CSE 574 – Introduction of Machine Learning

PROGRAMMING ASSIGNMENT - I

GROUP 12

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Description:

This report describes the basic implementation of Neural Networks using hidden nodes and varied values of lambda. We have implemented forward pass and back propagation on the neural networks and have incorporated regularization on the weights and have use validation set to tune hyper parameters (lamda and hidden nodes) ultimately testing the concept on the testing dataset.
We have implemented the following concepts in our neural networks:
Preprocessing
Feature Selection
Feed forward propagation
Error propagation and Backpropagation
Regularization of neural networks

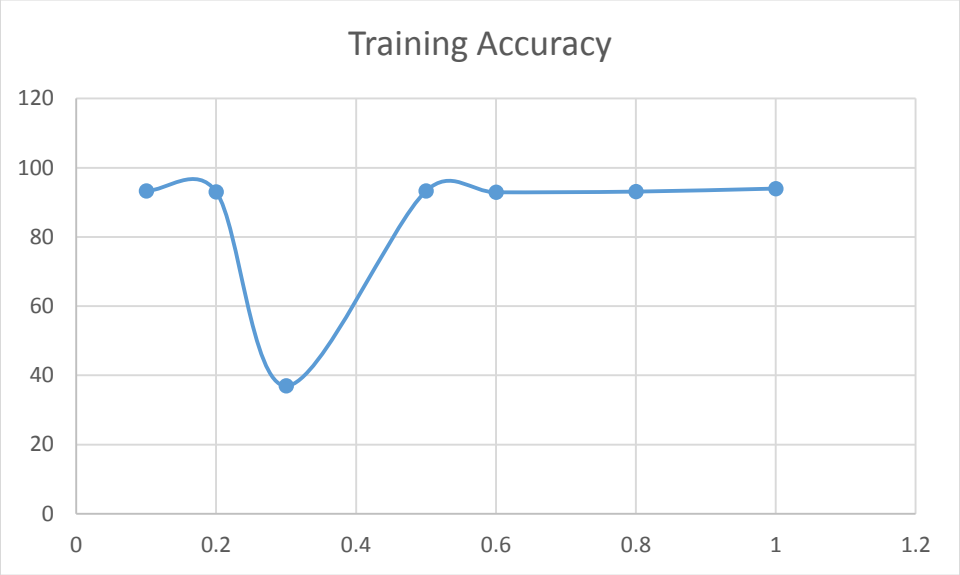
Values:

Lambda	Hidden nodes	Training Accuracy	Validation Accuracy	Testing Accuracy	Runtime (secs)
0.35	80	95.6	58.02	89.37	85.89
0.36	80	95.3	53.35	87.9	78.83
0.1	80	16.5	16.64	77.06	73.6
0.15	80	95.19	54.13	88.16	81.62
0.2	80	95.71	48.66	88.73	85.56
0.1	20	93.33	57.41	63.22	57.84
0.1	40	80.21	26.77	81.9	64.57
0.1	60	93.52	53.33	85.85	78.69
0.1	100	95.59	22.55	1.32	90.83
0.2	20	93.02	30.91	83.14	50.39
0.2	40	17.40	43.37	80.43	60.69
0.2	60	78.24	39.35	68.47	60.07
0.2	100	95.29	66.05	88.31	95.71
0.3	20	36.944	11.74	24.6	44.82
0.3	40	94.344	64.38	86.52	70.09
0.3	60	94.454	64.44	86.99	77.86
0.3	80	95.21	66.27	88.28	83.86
0.4	80	95.52	51.89	88.43	89.15
0.1	50	94.224	65.53	86.15	93.33

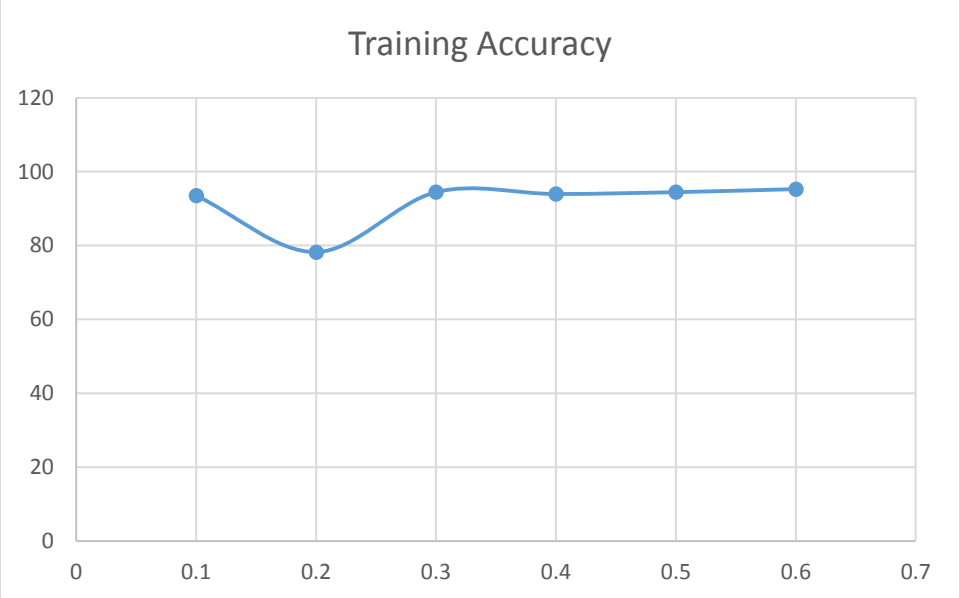
0.1	60	93.94	65.39	86	92.56
0.5	20	93.27	64.8	85.2	67.2
0.5	40	93.75	65.12	86.3	79.1
0.5	60	94.45	66	87.1	103.1
0.5	80	94.9	66.1	87.6	105.1
0.5	100	95.1	66.7	87.8	118.7
0.5	120	95.2	66.1	88.3	128.9
0.5	140	94.39	65.4	87.7	133.6
0.5	160	95.1	65.9	88.1	
0.6	20	92.9	64.8	84	65.4
0.6	40	94.2	65.6	82	78.1
0.6	60	95.27	65.75	87.85	97.9
0.6	120	94.3	66	87.8	134.8
0.6	4	77.8	53.2	66.8	149
0.6	8	88	61	80	54
0.6	12	90.1	63.1	79.9	57
0.6	16	92.48	64.4	84.1	59.9
0.8	4	72	55	65	55
0.8	8	85.1	60.4	75.6	47
0.8	12	91.4	64	81.14	58.16
0.8	16	92	64	83	58
0.8	20	93.1	64	85	66
0.8	40	94.3	65	86	85
0.8	80	94	65	86	85
0.8	100	95.46	66.36	88.09	129.4
1	4	58.87	49.02	52.74	48.7
1	8	86.54	61.57	73.84	5.35
1	12	91.19	63.61	81.43	58.06
1	16	93.45	65.09	83.58	61.4
1	20	93.98	65.31	84.97	64.69
1	40	94.71	65.76	83.76	83.35

Lambda vs Training Accuracy graph for same hidden nodes -

Hidden node is 20

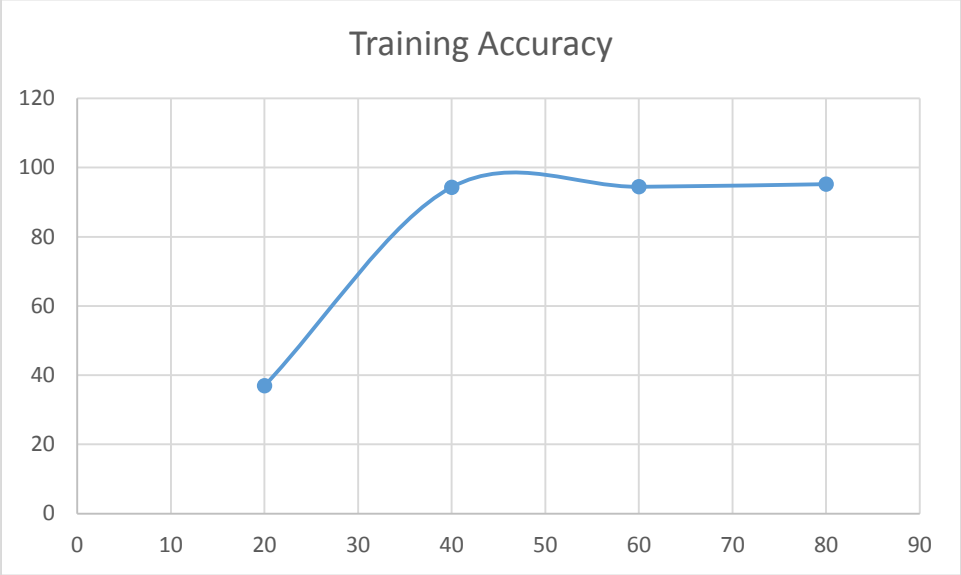


Hidden node is 60

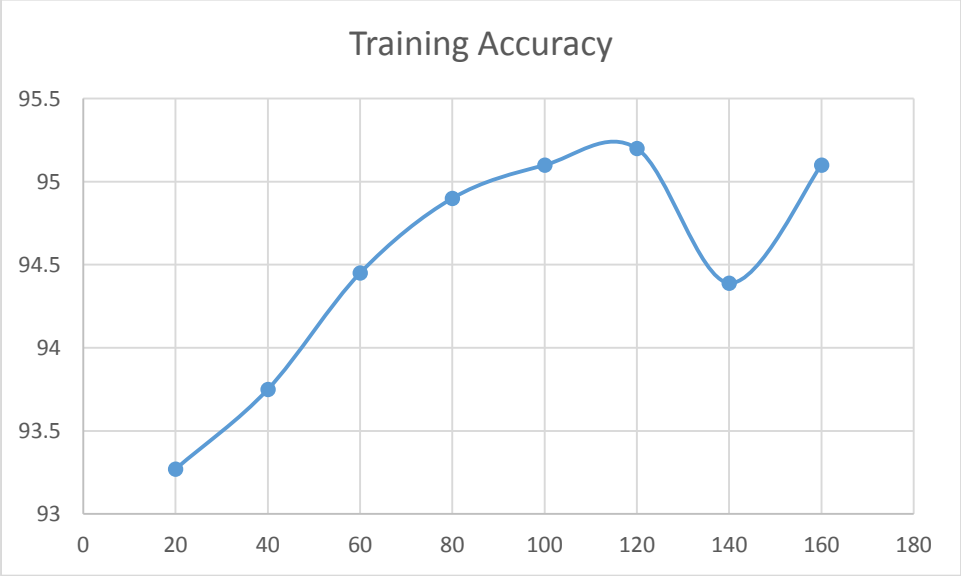


Hidden node vs Training Graph for same lambda values –

Lambda is 0.3



Lambda value is 0.5



Reason for Regularization in our assignment of Neural networks:

Regularization has been used in this Neural Network to avoid overfitting problem. The value of lambda has been changed with different varying values of hidden nodes of 20 to 100 for lambda values of 0.1 to 1.0. These varying values of lambda and hidden nodes have been plotted on the graph to show their changing behavior which affect the different accuracy values for training, validation and testing. As we all know, training Neural Network is very slow, especially when the number hidden units in Neural Network is large. In our project assignment, we have plotted the graph for lambda values from 0.1 to 1.0 for hidden nodes from 20 to 100 and analyzed the varying accuracy times which helps to infer that for most of the risk of overfitting the examples can be minimized if the variance factor is used in the error function to penalize neural network models with high curvatures. Knowing that the examples networks used in the neural networks are usually noisy, a fitness function with too small value will tend to overfit the training data, hence the noise. This will lead to wildly undulating surfaces that are not likely to make good predictions. Hence, we use regularization in neural networks.