**Machines Learning : Support Vector Machines**

Text, letter

Description automatically generated

Chart, scatter chart

Description automatically generated

**Store points closest to that hyper plane that will be our support vectors**

Chart, radar chart

Description automatically generated

**Dot product of two vectors grows large and positive if they point in the same direction**

**And large and negative if they point in opposite directions**

Graphical user interface, chart

Description automatically generated

Diagram, text

Description automatically generated

Chart, scatter chart

Description automatically generated

Diagram

Description automatically generated with medium confidence

* **The margin is always positive because the product is always positive**

Graphical user interface, text, application

Description automatically generated

* **Feasible regions may be empty**
* **Enforcing the region is a hard constraint**
* **The price of moving the point is denoted as , this is a called a slack parameter**

A picture containing text

Description automatically generated

* **Goal is to make sure that all points are correctly classified**
* **But if there is a point that cannot be correctly classified we can select a slack to be a value greater than or equal to 0 to move it in the correct direction**
* **Maximize margin**
* **Pay for the slack**
  + **C is a hyper parameter lets you control overfitting or underfitting**
    - **Small C value will lead to overfitting**
    - **Large value of C will lead to underfitting, very little room for adjustment**

Chart, scatter chart

Description automatically generated

* **W and b define the margin**

Chart, scatter chart

Description automatically generated

Text, letter

Description automatically generated

Diagram, whiteboard

Description automatically generated

Text

Description automatically generated with medium confidence

Chart, scatter chart

Description automatically generated

Diagram

Description automatically generated

Graphical user interface, text, application

Description automatically generated

Chart, scatter chart

Description automatically generated

**Kernels transform the above into a different representation**

A picture containing chart

Description automatically generated

Graphical user interface, application

Description automatically generated

* **There are many kernels**
  + **This can be a hyper parameter**

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, text

Description automatically generated

Graphical user interface, text, application

Description automatically generated

* **More powerful than naïve bayes or logistic regression but more computationally expensive**