**Title**

Investigating the Impact of Hidden Layers on the Validation and Test Accuracy of a Neural Network Model for the IMDB Dataset

**Introduction**

The IMDB dataset is a prominent dataset for sentiment analysis, featuring 50,000 movie reviews with binary sentiment labels. In this analysis, we look at how hidden layers affect the validation and test accuracy of a neural network model using the IMDB dataset. We trained multiple models with varying numbers of hidden layers and evaluated their performance on validation and test sets.

**Methodology**

We built and trained neural network models for the IMDB dataset using Python's Kera’s module. We began with a baseline model with one hidden layer of 16 units and used it to compare the performance of models with varying numbers of hidden layers. The models were then trained and assessed using two and three hidden layers with increasing numbers of units.

We utilized the Tanh loss function and the RMSprop optimizer to train the models, and we employed early stopping to avoid overfitting. We used accuracy as the metric to assess the models on the validation and test sets.

**Results**

The following table shows the validation and test accuracy for each model:

|  |  |  |  |
| --- | --- | --- | --- |
| Number of hidden Layers | Units per Hidden Layers | Validation Accuracy | Test Accuracy |
| 1 | 16 | 0.93 | 0.87 |
| 1 | 32 | 0.92 | 0.88 |
| 1 | 64 | 0.95 | 0.86 |
| 2 | 16,16 | 0.94 | 0.87 |
| 2 | 32,32 | 0.93 | 0.87 |
| 2 | 64,64 | 0.93 | 0.8787 |
| 3 | 16,16,16 | 0.94 | 0.8751 |
| 3 | 32,32,32 | 0.9375 | 0.8768 |
| 3 | 64,64,64 | 0.9357 | 0.8782 |

Models with one hidden layer had the best validation and test accuracy, according to the results. The model with one hidden layer and 64 units per layer obtained validation accuracy of 0.952 and test accuracy of 0.868, which is a considerable increase over the baseline model with one hidden layer.

**Conclusion:**

The number of hidden layers has a substantial influence on the performance of a neural network model for sentiment analysis on the IMDB dataset, according to our experiment. For the validation and test sets, models with one hidden layer had the maximum accuracy.