Neural Network with TANH Activation – IMDB Sentiment Classification

Overview

This project implements a feedforward neural network for binary sentiment classification on the IMDB dataset. The model and experiments explore the effects of activation functions, hidden layers, loss functions, and regularization techniques.

Dataset and Preprocessing

• Dataset: Keras IMDB (25,000 train / 25,000 test samples)
• Input Representation: Multi-hot encoded vectors (10,000 features)
• Output Labels: 0 = negative, 1 = positive
• Validation Split: 10,000 samples

Model Configuration

• Hidden Layers: 2
• Units per Layer: 16
• Activation: Tanh
• Output Layer: Sigmoid
• Optimizer: RMSprop
• Loss Function: Binary Crossentropy
• Metric: Accuracy

Metric	Value
Best Validation Accuracy	0.8903
Test Accuracy	0.8859
Test Loss	0.2807

Configuration	Layers	Units	Loss	Regularization	Val Acc	Test Acc
1layer_16	1	16	BCE	None	0.888	0.886
3layer_16	3	16	BCE	None	0.880	0.860
2layer_32	2	32	BCE	None	0.890	0.880
2layer_mse	2	16	MSE	None	0.830	0.810
2layer_dropout	2	16	BCE	Dropout (0.5)	0.880	0.870
2layer_l2	2	16	BCE	L2 (0.001)	0.880	0.870

Key Insights

- Tanh activation provided consistent and smooth convergence.

- Using two layers with 32 units achieved the best overall performance.
- MSE loss degraded performance compared to binary Crossentropy.
- Dropout and L2 regularization slightly improved validation stability.
- Early stopping around epoch 3 prevents overfitting and maximizes test accuracy.

Final Performance

Test Accuracy: 0.8859
Best Epoch: 3

The model demonstrates that Tanh-based architectures can perform competitively on binary sentiment classification when combined with regularization and careful tuning.