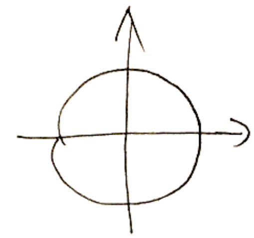
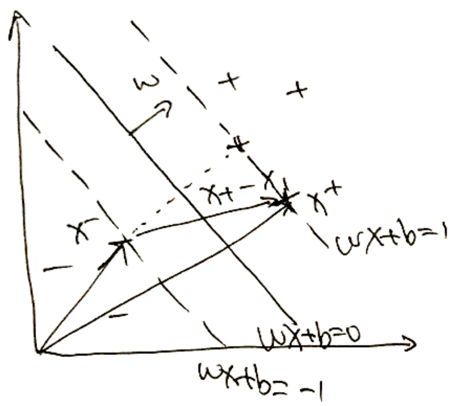
L2 Norm (Euclidean Norm)

$$\|w\|_2 = \sqrt{w_1^2 + w_2^2 + \dots + w_n^2}$$



SVM



hyperplane will lie exactly halfway between the nearest positive point and nearest negative point.

$$\text{Margin WIDTH} = (x_+ - x_-) \cdot \frac{w}{\|w\|} = \frac{2}{\|w\|}$$

$$wx_+ + b = 1$$
$$wx_- + b = -1$$

$$\max \frac{2}{\|w\|} \sim \max \frac{1}{\|w\|} \sim \min \|w\| \sim \min \frac{1}{2}\|w\|^2$$

Maximum Likelihood

$$g(P) = 3\log P + \log(1-P)$$

$$\frac{\partial}{\partial p} g(p) = 3 \cdot \frac{1}{p} + \frac{1}{1-p} \cdot (-1) = 0 \iff 3(1-P) - P = 0$$

$$3 - 4P = 0$$
$$P = 3/4.$$

$$\frac{\partial^2}{\partial p^2} g(p) = 3 \cdot \frac{-1}{p^2} + \frac{-1}{(1-p)^2} < 0$$

$$= \frac{\partial}{\partial p}\left(\frac{\partial}{\partial p} g(P)\right)$$

Perceptron

$\tilde{y} = wx + b$

If y is positive,

$w' = w + x$

$b' = b + 1$

$\tilde{y}' = w'x + b'$

$= (w + x)x + (b + 1)$

$= \underbrace{wx + b}_{\tilde{y}} + \underbrace{x^2 + 1}_{\geq 1}$