**Deep Learning Project Report**

# **Overview**

This project aimed to develop a predictive model for Alphabet Soup, a non-profit foundation that provides funding for organizations that support education, environmental sustainability, and social justice. The goal was to create a model that could accurately predict the likelihood of success for each applicant, based on various factors such as the applicant's organization type, income, and proposed use of funds.

To achieve this, the data underwent pre-processing to prepare it for modeling. This included removing any irrelevant columns that did not contribute to the prediction task, binning rare variable values to reduce noise in the data, and converting categorical data to numerical data that could be used in the model. The final dataset included ten relevant features, such as the applicant's organization type, income level, and requested funding amount, as well as the target variable, which was whether the applicant was successful or not (IS\_SUCCESSFUL).

The initial model that was trained on this dataset achieved an accuracy slightly below 75%, which was the desired threshold for this project. To improve the model's performance, optimization efforts were undertaken. These included modifying the model architecture by adding more hidden layers and adjusting the number of units in each layer, as well as adding regularization techniques such as dropout and L1/L2 regularization to prevent overfitting.

Despite these efforts, the model's accuracy was only able to achieve a slight improvement, reaching a maximum of 72.72%. To further improve the model's performance, other optimization techniques such as batch normalization, learning rate scheduling, and using different optimization algorithms can be explored. By continuing to iterate on the model and experimenting with different optimization techniques, we hope to improve its accuracy and provide more accurate predictions for Alphabet Soup's funding decisions.

# **Results**

### Data Preprocessing

1. What variable(s) are the target(s) for your model?

Target variable: IS\_SUCCESSFUL

1. What variable(s) are the features for your model?

Table

Description automatically generatedVariable Features: APPLICATION\_TYPE, AFFILIATION, CLASSIFICATION, USE\_CASE, ORGANIZATION, STATUS, INCOME\_AMT, SPECIAL\_CONSIDERATIONS, and ASK\_AMT.

1. What variable(s) should be removed from the input data because they are neither targets nor features?

Removed variables: EIN, NAME

A picture containing text

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### Compiling, Training, and Evaluating the Model

1. How many neurons, layers, and activation functions did you select for your neural network model, and why?

For the neural network model, I selected two hidden layers with 80 and 40 neurons, respectively, and an output layer with 1 neuron. The activation function used for the first two layers was ReLU, while the output layer used sigmoid activation.

I chose this architecture because ReLU is known to be effective for hidden layers in deep neural networks, while sigmoid activation is commonly used for binary classification tasks like the one in the Alphabet Soup project. Additionally, having fewer neurons in the hidden layers helps to reduce the risk of overfitting and improve model performance. Overall, this architecture strikes a good balance between model complexity and performance.

Graphical user interface

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1. Were you able to achieve the target model performance?

No, the target model performance of at least 75% accuracy was not achieved with the neural network model that was developed. The best accuracy achieved was 72.72% (seen in file AlphabetSoupCharity\_Optimization.ipynb).

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1. What steps did you take in your attempts to increase model performance?

I tried various techniques to improve the model performance, including cleaning up the data, adjusting the neural network architecture, and experimenting with different activation functions, optimization algorithms, and training epochs. Unfortunately, despite my best efforts, I was not able to achieve the desired model performance of at least 75% accuracy.

# **Summary**

The deep learning model developed for the Alphabet Soup project achieved a maximum accuracy of 72.72%, falling slightly below the desired threshold of 75%. A recommendation for improving the model's accuracy is to explore other classification algorithms like Random Forest Classifier or Support Vector Machine (SVM), which are suitable for high-dimensional datasets with complex relationships between features. This could help to provide better insights for Alphabet Soup's funding decisions.