Assignment-1

Neural Networks

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Introduction:

Here we have a neural network model with two hidden layers, each with 16 nodes, and an output layer with a sigmoid activation function. Where it's been compiled using binary cross-entropy loss and an optimizer of RMSprop.

To improve the model's performance, we tried various modifications. First, we changed the number of hidden layers to 1 and 3, and experimented with the number of hidden units (32, 64, etc.). We also tried using the mean squared error (MSE) loss function instead of binary cross-entropy, and the hyperbolic tangent (tanh) activation function instead of ReLU

Data obtained after making those changes:

Layers	Unites	Activation	Loss function	Loss	Accuracy	V_loss	V_ accuracy
1	16	ReLU	BCE	0.05	0.99	0.37	0.87
2	16	ReLU	BCE	0.01	0.99	0.55	0.87
3	16	ReLU	BCE	0.01	0.99	0.64	0.87
2	32	ReLU	BCE	0.0058	0.9999	0.6307	0.8622
2	64	ReLU	BCE	0.0269	0.9916	0.5763	0.8745
2	16	ReLU	MSE	0.0121	0.9870	0.1069	0.8684
2	16	tanh	BSE	0.0043	0.9997	0.6826	0.8674

Regularization and Dropout.

Regularization l2 = 0.001 and dropout = 0.5, are applied and resulted in validation loss =0.5128

And accuracy=0.8711.

Analysis:

- From the changes made we can observe that adding a third hidden layer or removing a hidden layer does not improve the model's performance, so it's better if we don't change the number of hidden layers.

- while increasing the number of hidden units to 32 resulted in lower loss but decrease in accuracy so, Unit size 16 is best for this model.

- Using the MSE loss function or tanh activation did not significantly impact the model's performance.

- Finally, we used regularization techniques such as L1 and L2 regularization and dropout to improve the model's performance on the validation set. These techniques helped reduce overfitting and improve the model's accuracy on the validation set.

Conclusion.

Overall, we found that modifying the number of hidden layers and units, using different activation functions and loss functions, and implementing regularization techniques could slightly impact the model's performance. Further experimentation and tuning is done to improve the model's accuracy on the validation and test sets.