An Overview on Basic Recognition System

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Detection, Classification & Recognition

Detection:

Object detection is the process of finding instances of real world objects such as faces, bicycles, and buildings in an images or videos using some basic features.

Ex. Finding face using circularity property. Could falsely include ball as a face.

Classification:

Detection is the process of identification and classification is the categorization of the object based on a previously defined classes or types.

Ex. Use classifier such as SVM to correctly classify face against ball. Here, previously classifier had trained up with

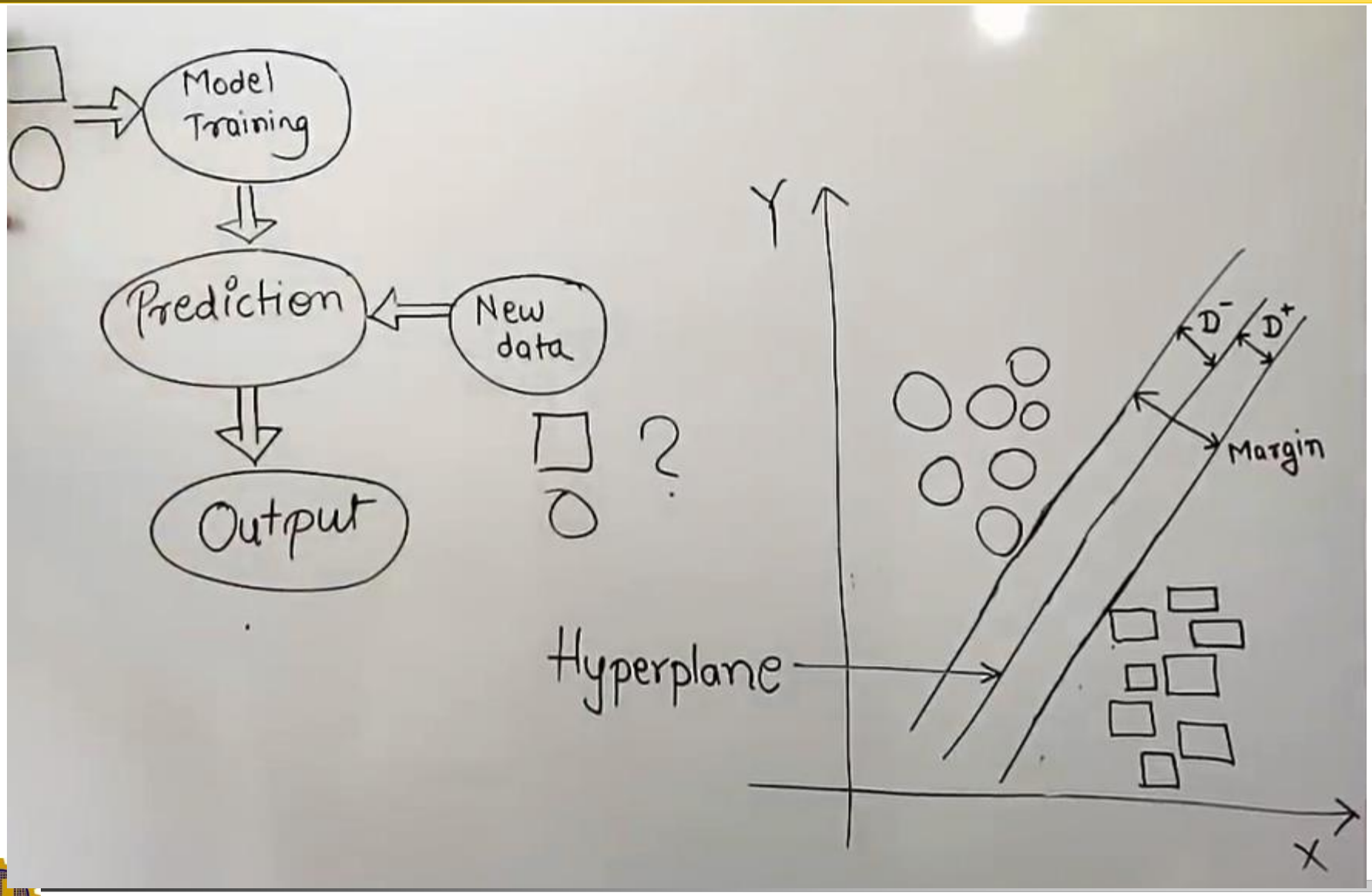
Detection, Classification & Recognition

Recognition:

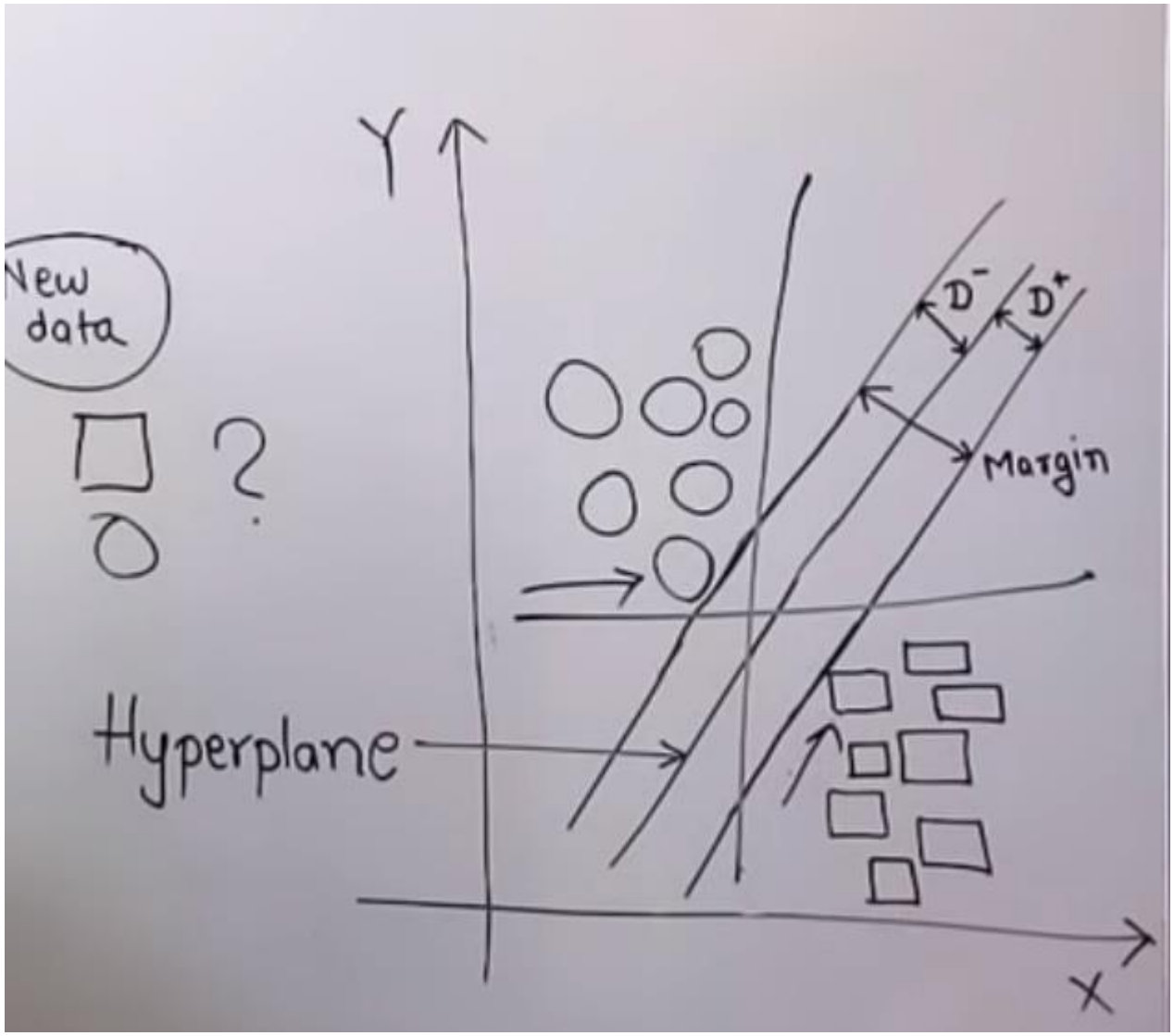
Object recognition is a process for identifying a specific object in a digital image or video. Object recognition algorithms rely on matching, learning, or pattern recognition algorithms using appearance-based or feature-based techniques.

Ex. Recognize the face of Mr. X among all classified faces.

Support Vector Machine (SVM)



Support Vector Machine (SVM)



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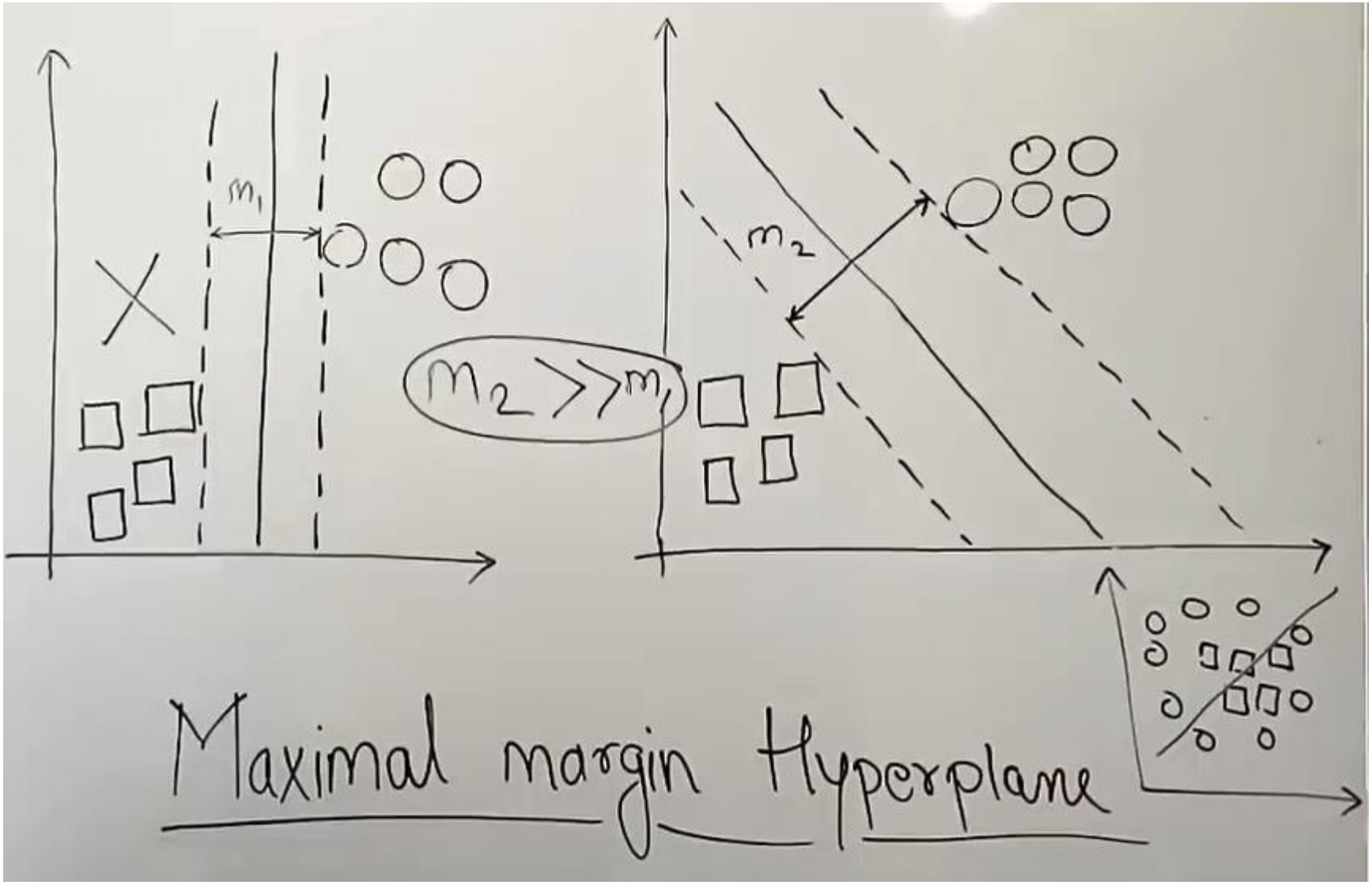

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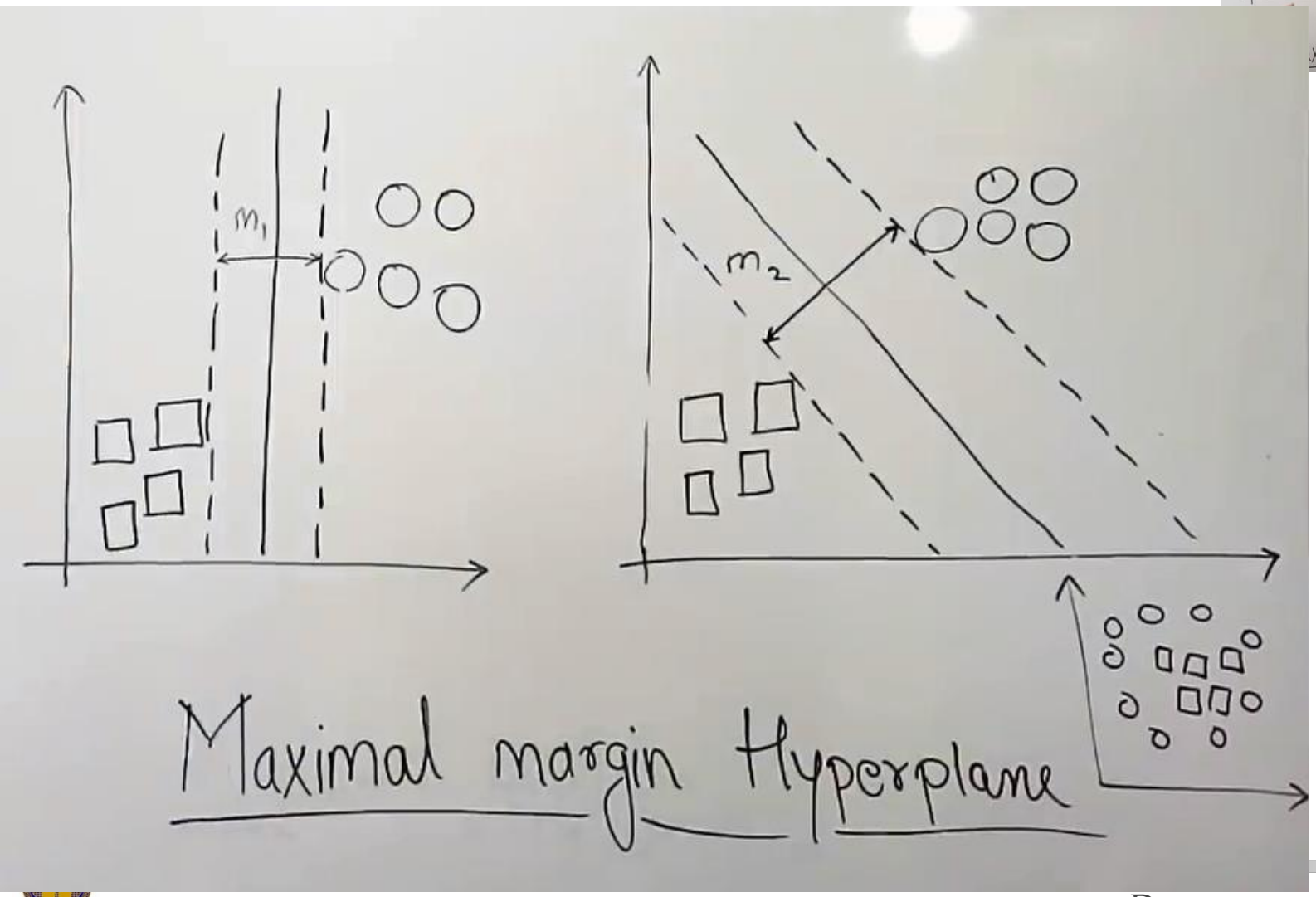
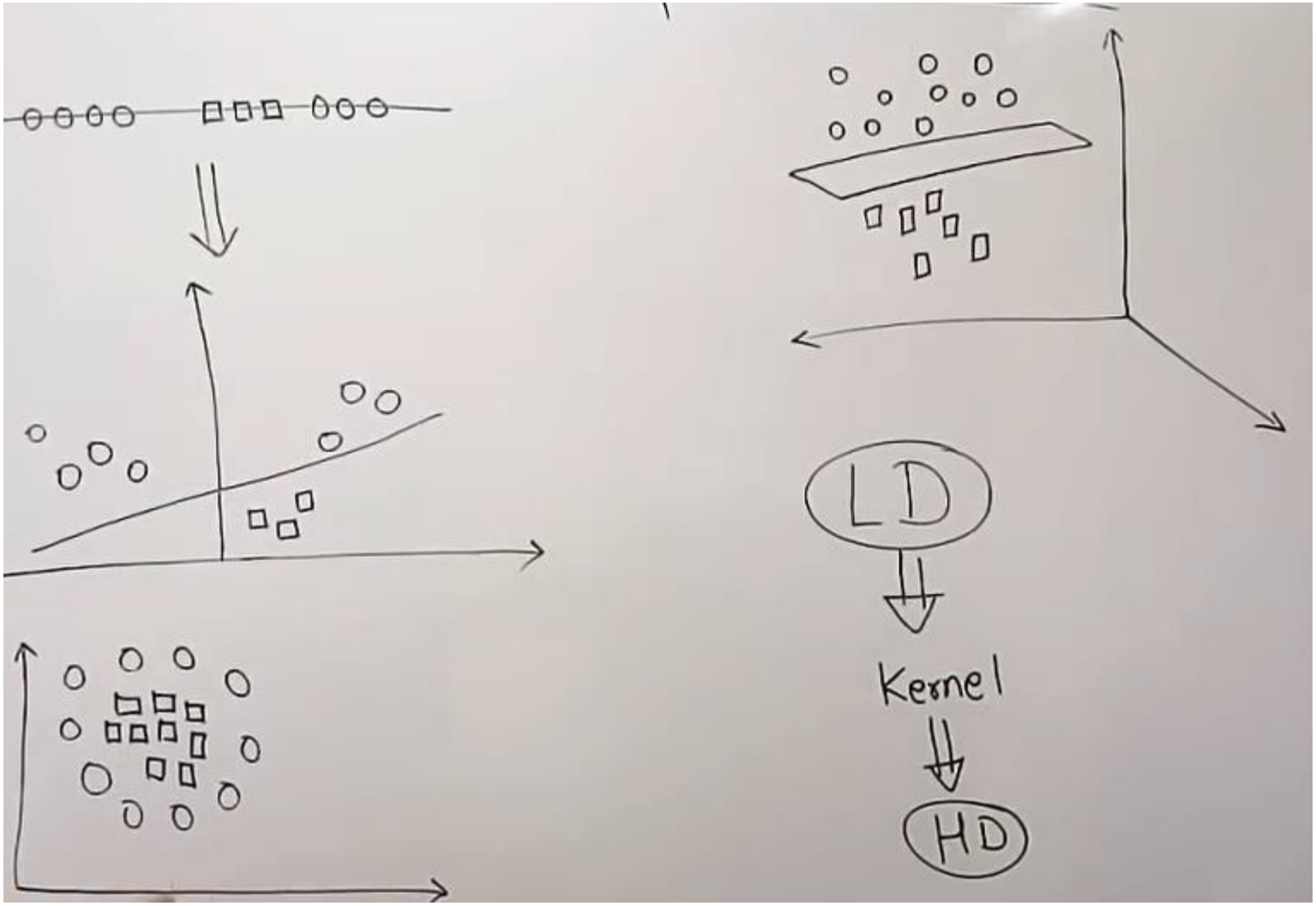
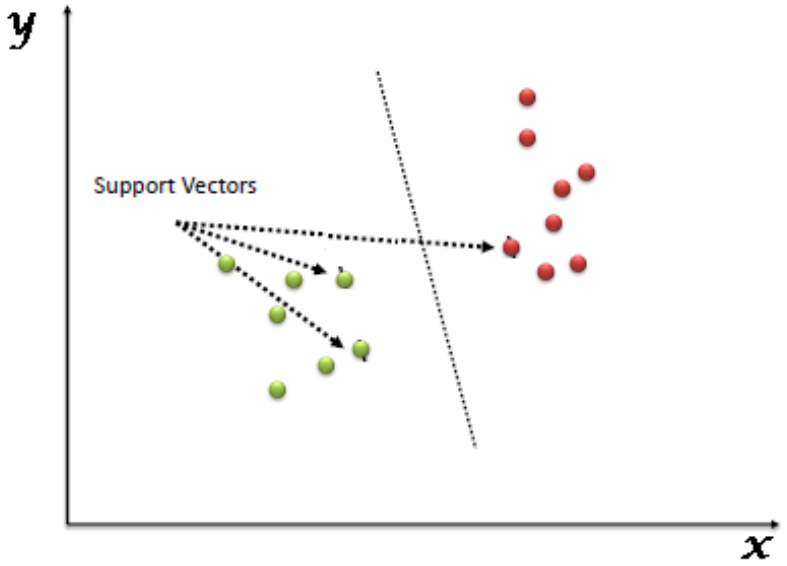


Non linear SVM and Kernel function



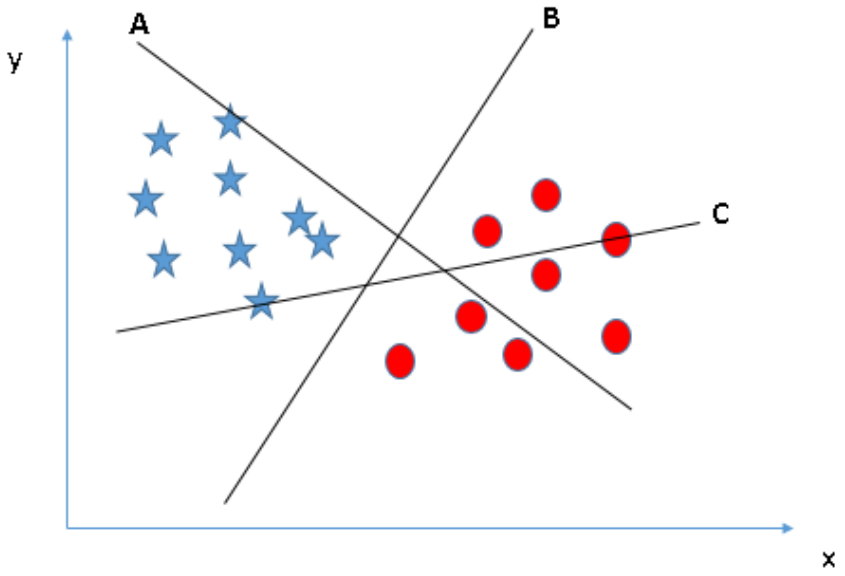
Support Vector Machine: A classifier

- It plots each data item as a point in n-dimensional space
- Perform classification by finding the hyperplane that differentiates the two classes very well
- Support Vectors are simply the coordinates of individual observation
- Support Vector Machine is a frontier which best segregates the two classes



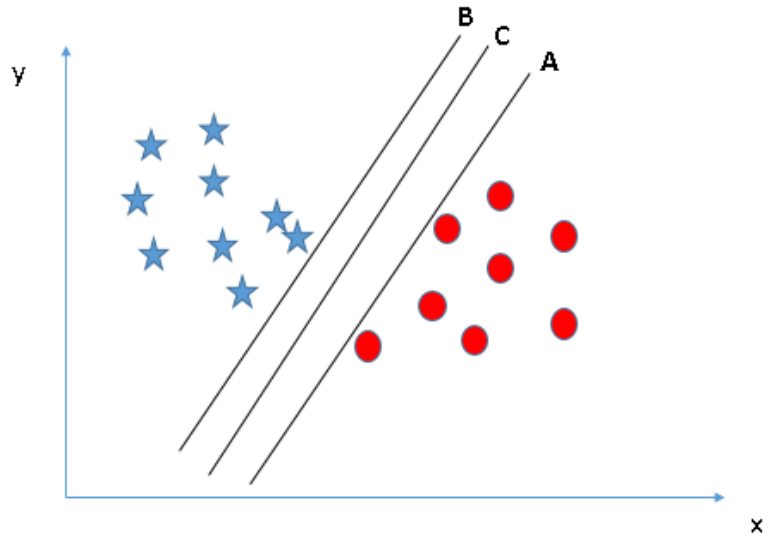
Identify the right hyper-plane (Scenario-1)

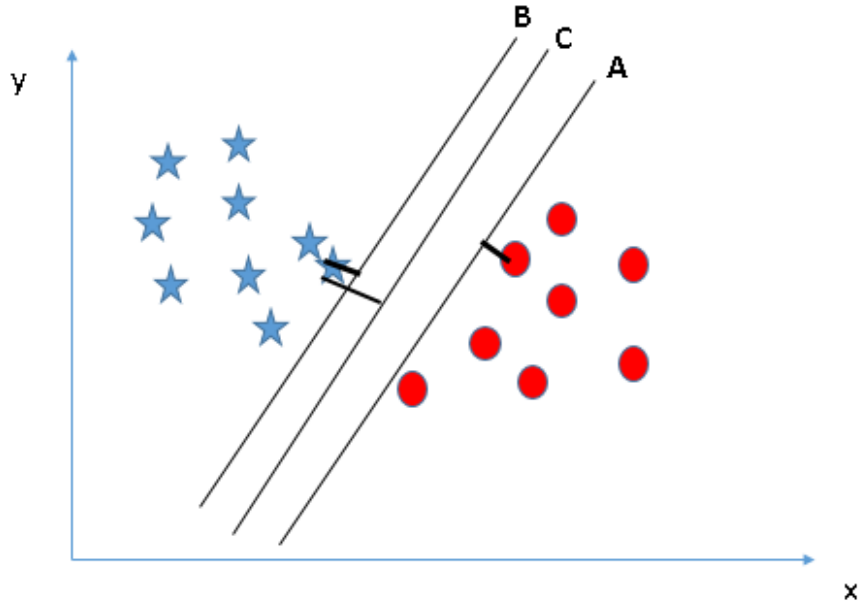
- Select the hyperplane which segregates the two classes better
- Select B



Identify the right hyper-plane (Scenario-2)

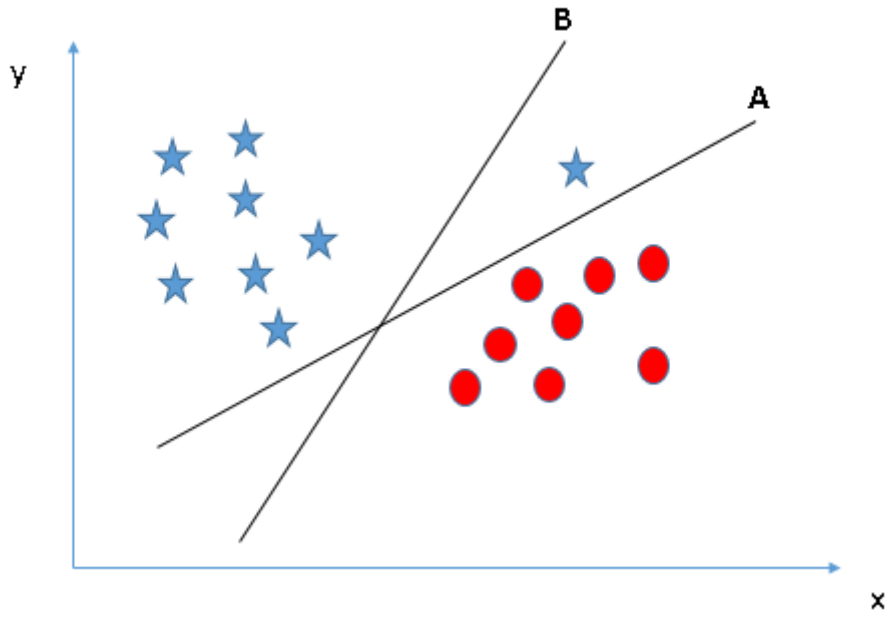
- Maximizing the distances between nearest data point
- This distance is called as Margin
- Select C





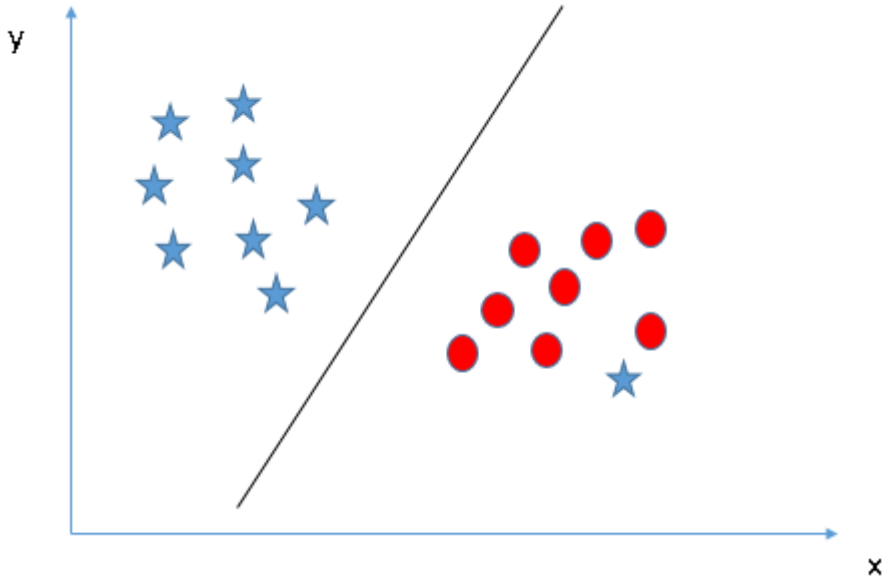
Identify the right hyper-plane (Scenario-3)

- Hyper-plane B has big margin with less classification error and A has classified all correctly with small margin
- Select A



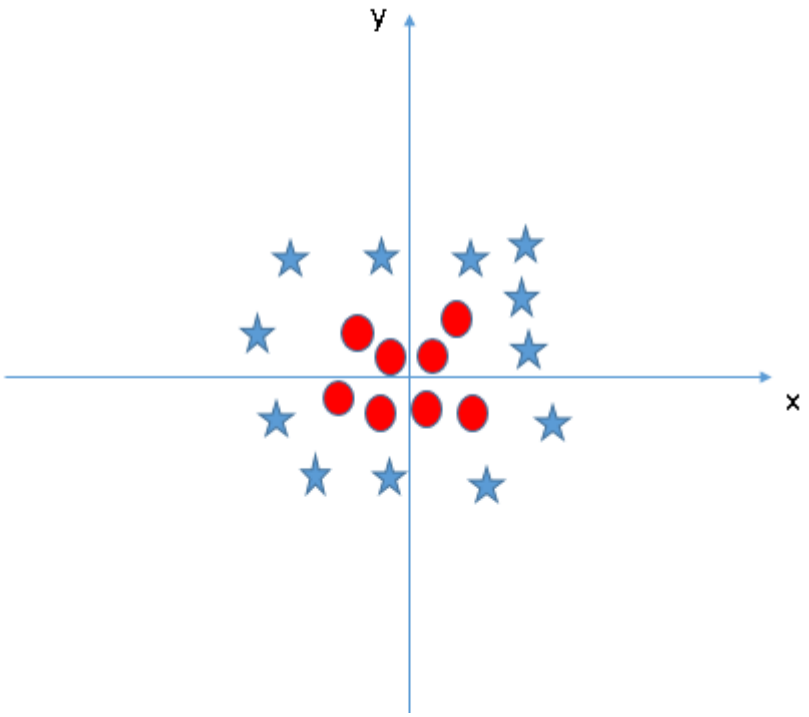
Can we classify two classes (Scenario-4)

- One of star lies in the territory of other (circle) class as an outlier
- SVM has a feature to ignore outliers and find the hyperplane that has maximum margin



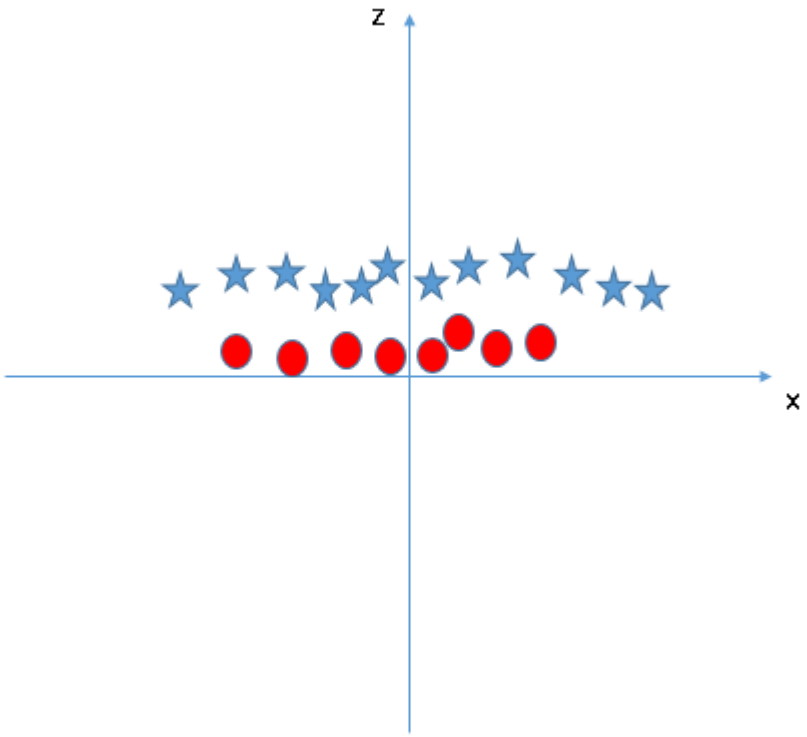
Find the hyperplane to segregate to classes (Scenario-5)

- We can't have linear hyperplane between the two classes



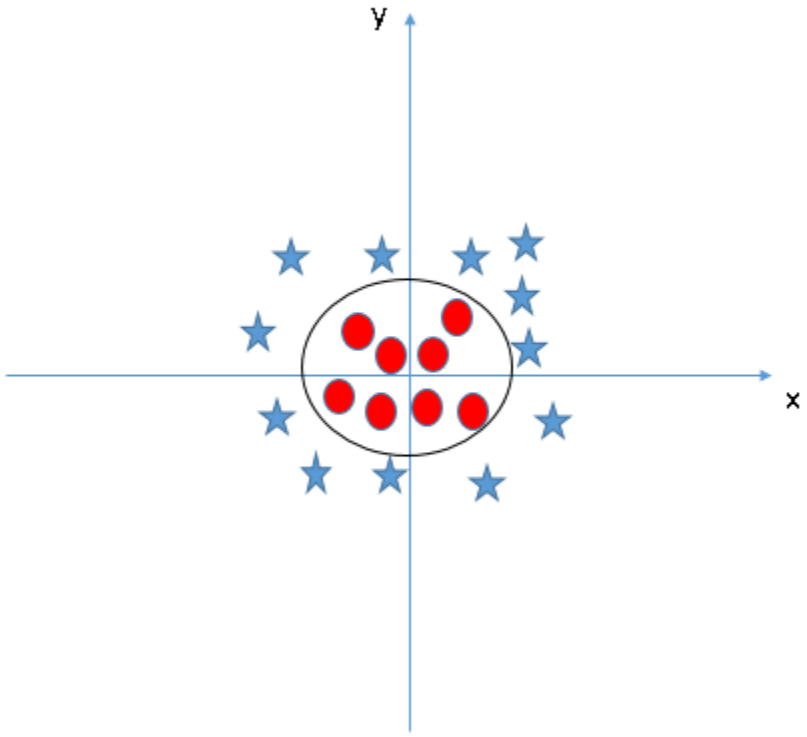
Find the hyperplane to segregate to classes (Scenario-5)

- We will add a new feature z=x^2+y^2
- In SVM, it is easy to have a linear hyperplane between these two classes



Non-linear hyper plane

- SVM has a technique called the kernel trick
- It converts not separable problem to separable problem
- It is mostly useful in non-linear separation problem



Radial Basis Function kernel

- The RBF kernel on two samples x and x', represented as feature vectors in some input space

$$k(x, x') = \exp(-\frac{||x - x'||^2}{2\sigma^2})$$