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I use deterministic recurrent neural network. Last time, I used parameter that the looping will stop after the first loop. And with this experience, I think that is not enough, so I modify it to :

the looping will stop after get (size of node+1 or 1 looping) times of same value.

In this report, I will compare some treatments for task 1 because it has local minimum problem. But actually I made a probabilistic option too for task 2.

Task 1 (solution: 1,1,1)

1.1. Deterministic

Initial input: (0,0,0) – opposite to the result	Initial input (1,1,0) --- Local minimum problem
Result: --(0,0,0) - E=0.0 ===== -change node 1 --S=0.0 --(1,0,0) - E=0.0 ===== -change node 2 --S=6.0 --(1,1,0) - E=0.0 ===== -change node 3 --S=4.0 --(1,1,1) - E=-1.0 ===== -change node 1 -- 1st same value --S=2.0 --(1,1,1) - E=-1.0 ===== -change node 2 -- 2nd same value --S=14.0 --(1,1,1) - E=-1.0 ===== -change node 3 -- 3rd same value --S=4.0 --(1,1,1) - E=-1.0 ===== -change node 1 -- 4th same value --S=4.0 --(1,1,1) - E=-1.0 ===== =====END=====	Result Deterministic: --(1,1,0) - E=3.0 ===== -change node 1 --S=6.0 --(1,1,0) - E=3.0 ===== -change node 2 --S=6.0 --(1,0,0) - E=1.0 ===== -change node 3 -- 1st same value --S=-4.0 --(1,0,0) - E=1.0 ===== -change node 1 -- 2nd same value --S=0.0 --(1,0,0) - E=1.0 ===== -change node 2 -- 3rd same value --S=6.0 --(1,0,0) - E=1.0 ===== -change node 3 -- 4th same value --S=6.0 --(1,0,0) - E=1.0 ===== =====END=====

There is a local minimum problem if the initial input is (1,1,0) and the solution become (1,0,0). That is why the next part, I will compare it with probabilistic.

1.2. Probabilistic

The important thing in probabilistic is alpha. In next table, I will explain how many times it get the right solution from 10 tries. Note: the looping will stop after get (size of node+1 or 1 looping) times of same value. I am using (1,1,0) which has a local minimum problem as an input.

Alpha	X out of 10 right
0.1	1 out of 10
0.3	6 out of 10
0.5	7 out of 10
0.7	4 out of 10
1.0	4 out of 10
1.2	0 out of 10

From those data I think alpha 0.5 is the best. But I think we need to use more data and more tries for each alpha so the best alpha will be more accurate.

Task 2 (1,0,1,1,0)

Task 2. Solve another simultaneous equation using the deterministic model by changing its initial state or using the probabilistic model

solution $(X_1, X_2, X_3, X_4, X_5) = (1, 0, 1, 1, 0)$

$$\begin{cases} X_1 - X_2 + X_3 - X_4 - X_5 = 1 \\ 2X_1 + X_2 - 2X_3 - X_4 + X_5 = 1 \\ -X_1 - X_2 + 3X_3 + X_4 - 2X_5 = 3 \\ X_2 - 3X_3 + X_4 + X_5 = -2 \\ X_1 - X_2 - X_3 + 2X_4 - 2X_5 = 2 \end{cases}$$

$$E = (X_1 - X_2 + X_3 - X_4 - X_5 - 1)^2 + (2X_1 + X_2 - 2X_3 - X_4 + X_5 - 1)^2 + (-X_1 - X_2 + 3X_3 + X_4 - 2X_5 - 3)^2 + (X_2 - 3X_3 + X_4 + X_5 + 2)^2 + (X_1 - X_2 - X_3 + 2X_4 - 2X_5 - 2)^2$$

$$= X_1^2 + X_2^2 + X_3^2 + X_4^2 + X_5^2 + 2(-2X_1X_2 + 2X_1X_3 - 2X_1X_4 - 2X_1X_5 - 2X_2X_3 + 2X_2X_4 + 2X_2X_5 - 2X_3X_4 - 2X_3X_5 + 2X_4X_5 - 2X_1 - 2X_2 - 2X_3 + 2X_4 + 2X_5 - 4)$$

weight

	1	2	3	4	5
1	0	-2	+19	+9	0
2	-2	0	+16	+9	-16
3	+19	+16	0	+2	+18
4	+9	+9	+2	0	+19
5	0	-16	+18	+19	0

$\theta_1 = 1$
 $\theta_2 = 23$
 $\theta_3 = -8$
 $\theta_4 = -1$
 $\theta_5 = 48$
 $C = 19$

Initial input: (0,1,0,0,1) – opposite to the result	Initial input (1,1,1,1,1)
Result: --(0,1,0,0,1) - E=87.0	Result: --(1,1,1,1,1) - E=18.0

=====	=====
-change node 1	-change node 1
--S=-2.0	--S=16.0
--(0,1,0,0,1) - E=87.0	--(1,1,1,1,1) - E=18.0
=====	=====
-change node 2	-change node 2
--S=-16.0	--S=2.0
--(0,0,0,0,1) - E=48.0	--(1,0,1,1,1) - E=-3.0
=====	=====
-change node 3	-change node 3
--S=18.0	--S=34.0
--(0,0,1,0,1) - E=22.0	--(1,0,1,1,1) - E=-3.0
=====	=====
-change node 4	-change node 4
--S=16.0	--S=20.0
--(0,0,1,1,1) - E=4.0	--(1,0,1,1,1) - E=-3.0
=====	=====
-change node 5	-change node 5
--S=32.0	--S=32.0
--(0,0,1,1,0) - E=-12.0	--(1,0,1,1,0) - E=-19.0
=====	=====
-change node 1	-change node 1 – 1st same value
--S=18.0	--S=18.0
--(1,0,1,1,0) - E=-19.0	--(1,0,1,1,0) - E=-19.0
=====	=====
-change node 2 – 1st same value	-change node 2 – 2nd same value
--S=18.0	--S=18.0
--(1,0,1,1,0) - E=-19.0	--(1,0,1,1,0) - E=-19.0
=====	=====
-change node 3 – 2nd same value	-change node 3 – 3rd same value
--S=16.0	--S=16.0
--(1,0,1,1,0) - E=-19.0	--(1,0,1,1,0) - E=-19.0
=====	=====
-change node 4 – 3rd same value	-change node 4 – 4th same value
--S=6.0	--S=6.0
--(1,0,1,1,0) - E=-19.0	--(1,0,1,1,0) - E=-19.0
=====	=====
-change node 5 – 4th same value	-change node 5 – 5th same value
--S=32.0	--S=32.0
--(1,0,1,1,0) - E=-19.0	--(1,0,1,1,0) - E=-19.0
=====	=====
-change node 1 – 5th same value	-change node 1 – 6th same value
--S=18.0	--S=32.0
--(1,0,1,1,0) - E=-19.0	--(1,0,1,1,0) - E=-19.0
=====	=====
-change node 2 – 6th same value	=====END=====
--S=18.0	=====
--(1,0,1,1,0) - E=-19.0	
=====	
=====END=====	
=====	

After a few tries, I didn't get any local minimum problem in this task.