**Assignment 2**

**Neural Networks Assignment Report**

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Introduction: The goal of this project is to explore various techniques to improve the performance of a neural network model on the IMDb dataset. We will modify an existing neural network model and compare the results of different approaches such as changing the number of hidden layers, units, loss function, activation function, and regularization techniques such as dropout.

Dataset: We used the IMDb dataset, which contains movie reviews labeled as positive or negative. The dataset consists of 25,000 movie reviews for training and 25,000 for testing.

Approach: We started by loading the data and defining the maximum number of words to be considered in each review and the maximum length of each review. Then, we built a baseline neural network model with one hidden layer containing 16 units. We used binary\_crossentropy as the loss function and relu as the activation function for the hidden layer.

We then explored different approaches to improve the performance of the model. First, we experimented with the number of hidden layers by building models with one and three hidden layers. We trained and evaluated the models on the training and test datasets and compared the results. We found that using three hidden layers resulted in slightly higher validation and test accuracy compared to using one hidden layer.

Next, we tried using layers with more hidden units or fewer hidden units, specifically 32, 64, and 128 units. We trained and evaluated the models with different numbers of hidden units and plotted the validation accuracy for each model. We found that increasing the number of hidden units generally led to higher validation and test accuracy, but increasing the number of hidden units too much can lead to overfitting.

We then tried using the mse loss function instead of binary\_crossentropy. We trained and evaluated the model with mse loss and compared the results with the baseline model. We found that using mse loss did not significantly affect the performance of the model.

Conclusion: Finally, we tried using dropout regularization to prevent overfitting. We built a new model with dropout layers and trained and evaluated the model on the training and test datasets. We found that using dropout regularization led to a higher validation accuracy compared to the baseline model.It can be concluded that different variations of the neural network models have varying levels of accuracy and loss. The Model\_Hyper achieved the highest accuracy and loss, which suggests that the use of three thick layers with a dropout rate of 0.5 can result in optimal performance for the IMDB dataset. Using the MSE loss function resulted in the lowest loss value, compared to binary cross-entropy. The tanh activation function had a lower accuracy due to the vanishing gradient problem. The Adam optimizer function was found to be efficient for computing the model. Regularization reduced overfitting and resulted in smaller losses, with the L-2 model showing slightly better accuracy. Finally, the dropout technique reduced the loss function, but did not affect the accuracy. Based on the graph, we can see that the Model\_Hyper has the highest accuracy with a reasonably low loss. The Model\_MSE has the lowest loss value but is not as accurate as the Model\_Hyper. The Model\_tanh has a low accuracy compared to other models, and the model\_regularization has a high loss and low accuracy compared to the other models. Therefore, we can conclude that the Model\_Hyper is the best-performing model among the ones evaluated.