

Machine Learning for Maths - Session 3

Basic Trigonometry in Vectors

- Triangle sides: P = Perpendicular, B = Base, H = Hypotenuse
- $\tan() = P / B$
- $\sin() = P / H$
- $\cos() = B / H$

Dot Product and Cosine Formula

$$\cos() = (x \cdot y) / (||x|| \cdot ||y||)$$

Projection of Vector x on y

- Projection magnitude: $||p|| = (x \cdot y) / ||y||$
- Unit vector in y's direction: $y / ||y|| =$

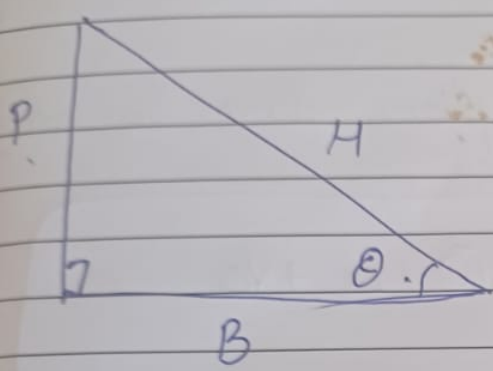
Weight Vector & Classifier Geometry

- Weight vector (w) is always perpendicular to decision boundary
- Shortest distance from point to line is at 90
- Positive half-space: in direction of w
- Negative half-space: opposite to w

Prediction Confidence

- Confidence is directly proportional to the position of the data point

ML for Maths session 3.



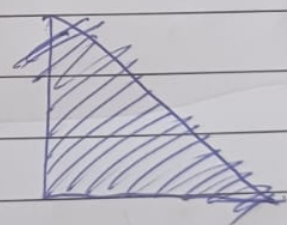
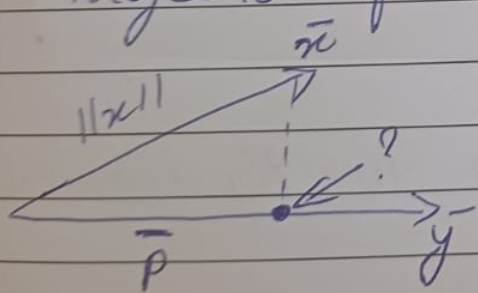
$$\tan \theta = \frac{P}{B}$$

$$\sin \theta = \frac{P}{H}$$

$$\cos \theta = \frac{B}{H}$$

Linear formula $\cos \theta = \frac{\bar{x}^T \cdot y}{\|\bar{x}\| \|\bar{y}\|}$

Projection of \bar{x} on \bar{y}



$$\|P\| = \frac{\bar{x}^T \bar{y}}{\|\bar{y}\|}$$

$$\frac{\bar{y}}{\|\bar{y}\|} = \bar{y} \text{ (unit vector)}$$

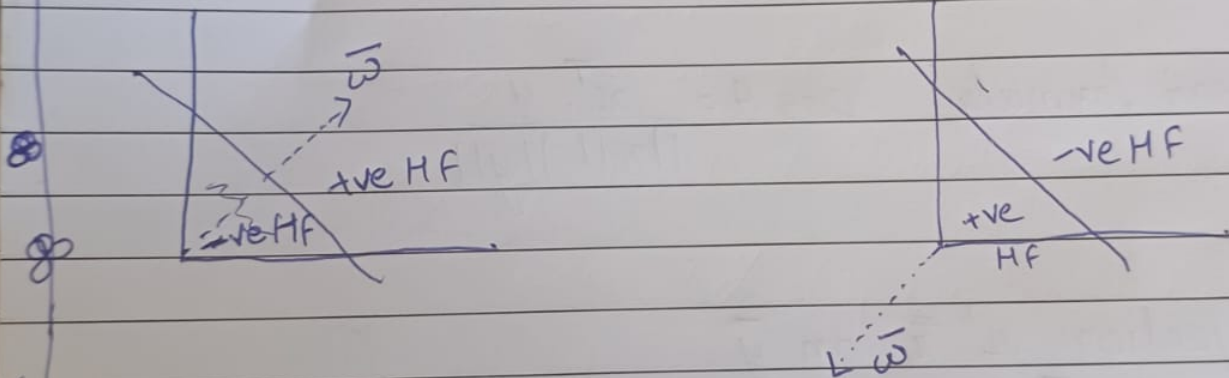
★★

Weight vector will always be \perp to the decision boundary/classifier

→ perpendicular

Shortest distance of point from line is always at 90°

Half Space in direction of \vec{w} is +ve



Confidence of Prediction is directly proportional to position of data point