

## Arbitrary norm support vector machines

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We want to separate two different classes  $C_+, C_- \subset \mathbb{R}^d$ . Therefore, we have access to training data of the form  $(a_i, y_i)$ ,  $i = 1, \dots, m$  with  $a_i \in \mathbb{R}^d$  and  $y_i \in \{-1, 1\}$ , i.e. we know the class each measurement vector  $a_i$  belongs to. Using this training data, we want to say whether a new signal  $x \in \mathbb{R}^d$  belongs to  $C_+$  or to  $C_-$ . A typical example for such a two class classification problem is a doctor, who has to distinguish whether a patient is sick or not.

To separate these two classes, we assume that they can be separated by some hyperplane through the origin and follow the idea of support vector machines (SVM). That is, we search for the hyperplane through the origin which maximizes the margin between the two classes with respect to some arbitrary norm on  $\mathbb{R}^d$ .