# Alphabet Soup Nonprofit Funding Analysis

## Overview

Alphabet Soup nonprofit is looking for a tool to predict what applicants for their funding would have the best chance of success in their ventures. I looked at 4 different neural network models to try to predict these outcomes using data provided about their funding from more than 34,000 organizations from the past.

## Results

**Test 1**

The first neural network model had 44 features with 3 hidden layers, 15, 10, 10 neurons, 200 epochs, and the relu activation functions resulted in only 70.59% accuracy and 58.37% model loss.

```
268/268 - 0s - loss: 0.5838 - accuracy: 0.7059 - 357ms/epoch - 1ms/step
Loss: 0.5837838649749756, Accuracy: 0.7058892250061035
```

**Test 2**

The second neural network model had a reduction in features to 31 with 3 hidden layers, 15, 15, 15 neurons, 200 epochs, and the relu activation functions resulted in only 63% accuracy and 63% model loss.

```
268/268 - 1s - loss: 0.6355 - accuracy: 0.6388 - 537ms/epoch - 2ms/step
Loss: 0.635496973991394, Accuracy: 0.6388338208198547
```

**Test 3**

The third neural network model had 44 features, 2 hidden layers, 15, 15 nuerons, 200 epochs, and the tanh activation function. It resulted in only 70.39% accuracy and 58% model loss.

```
268/268 - 1s - loss: 0.5802 - accuracy: 0.7039 - 514ms/epoch - 2ms/step
Loss: 0.5802459716796875, Accuracy: 0.7039067149162292
```

**Test 4**

The fourth neural network model had 44 features, 3 hidden layers 30, 30, 30 neurons, 200 epochs and the relu activation functions. It resulted in 70.3% accuracy, 59% model loss.

```
268/268 - 0s - loss: 0.5895 - accuracy: 0.7033 - 498ms/epoch - 2ms/step
Loss: 0.589515209197998, Accuracy: 0.7033236026763916
```

### Data Preprocessing:

- For this analysis the “IS_SUCCESSFUL” column was the target variable for the model in this analysis.
- The “APPLICATION_TYPE”, “AFFILIATION”, “CLASSIFICATION”, “USE_CASE”, “ORGANIZATION”, “STATUS”, “INCOME_AMOUNT”, “SPECIAL CONSIDERATION”, and

"ASK_AMT" were used as features for the 1st, 3rd, and 4th models in this analysis for a total of 44. In the 2nd model test and "AFFILIATION" and "CLASSIFICATION" were binned to remove values rare values. "SPECIAL_CONSIDERATION" AND "AFFILIATION" were removed as features for the model but were added back in as features for the model in tests 3 and 4. In addition, in the 2nd model test "INCOME_AMT" was binned to cutoff values less than 2000.

- The "EIN" and "NAME" columns were removed from the input data as they are just identification columns and not useful in classifying data. As mentioned above, "SPECIAL_CONSIDERATION" AND "AFFILIATION" were removed as input data for the model but were added back in as input data for the model in tests 3 and 4.

### Compiling, Training, and Evaluating the Model

- After some trial and error, the first neural network model was run with 3 hidden layers, with 15, 10 and 10 neurons respectively and the relu activation function. These choices were made to minimize the time it took to train the model while seeing what kind of accuracy was returned. In training the model for Test 2, I boosted the number of neurons so see if that would help make a difference in accuracy. In Test 3 I kept the number of neurons the same to see if a different activation function would make a difference from Test 1. In test 4 I chose 30 neurons in 3 layers to be close to the number of features that were input and the same activation functions as Test 1.
- I was not able to achieve 75% accuracy.
- Many of the steps taken to improve accuracy were incremental changes from the baseline accuracy of Test 1. This included changing the number and types of features for Test 2, changing the activation function Test 3 to see if that would gain better accuracy, and finally doubling the number of neurons in Test 4.

## Summary

In summary, the changes made to the model did not result in improved accuracy. It may be that more significant changes in number of neurons, epochs, and perhaps hidden layers, that create a much higher processing load, may be necessary to see a significant rise in accuracy for this neural network model.