Relatório LAB 5 AA – SVM (depois passamos para PDF)

2.1

By inspection we can find the following elements:

Maximum-margin separating straight line:

Support vector for class 1:

Support vectors for class -1:

Margin boundary for class 1:

Margin boundary for class -1:

(Ver resolução do sistema de equações no caderno:)

2.2

We will consider a simple nonlinear mapping to a three-dimensional feature space since this will enable us to compute a hyperplane that is able to separate the two classes. After computing the elements associated to the XOR function we can observe that we will have elements from class -1 in a horizontal plane with a height of 1 and that the elements from class 1 will be in a horizontal plane of height -1. This means that the horizontal plane with height 0 will be the hyperplane that separates the 2 classes.

(Ver cálculos e referencial 3D no caderno)

2.3

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | Class |
| -1 | -1 | 1 | -1 |
| -1 | 1 | -1 | 1 |
| 1 | -1 | -1 | 1 |
| 1 | 1 | 1 | -1 |

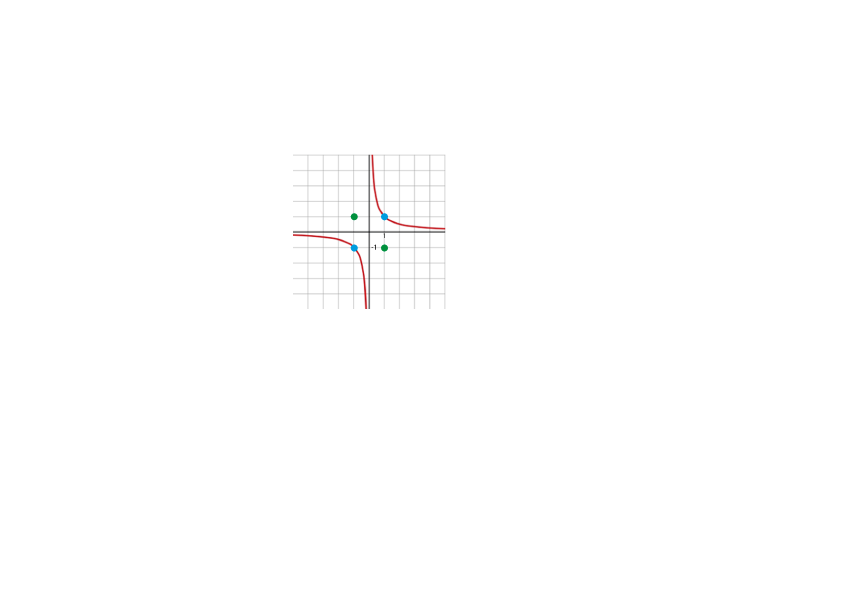
After computing the elements associated to the XOR function we can observe that we will have all elements from class -1 in a horizontal plane with a height of 1 and that all the elements from class 1 will be in a horizontal plane of height -1. This means that all vectors are support vectors.

Class -1 support vectors: (-1, -1, 1) and (1, 1, 1)

Class 1 support vectors: (-1, 1, -1) and (1, -1, -1)

b = -2

2.4

Classification border:

=> Class -1

=> Class 1

Margin boundaries:

For class -1:

For class 1:

(Ver plot no caderno)

In the figure only the class -1 margin boundaries are displayed, the class 1 boundaries are symmetric to the ones represented in the plot. Blue represents the class -1 inputs and green represents the class 1 inputs.

2.5

3.1

3.2

4.1 – Testing SVM with Poly kernel and findind optimal polynomial order

P = 1 -> Error = 46%, SV: 100

P = 2 -> Error = 35%, SV: 100

P = 3 -> Error = 35%, SV: 99

P = 4 -> Error = 20%, SV: 83

P = 5 -> Error = 14%, SV: 93

P = 6 -> Error = 0%, SV: 77

P = 7 -> Error = 0%, SV: 91

4.2 - Testing SVM with RBF kernel and sigma value

σ = 2 -> Error = 46%, SV: 100

σ = 1 -> Error = 30%, SV: 100

σ = 0.7 -> Error = 6%, SV: 98

σ = 0.5 -> Error = 0%, SV: 98

σ = 0.1 -> Error = 0%, SV: 100

σ = 0.01 -> Error = 0%, SV: 100

4.3 - Testing SVM with RBF kernel and sigma value W/Box Constraint

σ = 5 -> SV: 12

σ = 2 -> SV: 10

σ = 1 -> SV: 10

σ = 0.5 -> SV: 23

4.4

17 SV

4.5