DSE 220: Machine learning

Worksheet 10 — Solutions

1. To classify a point x, we evaluate the three linear functions and pick the one with the highest value.

   The region where class 1 beats class 2 is:

   $$w_1 \cdot x + b_1 > w_2 \cdot x + b_2 \;\Leftrightarrow\; (w_1 - w_2) \cdot x + (b_1 - b_2) > 0 \;\Leftrightarrow\; x_2 > 1$$

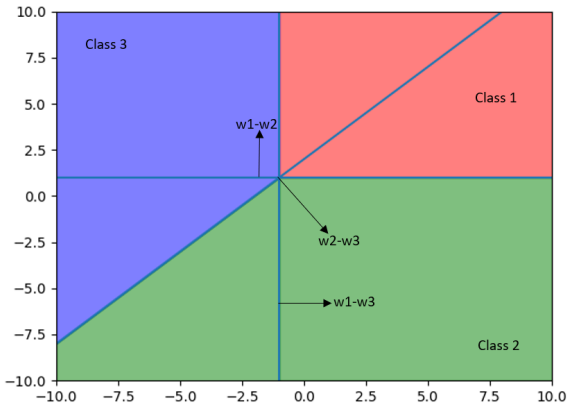
   The region where class 1 beats class 3 is:

   $$w_1 \cdot x + b_1 > w_3 \cdot x + b_3 \;\Leftrightarrow\; (w_1 - w_3) \cdot x + (b_1 - b_3) > 0 \;\Leftrightarrow\; x_1 > -1$$

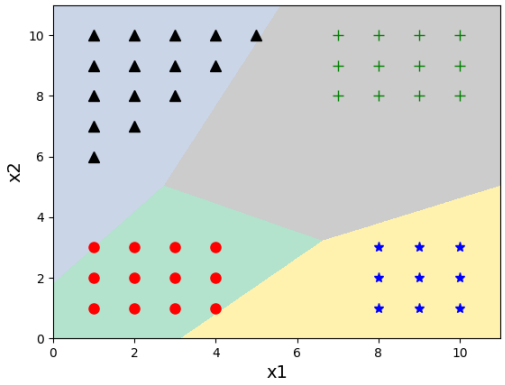
   The region where class 2 beats class 3 is:

   $$w_2 \cdot x + b_2 > w_3 \cdot x + b_3 \;\Leftrightarrow\; (w_2 - w_3) \cdot x + (b_2 - b_3) > 0 \;\Leftrightarrow\; x_1 - x_2 > -2$$

   So class 1 is predicted in the intersection of the first two regions, etc. This is summarized in the figure below.



2. *Multiclass Perceptron.*


x2
x1
0
2
4
6
8
10