Task 1 Report by Ryan Wickman

Experiment Settings

Binary Classification Hyperparameters

Hyperparameter	Value
Optimizer	Adam
Learning Rate	0.01
LR Decay Rate	0.99
Epochs	100
Batch Size	16
Early Stopping	True
Patience	10
Num. Random init	3
K-fold Split Size	5
Feature Scaling	Standardization

Multi-class Classification Hyperparameters

Hyperparameter	Value
Optimizer	Adam
Learning Rate	0.01
LR Decay Rate	0.99
Epochs	100
Batch Size	128
Early Stopping	True
Patience	10
Num. Random init	3
K-fold Split Size	N/a
Feature Scaling	Standardization

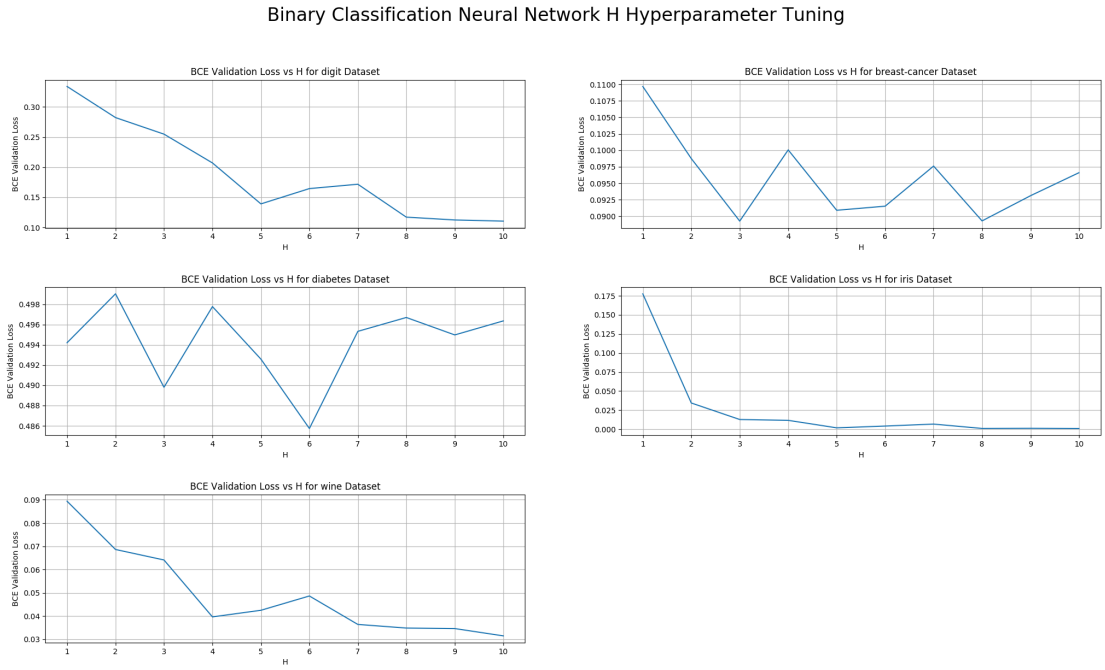
Parameter Tuning Results

Binary Classification Tuning Results

I used k-fold cross-validation to evaluate the number of units in the hidden layer, H, that provides the lowest validation loss. In my experiments, H was tested on values in the range of [1,10].

The table in the Binary Classification Hyperparameters section above provides details on how the experiments were setup.

The figure below displays the BCE Validation Loss vs H plot for every dataset:



From the graph above, you can easily evaluate the best H value for every dataset.

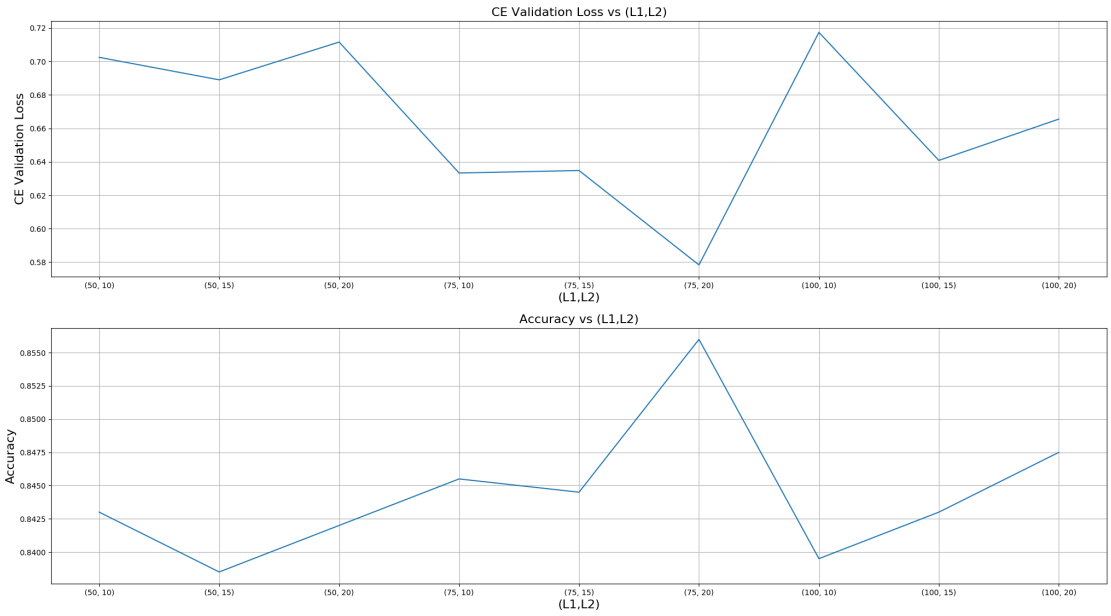
Multi-class Classification Tuning Results

I used normal cross-validation, a simple 80/20 split between the training and validation set. I used this to evaluate the number of units in to use in first hidden layer and the second hidden layer, L1 and L2; respectively. L1 was tested on values {50, 75, 100} and L2 was tested on values {10, 15, 20}.

The table in the Multi-class Classification Hyperparameters section above provides details on how the experiments were setup.

The figure below displays both the CE Validation Loss vs (L1, L2) plot and the Accuracy vs (L1, L2) plots, where every combination of L1 and L2 is included:

Multi-class Classification Neural Network (L1, L2) Hyperparameter Tuning



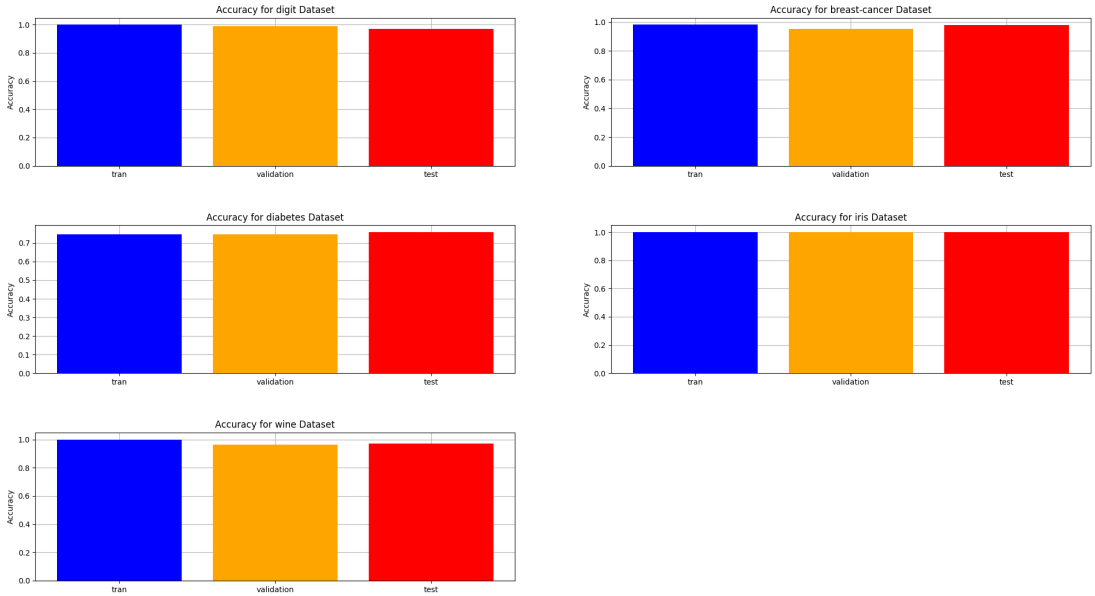
From the graph above, you can easily evaluate the best L1 and L2 combination. When L1 = 75 and L2 = 20, we get the minimum cross-entropy loss and the maximum accuracy.

Best Model Results

Binary Classification Best Model Results

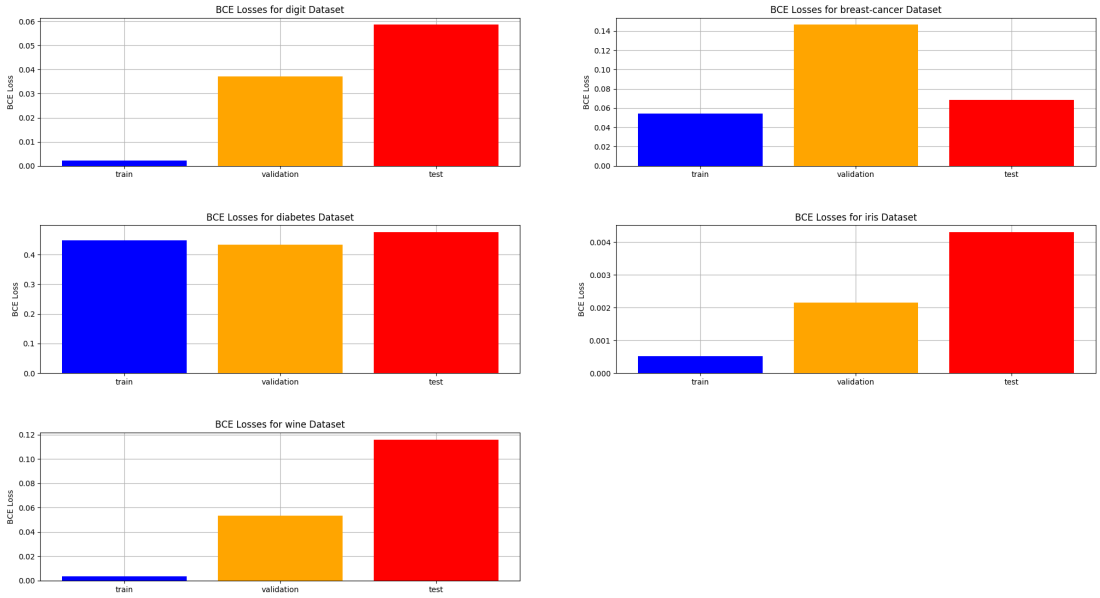
Using the best H value for every dataset, the figure below displays the accuracy on the training, validation, and testing set. This assumed a decision threshold = 0.5.

Binary Accuracy



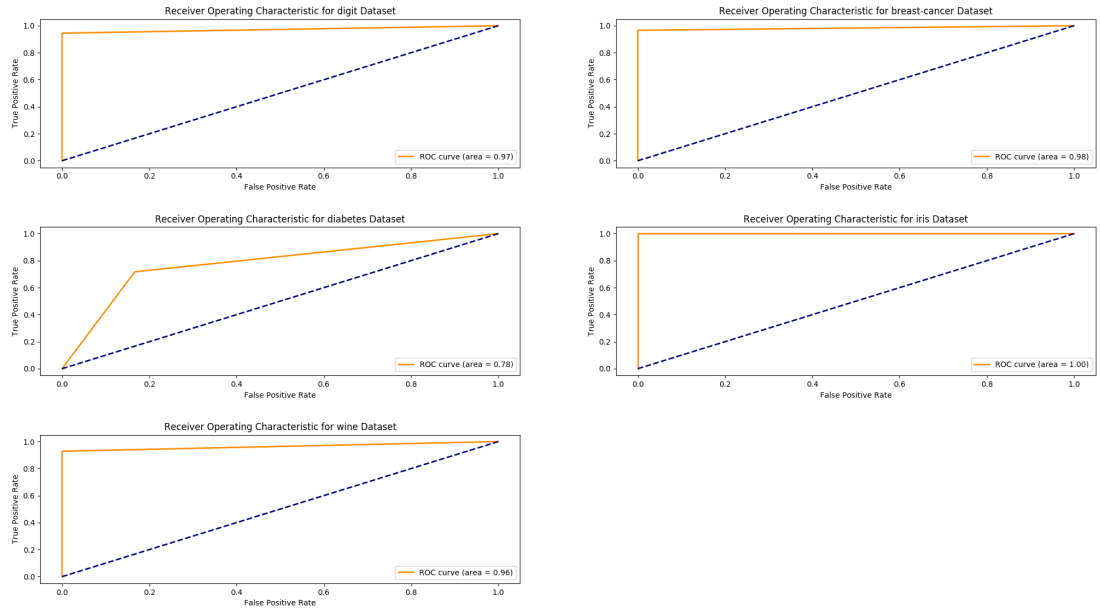
The figure below displays the BCE loss on the training, validation, and testing set.

BCE Loss



The figure belows displays the ROC curve based on the testing set.

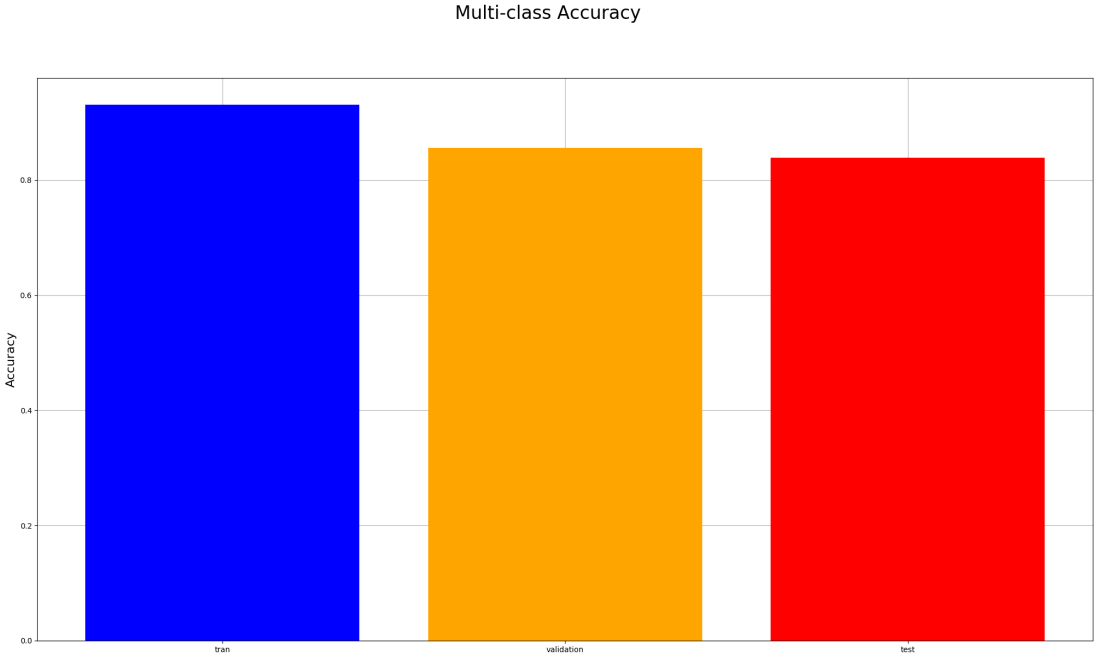
Binary ROC Curves



Amazingly, most of the models had an AUC score close to 1.

Multi-class Classification Best Model Results

The figure below displays the accuracy using L1 = 75 and L2 = 20 on the training, testing, and validation set.



As you can see, it was able to achieve a testing set accuracy of approximately 84%.