Machine Learning Algorithms: exercise 4 13.04.2023

1. Calculate the decision boundary for two-category two-dimensional normally distributed data. Priors for the categories are equal. Means and covariances for the categories are given below.

$$\boldsymbol{\mu}_1=\begin{bmatrix}3\\6\end{bmatrix},\ \boldsymbol{\Sigma}_1=\begin{bmatrix}0.5 & 0\\0 & 2\end{bmatrix} \text{ and } \boldsymbol{\mu}_2=\begin{bmatrix}3\\-2\end{bmatrix},\ \boldsymbol{\Sigma}_2=\begin{bmatrix}2 & 0\\0 & 2\end{bmatrix}.$$

2. Covariance matrix $\boldsymbol{\Sigma}_1$ from the first task can be considered as a scaling matrix that multiplies the first component of a vector by 0.5 and the second component by 2. What could be the effects of the matrices below?

$$\boldsymbol{\Sigma}_3=\begin{bmatrix}\cos(\alpha) & -\sin(\alpha)\\\sin(\alpha) & \cos(\alpha)\end{bmatrix}$$

$$\boldsymbol{\Sigma}_4=\begin{bmatrix}-1 & 0\\0 & -1\end{bmatrix}$$

3. Load in the https://archive.ics.uci.edu/ml/machine-learning-databases/iris/iris.data , build a logistic regression model (doc mnrfit) and classify the cases (6.5, 2.9, 5.5, 2.0), (5.0, 3.4, 1.5, 0.2) and (5.9, 2.7, 4.3, 1.3).
4. Load the data3.xlsx file and search for a direction **w** such that the margin between classes C_1 and C_2 is as large as possible. What is the length of the separating margin between the classes C_1 and C_2.
5. Load in Iris data set and use 40 first Iris-setosa cases, first 40 Iris-versicolor cases and fit a support vector machine (doc fitcsvm) that can separate the two classes. Predict the classes of the remaining ten setosa and versicolor cases.
6. Load in Iris data set and use 40 first Iris-setosa cases, first 40 Iris-versicolor, first 40 Iris-virginica cases and fit a support vector machine (doc fitcecoc) that can separate the three classes. Predict the classes of the remaining ten setosa, versicolor and virginica cases.