Neural Network Model Report

Report Overview:

The purpose of this analysis is to create a neural network model that can accurately help the Alphabet Soup nonprofit predict applicants with the best chances of success for funding. Using my knowledge of neural networks and machine learning, I created a model that could be trained and tested on historical data gathered by the company to predict any new applications for their chances of success.

Report Results:

**What variable(s) are the target(s) for your model?**

* The target for our model is whether the money used for funding ventures was used effectively or not (IS\_SUCCESSFUL).

**What variable(s) are the features for your model?**

* The variables that are features for our model are all columns within the original charity dataset that have been encoded minus the variables that are neither targets nor features.

**What variable(s) should be removed from the input data because they are neither targets nor features?**

* The EIN and NAME identification columns should be removed as they will not provide any contribution to the predictive power or accuracy of our model.

**How many neurons, layers, and activation functions did you select for your neural network model, and why?**

* I selected 2 hidden layers, 43 neurons for each hidden layer, and both “relu” and “sigmoid” activation functions. Firstly, I selected two hidden layers and 43 neurons for my model as a baseline to observe the differences in accuracy after optimization. Secondly, I used Rectified Linear Unit activation functions in my hidden layers because it is ideal for modeling positive input data that fits with our used dataset (Income amount and ask amount will need to be positive amounts for predicting successful ventures). Lastly, I used the sigmoid function for my output layer to be able to properly classify our target variable responses (IS\_SUCCESSFUL = 0 or 1).

**Were you able to achieve the target model’s performance?**

I was unable to achieve a target performance of 75% model accuracy; however, after performing 3 different optimization techniques to my initial model, I was able to achieve a model accuracy of 73.08%.

**What steps did you take in your attempts to increase model performance?**

* In my attempts to increase model performance, I ran three different optimization tests where I added another optimization technique to the model:
  + Model 1 (Accuracy = 73.20%): I increased the number of units I used in my second hidden layer from 43 to 86 (doubled the amount), increasing model performance by approximately 0.77%.
  + Model 2 (Accuracy = 72.90%): I increased the number of epochs from 100 to 120, decreasing my model performance by approximately 0.3% compared to my first optimization model.
  + Model 3 (Accuracy = 73.08%): I added a third hidden later to my model with 86 units, increasing my model performance by approximately 0.18% compared to my second optimization model.

Report Summary:

Overall, my initial neural network model and my models using optimization techniques had accuracies between 72% and 73% which was a few percent off from our target of 75%.

Because our model is predicting binary outcomes (0 or 1), an alternative logistic regression model to use could be a support vector machine. The support vector machine would be used to find a hyperplane that maximizes the distance between the classes for our target variable.