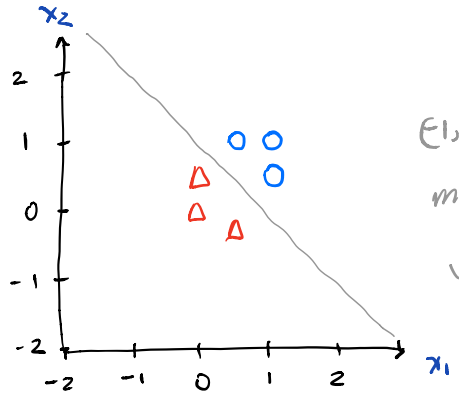
IAML Tutorial 4

1. Consider a linear SVM with a linear kernel run on the following dataset

x_1	x_2	y
0.5	1.00	1
1.0	0.5	1
1.0	1.00	1
0.0	0.5	2
0.5	-0.25	2
0.0	0.00	2



(1,2) (0,1)

$m = \frac{1-2}{1} = -1$

$y = -x + c$

$y = -x + 1$

a. By using your intuition, what weight vector do you think will result from training an SVM on this dataset?

eqn of DB → $x_2 = -x_1 + 1$

$x_1 + x_2 = 1$ $\quad$ $x_1 + x_2 - 1 = 0$

$\underline{w} = [1, 1]$

b. Plot the DB. done.

c. Which are the support vectors? What is the margin of this classifier?

constraint: $\min_i |\underline{w}^T \underline{x}_i + w_0| = 1$

* Goal: find $\underline{w}$ where the constraint holds

start from the point closest to DB

e.g. $(0, 0.5)$ → $|(w_1\ w_2)\begin{bmatrix}0\\0.5\end{bmatrix} + w_0| = 1$

we know that $w_1 = w_2$ from $\underline{w} = [1\ 1]$, $w_0 = -1$

→ $|(c\ c)\begin{bmatrix}0\\0.5\end{bmatrix} - c| = 1$

$|(0.5c - 1\ c)| = 1$

$0.5c = 1$

$c = 2$

So we have $w = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$ and $w_0 = -2$.

to calculate the margin

$$\frac{1}{\|w\|} \min_i |w^T x_i + w_0|$$

But since the maximum margin satisfies the constraint

$$\min_i |w^T x_i + w_0| = 1$$

then the ~~MMH~~ is just

$$\frac{1}{\|w\|} = \frac{1}{\sqrt{2^2 + 2^2}} = \frac{1}{\sqrt{8}}$$