**IMDB Sentiment Classification: RNN vs ANN**

**Objective**

To implement and compare two different neural network architectures (RNN and ANN) for binary sentiment classification on the IMDB movie reviews dataset using TensorFlow and Keras.

**Dataset and Preprocessing**

* **Dataset**: IMDB reviews dataset (25,000 training and 25,000 testing samples).
* **Preprocessing**:
  + Used only the top 10,000 most frequent words.
  + Applied padding to ensure uniform input length.
  + Used maxlen = 467 (maximum review length) for padding.

A screen shot of a computer

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**Model 1: Recurrent Neural Network (RNN)**

**Architecture:**

* Embedding Layer
* LSTM Layer
* Dense Layer
* Output Layer

**Hyperparameter Tuning with Keras Tuner**

* Tuned: embedding\_dim, lstm\_units, dense\_units, learning\_rate

A screenshot of a computer program

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**Training:**

* Used early stopping
* Trained on 80% of training data, validated on 20%

**Performance:**

* Validation Accuracy: ~87%
* Observed some overfitting (validation loss increased mid-training)

**Model 2: Artificial Neural Network (ANN)**

**Architecture:**

* Embedding Layer
* GlobalAveragePooling1D
* Dense Layer
* Output Layer

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**Performance:**

* Validation Accuracy: ~89%
* Validation loss decreased smoothly — indicating better generalization

**Metrics Visualization:**

Base Model’s Visualization

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Fined-tuned model Visualization

A graph of a line

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ANN model Visualization

A graph of different colored lines

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**Model Comparison**

| **Metric** | **RNN Model** | **ANN Model** |
| --- | --- | --- |
| Validation Accuracy | ~87% | ~89% |
| Training Speed | Slower | Faster |
| Generalization | Moderate | Strong |

**Analysis & Insights**

* Despite being simpler, the ANN model outperformed the RNN.
* The IMDB dataset is relatively small and binary-labeled — sequence information might not be essential.
* RNNs are powerful but sensitive to overfitting and hyperparameter tuning.
* For basic sentiment classification tasks, FFNNs can be surprisingly strong baselines.

**Conclusion**

* RNNs may not always be the best choice for all NLP tasks, especially when the dataset is small and task is simple.
* ANN provided better generalization and stability with faster training.
* Hyperparameter tuning, early stopping, and model simplicity play a significant role in practical performance.

This exercise provided practical insight into model selection, tuning, and the importance of testing assumptions even in deep learning.