

Experimental report on deep learning of symbolic value data

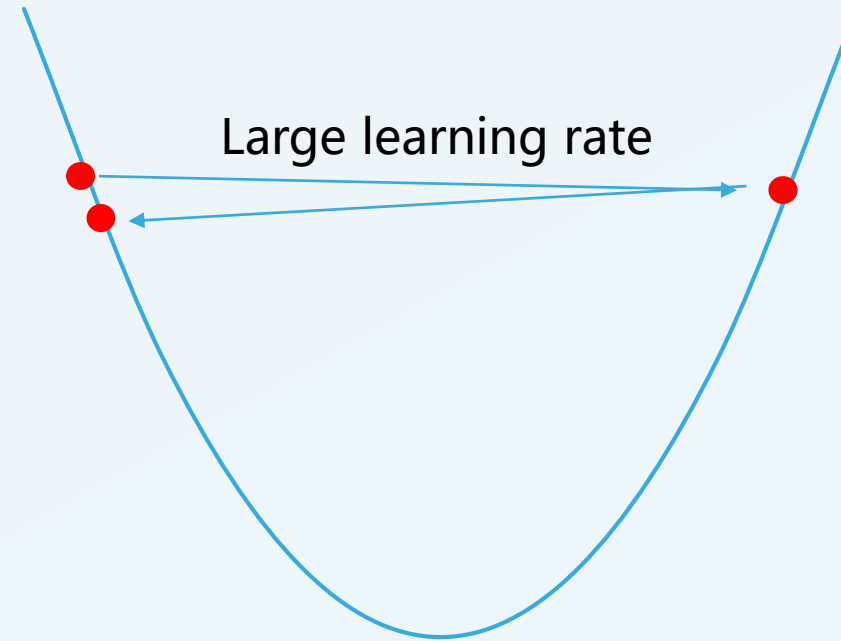
- Chen Shuyue
- ShenZhen University

The effect of learning rate on neural network

hash		
scale	Training accuracy	Testing accuracy
1 layer, 100 node	0.5113938	0.510315

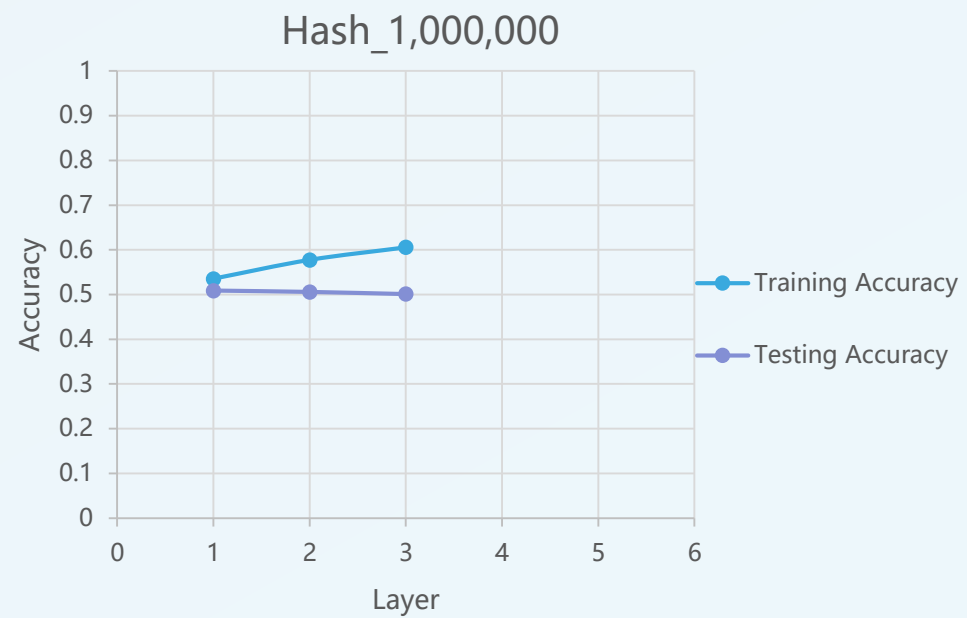
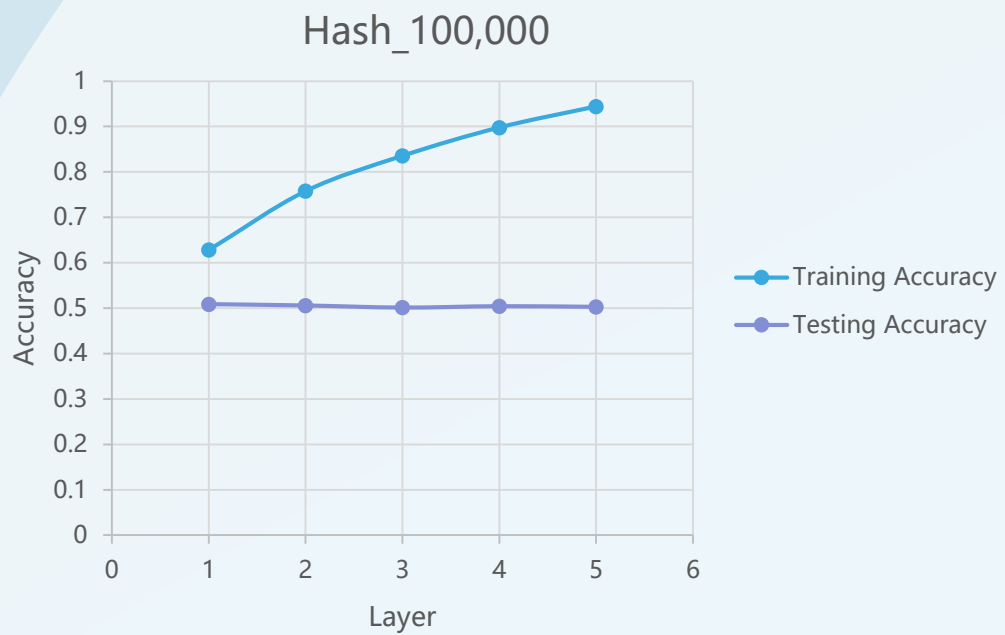
Iteration 1, loss = 0.69353438
Iteration 2, loss = 0.69301058
Iteration 3, loss = 0.69297232
Iteration 4, loss = 0.69297418
Iteration 5, loss = 0.69296742
Training loss did not improve more than $\text{tol}=0.000100$ for two consecutive epochs.
Stopping.

The effect of learning rate on neural network

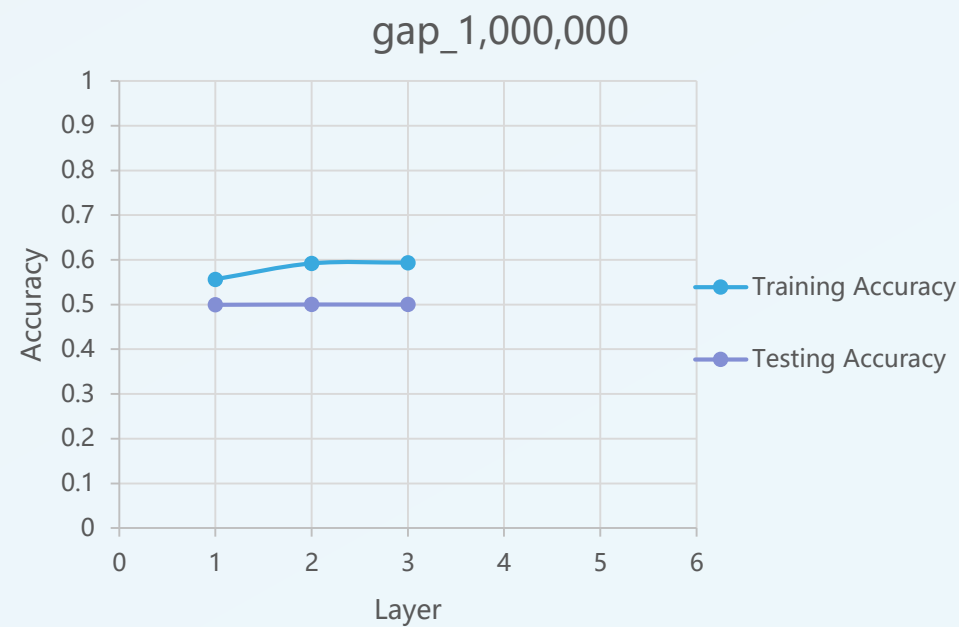
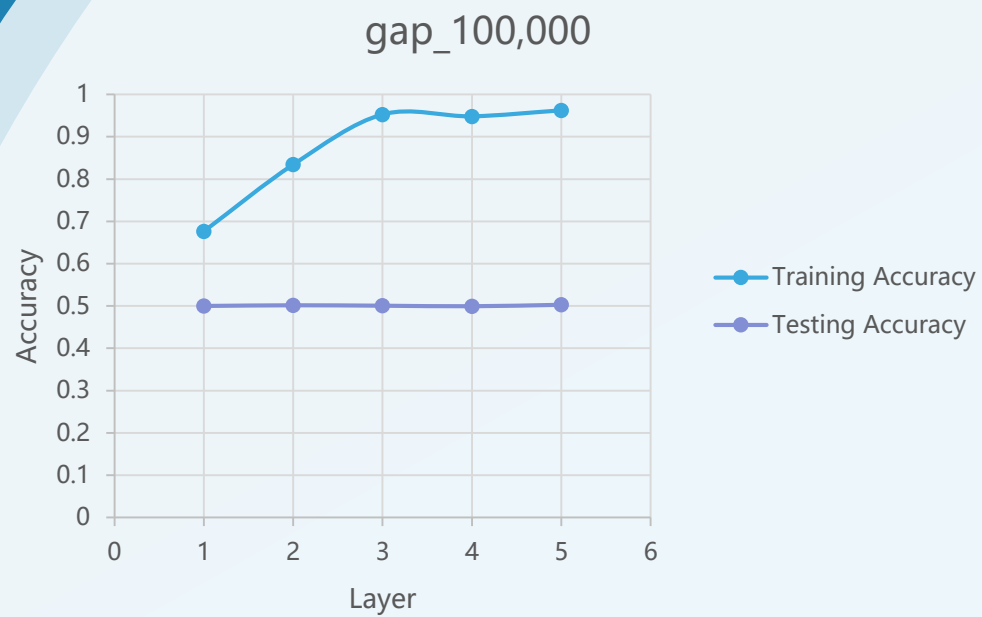


If the learning rate is too large, gradient descent can overshoot the minimum. It may fail to converge, or even diverge

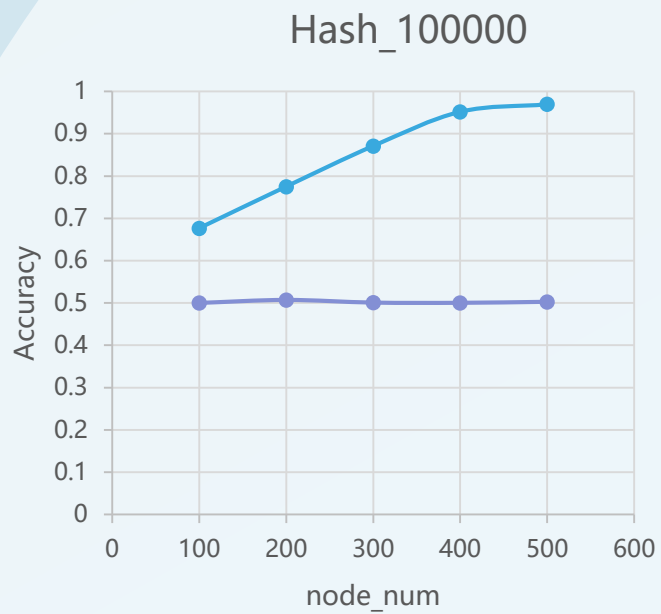
01 The effect of layer on training accuracy



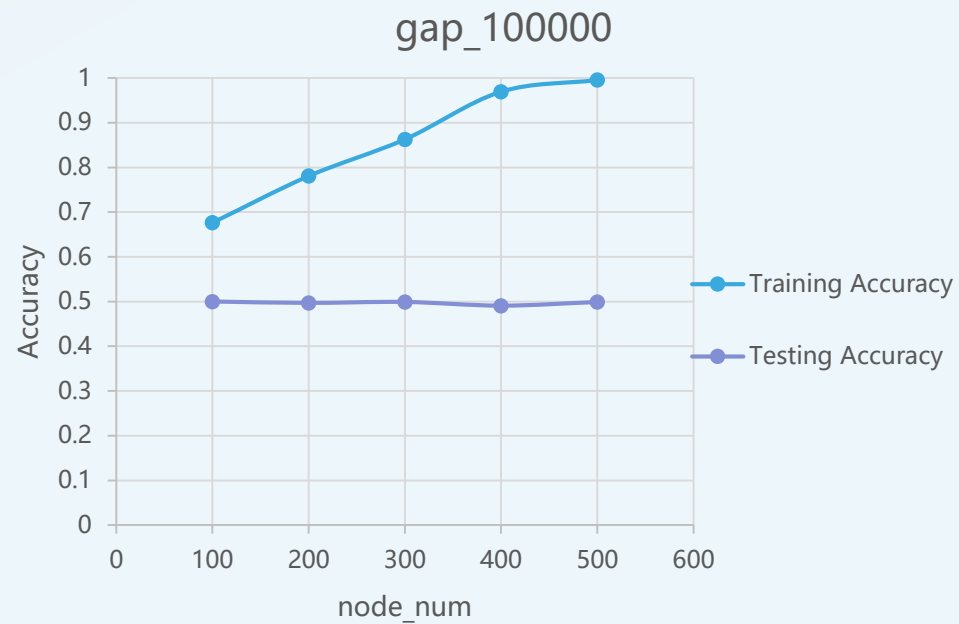
01 The effect of data set size on training accuracy



01 The effect of node size on training accuracy



Training Accuracy
Testing Accuracy



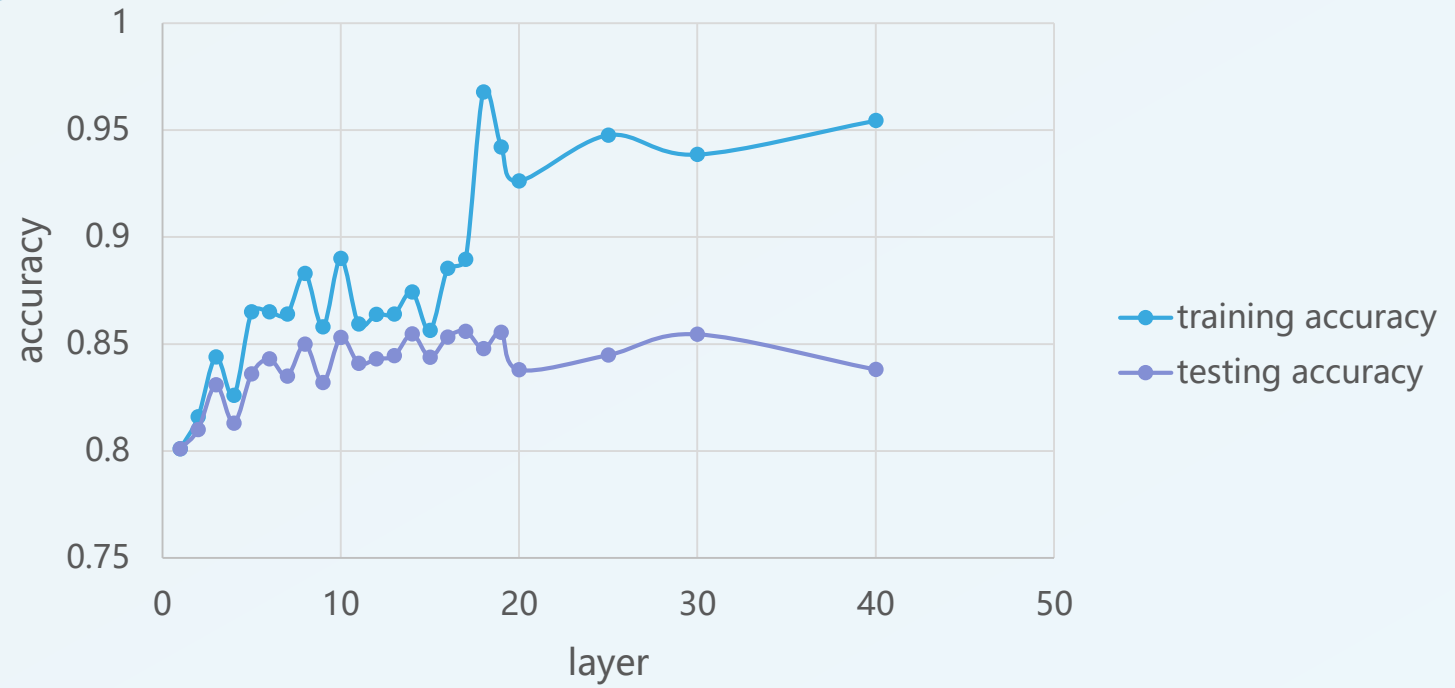
Training Accuracy
Testing Accuracy

Summary

hidden_layer_num = 1				hidden_layer_num = 2			
Training accuracy	Testing accuracy	time	nuuron_num	Training accuracy	Testing accuracy	time	nuuron_num
0.794	0.796	27.9	10	0.796	0.798	27.0	10
0.818	0.819	45.5	20	0.822	0.814	36.7	20
0.831	0.821	41.9	30	0.839	0.831	47.2	30
0.832	0.826	48.7	40	0.832	0.815	52.3	40
0.840	0.830	59.4	50	0.841	0.822	53.0	50
0.844	0.832	71.4	60	0.853	0.838	69.0	60
0.848	0.838	84.7	70	0.864	0.842	82.5	70
0.849	0.832	76.0	80	0.867	0.843	98.1	80
0.854	0.840	93.9	90	0.865	0.843	91.3	90
0.851	0.838	97.4	100	0.870	0.847	96.9	100

The testing accuracy and training accuracy of neural network will increase with the increase of network complexity under the condition of underfitting

Summary



Over-complex network structure will lead to over-fitting

Summary

	Training accuracy	Testing accuracy	Time	Training accuracy	Testing accuracy	Time	Training accuracy	Testing accuracy	Time	Training accuracy	Testing accuracy	Time
	0.656	0.657	9.4	0.879	0.856	210.3	0.892	0.843	156.7	0.752	0.755	15.1
active function	$S(x) = \frac{1}{1 + e^{-x}}$			$\tanh x = \frac{\sinh x}{\cosh x} = \frac{e^x - e^{-x}}{e^x + e^{-x}}$			$f(x) = \max(0, x)$			$f(x) = x$		

The sigmoid active function performs poorly when dealing with symbolic value data sets

Summary

hidden_layer_num = 2	Training accuracy	Testing accuracy	Training accuracy	Testing accuracy	Training accuracy	Testing accuracy	Training accuracy	Testing accuracy	Training accuracy	Testing accuracy	Training accuracy	Testing accuracy
Neuron_num	Car Evaluation (1728, 6)		Chess (3196, 36)		Connect-4 (67557, 42)		mushroom (8124, 22)		Nursery (12960, 8)		Pokerhand (1025010, 10)	
100	1	0.995	1	0.979	0.839	0.831	1	0.996	1	0.999	0.991	0.979

The neural network performs well in processing symbolic value data sets

THANK YOU!