Project Report

Optimizing Market Segmentation through Artificial Neural Networks

1. Introduction

This report presents a comprehensive approach to training a machine learning model for classification using neural networks. The project involves hyperparameter tuning to optimize the model's performance. Key performance metrics, including accuracy and validation loss, were recorded to evaluate the model.

2. Methodology

The model was built using a sequential neural network with two hidden layers and an output layer.

Hyperparameter tuning was conducted using the following parameter choices:

- **Initializer:** 'he_normal', 'glorot_normal', 'random_normal'
- **Number of Units (Layer 1):** 50, 100, 150, 200
- **Activation (Layer 1):** relu, tanh, sigmoid
- **Number of Units (Layer 2):** 50, 100, 150, 200
- **Activation (Layer 2):** relu, tanh, sigmoid
- **Optimizer:** adam, rmsprop, sgd

The model was compiled with sparse categorical cross-entropy loss for multiclass binary classification and accuracy as a metric.

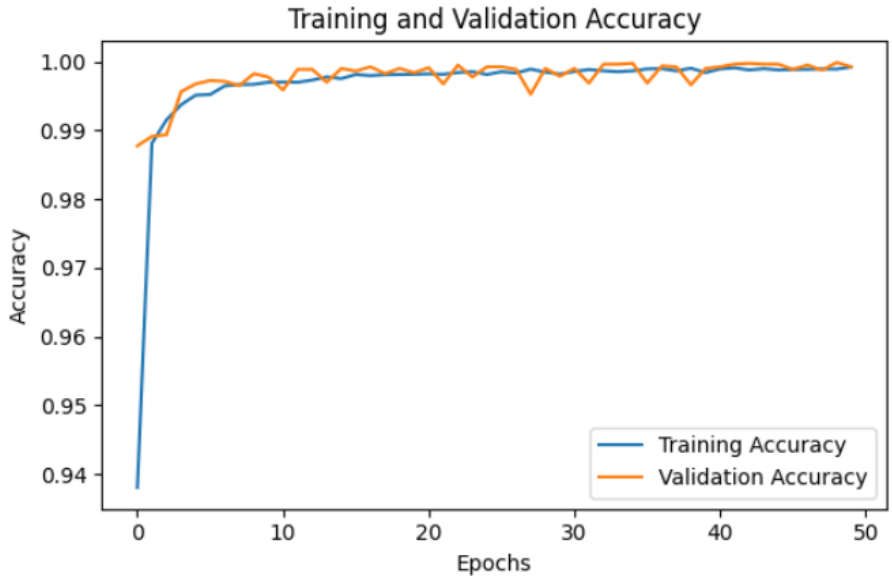
3. Results

The following metrics were recorded for the best-performing model:

Metric/Parameter	Value
Best Model - Validation Loss	0.0019
Best Model - Accuracy	0.9999

Best Hyperparameter	Value
Initializer	he_normal
Number of Units (Layer 1)	200
Activation (Layer 1)	relu
Number of Units (Layer 2)	50
Activation (Layer 2)	sigmoid
Optimizer	adam

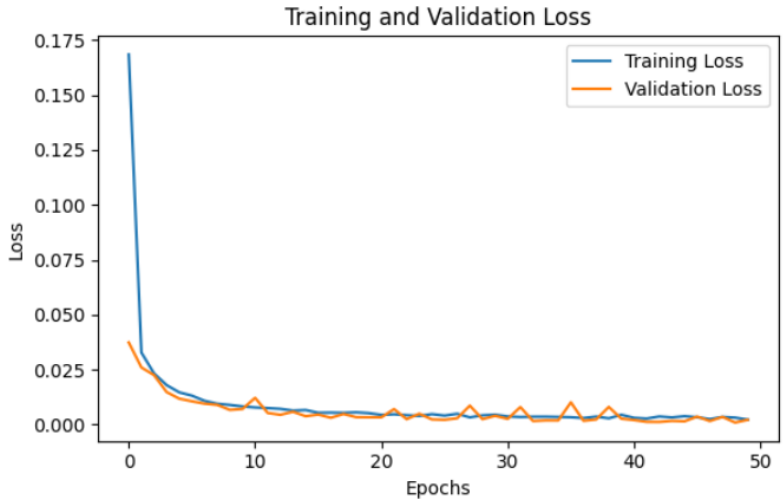
Training and Validation Accuracy Graph:



Insights:

- The training and validation accuracy are both high, indicating the model is learning well on the training data and generalizing well to the validation data.
- The accuracy stabilizes quickly, suggesting that the model has converged.
- The similar trends between training and validation accuracy imply that there's minimal overfitting.

Training and Validation Loss Graph:



Insights:

- Both training and validation loss decrease rapidly in the initial epochs, showing that the model is effectively minimizing error.
- The low and stable validation loss indicates good generalization to unseen data, as it stays close to the training loss.
- The loss does not fluctuate significantly after a certain point, suggesting a stable and well-trained model.

4. Conclusion

The model achieved high accuracy (0.9999) with minimal validation loss (0.0019), indicating excellent performance. The selected hyperparameters contributed significantly to optimizing model performance. This project demonstrates the potential of using hyperparameter tuning to enhance model accuracy and reliability.