

2020 Computational Mathematics Bootcamp

# Introduction to SVM (Support Vector Machines)

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# Intro

SVMs (Support vector machines) are a set of supervised learning methods for both classification & regression.

The main application is splitting data into two classes.

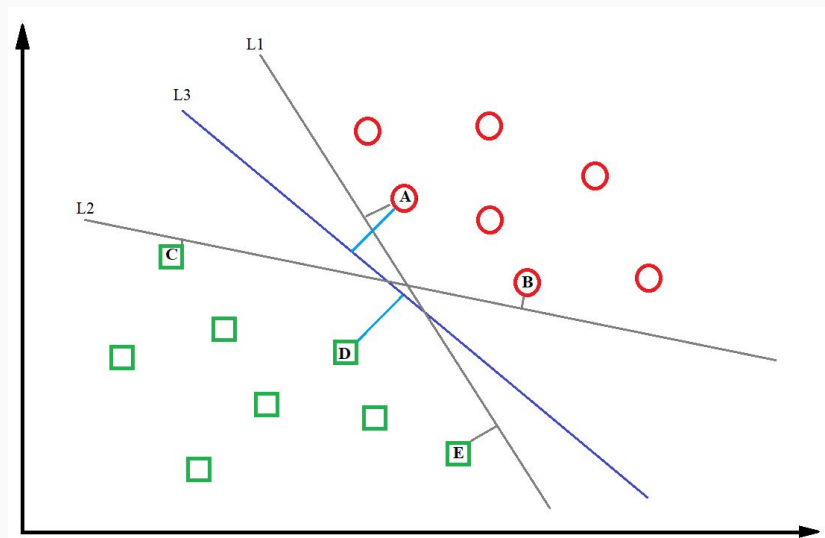
# A Simple Example

Find a line to classify two data sets.

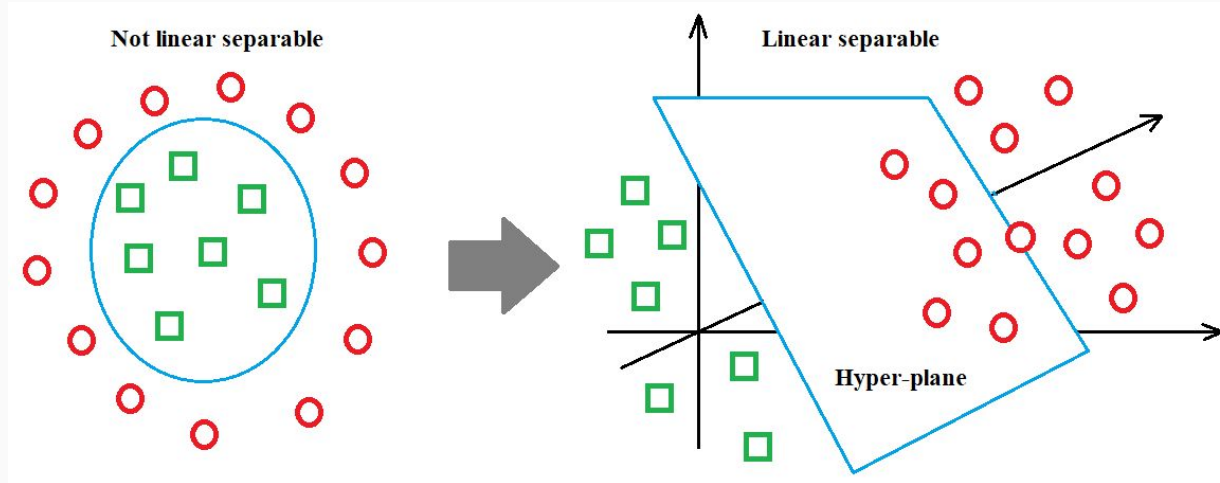
Multiple ways, which is the best ?

Maximize the distance between the closest data point to the line.

What if: not linear separable ? high-dimension case ?



# Not linear separable ? Not a problem !



Find a mapping so that the data is linear separable in higher-dimension space.

The “line” becomes hyper-plane in high-dimension case.

How to find “the mapping” ?

# “ The mapping ”

It is “possible” to find it manually.

Actually we do not have to find the expression of the mapping.

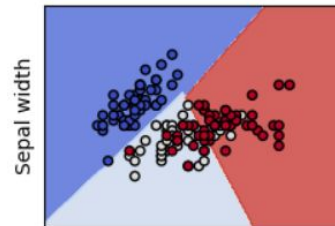
Keep it as a “black box”, which is also called “kernel function”.

Why this works ? Because every time the data point shows up, it is in the form of inner product, which output is a value. So we do not need to know the coordinates of the data point in the new (higher-dimension) space, we only need to know “the value”.

Dimension: the higher, the better ? Not really.

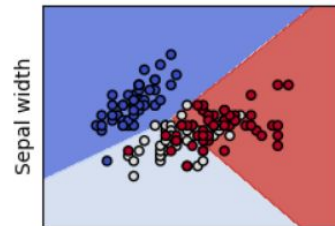
SVM can be  
extended to  
multiple classes

SVC with linear kernel



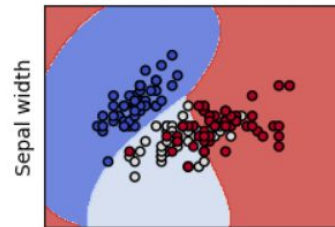
Sepal length

LinearSVC (linear kernel)



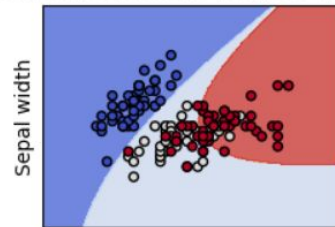
Sepal length

SVC with RBF kernel



Sepal length

SVC with polynomial (degree 3) kernel



Sepal length

# SVM

Split the points with a line (hyperplane)

If you can't find such a plane, map into a higher dimensional space and find one there

Thank you!