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CMPE-257-01 - HW1

Exercise - 1.3

(a) Show that $y(t)W^T(t)x(t) < 0$

Ans:- since $x(t)$ is misclassifide by $w(t)$

$$y(t) \neq \text{sign}(W^T(t)\,x(t))$$

we also know that $y = \{+1, -1\}$ (yes/No)

and sign() converts anything >0 to $+1$ & <0 to -1

which implies $y(t)$ and $\text{sign}(W^T(t)\,X(t))$ are opposite

and whatever $\text{sign}(W^T(t)\,X(t))$ give out will be of

same sign of $W^T(t)\,X(t)$ [if ~~negative~~ -1 then $W^T(t)X(t)$ is

some negative value)

$$\Rightarrow \quad y(t)\,W^T(t)\,X(t) = y(t)\,(W^T(t)\,X(t))$$

and multiplication of positive to negative is always negative and less than zero

$$y(t)\,W^T(t)\,X(t) < 0 .$$

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b) Show $y(t)\,w^T(t+1)\,x(t) > y(t)\,w^T(t)\,x(t)$

From update rule $w(t+1) = w(t) + y(t)\,x(t)$

Substituting $y(t)\left(w(t) + y(t)x(t)\right)^T x(t)$

$y(t)\,w^T(t)x_{(t)} + y(t).y(t)\;x^T(t)\,x(t)$

value is greater

$y(t)\,w^T(t)\,x(t) + \boxed{y^2(t)\;x^T(t)\;x(t)} \rightarrow > 0$

$\therefore$ ~~$y(t)\,w^T(t+1)$~~ $y(t)\,w^T(t+1)\,x(t) > y(t)\,w^T(t)\,x(t)$

(c) from the above 2 props when $w(t)$ is moved to $w(t+1)$ the model move towards the point which has been misclassified by including the ~~w~~ error in the misclassific, ~~which~~ ~~can~~ be using the point's own ~~x~~ charach in case of credit the person Data about finances.

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Ex :- 1.6

a) Recomending a book to useu in online book stou

- Supuvised learning

→ traing data: ~~pus~~ usus choice data
Books categories.

b) Playing tic-tac-toe

- Reinforcement learning

→ traing data: Move made, Resut of Move made
(grade of output)

c) categorizing move into diff type

- Unsupervised learning

→ sequence of the sceancs and actors, ~~pto~~

d) Learning to play music

- Supervised learning

→ Using previous songs and tones frequency

- Reinforcement learnin

→ Creating tones & gathering opinion.

e) Credit limit :-

- Supervised learning → Previous cost data; limit authorizer

Ex 1.8 $\mu = 0.9$, Prob of Sample with 10 marbles with $\nu \leq 0.1$?

A) No of iteration $= 10$
(n)

Probability of each marble to be red from bin $= 0.9$

For $\nu \leq 0.1$, there can be only 0 (or) 1 Red marble in the sample of 10 [1/10 or less]

Using Binomial prob formulae to find out the probability

Required

$$P_b(x) = {}^{n}C_{x}\, \mu^{x} (1-\mu)^{n-x} \quad \text{(Online)}$$

where $x = 0$ (or) 1

$$P_b(0) = {}^{10}C_0 (0.9)^0 (1-0.9)^{10-0} = 1 \cdot 1 \cdot (0.1)^{10} = \left(\tfrac{1}{10}\right)^{10}$$

$$= 1 \times 10^{-10}$$

$$P_b(1) = {}^{10}C_1 (0.9)^1 (1-0.9)^{10-1} = 10 \cdot 0.9 \cdot (0.1)^9$$

$$= 90 \times 10^{-10}$$

Total Probability of marble to be red when $\nu \leq 1$ $= P_b(0) + P_b(1)$

$$= 91 \times 10^{-10}$$

Ex 1.9 :-

Ans) Hoeffding Inequality

$$P[|\nu-\mu| > \varepsilon] \leq 2e^{-2\varepsilon^2 N}$$

consider $\nu \leq 0.1$ (and subtract μ on both side)

$$\nu-\mu \leq 0.1-\mu \Rightarrow \nu-\mu \leq 0.1-0.9$$

$$\nu-\mu \leq 0.8 \Rightarrow |\nu-\mu| \geq 0.8$$

comparing with the Inequality ε canbe 0.8 or less

consider $\varepsilon = 0.8$ & Substitue in Inequality with

$N = 10$

$$P[|\nu-\mu| > \varepsilon] \leq 2 \cdot e^{-2(0.8)^2 \times 10}$$

$$\leq 2 \cdot e^{-12.8}$$

$$\leq 5.5215e^{-6}$$

$$\leq 5.521 \times 10^{-6}$$

while the solution for 1.8 Ex is 91×10^{-10}

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Problems :-

1.2

Ans) a) $h(x) = \text{sign}(w^T x)$

$w = [w_0, w_1, w_2]^T$ & $x = [1, x_1, x_2]^T$

line eq $\Rightarrow$ $x_2 = a x_1 + b$

but ~~form~~ if $h(x)$ is considered it is of $+1$ (or) -1

So ~~sign~~ $w^T x$ must be >0 (or) <0 respectively

The line dividing these two must be $w^T x = 0$

$$w_0 + w_1 x_1 + w_2 x_2 = 0 \quad \text{[by expanding matrix]}$$

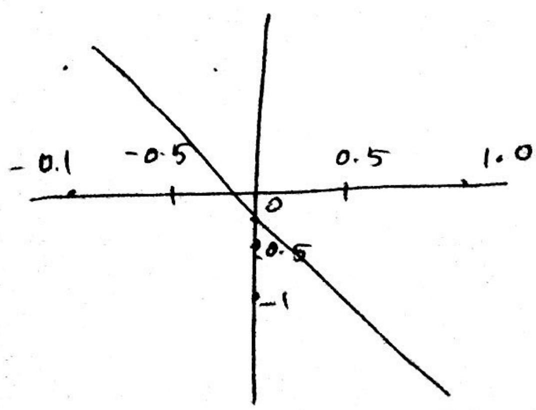
~~by~~ ~~on~~ for comparision $w_2 x_2 = -w_1 x_1 - w_0$

$$x_2 = -\frac{w_1}{w_2} x_1 - \frac{w_0}{w_2}$$

$$\therefore a = \frac{-w_1}{w_2}, \quad b = -\frac{w_0}{w_2}$$

b) For $w = (1, 2, 3)^T$

The graph will look like



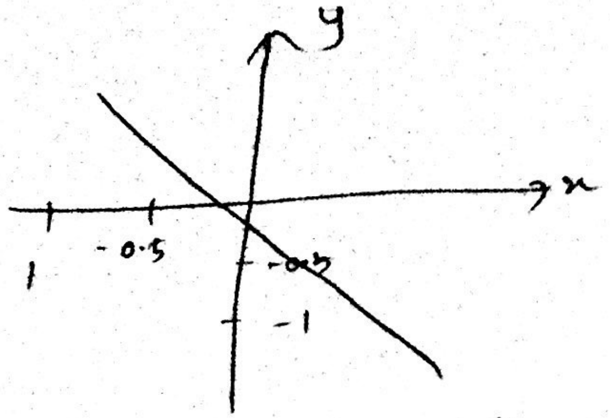
($a = -0.66$

$b = -0.33$

For

$w = -(1,2,3)^T$

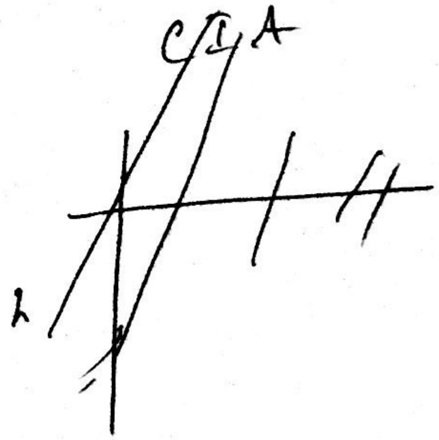
graph will be identical to previous.



but since the weight have a negative sign the Regions will be reversed.

Problem 1.1

From Example 1.1



		Supermarket f	
		+1	-1
h	+1	0	1
	-1	10	0

$$E_{in}(h) = \frac{1}{N}\sum_{n=1}^{N}\left[e(h(x_n), f(x_n))\right)$$

$$= \frac{1}{N}\left[\sum_{y_n=1} e(h(x_n), 1) + \sum_{y_n=-1} e(h(x_n), -1)\right]$$

$$= \frac{1}{N}\left\{10 \sum_{y_n=1}^{N} [[h(x_n \neq 1)]] + \sum_{y_n=-1}^{N} ([h(x_n) \neq 1])\right\}$$

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$$\begin{array}{c|cc} & & f \\ & +1 & -1 \\ \hline h\ +1 & 0 & 1000 \\ -1 & 1 & 0 \end{array}$$

$$\frac{1}{N} \sum_{n=1}^{n} [[f(x_n) \neq h(x_n)]]$$

$$= \frac{1}{N} \left[1000 \sum_{y_n=1} [[h(x_n) = -1]] + \sum_{y_n=1} [[h(x_n) \neq 1]] \right]$$

1.4, 1.5 ~~submit~~. will submit electonically