Homework 4

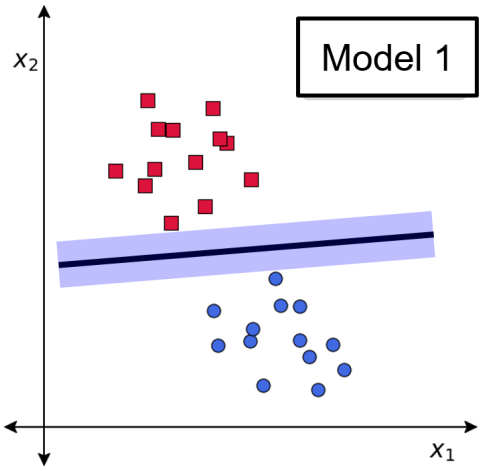
Instructions
This homework contains **6** concepts and **9** programming questions. In MS word or a similar text editor, write down the problem number and your answer for each problem. Combine all answers for concept questions in a single PDF file. Export/print the Jupyter notebook as a PDF file including the code you implemented and the outputs of the program. **Make sure all plots and outputs are visible in the PDF.**

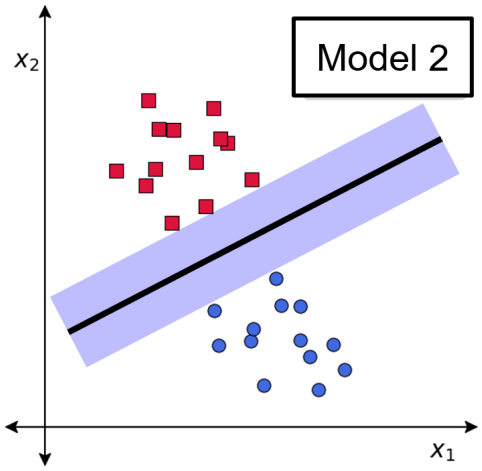
Combine all answers into a single PDF named andrewID_hw4.pdf and submit it to Gradescope before the due date. Refer to the syllabus for late homework policy. Please assign each question a page by using the "Assign Questions and Pages" feature in Gradescope. Submissions to anywhere other than Gradescope will not be graded.

Here is a breakdown of the points for programming questions:

Name	Points
M4_HW1	20
M4_HW2	20
M4_HW3	20
M4_L1_P1	5
M4_L1_P2	5
M4_L1_P3	5
M4_L2_P1	5
M4_L2_P2	5
M4_L2_P3	5

Problem 1 (1 points)
Which of the following two models represents a better discriminator?





Problem 2 (1 points)
Multiple Choice (select one)

Consider an SVM classifier:

$$\underset{\mathbf{w},b}{\text{minimize}}\ \frac{1}{2}\|\mathbf{w}\|^2$$
$$\text{subject to: } y_i\left(\mathbf{w}^T\mathbf{x}_i + b\right) \geq 1$$

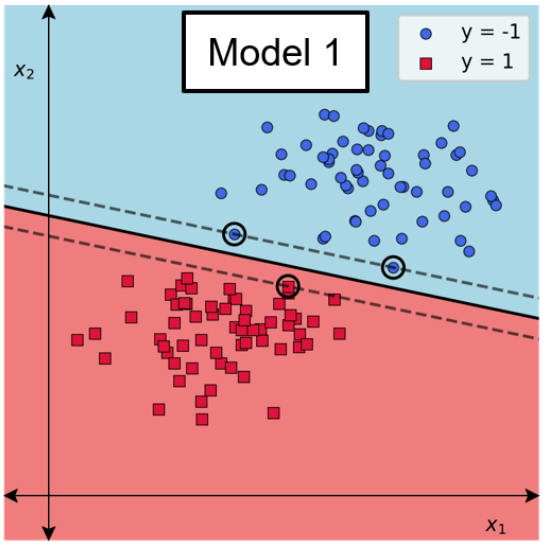
We would like to solve the problem with a quadratic programming solver:

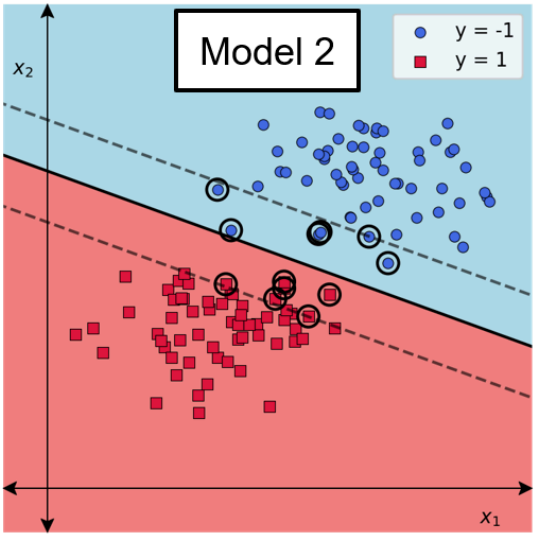
$$\begin{array}{ll}\text{minimize} & (1/2)x^TPx + q^Tx \\ \text{subject to} & Gx \preceq h \\ & Ax = b\end{array}$$

When inputting the inequality constraint for quadratic programming packages, how should G and h be formulated? Consider

1. G = y*[x_1,x_2,1], h = 1
2. G = -y*[x_1,x_2,1], h = 1
3. G = y*[x_1,x_2,1], h = -1
4. G = -y*[x_1,x_2,1], h = -1

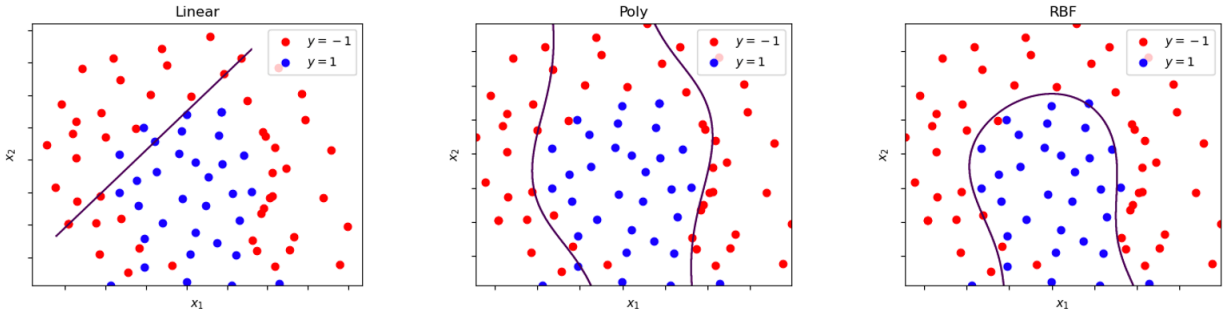
Problem 3 (2 points)
Which of the following two trained models will be faster to evaluate a set of 1000 test points?





Problem 4 (2 points)
(Multiple Choice - select one)
Visually, which of the following SVM models classifies the data best?

1. Linear
2. Polynomial
3. RBF



Problem 5 (2 points)
Consider a multiclass SVM which classifies between 3 different classes. Each class has the same number of data points. Which would be faster to train, a one-versus-one or one-versus-rest classifier?

Problem 6 (2 points)
The following SVR model is fit to the data with an RBF kernel. Assume the model uses epsilon insensitive loss, L_ϵ. How many data points contribute to the loss L_ϵ for the given model?