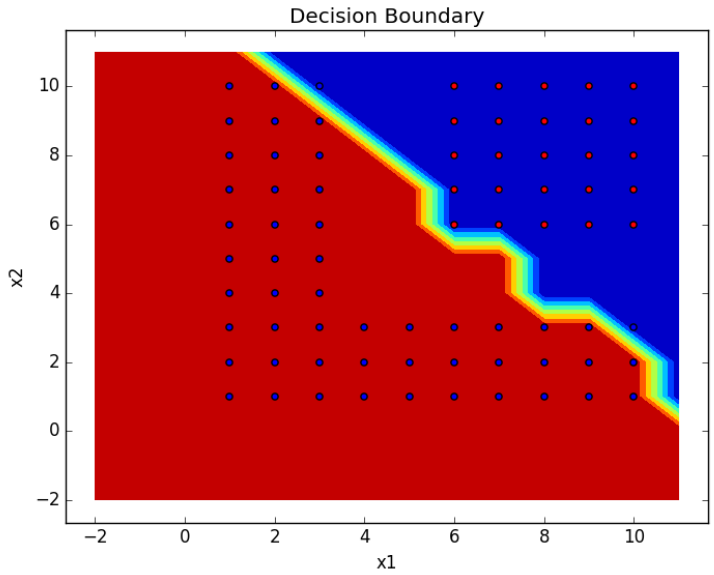
Homework 5

Problem 1:

a. The decision boundary for a voted perceptron algorithm is as follows (T=10):



The final decision boundary is non linear

b. Pseudocode for voted perceptron with down-sampling:

- $l = 0, c_l = 0, w_l = 0$
- Repeat T times:
  - Randomly permute the data points
  - for i = 1 to n:
    - $If\ (x^{(i)}, y^{(i)}) is\ missclassified\ by\ w_l$:

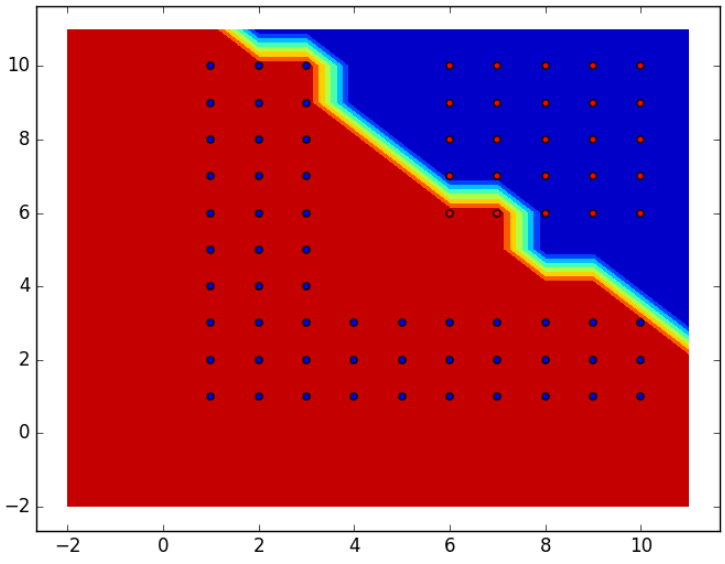
- If l + 1 > L:

// Remove the (c, w) with the most minimum c
minI = argmin(c)
del c[minI], del w[minI]
decrement l
$w_{l+1} = w_l + y^{(i)}x^{(i)}$
$c_{l+1} = 1, l = l + 1$

- Else:

$c_l = c_l + 1$

The decision boundary using down sampling is as follows (T=100, L=100):



c. Pseudocode for averaged perceptron tracking at most 2 w's is as follows:

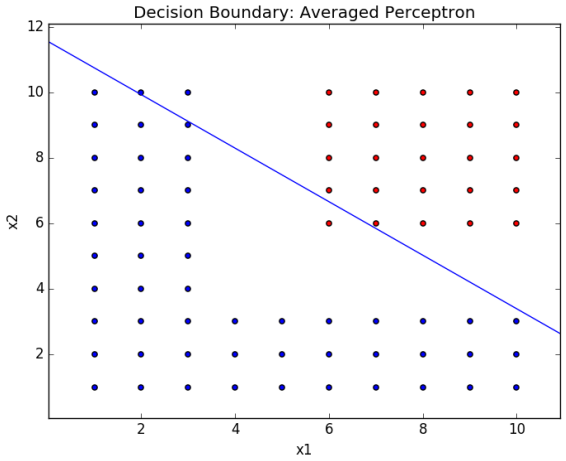
- $l = 0, = 0,\ \mathrm{w}_{\mathrm{final}} = \mathrm{w}_{\mathrm{update}} = 0$
- Repeat T times:
  - Randomly permute the data points
  - for i = 1 to n:
    - $If\ \left(x^{(i)}, y^{(i)}\right) is\ missclassified\ by\ w_l$:

      $\mathrm{w}_{\mathrm{final}} = \mathrm{w}_{\mathrm{update}} * c$

      $\mathrm{w}_{\mathrm{update}} = \mathrm{w}_{\mathrm{update}} + y^{(i)}x^{(i)}$

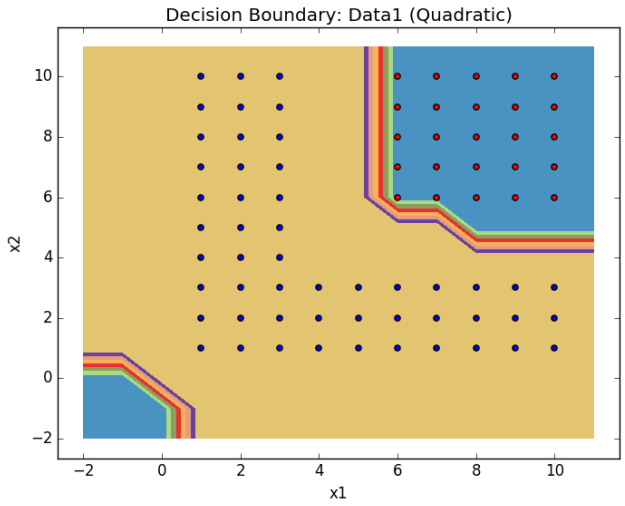
      $c = 1$
    - Else: c = c + 1

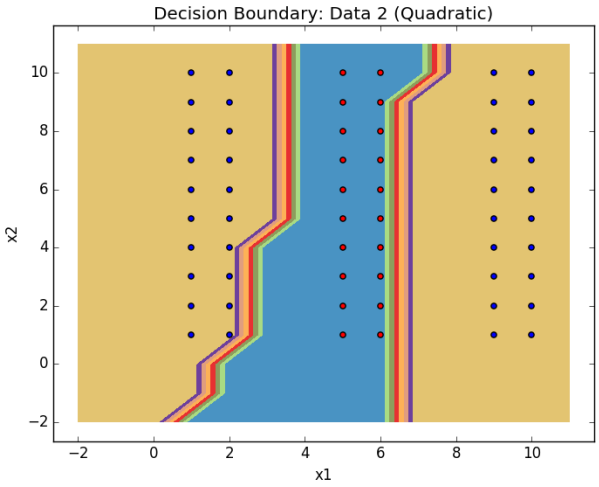
The decision boundary is as follows:



Problem 2:

Decision boundary obtained by quadratic kernels:





Decision boundary obtained by RBF kernels: