Advanced machine learning

Assignment – 2

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Given, the assignment is provided with 2-layer code and our task is to play with the parameters and improve the overall accuracy.

We will focus on two important parameters validation accuracy and test accuracy to determine the performance.

Initially, we will discuss about the important parameters

Hidden Layers:

Hidden layer is a layer of neurons that receives inputs from the previous layer and produces outputs that are passed to the next layer. The term "hidden" refers to the fact that the layer's computations are not directly visible or accessible from outside the network.

Hidden Units:

A hidden unit is a single neuron in a hidden layer. A hidden unit receives input from the previous layer and produces an output that is passed on to the next layer.

The number of hidden units in a hidden layer is a hyperparameter that can be adjusted to optimize the performance of the neural network. Adding more hidden units can increase the model's capacity to learn complex patterns.

Activation function:

An activation function is a non-linear function that is applied to the output of a neuron in a neural network. The purpose of an activation function is to introduce non-linearity into the model, allowing it to capture more complex patterns in the data.

Some common activation functions include:

- 1. Sigmoid
- 2. Tanh
- 3. ReLU

Optimizer:

The goal of an optimizer is to find the set of parameters that result in the lowest possible value of the loss function, which indicates that the model is making accurate predictions on the training data.

Regularizers:

Regularizer is a technique used to prevent overfitting of a model. Overfitting occurs when a model is too complex and is able to fit the training data too closely, resulting in poor performance on new, unseen data.

Dropouts:

Dropout is a widely used regularization technique in deep learning, and has been shown to improve the performance of neural networks on a variety of tasks.

Below is the brief description about the different cases that we are asked to play, and I tried with the various combinations, mentioned its training, validation and test accuracy with the graphs too.

Parameter	Training Accuracy	Validation Accuracy	Test Accuracy	Training & Validation loss Graph	Training & Validation Accuracy Graph
Hidden Layers – 1 Hidden Units – 128 Loss function – mse Activation Function – "Tanh" Regularization - NO Dropout – NO Optimizer – 'rmsprop' Metrics - "accuracy"	<mark>97.59</mark>	<mark>87.36</mark>	88.42	Passing and validation last	Talaning and validation accuracy ***********************************
Hidden Layers – 3 Hidden Units – 32 Loss function – mse Activation Function – "Tanh" Regularization - Dropout – NO Optimizer – "rmsprop" Metrics - "accuracy"	98.27	87.14	87.68	Nearing and well-date New York New Yor	Thermory and variations accuracy 100 100 100 100 100 100 100 1
Hidden Layers – 1 Hidden Units – 64 Loss function – mse Activation Function – "Tanh" Regularization - Dropout –	98.39	86.59	87.17	Descript and verification less C C C C C C C C C	Thermore and variations accuracy 10

Optimizer –					
Metrics - "accuracy"					
Hidden Layers – 3	99.10	86.64	87.47	0.300 Training and validation loss	Training and validation accuracy (3)
Hidden Units – 64	99.10	80.04	07.47	0.350 - Velidation (stra)	Training acc — Validation acc 0.95
				6135 g 6166	g 0.90
Loss function – mse				0.035 -	0.85
Activation Function –				2.5 5.0 7.5 13.0 12.5 15.0 17.5 20.0 Epochs	0.80-
"Tanh"					2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 Epochs
Regularization -					
Dropout –					
Optimizer –					
Metrics - "accuracy"					
Hidden Layers – 1	<mark>93.87</mark>	<mark>86.93</mark>	<mark>88.63</mark>	0.250 - Validation loss Training loss - Validation loss	Training and validation accuracy
Hidden Units – 128				0.200 - g 0.175 -	0.92 -
Loss function – mse				0.150	ACCURACY - 680 D CCURACY - 680
Activation Function –				0.100	0.84 - Training acc
<mark>"Tanh"</mark>				2.5 50 2.5 100 12.5 15.0 17.5 20.0 Epochs	2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 Epochs
Regularization – L2 reg					
Dropout – NO					
Optimizer – 'adam'					
Metrics - "accuracy"					
Hidden Layers – 3	99.55	86.31	85.79	Training and validation loss	Training and validation accuracy 2.20
Hidden Units – 32				910-	0.96 -
Loss function – mse				₹ 0.06 - • Training foot — Validetion foot	Training acc Validation acc Validation acc
Activation Function –				0.00 25 50 25 500 225 158 175 200	0.90 -
"Tanh"				Tgacks	0.86 - 2.5 50 7.5 10.0 12.5 15.0 17.5 20.0
Regularization – L2 reg					Epochs
Dropout – NO					
Optimizer – 'adam'					
Metrics - "accuracy"					
	00.40	86.74	05.00	Training and validation loss	Training and validation accuracy
Hidden Layers – 3	99.48	86.74	85.89	0.200 • • Training loss — Validation loss 0.275 - 0.250 -	0.95
Hidden Units – 32				0.125 § 0.100 -	· 0.90 -
Loss function – mse				0.050 -	0.85
Activation Function –				2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 Epochs	0.80 - Training acc — Validation acc
"Tanh"					2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 Spechs
Regularization – L2 reg					
Dropout – yes					
Optimizer – 'adam'					
Metrics - "accuracy"				Training and validation loss	Training and validation accuracy
Hidden Layers – 1	99.67	86.51	86.73	0.34 * Training loss	0.975
Hidden Units – 64				300	0.950 - 0.025
Loss function – mse				0.04	0.875
Activation Function –				0.00 2.5 5.0 7.5 10.0 12.5 12.6 17.5 20.0 tpochs	0.850 - 0.825 - 0.825
"Tanh"					0.500 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0
Regularization – L2 reg					
Dropout – NO					
Optimizer – 'adam'					
Metrics - "accuracy"					
,		1	1		

Hidden Layers – 2 Hidden Units – 64 Loss function – mse Activation Function – "Tanh" Regularization – L2 reg Dropout – NO	99.40	86.71	87.59	Training and validation less	Thereing and withinfation accuracy 6373
Optimizer – 'adam' Metrics - "accuracy"					
Hidden Layers – 3 Hidden Units – 64 Loss function – mse Activation Function – "Tanh" Regularization – L2 reg Dropout – yes Optimizer – 'adam'	98.57	85.91	87.30	** ** ** ** ** ** ** ** ** ** ** ** **	Training and validation accuracy 0.975 0.
Metrics - "accuracy"					

Conclusion:

All the combinations, produced the decent result, however the highlighted (yellow colored) are best.

So the final combination of parameters are:

