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Supervised Learning

(Types of Support Vector Machine)

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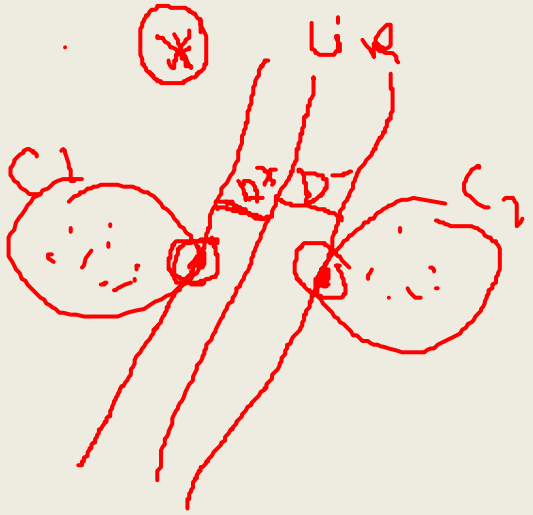
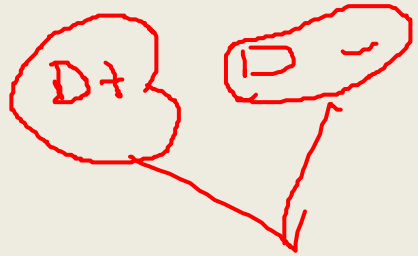
Previous Lecture

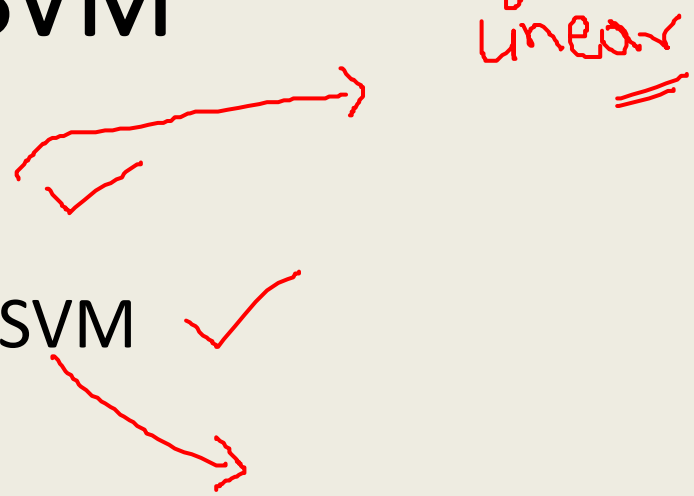




- Introduction to SVM
- Why SVM?
  - An example to predict a fruit
  - SVM model for classification by an example
- What is a SVM?
  - Which line is the best for hyperplane?
  - Discuss various terms – Hyperplane, Distance Margin, Support Vectors, D+, D-
- Understanding SVM
  - Kernel function

Type of SVM

- Linear SVM
- Non-Linear SVM



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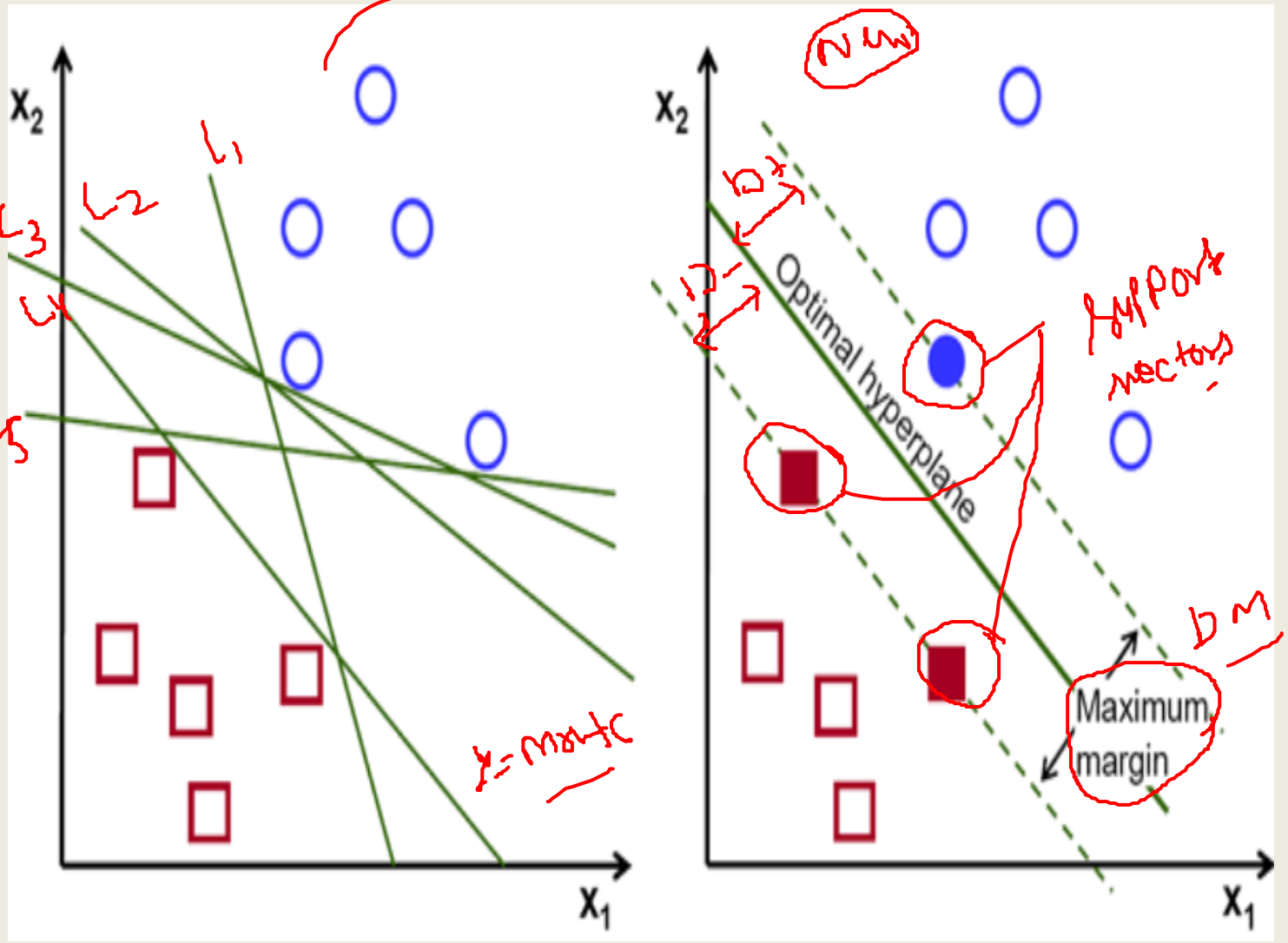
Linear SVM

- Linear SVM : Linear SVM is used for data that are linearly separable i.e. for a dataset that can be categorized into two categories by utilizing a single straight line. Such data points are termed as linearly separable data, and the classifier is used described as a Linear SVM classifier.



Non-Linear SVM

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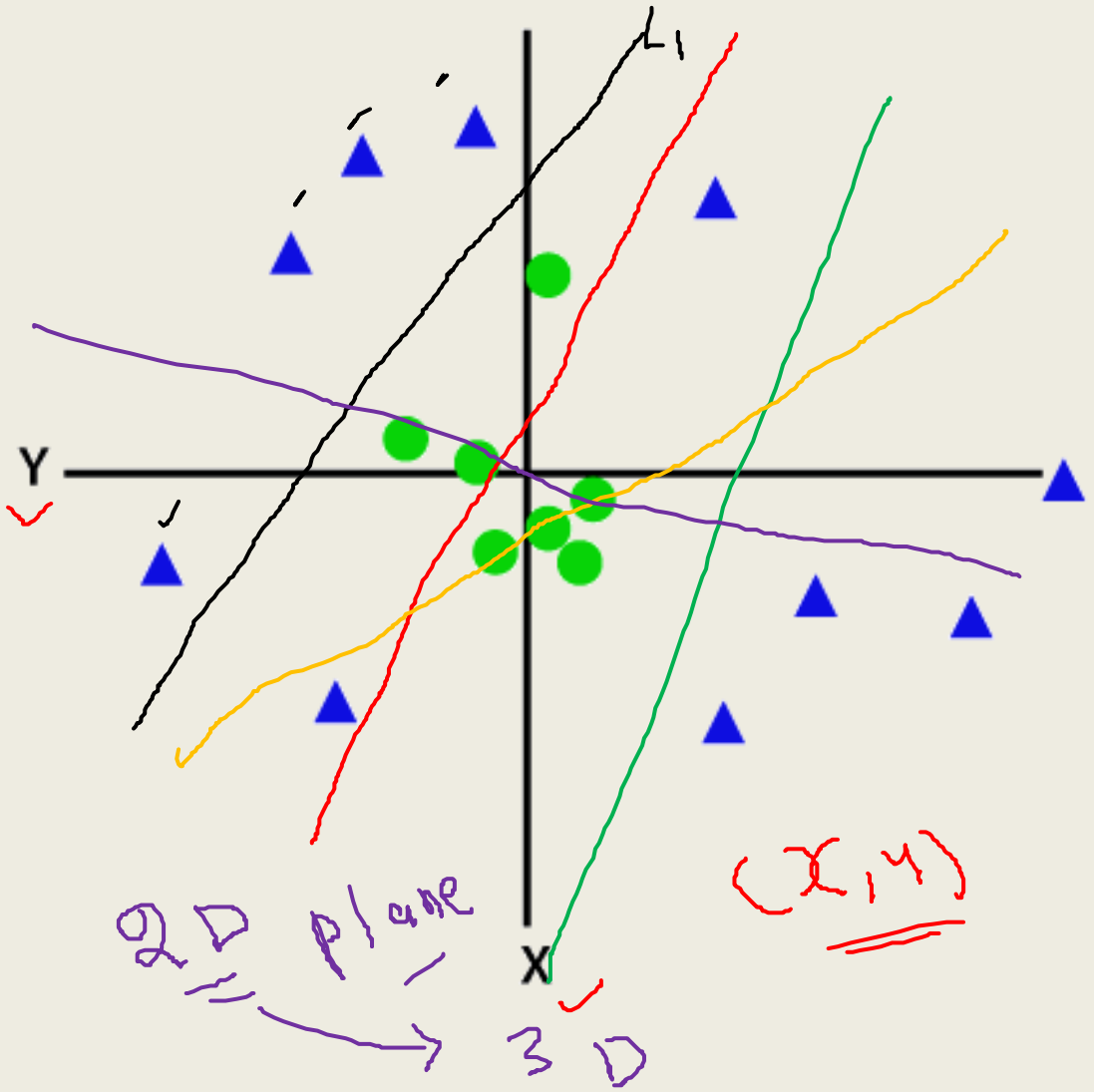
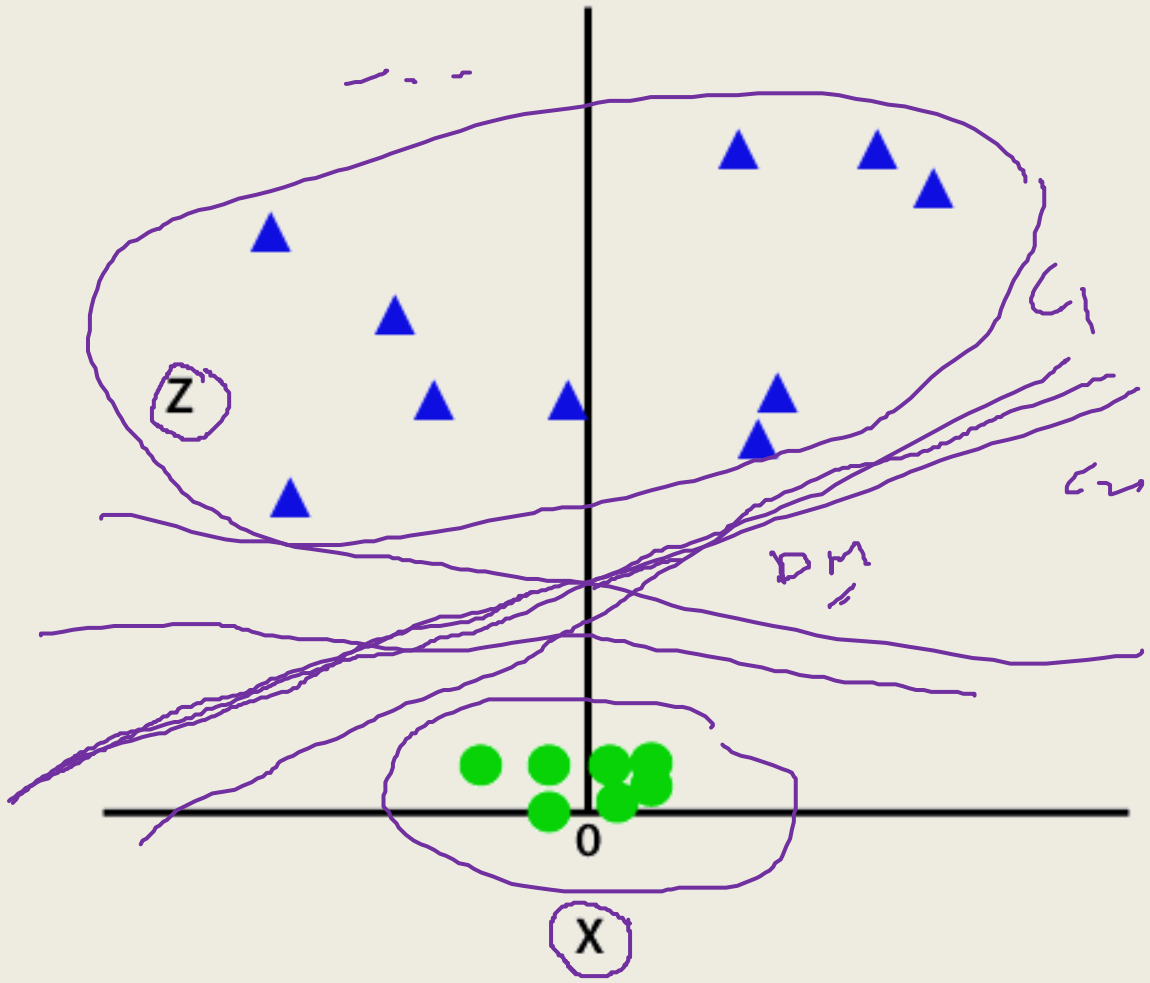
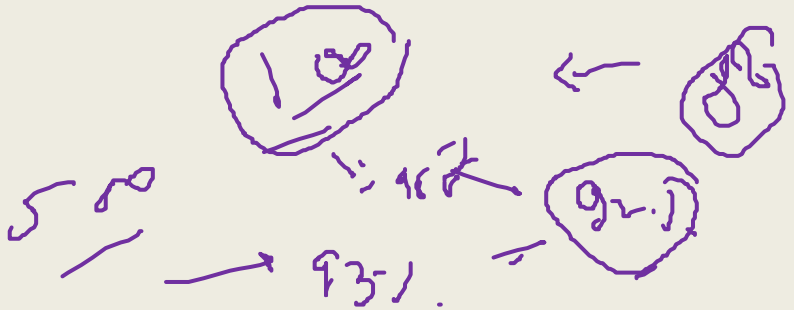
- Non-linear SVM: Non-Linear SVM is used for data that are non-linearly separable data i.e. a straight line cannot be used to classify the dataset. For this, we use something known as a kernel trick that sets data points in a higher dimension where they can be separated using planes or other mathematical functions. Such data points are termed as non-linear data, and the classifier used is termed as a Non-linear SVM classifier.



- To separate non linearly separable data points, we have to add an extra dimension. For linear data, two dimensions have been used, that is, x and y. For these data points, we add a third dimension, say z. For the example below let $z=x^2+y^2$.

- This z function or the added dimensionality transforms the sample space and the above image will become as the following:



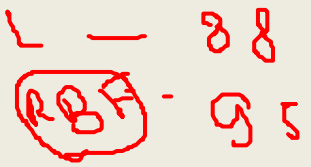


- On close analysis, it is evident that the above data points can be separated using a straight line function that is either parallel to the x axis or is inclined at an angle. Different types of kernel functions are present — linear, nonlinear, polynomial, radial basis function (RBF), and sigmoid.

- What RBF does in simple words is — if we pick some point, the result of an RBF will be the norm of the distance between that point and some fixed point.

Which Kernel to choose?

- A nice method to determine which kernel is the most suitable is to make various models with varying kernels, then estimate each of their performance, and ultimately compare the outcomes. Then you pick the kernel with the best results. Be particular to estimate the model's performance on unlike observations by using K-Fold Cross-Validation and consider different metrics like Accuracy, F1 Score, etc.



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