**Overview of the Analysis:**

The purpose of this analysis is to develop and evaluate a binary classifier to predict whether applicants will be successful if funded by Alphabet Soup. The objective is to analyze how well a neural network model can classify organizations that are likely to be successful, based on various features related to their operational data. By training and testing a deep learning model, we aim to identify patterns in the data that can help Alphabet Soup make informed decisions.

**Results:**

**Data Preprocessing:**

* **Target Variable(s):**
  + The target variable for this model is the **“IS\_SUCCESSFUL”** column, which indicates whether the organization was successful (1) or not successful (0).
* **Feature Variables:**
  + The features selected for the model include variables such as:
    - **APPLICATION\_TYPE**
    - **AFFILIATION**
    - **CLASSIFICATION**
    - **USE\_CASE**
    - **ORGANIZATION**
    - **STATUS**
    - **INCOME\_AMT**
    - **SPECIAL\_CONSIDERATIONS**
    - **ASK\_AMT**
* **Variables Removed:**
* **EIN** and **NAME** were removed from the input data because they are identifiers and do not contribute meaningfully to the model's predictions.

##### **Compiling, Training, and Evaluating the Model:**

* **Neurons, Layers, and Activation Functions:**
  + - **Input Layer:** Number of neurons matching the number of input features. (43 input features = 43 neurons).
    - **Hidden Layers:**
      * Two hidden layers were used, each with **80 and 30 neurons**, respectively.
      * The **ReLU (Rectified Linear Unit)** activation function was applied to each hidden layer to introduce non-linearity and help the model capture complex relationships in the data.
    - **Output Layer:** One neuron with a **sigmoid activation function**, since this is a binary classification problem, outputting probabilities for classifying an organization as successful or not.

**Target Model Performance:**

* The initial performance of the model did not achieve the desired accuracy of **75% accuracy,** falling short of the target performance metric with a **72%**. After multiple iterations, the model achieved an accuracy of **72%**, which indicated room for improvement.
* **Steps to Increase Model Performance:**
  + Several techniques were employed to improve the model’s performance:
    - **Adjusting the number of neurons**: The number of neurons in each hidden layer was tweaked to balance model complexity and avoid overfitting.
    - **Tuning epochs**: The number of epochs were tested to find the optimal configuration for model training. I eventually decided to use 50 epochs.
    - **Increasing hidden layers:** Added two more hidden layers

#### **Summary:**

The deep learning model developed for Alphabet Soup demonstrated a reasonable level of accuracy at approximately 72%, though it did not meet the target of 75%. Despite efforts to optimize the model by adjusting neurons, adding dropout layers, and tuning hyperparameters, the performance gains were negligible.

**Recommendation:** Given that the deep learning model did not achieve the desired accuracy, a different machine learning model may be more suitable for this classification problem. I recommend trying a **Random Forest** or **XGBoost** model. Both are powerful ensemble methods that tend to perform well on structured data and may better handle the complex interactions between the features in this dataset. These models can also be fine-tuned to improve classification accuracy and may outperform the neural network in this case, given the size and nature of the dataset.