HomeWork -1

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2) What Types of Machine learning ?

a) Supervised Learning in inferred. As learning isn't by algorithm as it's from pre-defined statistical feed.

b) Supervised learning.

c) Semi Supervised

d) Un supervised

e) Reinforcement learning**.** Here system takes the feedback from its moves, accordingly rewards and penalises it position to counter opponent.

3) answer is 0.6666666667

explanation :

3) $P(A|B) = \dfrac{P(A \cap B)}{P(B)}$

$\Rightarrow P(B) = (1)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)\cdot\left(\frac{1}{2}\right) = 3/4.$

$\Rightarrow P(A \cap B) = (1)(1/2) + (0)(1/2) = 1/2.$

$\therefore P(A|B) = \dfrac{1/2}{3/4} = 2/3 \simeq 0.66.$

4th)

(4) Given the sample of 10, drawn with a replacement, The probability of no red is $(0.35)^{10}$

$$\therefore P = 2.758547354 \times 10^{-5}$$

(a)

From above probability of no red happening in any trail is $1-P$. The probability that event shouldn't occur over 1000 times is $(1-P)^{1000}$

So, probability for atleast once is $1 - [(1-P)^{1000}]$

(b)

$$= 1 - (0.9999724145^{1000})$$

$$= 1 - (0.9727911609)$$

$$= 0.0272088906$$

5th

5

x_n			y_n
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	
1	1	0	
1	1	1	

possible f values

f_1	f_2	f_3	f_4	f_5	f_6	f_7	f_8
0	0	0	0	1	1	1	1
0	0	1	1	0	0	1	1
0	1	0	1	0	1	0	1

(a) score $= \underset{\uparrow\, f_8}{1\times 3} + \underset{\uparrow\, f_7, f_6, f_4}{3\times 2} + \underset{\uparrow\, f_2, f_3, f_5}{3\times 1} + 0$

$= 12.$

(b) score $= \underset{\uparrow\, f_1}{1\times 3} + \underset{\uparrow\, f_2, f_3, f_5}{3\times 2} + \underset{\uparrow\, f_4, f_6, f_7}{3\times 1} + 0$

$= 12.$

(c) ~~score~~ g is the XOR function, returns 0, 0, 1

$\therefore$ score $= 1\times 3 + 3\times 2 + 3\times 1 + 0$
$= 12.$

(d) g is the inversion of XOR function, which returns 1, 1, 0

$\therefore$ score $= 1\times 3 + 3\times 2 + 3\times 1 + 0$
$= 12.$

6) Exercise 1.3 from textbook solution

6) Exercise 1.3 solution: 013774228

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

here $x(t)$ is misclassified by $w(t)$
so $y(t) \neq sign(w^T(t) x(t))$

This meant $w^T(t) x(t)$ is having sign opposite of $y(t)$

$\therefore\ y(t) w^T(t) x(t) < 0$

(b) Show that $y(t) w^T(t+1) x(t) > y(t) w^T(t) x(t)$
considering updated weight rule
$w(t+1) = w(t) + y(t) x(t)$
misclassified value be $y(t) x(t)$

$\Rightarrow\ y(t) x(t) (w^T(t+1))$
$= y(t) [w^T(t) + y(t) x(t)] \cdot x(t)$

$= [y(t) w^T(t) + y^2(t)] x(t)$
$= y(t) w^T(t) x(t) + y^2(t) |x(t)|^2$

as $y^2(t) |x(t)|^2$ results +ve component

$y(t) w^T(t+1) x(t) > y(t) w^T(t) x(t)$

(c) As far as classifying $x(t)$ is concerned, argue that the move from $w(t)$ to $w(t+1)$ is a move in right direction
* From a and b it clearly indicates PLA algorithm increases $y(t) w^T(t) x(t)$ until it crosses 0, thus $\{x(t), y(t)\}$ are no longer misclassified.

7th

(7) Given $h(x) = \text{sign}(w^T x)$ where $w = [w_0, w_1, w_2]^T$ and $x = [1, x_1, x_2]^T$.

(a) here $h(x) = +1$ and $h(x) = -1$ are separated by a line holistically represents $w^T x > 0$ i.e separation between these two regions is the line whose equation is $w^T x = 0$

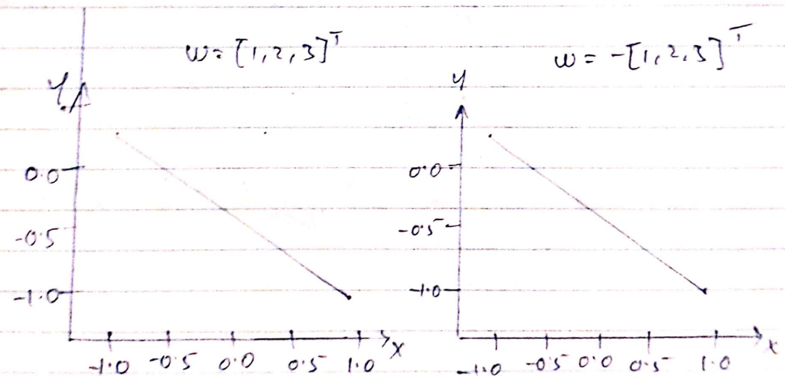
$$w_0 + w_1 x_1 + w_2 x_2 = 0$$

$$\Rightarrow \quad x_2 = a x_1 + b$$

where $a = -w_1 / w_2$

$b = -w_0 / w_2$.

(b) Draw picture for cases $w = [1,2,3]^T$, $w = -[1,2,3]$



graphs might look identical, however regions $h(x) = +1$ and $h(x) = -1$ are different, perhaps +ve region for $w = [1,2,3]^T$ is above the line and for $w = -[1,2,3]^T$ is below the line.

8th and 9th solutions are attached as part of ipynb files uploaded along with this file.

10th)

10)

Supermarket:

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

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

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

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

CIA:

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

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

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

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