

**Task 1 and 2)** You have to implement iterative algorithms (perceptron algorithm in Task 1, relaxation algorithm in Task 2) that find linear discriminant functions. The information can be found on pages 18-29 in the file “LDA\_presentation.pdf”.

Additional tips: A general idea of both algorithms:

0. start from the random weight vector ( $\mathbf{v}$ )

1. classify all data points and determine a set of those incorrectly classified ( $Y$ )

$$Y = \{ \mathbf{y}_i | \mathbf{v}^T \mathbf{y}_i < 0 \} \quad (\text{perceptron algorithm})$$

$$Y = \{ \mathbf{y}_i | \mathbf{v}^T \mathbf{y}_i \leq b \} \quad (\text{relaxation algorithm})$$

If all classifications are correct (i.e. if  $Y$  is an empty set) then stop the algorithm, otherwise

2. update weight vector using the sum of misclassified data points:

$$\mathbf{v}_{k+1} = \mathbf{v}_k + \rho_k \sum_{\mathbf{y}_i \in Y} \mathbf{y}_i \quad (\text{perceptron algorithm})$$

$$\mathbf{v}_{k+1} = \mathbf{v}_k + \rho_k \sum_{\mathbf{y}_i \in Y} \frac{b - \mathbf{v}^T \mathbf{y}_i}{\|\mathbf{y}_i\|^2} \mathbf{y}_i \quad (\text{relaxation algorithm})$$

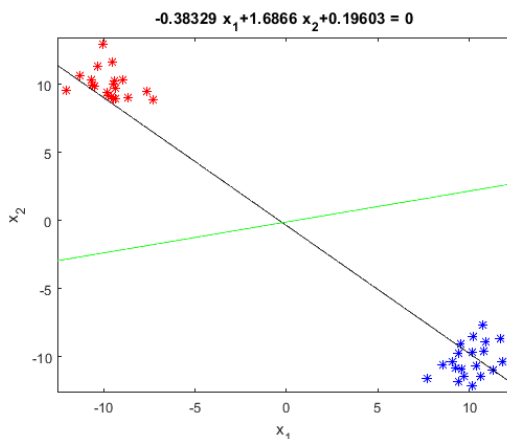
3. go to the step 1.

Please pay attention to the correct definitions of vectors  $\mathbf{v}$  and  $\mathbf{y}$ .

Example of the results:

black line - corresponds to the initial random weight vector

green line - corresponds to the obtained final weight vector



**Task 3)** You have to calculate Fisher’s linear discriminant analysis formulas, that can be found on pages 22-23 in the file “LDA\_lect.pdf”.