

## Homework Assignment 7

*Due date: 13th of January 2014*

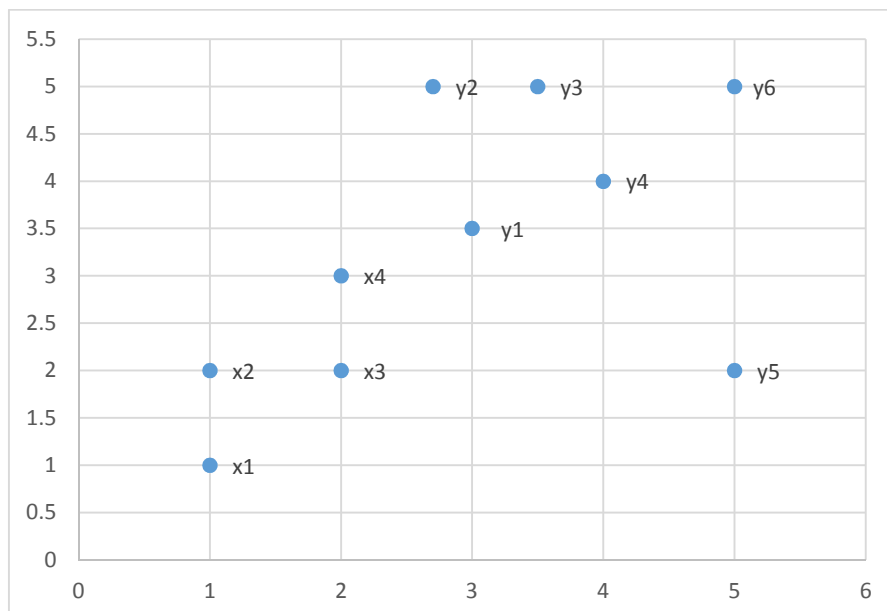
Please note that even though the homework assignments are optional, you're still highly encouraged to answer them, as they will help you prepare for your final exam. You can work in a group of two or alone. Solutions can be dropped off at the institute's homework mailbox located on the 2<sup>nd</sup> floor, next to room 238. In that case, please make sure both your name and matriculation number is noted down. If your answers span more than one sheet, kindly staple them together. Another alternative is to send your homework via email to: elmaarry@ifis.cs.tu-bs.de

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### LECTURE 9: SUPPORT VECTOR MACHINES

Given the following training dataset, with 2 classes : x and y, where x points are denoted by -1 class and y points denoted by 1 class, find the Maximum margin classifier, where the SVM to be constructed aims at minimizing the decision hyperplane normal vector  $\|w\|$  as explained in the lecture.

$$z_i \cdot (w \cdot y_i + b) - 1 \geq 0, \text{ for } i = 1, \dots, n$$



#### EXERCISE 9.1

How many support vector points are needed? List them.

**EXERCISE 9.2**

What is the optimal cutting hyperplane (i.e. Define it by computing its normal vector  $\mathbf{w}$  and the intercept term  $\mathbf{b}$ ) ?

**EXERCISE 9.3**

What is the margin width of the constructed hyperplane?