

Linear Classification

Consider problem of classification into three classes and a 2D space of signs $\mathbf{x} = [x_1, x_2]^\top$. For each class we have following data (transposition will be left out for simplified notation, but all vectors are implicitly in columns).

$$\text{A: } \mathcal{T} = \{[-1, 4.5], [3, 4.0]\}$$

$$\text{B: } \mathcal{T} = \{[4, -0.5], [6, 3.0]\}$$

$$\text{C: } \mathcal{T} = \{[7, -1.0], [8, 5.0]\}$$

Find parameters of discrimination function so that

$$s^* = \arg \max_{s \in S} f_s(\mathbf{x}) \quad (1)$$

will classify these data without mistakes. Discrimination function is linear (affine), in form of

$$f_s(\mathbf{x}) = \mathbf{w}_s^\top \mathbf{x} + w_{s0} \quad (2)$$

For every class, we are trying to find three numbers. For completeness we point out, that valid result is not a drawing lines into graph, but finding three numbers for each of these classes.