

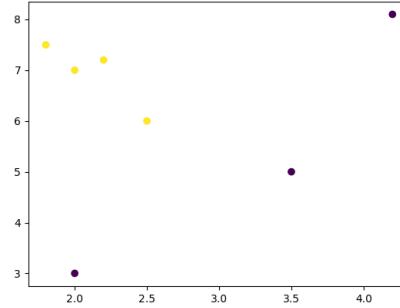
Machine Learning Exercise 2

EXERCISE 1

Construct (on paper) an example for a 2-dimensional dataset which is linearly separable, but for which linear discriminant analysis (LDA) will not define decision regions that separate the data. To answer this question it is only important to understand the underlying principles of LDA, not the exact computations by which an LDA model is learnt.

EXERCISE 2 Here is a very small dataset with two classes:

X_1	X_2	Y
2.	3.	0
3.5	5.	0
4.2	8.1	0
2.	7.	1
2.2	7.2	1
2.5	6.	1
1.8	7.5	1



Compute the mean vectors μ_0, μ_1 and covariance matrices Σ_0, Σ_1 for the two classes $Y = 0, 1$ (cf. slide 2.9).

EXERCISE 3

Consider the following dataset. The data has one numeric attribute X_1 , a categorical attribute X_2 with three possible states $\{a, b, c\}$, and a binary class label Y .

X_1	X_2	Y
25	a	0
2	a	1
1	b	0
-5	b	0
2	c	1
2	b	0

Find parameters for a logistic regression model that classifies these 6 datapoints correctly (there are many solutions).

EXERCISE 4

Consider again our XOR example, where we want to classify 4 datapoints as follows:

A	B	Class
1	1	⊖
1	0	⊕
0	1	⊕
0	0	⊖

Define a feature function $\phi : \mathbb{R}^2 \rightarrow \mathbb{R}^D$ (for some suitable choice of D), so that the 4 datapoints become linearly separable in the feature space.