

# ASSIGNMENT 10 – ADVANCED DEEP LEARNING

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**Course:** Applied Data Science with AI

**Title:** Customer Churn Prediction

## Objective

The goal of this task was to apply an advanced deep learning technique (CNN/RNN) on the given dataset. However, since the dataset contains structured/tabular customer data instead of images or text, a deep neural network (Sequential model) was used as a best-fit alternative.

## Model Used

A Deep Neural Network was built using TensorFlow (Keras) with the following architecture:

Input → Dense(32, ReLU) → Dropout(0.3) → Dense(16, ReLU) → Dense(1, Sigmoid)

## Why CNN/RNN Were Not Used

- CNN is mainly suitable for image-based data.
- RNN is mainly used for sequential or time-series data.
- The dataset is tabular (numerical + categorical), so a Dense Neural Network was more appropriate and realistic.

## Results

After training for 20 epochs, the model achieved a good accuracy on the test data. The accuracy may vary depending on data split, scaling, and training parameters.

Epoch 1/20
<b>159/159</b> ————— <b>2s</b> 5ms/step - accuracy: 0.6954 - loss: 0.5747 - val accuracy: 0.8064 - val loss: 0.4264
Epoch 2/20

<b>159/159</b> _____ <b>1s</b> 4ms/step -
accuracy: 0.7761 - loss: 0.4580 - val accuracy: 0.8135 - val loss: 0.4126
Epoch 3/20
<b>159/159</b> _____ <b>1s</b> 4ms/step -
accuracy: 0.7933 - loss: 0.4328 - val accuracy: 0.8153 - val loss: 0.4080
Epoch 4/20
<b>159/159</b> _____ <b>1s</b> 4ms/step -
accuracy: 0.7957 - loss: 0.4331 - val accuracy: 0.8135 - val loss: 0.4028
Epoch 5/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.7881 - loss: 0.4368 - val accuracy: 0.8224 - val loss: 0.4017
Epoch 6/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8067 - loss: 0.4141 - val accuracy: 0.8224 - val loss: 0.3992
Epoch 7/20
<b>159/159</b> _____ <b>0s</b> 2ms/step -
accuracy: 0.7975 - loss: 0.4274 - val accuracy: 0.8224 - val loss: 0.3975
Epoch 8/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.7926 - loss: 0.4346 - val accuracy: 0.8224 - val loss: 0.3951
Epoch 9/20
<b>159/159</b> _____ <b>1s</b> 2ms/step -
accuracy: 0.8019 - loss: 0.4116 - val accuracy: 0.8259 - val loss: 0.3937
Epoch 10/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8052 - loss: 0.4269 - val accuracy: 0.8242 - val loss: 0.3920
Epoch 11/20
<b>159/159</b> _____ <b>1s</b> 3ms/step -
accuracy: 0.8133 - loss: 0.4027 - val accuracy: 0.8259 - val loss: 0.3930
Epoch 12/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8128 - loss: 0.4149 - val accuracy: 0.8242 - val loss: 0.3936
Epoch 13/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8081 - loss: 0.4154 - val accuracy: 0.8259 - val loss: 0.3922
Epoch 14/20

<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8147 - loss: 0.4048 - val accuracy: 0.8259 - val loss: 0.3904
Epoch 15/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8145 - loss: 0.4025 - val accuracy: 0.8277 - val loss: 0.3906
Epoch 16/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8120 - loss: 0.4088 - val accuracy: 0.8153 - val loss: 0.3952
Epoch 17/20
<b>159/159</b> _____ <b>0s</b> 2ms/step -
accuracy: 0.8065 - loss: 0.4170 - val accuracy: 0.8188 - val loss: 0.3931
Epoch 18/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8045 - loss: 0.4082 - val accuracy: 0.8224 - val loss: 0.3917
Epoch 19/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8128 - loss: 0.4140 - val accuracy: 0.8206 - val loss: 0.3925
Epoch 20/20
<b>159/159</b> _____ <b>0s</b> 3ms/step -
accuracy: 0.8141 - loss: 0.4132 - val accuracy: 0.8206 - val loss: 0.3928

**44/44** \_\_\_\_\_ **0s** 2ms/step - accuracy: **0.7829** - loss: **0.4302**

**Deep Learning Model Accuracy: 0.7924662232398987**

## Conclusion

This deep learning-based approach served as a specialized AI model for predictive analysis. Although traditional machine learning models like Random Forest performed slightly better in some cases, the neural network provided a strong baseline for deep learning applications on tabular data.

## GitHub Link

<https://github.com/amannadeem126/Customer-Churn-Prediction>