

Overview of the Analysis

The objective of this analysis was to develop a model to predict the success of funding applications for the Alphabet Soup nonprofit foundation. I aimed to create a model that can accurately determine if an organization will be successful if funded, based on historical data.

Results

- **Target Variable:**
 - IS_SUCCESSFUL - Indicates whether the funding was used effectively (1 for successful, 0 for not successful).
- **Feature Variables:**
 - Includes all columns after encoding categorical variables: APPLICATION_TYPE, AFFILIATION, CLASSIFICATION, USE_CASE, ORGANIZATION, STATUS, INCOME_AMT, SPECIAL_CONSIDERATIONS, and ASK_AMT.
- **Columns Removed:**
 - EIN and NAME - These columns were dropped as they are non-informative identifiers.
- **Preprocessing Steps:**
 - Categorical variables were converted to numerical format using one-hot encoding.
 - Rare categories in APPLICATION_TYPE and CLASSIFICATION were combined into "Other" to simplify the model and reduce dimensionality.

Compiling, Training, and Evaluating the Model

- **Model Architecture:**
 - **Input Layer:** Matches the number of features after preprocessing.
 - **First Hidden Layer:** 80 neurons with ReLU activation.
 - **Second Hidden Layer:** 30 neurons with ReLU activation.
 - **Output Layer:** 1 neuron with a sigmoid activation function.
- **Model Summary:**
 - The model is a sequential neural network with:
 - **Layer 1:** Dense layer with 80 neurons (3,520 parameters)
 - **Layer 2:** Dense layer with 30 neurons (2,430 parameters)
 - **Layer 3:** Output Dense layer with 1 neuron (31 parameters)
 - **Total Parameters:** 5,981 (Trainable: 5,981; Non-trainable: 0)
- **Training Performance:**
 - **Epochs:** 20
 - **Training Loss:** Decreased from 0.5727 to 0.5429.
 - **Training Accuracy:** Increased from 71.71% to 73.46%.
 - **Validation Loss:** Decreased from 0.5525 to 0.5416.
 - **Validation Accuracy:** Increased from 73.41% to 73.87%.
- **Final Model Evaluation:**
 - **Test Loss:** 0.5416
 - **Test Accuracy:** 73.87%

Summary

The deep learning model achieved a test accuracy of 73.87%, which is close to but slightly below the target of 75%. The model's performance improved throughout the training epochs, suggesting effective learning.

Recommendation: To enhance the model's performance:

- **Hyperparameter Tuning:** Experiment with different numbers of neurons, layers, or learning rates.
- **Model Architecture:** Adding more hidden layers or experimenting with different activation functions might help.
- **Feature Engineering:** Reassess preprocessing, including feature selection or creating new features.