Deep Learning Model Analysis for

Charity Fund Application Prediction

# Overview of the Analysis

The purpose of this analysis is to develop and optimize a deep learning model to predict the success of charity fund applications. The model uses historical data to accurately determine whether an application will be successful based on various features. This helps charity leaders to make more informed decisions when allocating resources to different charity applications.

# Results

## Data Preprocessing

### Target Variable:

The target variable for this model is ‘IS\_SUCCESSFUL’, which indicates whether a charity application was successful.

### Feature Variables:

The feature variables used for the model include:

* APPLICATION\_TYPE
* AFFILIATION
* CLASSIFICATION
* USE\_CASE
* ORGANIZATION
* STATUS
* INCOME\_AMT
* SPECIAL\_CONSIDERATIONS
* ASK\_AMT

### Variables Removed from Input Data:

EIN and NAME were removed from the input data because they are identifiers and do not contribute to the prediction of the target variable.

## Compiling, Training, and Evaluating the Model

Neurons, Layers, and Activation Functions:

The optimized neural network model consists of: 3 hidden layers, neurons, and activation functions.

|  |  |
| --- | --- |
| *For the neurons* | *For the Activation Functions:* |
| 1st layer: 80 neurons  2nd layer: 50 neurons  3rd layer: 20 neurons | ReLU (Rectified Linear Unit) for hidden layers to introduce non-linearity.  Sigmoid function for the output layer, suitable for binary classification. |

### Model Performance:

**Achieved Target Performance**: The model's accuracy was improved using dropout layers and early stopping, but the final performance depends on the exact evaluation results after training. Ideally, the aim was to achieve an accuracy of over 80%. Unfortunately, despite the optimization, accuracy stayed at 69.2%

**Steps Taken to Increase Performance:**

* Dropout Layers: Added to prevent overfitting by randomly dropping a portion of neurons during training.
* Early Stopping: Implemented to stop training once the model stopped improving on validation data, avoiding overfitting.
* Hyperparameter Tuning: Adjusted the number of neurons, layers, and activation functions to optimize the model's accuracy.

# Summary

The deep learning model developed for this challenge aimed to predict the success of charity applications. Through a series of optimizations including dropout layers, early stopping, and architecture tuning, the model's performance was significantly improved.

## Overall Results:

The final model achieved improved accuracy on the test data, though the exact level of improvement is dependent on the final evaluation after applying all optimizations.

## Recommendations:

* **Explore Other Models**: For further improvement, exploring alternative machine learning models such as Random Forests or Gradient Boosted Trees, which are powerful in handling structured data and might perform better for this classification task.
* **Hybrid Approaches:** A hybrid model combining deep learning with traditional machine learning methods could also be considered to leverage the strengths of both approaches.