**Neural Networks Assignment Report**

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**Introduction**:

In this report, we will evaluate the performance of nine different neural network models on the IMDB dataset. The evaluation is based on their accuracy and loss values.

**Methodology:**

We trained and tested nine different neural network models on the IMDB dataset using various configurations. These configurations include a different number of hidden layers, different numbers of hidden units, different activation functions, and different loss functionsas follows.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **No. of models** | **Layers** | **Activation** | **Nodes** | **Optimizer** | **Loss Function** | **Loss** | **Accuracy** |
| 1 | 2 | Relu | 16 | rmsprop | Binary  Cross entropy | 0.3028 | 0.8856 |
| 2 | 1 | Tanh | 64 | rmsprop | MSE | 0.0847 | 0.8837 |
| 3 | 3 | Relu | 64 | rmsprop | Binary Cross entropy | 0.4290 | 0.8808 |
| 4 | 2 | Relu | 64 | rmsprop | Binary Cross entropy | 0.2964 | 0.8852 |
| 5 | 1 | Tanh | 32 | Adam | MSE | 0.0882 | 0.8787 |
| 6 | 2 | Relu | 16 | rmsprop | Binary Cross entropy | 0.2896 | 0.8871 |
| 7 | 2 | Relu | 16 | rmsprop | Binary Cross entropy | 0.2740 | 0.8885 |
| 8 | 2 | Relu | 16 | rmsprop | Binary Cross entropy | 0.3696 | 0.8860 |
| 9 | 2 | Tanh | 32 | rmsprop | MSE | 0.3143 | 0.8810 |

**Discussion:**

* As we can see from the table, the models have different levels of loss and accuracy. **Model 7** has the highest accuracy of **0.8885**, while Model 5 has the lowest accuracy of 0.8787. Model 2 has the lowest loss of 0.0847, while **Model 3** has the highest loss of **0.4290.**
* We can say that the best-performing model in terms of accuracy was Model 7. This model had two hidden layers, both with Relu activation, and 16 nodes per layer. It used the rmsprop optimizer and binary crossentropyropy loss function.
* Model 6 also performed well, with an accuracy of 0.8871, and was similar to Model 7, except that it used fewer nodes per layer (16 instead of 64).
* We also observed that using the **tanh activation** function generally resulted in lower accuracy than using **Relu**, as seen in Models 2 and 9. This may be due to the vanishing gradient problem and computational expense associated with the tanh function.
* Overall, our study highlights the importance of carefully selecting the architecture, activation functions, and hyperparameters of a neural network, as these choices can significantly impact the performance of the model on a given task.

**Conclusion:**

In conclusion, we have evaluated the performance of nine different neural network models trained on the IMDB dataset. The models were evaluated based on their loss and accuracy values. The results show that different configurations can lead to different levels of performance.