HW1-Report

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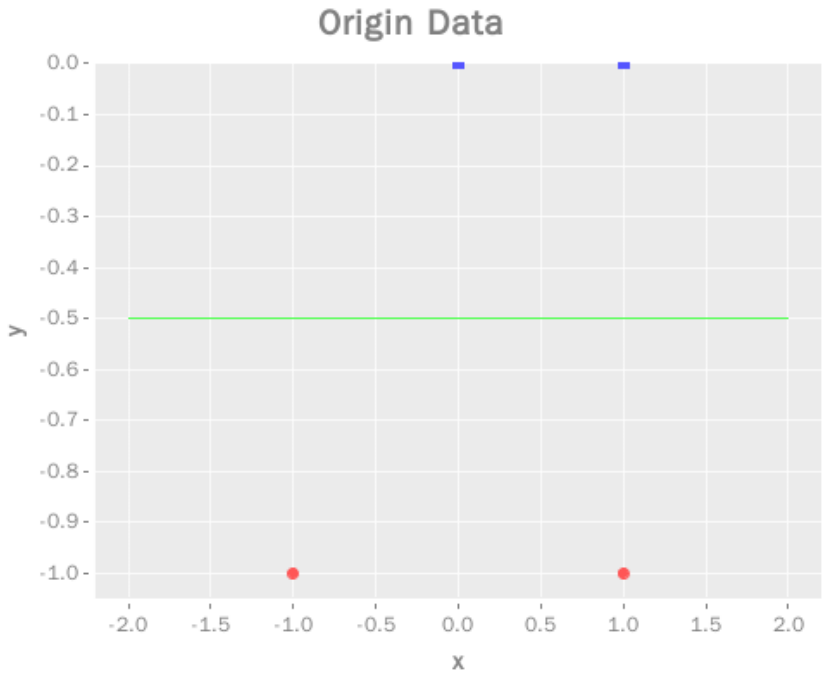
Contents

1 Problem 1

1.1 1



λ = [0,-1] c = 0.5
a = hardlim(p) = hardlim(Wp + b) = hardlim ($\begin{bmatrix}0 & -1\end{bmatrix} p - 0.5$)

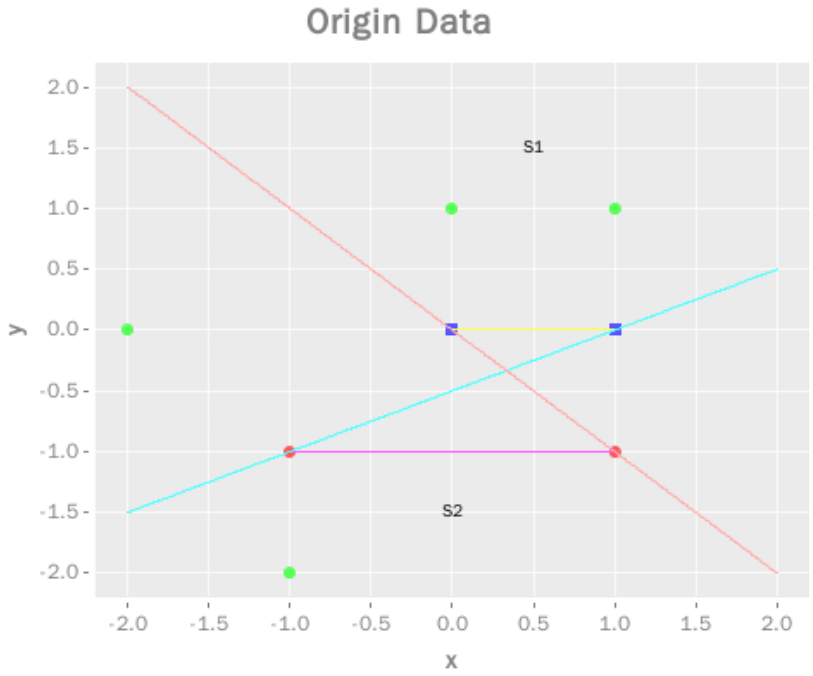
1.2 2

p	position	a	t
p1	(1,-1)	1	1
p2	(-1,-1)	1	1
p3	(0,0)	0	0
p4	(1,0)	0	0

1.3 3

p	position	a
p5	(-2,0)	0
p6	(1,1)	0
p7	(0,1)	0
p8	(-1,-2)	1

1.4 4



Since the single-neuron machine can only separete the space with a hyperplane (in this case is seperating the plane with a straight line), only the points in area S1 and S1 will be grouped no matter how we choose W and b.

The points are: P6 P7 and P8

1.5 5

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No. 0 : w =  [0 0] b =  0  data =  [1 -1] t =  1
No. 1 : w =  [0 0] b =  0  data =  [-1 -1] t =  1
No. 2 : w =  [0 0] b =  0  data =  [0 0] t =  0
No. 3 : w =  [0 0] b =  -1  data =  [1 0] t =  0
No. 4 : w =  [0 0] b =  -1  data =  [1 -1] t =  1
No. 5 : w =  [1 -1] b =  0  data =  [-1 -1] t =  1
No. 6 : w =  [1 -1] b =  0  data =  [0 0] t =  0
No. 7 : w =  [1 -1] b =  -1  data =  [1 0] t =  0
No. 8 : w =  [0 -1] b =  -2  data =  [1 -1] t =  1
No. 9 : w =  [1 -2] b =  -1  data =  [-1 -1] t =  1
No. 10 : w =  [1 -2] b =  -1  data =  [0 0] t =  0
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No. 11 : w =  [1 -2] b =  -1  data =  [1 0] t =  0
No. 12 : w =  [0 -2] b =  -2  data =  [1 -1] t =  1
No. 13 : w =  [0 -2] b =  -2  data =  [-1 -1] t =  1
No. 14 : w =  [0 -2] b =  -2  data =  [0 0] t =  0
No. 15 : w =  [0 -2] b =  -2  data =  [1 0] t =  0
{:w [0 -2], :b -2}
```

The result is :

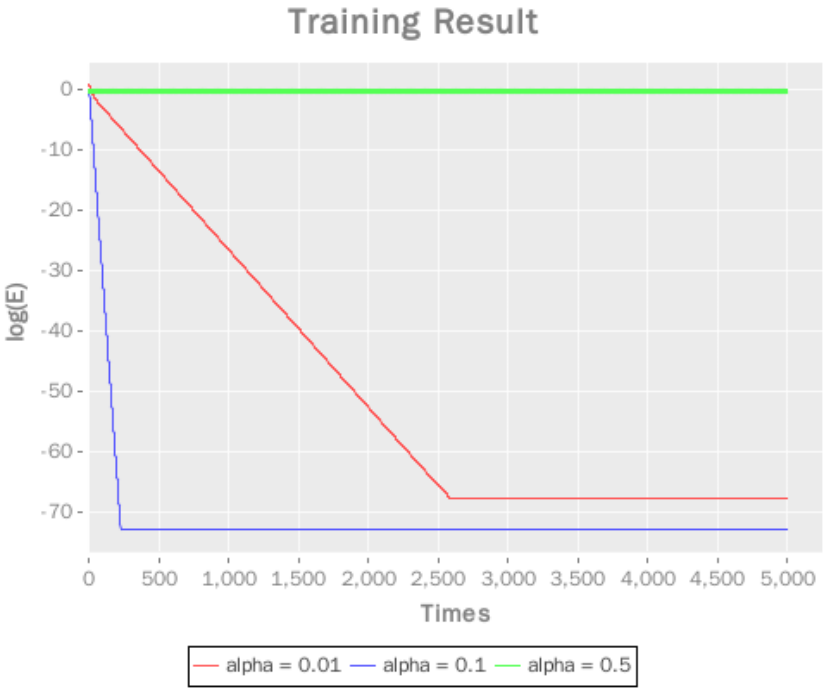
p	position	a
p5	(-2,0)	0
p6	(1,1)	0
p7	(0,1)	0
p8	(-1,-2)	1

2 Probelm 2

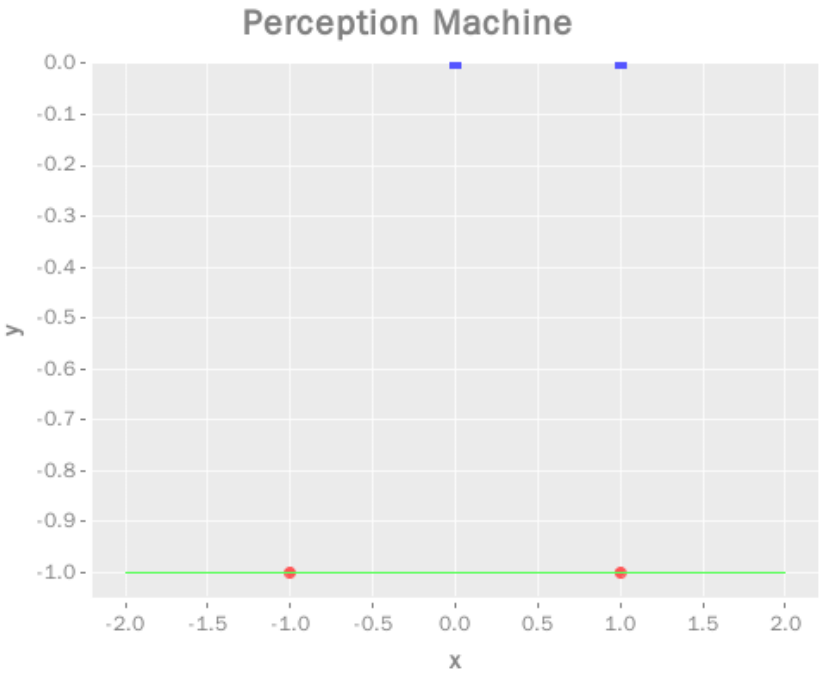
2.1 Initial State

w = $\begin{bmatrix}1 & 1\end{bmatrix}$
b = 1

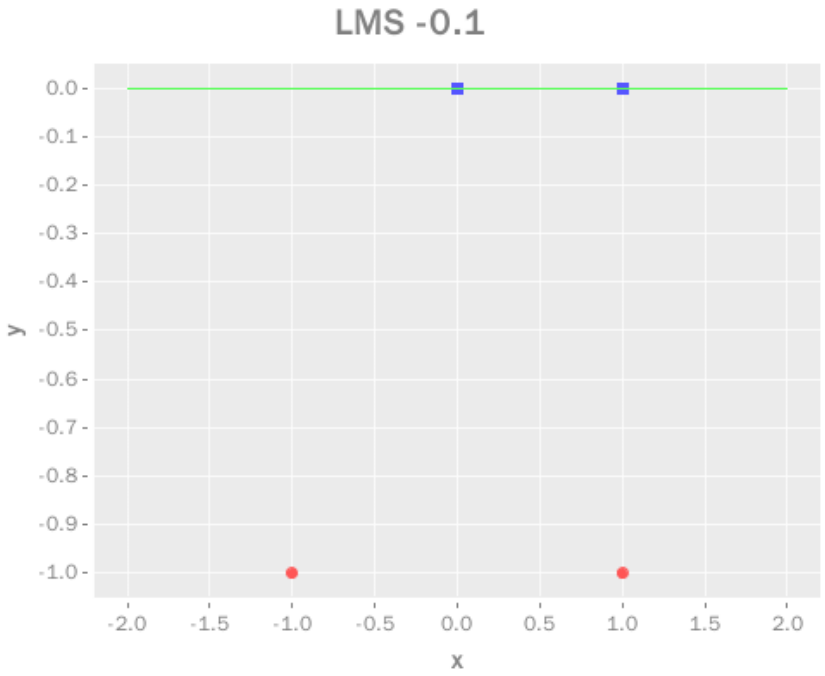
2.2 Result



The base of logarithm is e.
The result of perception machine is:



The result of LMS algorithm when alpha = 0.1 (which get the best result) is:

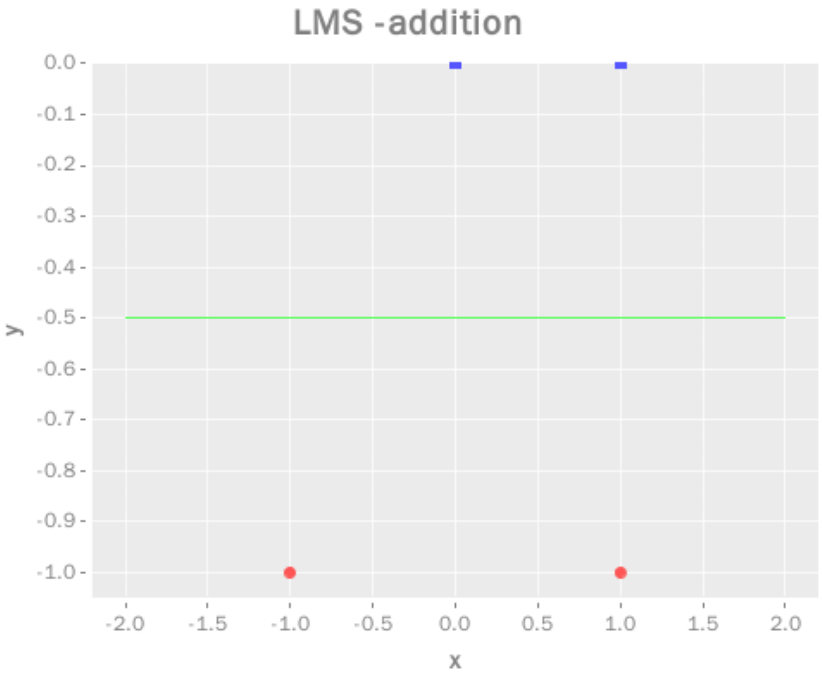


2.3 Analyse

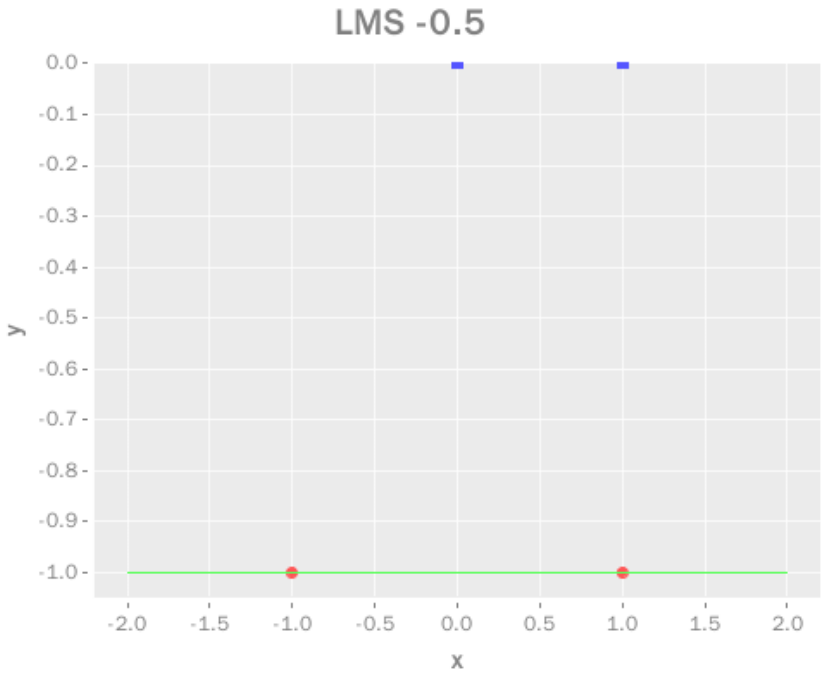
The difference between the two algorithm is, The perception machine halts once all the input can get correct answer(as it use hardlim), while the LMS will continue to adapt to the data to reduce $E[e^2]$.

So perception machine is more likely to get a rough line which just seperate the classes.

While LMS also get such a line which do not seperate the points "averagely".But the reason is we set $t \in \{0,1\}$ so LMS will try to put the line cross zero points.In addition,I mapped t_i from {0,1} to {-1 1} and get a beautiful result:



By the way,LMS get a similar answer with perception machine when alpha = 0.5. The reason is each step is too large so the algorithm get traped. See:


LMS -0.5
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1.0
y
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
x