VC Dimension

Hypothesis space is set of parallel lines

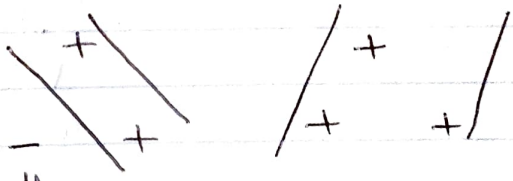
- Consider 1 point, the point can be shattered by the hypothesis space.

$VC(H) \geq 1$

- Consider 2 points, the points can be shattered by the hypothesis space.

$VC(H) \geq 2$

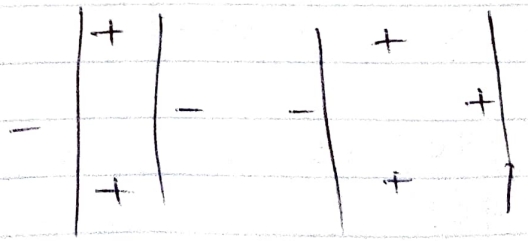
- Consider 3 points, the points can be shattered by the hypothesis space



$VC(H) \geq 3$

and other variations

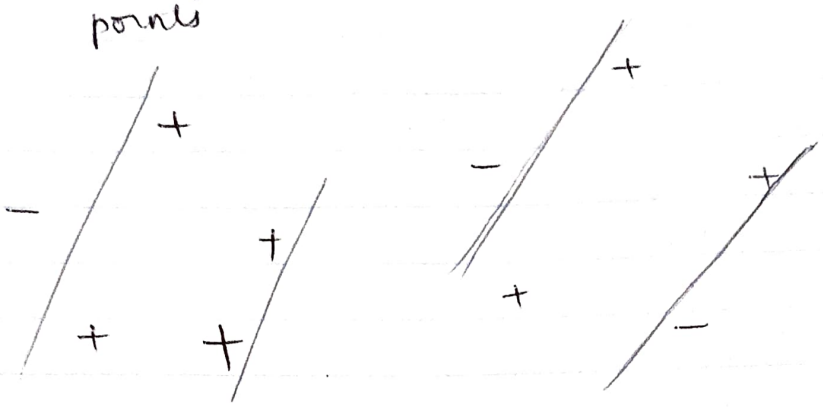
- Consider 4 points, the points can be shattered by the hypothesis space in all configurations



$VC(H) \geq 4$

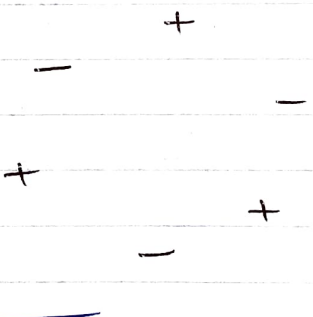
parallel lines can be drawn to enclose + Labels

- Consider 5 points placed in a circle, the hypotheses space can shatter the points



$VC(H) \geq 5$

- Consider 6 points which labeled in alternate manner, it cannot be shattered by the hypothesis space



Hypothesis space parallel lines can only include 2/3 of the '+' in this arrangement

$VC(H) = 5$

$\delta = 1 - 0.95 = 0.05$

$e = 0.2$

$$M \geq \frac{1}{0.2}\left(4 \ln\left(\frac{2}{0.05}\right) + 8(5)\ln\left(\frac{13}{0.2}\right)\right)$$

$M \geq 908.65$

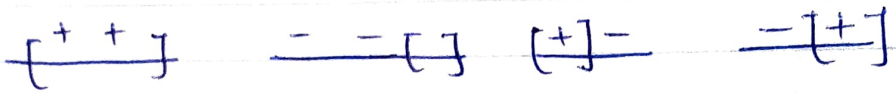
$M \geq 909$

1.2. VC Dimension

- Consider 1 point, the hypothesis space can shatter it. H_1 can shatter so H' can shatter

Setting $\alpha_2 = 0$ $\quad VC(H') = VC(H) \geq 1$

- Consider 2 points, the hypothesis space can shatter it.



H_1 can shatter so H' can shatter.
Setting $\alpha_2 = 0$ $\quad VC(H') = VC(H) \geq 2$

- consider 3 points, the hypothesis H_1 and H_2 cannot shatter individually if they are arranged as +, −, +

Let H_1 be  $\alpha_1 = 0.5$

Let H_2 be  $\alpha_2 = 0.5$

Combining 2 Hypotheses.

$$H' = \alpha_1 H_1 + \alpha_2 H_2$$

H' can shatter 3 points above

$$VC(H') \geq 3$$

- By same argument for 3 points, 4 points can be shattered

$$VC(H') \geq 4$$

- Consider 5 points arranged as + − + − +
  These points can not be shattered by 2 Hypotheses. Hence it cannot be used to shatter with boosting

$$\boxed{VC(H') = 4}.$$