x denotes a point in the 2-D space. Notice that $\phi(x)_1 = x_1$ and $\phi(x)_2 = x_2$, or in other words, the first and second coordinates are unchanged by the transformation.



Which of the following functions could have been used to compute the value of the 3rd coordinate, $\phi(x)_3$ for each point?

- $\phi(x)_3 = x_1 + x_2$
- $\phi(x)_3 = x_1^2 + x_2^2$ ✔
- $\phi(x)_3 = x_1 x_2$
- $\phi(x)_3 = x_1^2 - x_2^2$

Think about how a linear decision boundary in the 3 dimensional space ($\{\phi \in \mathbb{R}^3 : \theta \cdot \phi + \theta_0 = 0\}$) might appear in the original 2 dimensional space.

For example, suppose the decision boundary in the 3 dimensional space is $z = 4$.

Provide an equation $f(x_1, x_2) = 0$ in the 2 dimensional space such that all the points (x_1, x_2) with $f(x_1, x_2) > 0$ correspond to $z > 4$ in the 3 dimensional space.

$f(x_1, x_2) = 0 =$ x_1^2 + x_2^2 - 4 ✔

$x_1^2 + x_2^2 - 4$

Submit You have used 1 of 3 attempts

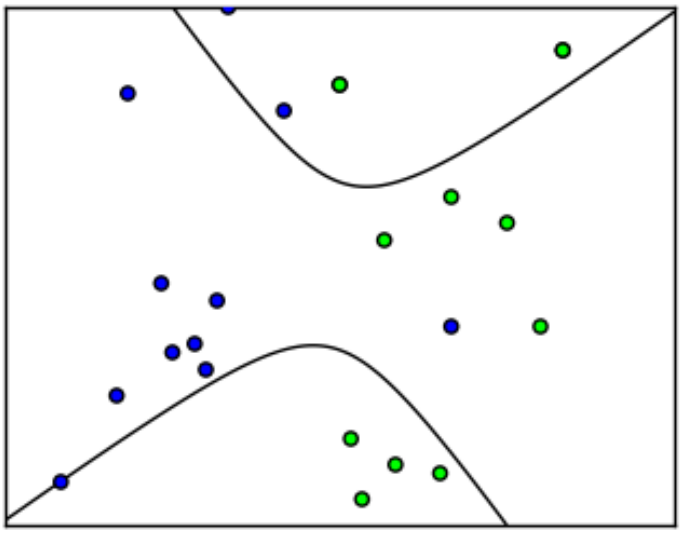
4. (b)

5/5 points (graded)

Consider fitting a kernelized SVM to a dataset where and for all . To fit the parameters of this model, one computes and to minimize the following objective:

where is the feature vector associated with the kernel function. Note that, in a kernel method, the optimization problem for training would be typically expressed solely in terms of the kernel function (dual) rather than using the associated feature vectors (primal). We use the primal only to highlight the classification problem solved.

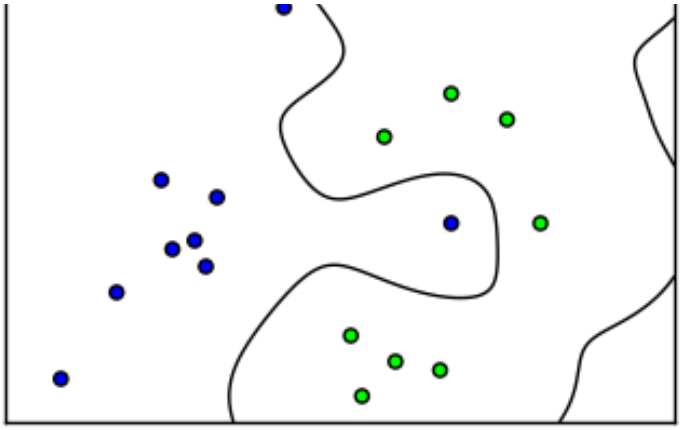
The plots below show 4 different kernelized SVM models estimated from the same 11 data points. We used a different kernel to obtain each plot but got confused about which plot corresponds to which kernel. Help us out by assigning each plot to one of the following models: linear kernel, quadratic kernel, order 3 kernel, and RBF kernel.



Which kernel is used in the above model?

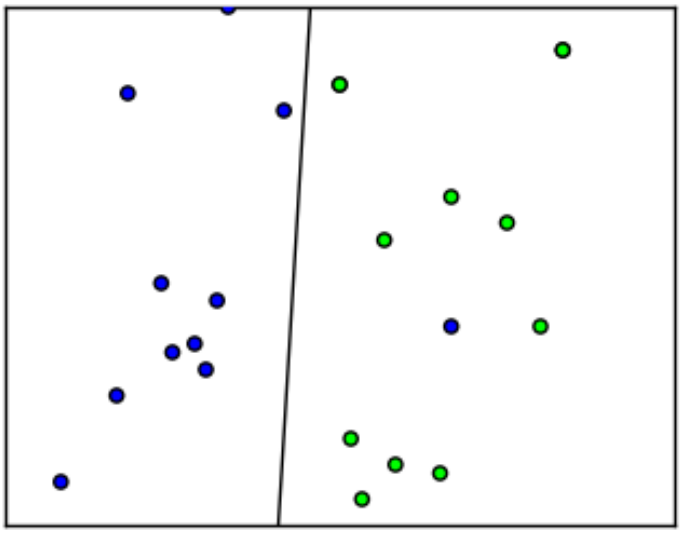
- ○ linear kernel
- ◉ quadratic kernel
- ○ order 3 kernel
- ○ RBF kernel

✔



Which kernel is used in the above model?

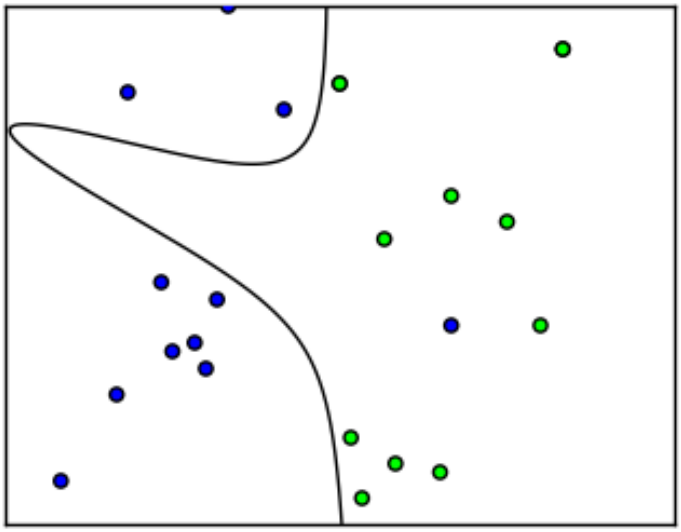
- linear kernel
- quadratic kernel
- order 3 kernel
- RBF kernel ✔



Which kernel is used in the above model?

- linear kernel ✔
- quadratic kernel
- order 3 kernel
- RBF kernel

RBF kernel



Which kernel is used in the above model?

- linear kernel
- quadratic kernel
- order 3 kernel
- RBF kernel

Previous Next

How would ...i... ...e value of ... is increased, the fitting of model would be

?	Invalid Input: x not permitted in answer as a variable Same issue here, trying to input the answer, but getting error Invalid Input: x not permitted in answer as a variable..	2
💬	Play with SVM and kernels - short video https://www.youtube.com/watch?v=Q7vT0--5VII	1
💬	A good visual presentation of a polynomial kernel https://www.youtube.com/watch?v=3liCbRZPrZA	2
?	For z = 4 in the 3 dimensional space, how will the equation look like? I am not sure how to come up with the equation of the line.	7
💬	Hint: for 4A For first question: Which is the form of the distribution of the 2d plot point? Once you get, go and find the equation. For sec...	1
?	4-a theta_0 Am I supposed to guess a value given the graph for theta_0?	1
?	4. (a) Graphically my equation is correct, it classify with a negative or positive number what is requested. Someone can tell me w...	2
?	Problem 4a- second part : I dont understand it I don't understand : define f(x1, x2) = 0 in 2-d and a little further they say if f(x1, x2) > 0 z must be > 4 in 3d?? Can this be ...	2