**Step 4: Write a Report on the Neural Network Model**

**Neural Network Model Report**  
**Jose Moncada - Module #21 - Deep Learning Challenge**

**Overview**

This analysis aims to build and optimize a deep learning model to predict whether applicants for Alphabet Soup’s funding will be successful. By training a neural network, we seek to identify key factors influencing funding outcomes and improve prediction accuracy.

**Results**

**Data Preprocessing**

* **Target Variable:** The model predicts whether an applicant will be successful (binary classification).
* **Feature Variables:** Various applicant attributes, including organization type, income, and funding amount requested.
* **Removed Variables:** Unnecessary columns such as unique identifiers (e.g., EIN and NAME) that don’t contribute to predictions.

**Model Training & Evaluation**

* **Neural Network Structure:** The model includes multiple hidden layers with ReLU activation functions and an output layer using sigmoid activation for binary classification.
* **Performance:** Initial accuracy was lower than expected (~53.7%), whereas the target accuracy was closer to ~72.6%.
* **Optimization Steps:**
  + Adjusted the number of neurons and layers.
  + Tried different activation functions.
  + Experimented with batch sizes and epochs.
  + Implemented feature scaling and dropout regularization to reduce overfitting.

**Summary & Recommendations**

The final model did not fully reach the target accuracy, despite multiple optimizations. A potential improvement could be using a different machine learning approach, such as:

* **Random Forest or Gradient Boosting** – These models handle structured data well and may provide better interpretability.
* **Hyperparameter Tuning** – Further refining layer configurations and learning rates.
* **Feature Engineering** – Creating new variables or reducing noise in existing ones to improve model performance.

While deep learning is a powerful tool, traditional ML models might be more efficient for this type of structured data classification. Future work should explore alternative methods for better accuracy and reliability.