Linear Classification Logistic Regression. In-class Exercise 2 Solution

EL-GY 6143 Intro Machine Learning. Prof. Sundeep Rangan

Question

We are given the following six data points with binary labels $y_i \in \{0,1\}$.

i	x_{i1}	x_{i2}	y
1	1	1	0
2	1	3	0
3	2	2	1
4	2	3	1
5	3	2	0
6	4	1	1

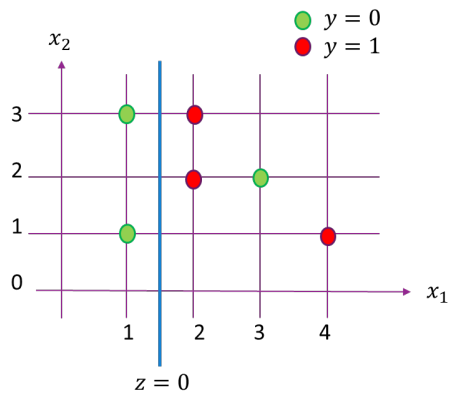
(a) Draw the points on a graph with different labels for each class

(b) Is the data linearly separable?

(c) Write a classifier for the data that makes a minimum number of errors. You must write a mathematical function describing the classifier output $\hat{y}$ in terms of x_1 and x_2. Do not just draw the boundary.

(d) Write a short python function that performs the classification on a data matrix. It should output a vector of classification decisions, one for each sample.

Solution



(a) The points can be graphed as on the left

(b) Data is not linearly separable

(c) One possible classifier is:

$$\hat{y} = \begin{cases} 1 & z > 0 \\ 0 & z \leq 0 \end{cases}, \quad z = -x_1 + 1.5$$

The boundary ($z = 0$) is shown on the graph

(d) One simple python code could be as follows. Note that you need to convert from Boolean to integer.

```
def predict(X):
    yhat = (X[:,0] < 1.5).astype(int)
```