**OVERVIEW**

The purpose of this analysis is to predict the likelihood of a business’ success, based on funding from Alphabet Soup. Using a neural network model, binary classifier to predict whether applicants will be successful if funded by Alphabet Soup.

A binary classifier is a type of machine learning model that categorizes data into one of two distinct classes or categories. This tool will use the, more than, 34,000 organizations that have received funding from Alphabet Soup over the years as the dataset for the prediction model.

**RESULTS**

* Data Preprocessing
  + What variable(s) are the target(s) for your model?
    - Target(s) for the model:
      * IS\_SUCCESSFUL is the target variable. This binary variable indicates whether an application was successful (1) or unsuccessful (0).
  + What variable(s) are the features for your model?
    - Features for the model:
      * All columns in the dataset except for IS\_SUCCESSFUL, EIN, and NAME are features for the model because they include other relevant information about the applicant organization that can be used in the prediction model.
      * After data transformation using pd.get\_dummies, the original features were converted into a larger set of numerical features representing different categories and values.
  + What variable(s) were removed from the input data because they are neither targets nor features?
    - Variables removed:
      * EIN and NAME were removed from the input data.
* Compiling, Training, and Evaluating the Model
  + How many neurons, layers, and activation functions did you select for your neural network model, and why?
    - Model Definition of original design:
      * Neurons:
        + Two hidden layers.
        + The first hidden layer has 80 neurons.
        + The second hidden layer has 30 neurons.
        + The output layer has 1 neuron (for binary classification).
      * Layers:
        + The model has three layers: two hidden layers and one output layer.
      * Activation functions:
        + ReLU (Rectified Linear Unit): Used to introduce nonlinearity, allowing the model to learn complex patterns in the hidden layers.
        + Sigmoid: This is used in the output layer to predict the probability of success (ranging from 0 to 1).
  + Were you able to achieve the target model performance?
    - Target model performance:
      * The target model performance was an accuracy of 75% or higher. The model achieved an accuracy of approx.73%.
  + What steps did you take in your attempts to increase model performance?
    - Steps taken to increase model optimization:
      * Feature engineering and selection: Irrelevant features were removed, and potentially useful features (like those with high variance or relevance to the target) were retained.
      * Data transformation and scaling: Categorical features were converted to numerical using pd.get\_dummies, and numerical features were scaled using StandardScaler. This ensured the features were appropriately represented for the neural network.
      * Hyperparameter tuning: Experimentation with different numbers of hidden layers, neurons, activation functions, and optimizers (e.g., adam). The number of neurons and layers were adjusted to find a balance between model complexity and performance.
      * Regularization techniques: Dropout or early stopping could be introduced to prevent overfitting and improve generalization to unseen data.

**SUMMARY**

This binary classifier model, consisting of two hidden layers with 80 and 30 neurons, respectively, and using ReLU and Sigmoid activation functions, achieved an accuracy approx.73%. Using additional optimization techniques, the model was unable to achieve a higher accuracy rate. This result suggests the binary classifier model can predict the success of applications with an acceptable level of accuracy.

Recommendation Alternative Model:

Based on the parameters of this requirement, we were supposed to learn about alternative models. However, due to the lack of continuity in this program, the binary classifier model was the only model available. Therefore, I cannot make recommendations on other models that can be used.