Spring 2018 final

Q3] SVM

Primal form

Objective $\underset{w,b}{\text{minimize}} \frac{1}{2}\|w\|^2$

s.t. $y_i(w^T x_i + b) \geq 1$

$\Rightarrow -1([w_1, w_2]^T \cdot [0, 0] + b) \geq 1$

$1([w_1, w_2]^T \cdot [-1/3, 1] + b) \geq 1$

$1([w_1, w_2]^T \cdot [+1/3, 1] + b) \geq 1$

$\Rightarrow -b \geq 1$

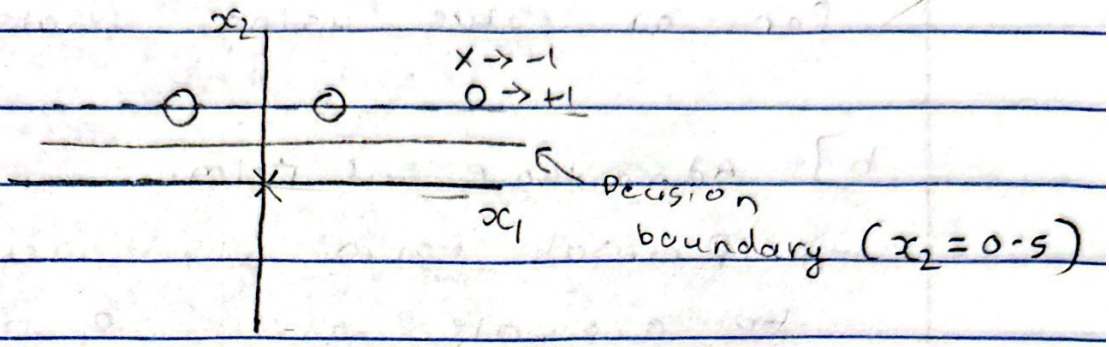
$-w_1/3 + w_2 + b \geq 1$

$w_1/3 + w_2 + b \geq 1$, while minimizing

★ Q 3] Hack, caution: dont use this method on exam

To provide precize w, b

Hack the question, I mean use cheat code : plotgraph



we know decision boundary $\Rightarrow x_2 = 0.5$

Support vectors are $\Rightarrow$ $x_2 = 1$, $x_2 = 0$

↳ these are eq^n of lines

$\Rightarrow$ At support vector

$w_1 x_1 + w_2 x_2 + b = +1$ (positive margin)

$w_1 x_1 + w_2 x_2 + b = -1$ (negative margin)

Also, we know that $w_1 = 0$ since our margins are all horizontal

$\Rightarrow$ $w_2 x_2 + b = 1$, $w_2 x_2 + b = -1$

At ~~positive~~ negative margin, $x_1 = 0, x_2 = 0$

$\Rightarrow$ $w_2 \times 0 + b = -1$, $b = -1$

At positive margin

$\Rightarrow$ $w_2 \times 1 + b = +1$

$\Rightarrow$ $w_2 = 2$

Hmm, we cheated & got right ans obviously

Width of margin $= \frac{2}{\|w\|} = \frac{2}{\sqrt{0^2+2^2}} = \frac{2}{2} = 1$