Linear Classification A

Classification into 3 classes, $\vec{x} = [x_1, x_2]^T$

A: $\tau = \{[-1, 4.0], [0, 2.5]\}$
B: $\tau = \{[2, 3.0], [4, 1.5]\}$
C: $\tau = \{[7, 3.0], [8, 1.0]\}$

Find parameters of discrimination funcs s.t

$$s^* = \arg\max_{s \in S} f_s(x)$$

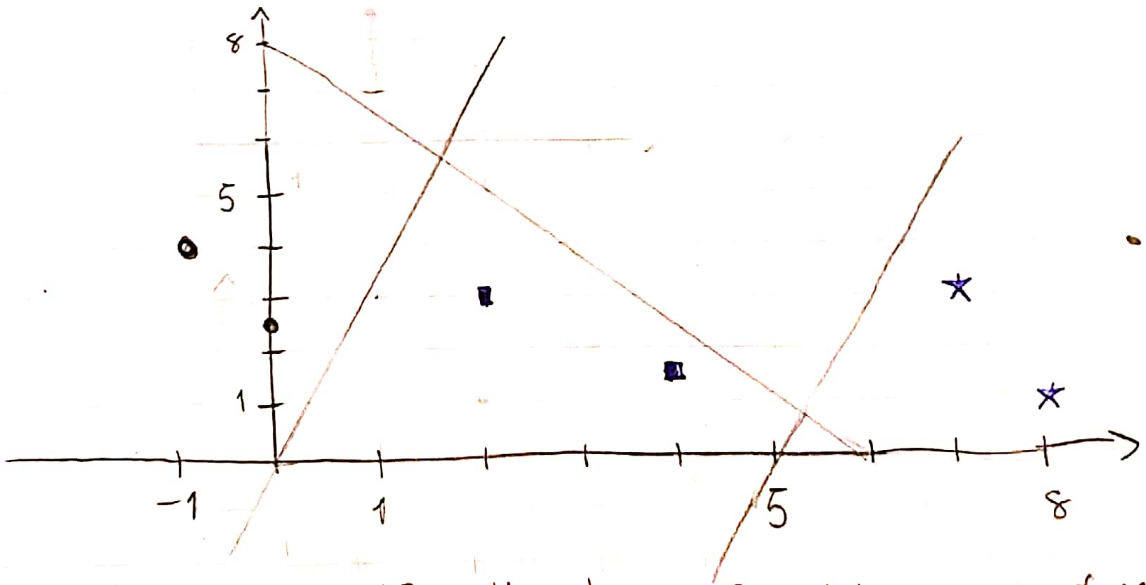
will classify data without mistakes

$$f_s(\vec{x}) = \vec{w}_s^T \vec{x} + w_{s0}$$

$\vec{x} = [x_1, x_2]$, so we want

$$f_s(\vec{x}) = \begin{bmatrix} w_{1s} \\ w_{2s} \end{bmatrix}^T [x_1, x_2]^T + w_{s0}$$

A: • B: ▪ C: ✕



want to classify without errors, wich can be done in many ways. Class A: Seems like we want a bit of a steep line that is in the [-, -] side of the graph when $x_1 = -1$, but then gets more positive as x_1 grows. Can let $w_{2A} = 0$ and $w_{A0} = 0$. Then $w_{1A} = 3$ for instance, s.t it doesn't come close to class B.

$f_A(x) = [3\ 0]x + 0 = [3\ 0]x$

$f_B(x)$ seems to work well if it reaches $x_2 = 0$ about when $x_1 = 6$. After that it should be negative. Can let $w_{B0} = 8$. Then $w_{2B} = 0$, and for w_{1B} we want $w_{1B} \cdot x_1$ to be -8 at 6: $w_{1B} = \frac{-8}{6} = \frac{-4}{3}$

$f_B(x) = [-\frac{4}{3}\ 0]x + 8$

Can let $f_C(x)$ cross 0 at $x_1 = 5$. It should unlike $f_B(x)$ move upwards to capture the points, and also start out quite negative. If I let $w_{CC} = -20$, and $w_{2C} = 0$, I need $w_{1B} \cdot 5 = 20 \Rightarrow w_{1B} = 4$

$f_C(x) = [4\ 0]x - 20$