SUPPORT VECTOR MACHINE

Agenda

- What is SVM?
- Ideology behind SVM
- Intuition Development
- Terminologies used in SVM
- How does it work?
- What is Kernel trick?
- Types of kernel
  - Polynomial Kernel
  - Gaussian RBF Kernel
- Support Vector Regression
- Pros and Cons of SVM
- Data preparation for SVM
- Use Case - House Prices

What is SVM?

Supervised learning algorithm which can be used for,

Classification - **Support Vector Classification (SVC)**

Regression - **Support Vector Regression (SVR)**

What is SVM?

Used for **smaller dataset** as it takes **too long to process**.

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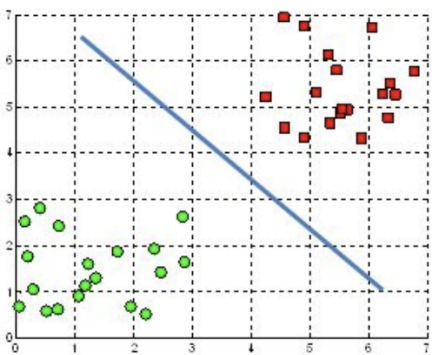
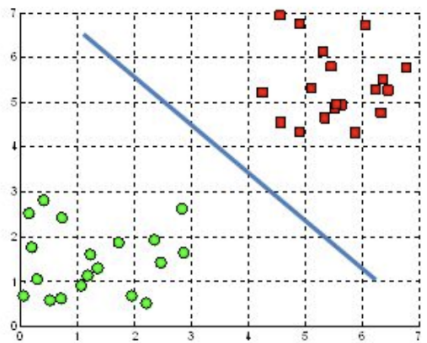
The ideology behind SVM

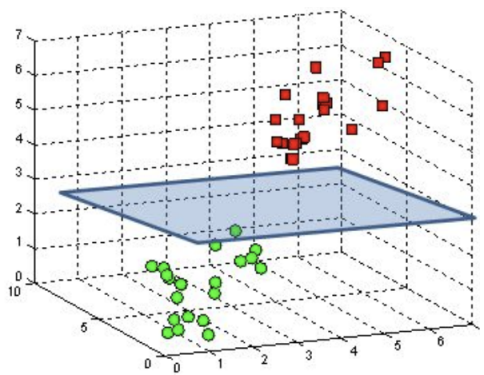
SVM is based on the idea of finding a **hyperplane** that best separates the features into different domains.



What is Hyperplane?

We can draw a **line in 2-D**, a **plane in 3-D**, **anything beyond** is a **hyperplane**.





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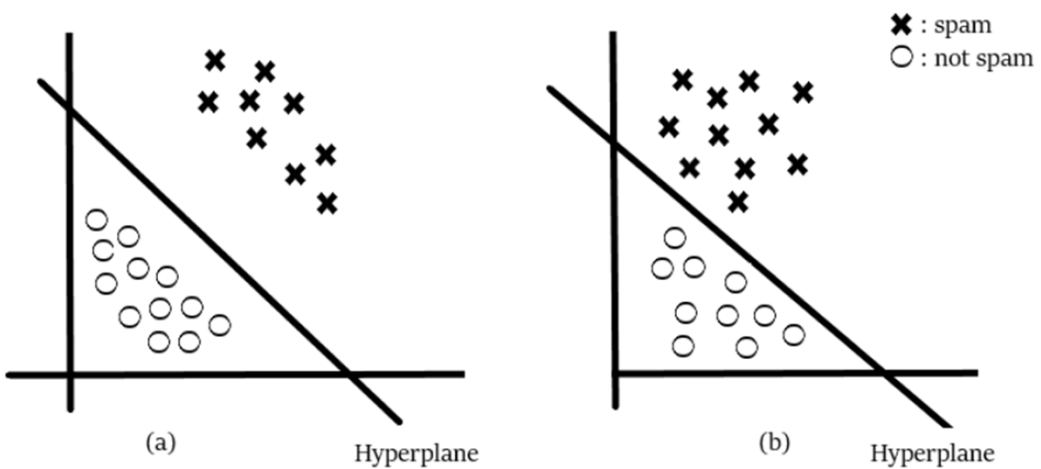
Intuition Development

Classify emails as **spam** or **ham** using a **function(hyperplane)**

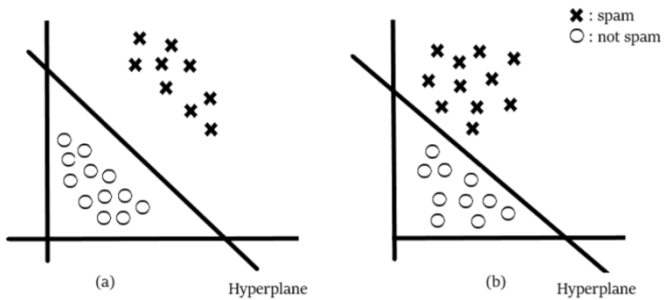
Two cases in which the hyperplane are drawn, which one will you pick and why?



Intuition Development

- I guess you would have picked the **fig(a)**.

  Did you think **why** have you picked the fig(a)?



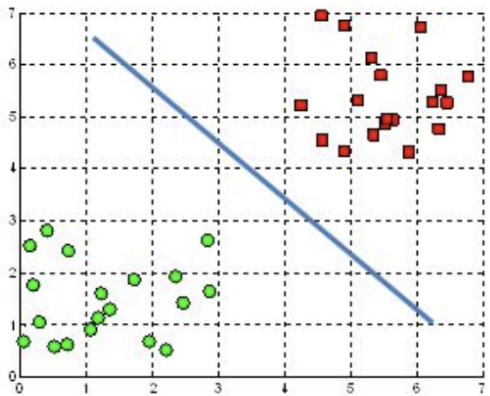
- Because the **emails in fig(a)** are **clearly classified** and

  you are **more confident** about that **as compared to fig(b)**.

Intuition Development

Hyperplane(Decision Surface)

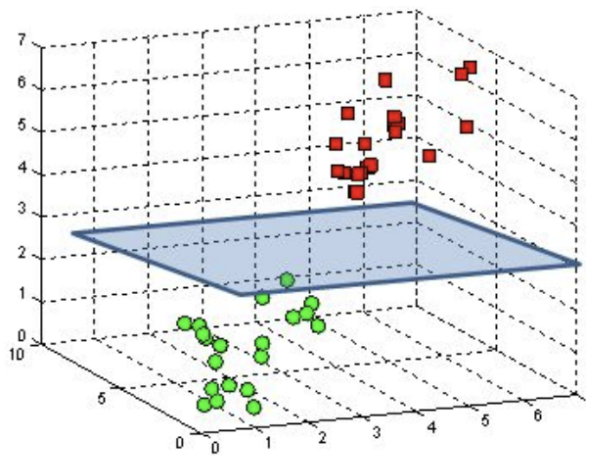
- The hyperplane is a **function** which is used to **differentiate between features**.
- In a **2-D data**, the function used to classify is a **LINE**.



Intuition Development

Hyperplane(Decision Surface)

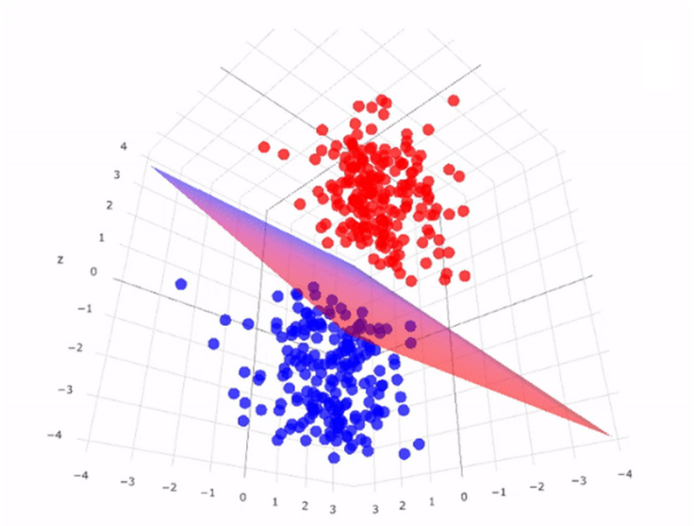
- The function used to classify the features in a **3-D data** is a **PLANE**.
- Beyond **3-D** its a **HYPERPLANE**.



Intuition Development

Basically, SVM is composed of the idea of coming up with an **Optimal hyperplane** which will **clearly classify the different classes.**

(In this case they are **binary** classes)



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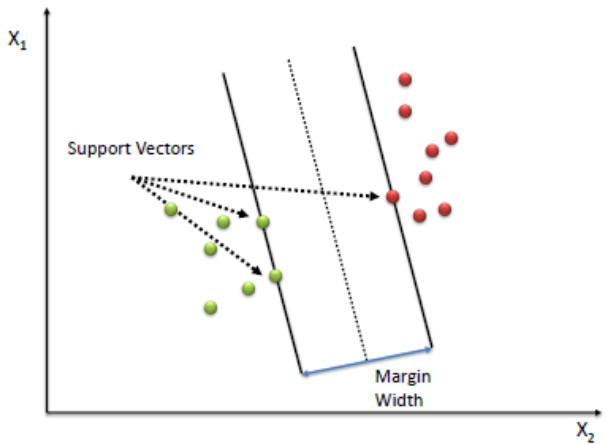
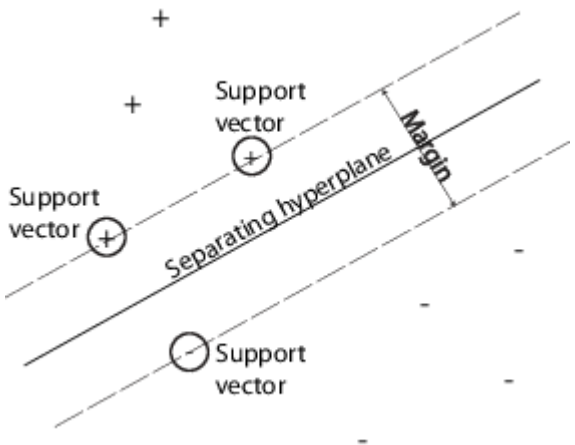
Terminologies used in SVM

- The **points closest** to the **hyperplane** are called **SUPPORT VECTORS**.
- The **distance** of the **vectors from** the **hyperplane** is called **MARGIN**.



Terminologies used in SVM



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How does it work?

We got accustomed to the process of segregating the two classes with a hyper-plane.

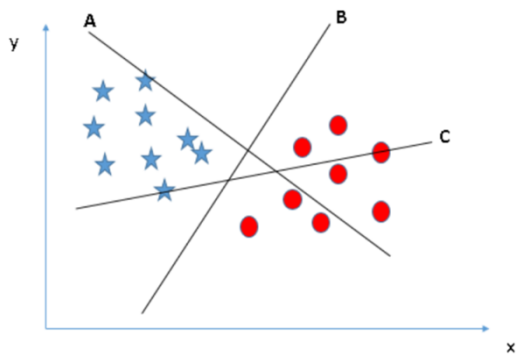
Now the burning question is **“How can we identify the right hyper-plane?”**.

How does it work?

Scenario-1 (Linearly Separable Data)

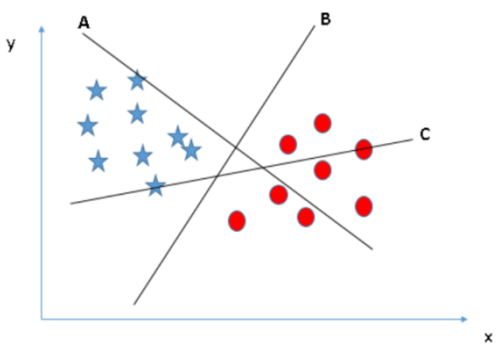
Identify the right hyper-plane :

- Here, we have three hyper-planes (A, B and C).
- Now, identify the right hyper-plane to classify star and circle.



How does it work?

Scenario-1 (Linearly Separable Data)

You need to remember a thumb rule to identify the right hyper-plane

- **Select the hyper-plane which segregates the two classes best**.
- In this scenario, **hyper-plane "B"** has excellently performed this job.