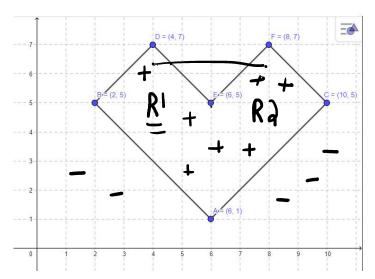
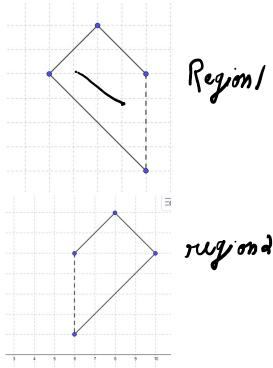
Multi-Layer Neural network for a Convex Decision Boundary





The equation of lime through
$$A(6,1)$$
 of $B(3,5)$

$$\frac{x_3-5}{x_1-3} = \frac{1-5}{6-\lambda} \implies 4(x_3-5) = -4(x_1-\lambda)$$

$$\Rightarrow -x_1+3-x_2+5=0 \Rightarrow \boxed{x_1+x_2-7=0}$$

The equation of lime through
$$B(a,5)$$
 & $D(4,7)$

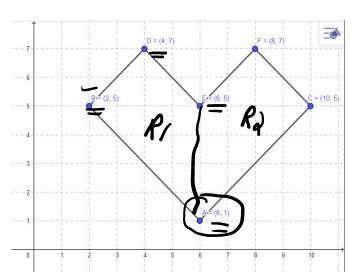
$$\frac{x_3-7}{x_1-4} = \frac{5-7}{a-4} \Rightarrow -a(x_3-7) = -a(x_1-4)$$

$$\Rightarrow x_1-4-x_2+7=0 \Rightarrow \sqrt{x_3-x_3+3}=0$$

The equation of lime through
$$D(4,7)$$
 & $E(6,5)$

$$\frac{x_3-5}{x_3-6} = \frac{7-5}{4-6} \Rightarrow -3(x_3-5) = 3(x_1-6)$$

$$\Rightarrow x_1-6+x_3-5=0 \Rightarrow \boxed{x_1+x_3-11=0}$$



The equation of line through
$$\frac{\mathcal{E}(6,5)}{2}$$
 and $\frac{\mathcal{E}(6,1)}{2}$ is $\frac{|\alpha_1+0\alpha_2-6=0|}{2}$

The equation of lime through
$$\underbrace{\mathcal{E}(6,5)}_{6-8} \notin \underbrace{F(8,7)}_{-3}$$

$$\underbrace{\frac{x_3-7}{x_1-8}}_{-3} = \underbrace{\frac{5-7}{6-8}}_{-8} \Rightarrow -3(x_3-7) = -3(x_1-8)$$

$$\Rightarrow x_1-x_3-8+7=0 \Rightarrow \boxed{x_1-x_3-1=0}$$

The equation of lime through
$$F(\xi,7)$$
 & $C(10,5)$

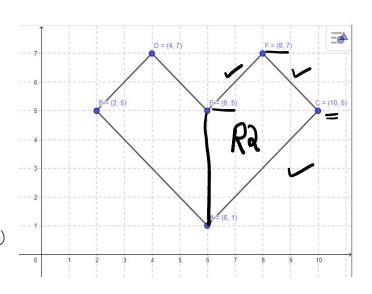
$$\frac{x_3-5}{x_1-10} = \frac{7-5}{8-10} \Rightarrow -2(x_3-5) = 2(x_1-10)$$

$$\Rightarrow x_1-10+x_3-5 \Rightarrow \boxed{x_1+x_3-15=0}$$

The equation of line through
$$C(10, 5) & A(6, 1)$$

$$\frac{x_3 - 5}{x_1 - 10} = \frac{1 - 5}{6 - 10} \Rightarrow -4(x_3 - 5) = -4(x_1 - 10)$$

$$\Rightarrow x_1 - 10 - x_3 + 5 = 0 \Rightarrow \boxed{x_1 - x_3 - 5} = 0$$



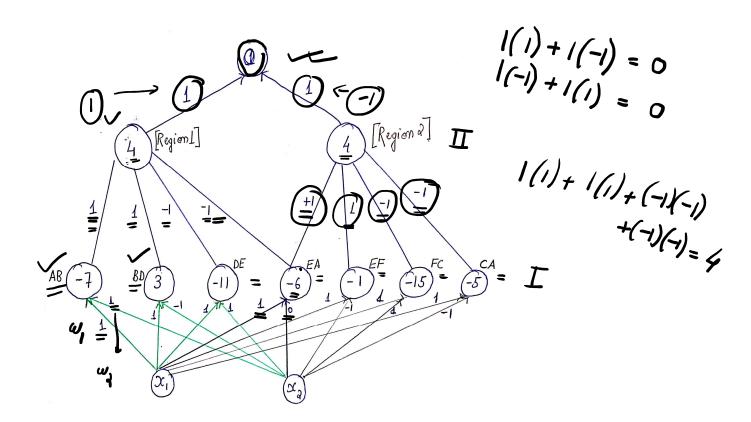
Durinay Boundary

$$\begin{cases} -1 & |w|x| + |w|x| + p < 0 \\ +1 & |w|x| + |w|x| + p < 0 \end{cases}$$

$$-\frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 0$$

Lime	equation	w,	w	В.	Durion Boundary $ \begin{cases} +1 & \text{if } w_1 x_1 + w_2 x_3 + b \ge 0 \\ -1 & \text{else.} \end{cases} $
AB	$x_1 + x_2 - 7 = 0$	0	<u> </u>	Ð	S+1 if x,+x,-720
BD:	$x_1 - x_2 + 3 = 0$	1	1	3.	$\begin{cases} 1 & \text{if } x_1 - x_2 + 3 \ge 0 \\ 1 & \text{otherwise} \end{cases}$
DE_	$x_1 + x_2 - 1 = 0$	1	1	-11	$\begin{cases} +1 & \text{if } \alpha_1 + \alpha_2 - 11 \ge 0 \\ -1 & \text{else.} \end{cases}$
EA =	x,+0xz-6=0	<u>-</u>	0	-6 -	$\begin{cases} 5+1 & \text{if } x_1-6 \ge 0 \\ 1-1 & \text{else.} \end{cases}$
EF	x, -x2-1=0	1	-1	-1	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
FC.	$\alpha_1 + \alpha_2 - 15 = 0$	ı	1	-15	(+1 if x,+x,-15≥0) (-1 else.
CA	x, -x, -5=0	1	-1	-5	$\begin{cases} +1 & \text{if } x_1 - x_2 - 5 \ge 0 \\ -1 & \text{else.} \end{cases}$

Lime	outcome in rugion 1	outcome in rugion a	· · · · · · · · · · · · · · · · · · ·
AB	1	0	D = (4, 7) + W F = (8, 7)
BD.	1	<u>0</u> . √	$B_{1}=(2,5)$ $B_{2}=(6,5)$ $C=(10,5)$
DE	-1	<u>O</u> ·	-W Ry
EA	(-1)	(+ <u> </u>)	
E.F.	0	+1	2 -4 -4
FC	0	-1 -	Ar€ (6, 1) Q=ve
CA	0	-1.	0 1 2 3 4 5 6 7 8 9 10



Lime AB	equation $x_1 + x_2 - 7 = 0$	w,	w ₃	в. -7	Runon Boundary $ \begin{cases} +1 & \text{if } u_1 x_1 + u_2 x_3 + b \ge 0 \\ -1 & \text{clas.} \end{cases} $ $ \begin{cases} +1 & \text{if } x_1 + x_3 - 7 \ge 0 \\ -1 & \text{clas.} \end{cases} $		alue.	ypr 1 	Layer Q.	1	Fonol
BD	$x_1 - x_2 + 3 = 0$	1	-1	3.	$\begin{cases} +1 & \text{if } x_1 - x_2 + 3 \ge 0 \\ -1 & \text{div} \end{cases}$	(4,	B B	D = 1	Rugion I valu = 1(1)+1(+ (-1)(- Durnion =	i) = 4	$f(1) + (-1)(1)$ $= 0 \ge 0$
DE	$x_1 + x_2 - = 0$	1	1	-11	$\begin{cases} + i \int_{-1}^{1} x_1 + x_2 - 1 \ge 0 \\ - else \end{cases}$		7	A = -1 - - - - - - - - -	0 0 1/0	Int	gunult = I
EA	x1+0x2-6=0	1	0	- 6	$5+1 \text{ if } x_1-6 \ge 0$ [-1 cln.]		E F C	= -1	= -1(1)+1(-1 +(-1)(- Decipion =	1) = 0	
EF	$ x_1 - x_2 - 1 = 0$	1	-1	-1	$\begin{cases} +1 & \text{if } x_1 - x_2 - 1 \ge 0 \\ -1 & \text{else.} \end{cases}$	-	c A	= -	[.: 0<4]	-	
FC.	x, + x, - 15=0	ţ	1	-15	$\begin{cases} +1 & \text{if } x_1 + x_2 - 15 \ge 0 \\ -1 & \text{else.} \end{cases}$						
CA	x, -x, -5=0	1	-1	-5	$\begin{cases} +1 & \text{if } x_1 - x_2 - 5 \ge 0 \\ -1 & \text{else.} \end{cases}$	_					
Lime	equation	w,	W	в.	Runnon Boundary. $S+1$ if $U_1 x_1 + U_2 x_3 + b \ge 0$ I-1 else.	_	1	[, .		Final rus	ult
AB	$\begin{array}{c} x_1 + x_2 - 7 = 0 \\ = \end{array}$	f	J	-7	S+1 of x,+x,-720	Value	Layer 1	Layır d.		7 11,100	
BD	$x_1 - x_2 + 3 = 0$	1	1	3,	$\int_{-1}^{2} \frac{1}{4} \int_{-1}^{2} $	(9,1)	AB = 1 BD = 1	= 1 (i	1 volue 1 + 1(1) - 1(-1)	-1 (1) -	1(1)
DE	$x_1 + x_2 - 11 = 0$	1	1	-11	$\begin{cases} + i \int_{-1}^{1} x_1 + x_2 - 1 \ge 0 \\ - else \end{cases}$	=	DE = -1	ا- اس	(1) = 2. < 4 m = -1		a < 0
EA	x1+0x2-6=0	1	0	- 6	S+1 if x,-6≥0 [1 else.		EA = 1	✓ Regia	n 2 value	p work	4
EF	$x_1 - x_2 - l = 0$	1	-1	-1	5+1 if x,-x,-1≥0		EF = 1 Fc = -		_ 1(1) -1(-1) + (-1)(1)		
FC	x + x - 15-0	1	<u> </u>	-15	(+1 il x,+x,-15≥0	_	cA = 1	Dic	inien = -1		

 $-15 \begin{cases} +1 & \text{if } \alpha_1 + \alpha_2 - 15 \ge 0 \\ -1 & \text{else.} \end{cases}$

 $\begin{cases} +1 & \text{if } x_1 - x_2 - 5 \ge 0 \\ -1 & \text{else.} \end{cases}$

FC.

CA

 $x_1 + x_2 - 15 = 0$

