10/15/24, 3:30 PM Assignment7ml

In [1]:

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In [2]:

**import** math

**import** numpy **as** np

**import** pandas **as** pd

**import** tensorflow **as** tf

**import** matplotlib.pyplot **as** plt

**from** tensorflow.keras **import** Model

**from** tensorflow.keras **import** Sequential

**from** tensorflow.keras.optimizers **import** Adam

**from** sklearn.preprocessing **import** StandardScaler

**from** tensorflow.keras.layers **import** Dense, Dropout

**from** sklearn.model\_selection **import** train\_test\_split

**from** tensorflow.keras.losses **import** MeanSquaredLogarithmicError

In [3]:

df **=** np**.**loadtxt('https://raw.githubusercontent.com/jbrownlee/Datasets/master/pim

In [4]:

df

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Out[4]: | array([[ | 6. | , | 148. | , | 72. | , | ..., | 0.627, | 50. | , | 1. | ], |
|  | [ | 1. | , | 85. | , | 66. | , | ..., | 0.351, | 31. | , | 0. | ], |
|  | [ | 8. | , | 183. | , | 64. | , | ..., | 0.672, | 32. | , | 1. | ], |
| ..., | | | | | | | | | | | | | |
|  | [ | 5. | , | 121. | , | 72. | , | ..., | 0.245, | 30. | , | 0. | ], |
|  | [ | 1. | , | 126. | , | 60. | , | ..., | 0.349, | 47. | , | 1. | ], |
|  | [ | 1. | , | 93. | , | 70. | , | ..., | 0.315, | 23. | , | 0. | ]]) |
| In [5]: | df**.**shape |  |  |  |  |  |  |  |  |  |  |  |  |
| Out[5]: | (768, 9) |  |  |  |  |  |  |  |  |  |  |  |  |

In [6]:

x **=** df[:,:8]

y **=** df[:,8]

In [7]:

**from** sklearn.model\_selection **import** train\_test\_split

X\_train, X\_temp, y\_train, y\_temp **=** train\_test\_split(x, y, test\_size**=**0.2, random\_

X\_test, X\_val, y\_test, y\_val **=** train\_test\_split(X\_temp, y\_temp, test\_size**=**0.5, r

In [8]:

print(f"x train shape{X\_train**.**shape}") print(f"y train shape{y\_train**.**shape}") print(f"x test shape{X\_test**.**shape}")

print(f"y test shape{y\_test**.**shape}") print(f"x val shape{X\_val**.**shape}") print(f"y val shape{y\_val**.**shape}")

x train shape(614, 8) y train shape(614,)

x test shape(77, 8) y test shape(77,)

x val shape(77, 8) y val shape(77,)

In [9]:

**from** sklearn.preprocessing **import** StandardScaler scaler **=** StandardScaler()

X\_train **=** scaler**.**fit\_transform(X\_train)

10/15/24, 3:30 PM Assignment7ml

X\_test **=** scaler**.**transform(X\_test) X\_val **=** scaler**.**transform(X\_val)

In [10]:

**from** collections **import** Counter Counter(y)

Out[10]: Counter({1.0: 268, 0.0: 500})

In [11]:

**import** seaborn **as** sns

In [12]:

*# sns.countplot(y)*

In [13]:

**from** tensorflow.keras.models **import** Sequential

In [14]:

model **=** Sequential([

tf**.**keras**.**layers**.**InputLayer(8,), Dense(50,activation**=**'relu'),

Dense(50,activation**=**'relu'), Dense(50,activation**=**'relu'), Dense(50,activation**=**'relu'),

Dense(1,activation**=**'sigmoid')

])

2022-11-12 19:23:28.405404: I tensorflow/core/common\_runtime/process\_util.cc:146] Creating new thread pool with default inter op setting: 2. Tune using inter\_op\_pa rallelism\_threads for best performance.

In [15]:

model**.**summary()

Model: "sequential"

Layer (type) Output Shape Param #

=================================================================

|  |  |  |  |
| --- | --- | --- | --- |
| dense (Dense) | (None, | 50) | 450 |
| dense\_1 (Dense) | (None, | 50) | 2550 |
| dense\_2 (Dense) | (None, | 50) | 2550 |
| dense\_3 (Dense) | (None, | 50) | 2550 |
| dense\_4 (Dense) | (None, | 1) | 51 |

=================================================================

Total params: 8,151

Trainable params: 8,151

Non-trainable params: 0

In [16]:

opt **=** tf**.**keras**.**optimizers**.**Adam(learning\_rate**=**0.0001)

model**.**compile(loss**=**'binary\_crossentropy', optimizer**=**opt, metrics**=**['accuracy'])

In [17]:

history **=** model**.**fit(x**=**x,y**=**y,epochs**=**300, batch\_size**=**50,validation\_data**=**(X\_val,y\_v

2022-11-12 19:23:28.666100: I tensorflow/compiler/mlir/mlir\_graph\_optimization\_pa ss.cc:185] None of the MLIR Optimization Passes are enabled (registered 2)

10/15/24, 3:30 PM Assignment7ml

Epoch 1/300

16/16 [==============================] - 1s 20ms/step - loss: 4.3687 - accuracy:

0.6484 - val\_loss: 0.7085 - val\_accuracy: 0.3766 Epoch 2/300

16/16 [==============================] - 0s 5ms/step - loss: 1.8559 - accuracy: 0.5820 - val\_loss: 0.7094 - val\_accuracy: 0.4156

Epoch 3/300

16/16 [==============================] - 0s 5ms/step - loss: 0.9362 - accuracy: 0.4987 - val\_loss: 0.7087 - val\_accuracy: 0.4286

Epoch 4/300

16/16 [==============================] - 0s 5ms/step - loss: 0.7237 - accuracy: 0.6276 - val\_loss: 0.7089 - val\_accuracy: 0.4286

Epoch 5/300

16/16 [==============================] - 0s 6ms/step - loss: 0.6846 - accuracy: 0.6341 - val\_loss: 0.7092 - val\_accuracy: 0.4156

Epoch 6/300

16/16 [==============================] - 0s 5ms/step - loss: 0.6645 - accuracy: 0.6406 - val\_loss: 0.7088 - val\_accuracy: 0.4156

Epoch 7/300

16/16 [==============================] - 0s 5ms/step - loss: 0.6514 - accuracy: 0.6471 - val\_loss: 0.7083 - val\_accuracy: 0.4026

Epoch 8/300

16/16 [==============================] - 0s 5ms/step - loss: 0.6433 - accuracy: 0.6562 - val\_loss: 0.7080 - val\_accuracy: 0.4156

Epoch 9/300

16/16 [==============================] - 0s 5ms/step - loss: 0.6350 - accuracy: 0.6641 - val\_loss: 0.7077 - val\_accuracy: 0.4156

Epoch 10/300

16/16 [==============================] - 0s 5ms/step - loss: 0.6243 - accuracy: 0.6706 - val\_loss: 0.7072 - val\_accuracy: 0.4156

Epoch 11/300

16/16 [==============================] - 0s 5ms/step - loss: 0.6146 - accuracy: 0.6667 - val\_loss: 0.7070 - val\_accuracy: 0.3896

Epoch 12/300

16/16 [==============================] - 0s 5ms/step - loss: 0.6075 - accuracy: 0.6849 - val\_loss: 0.7066 - val\_accuracy: 0.3896

Epoch 13/300

16/16 [==============================] - 0s 5ms/step - loss: 0.6069 - accuracy: 0.6823 - val\_loss: 0.7061 - val\_accuracy: 0.4026

Epoch 14/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5973 - accuracy: 0.6888 - val\_loss: 0.7054 - val\_accuracy: 0.4026

Epoch 15/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5979 - accuracy: 0.6823 - val\_loss: 0.7049 - val\_accuracy: 0.4156

Epoch 16/300

16/16 [==============================] - 0s 5ms/step - loss: 0.6024 - accuracy: 0.6901 - val\_loss: 0.7043 - val\_accuracy: 0.4156

Epoch 17/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5915 - accuracy: 0.6927 - val\_loss: 0.7039 - val\_accuracy: 0.4156

Epoch 18/300

16/16 [==============================] - 0s 6ms/step - loss: 0.6017 - accuracy: 0.6797 - val\_loss: 0.7033 - val\_accuracy: 0.4416

Epoch 19/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5847 - accuracy: 0.6888 - val\_loss: 0.7029 - val\_accuracy: 0.4416

Epoch 20/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5832 - accuracy: 0.7044 - val\_loss: 0.7021 - val\_accuracy: 0.4675

10/15/24, 3:30 PM Assignment7ml

Epoch 21/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5780 - accuracy: 0.7070 - val\_loss: 0.7018 - val\_accuracy: 0.4675

Epoch 22/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5734 - accuracy: 0.7044 - val\_loss: 0.7014 - val\_accuracy: 0.4545

Epoch 23/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5774 - accuracy: 0.7109 - val\_loss: 0.7009 - val\_accuracy: 0.4675

Epoch 24/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5749 - accuracy: 0.7096 - val\_loss: 0.7004 - val\_accuracy: 0.4805

Epoch 25/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5749 - accuracy: 0.7122 - val\_loss: 0.7001 - val\_accuracy: 0.4935

Epoch 26/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5731 - accuracy: 0.7135 - val\_loss: 0.6995 - val\_accuracy: 0.5325

Epoch 27/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5646 - accuracy: 0.7331 - val\_loss: 0.6993 - val\_accuracy: 0.5195

Epoch 28/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5831 - accuracy: 0.6979 - val\_loss: 0.6987 - val\_accuracy: 0.5195

Epoch 29/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5697 - accuracy: 0.7005 - val\_loss: 0.6983 - val\_accuracy: 0.5195

Epoch 30/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5623 - accuracy: 0.7292 - val\_loss: 0.6980 - val\_accuracy: 0.5195

Epoch 31/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5587 - accuracy: 0.7109 - val\_loss: 0.6975 - val\_accuracy: 0.5065

Epoch 32/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5611 - accuracy: 0.7174 - val\_loss: 0.6971 - val\_accuracy: 0.5065

Epoch 33/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5619 - accuracy: 0.7227 - val\_loss: 0.6967 - val\_accuracy: 0.4935

Epoch 34/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5540 - accuracy: 0.7357 - val\_loss: 0.6963 - val\_accuracy: 0.5065

Epoch 35/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5552 - accuracy: 0.7214 - val\_loss: 0.6960 - val\_accuracy: 0.4935

Epoch 36/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5528 - accuracy: 0.7279 - val\_loss: 0.6955 - val\_accuracy: 0.5065

Epoch 37/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5540 - accuracy: 0.7174 - val\_loss: 0.6952 - val\_accuracy: 0.5065

Epoch 38/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5522 - accuracy: 0.7357 - val\_loss: 0.6950 - val\_accuracy: 0.4805

Epoch 39/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5536 - accuracy: 0.7214 - val\_loss: 0.6945 - val\_accuracy: 0.4675

Epoch 40/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5521 - accuracy: 0.7266 - val\_loss: 0.6941 - val\_accuracy: 0.4675

10/15/24, 3:30 PM Assignment7ml

Epoch 41/300

16/16 [==============================] - 0s 7ms/step - loss: 0.5580 - accuracy: 0.7201 - val\_loss: 0.6935 - val\_accuracy: 0.4675

Epoch 42/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5480 - accuracy: 0.7331 - val\_loss: 0.6930 - val\_accuracy: 0.4675

Epoch 43/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5494 - accuracy: 0.7214 - val\_loss: 0.6927 - val\_accuracy: 0.5065

Epoch 44/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5573 - accuracy: 0.7227 - val\_loss: 0.6923 - val\_accuracy: 0.4935

Epoch 45/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5440 - accuracy: 0.7318 - val\_loss: 0.6919 - val\_accuracy: 0.5065

Epoch 46/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5462 - accuracy: 0.7135 - val\_loss: 0.6917 - val\_accuracy: 0.5065

Epoch 47/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5392 - accuracy: 0.7292 - val\_loss: 0.6909 - val\_accuracy: 0.5325

Epoch 48/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5374 - accuracy: 0.7344 - val\_loss: 0.6908 - val\_accuracy: 0.5325

Epoch 49/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5382 - accuracy: 0.7266 - val\_loss: 0.6904 - val\_accuracy: 0.5455

Epoch 50/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5440 - accuracy: 0.7279 - val\_loss: 0.6902 - val\_accuracy: 0.5455

Epoch 51/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5350 - accuracy: 0.7305 - val\_loss: 0.6898 - val\_accuracy: 0.5455

Epoch 52/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5325 - accuracy: 0.7344 - val\_loss: 0.6893 - val\_accuracy: 0.5455

Epoch 53/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5316 - accuracy: 0.7318 - val\_loss: 0.6887 - val\_accuracy: 0.5455

Epoch 54/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5328 - accuracy: 0.7487 - val\_loss: 0.6885 - val\_accuracy: 0.5584

Epoch 55/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5327 - accuracy: 0.7305 - val\_loss: 0.6882 - val\_accuracy: 0.5584

Epoch 56/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5335 - accuracy: 0.7422 - val\_loss: 0.6879 - val\_accuracy: 0.5584

Epoch 57/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5343 - accuracy: 0.7331 - val\_loss: 0.6875 - val\_accuracy: 0.5584

Epoch 58/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5298 - accuracy: 0.7370 - val\_loss: 0.6869 - val\_accuracy: 0.5714

Epoch 59/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5294 - accuracy: 0.7409 - val\_loss: 0.6862 - val\_accuracy: 0.5584

Epoch 60/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5323 - accuracy: 0.7461 - val\_loss: 0.6859 - val\_accuracy: 0.5714

10/15/24, 3:30 PM Assignment7ml

Epoch 61/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5301 - accuracy: 0.7383 - val\_loss: 0.6855 - val\_accuracy: 0.5714

Epoch 62/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5381 - accuracy: 0.7318 - val\_loss: 0.6852 - val\_accuracy: 0.5714

Epoch 63/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5295 - accuracy: 0.7370 - val\_loss: 0.6850 - val\_accuracy: 0.5714

Epoch 64/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5247 - accuracy: 0.7344 - val\_loss: 0.6847 - val\_accuracy: 0.5714

Epoch 65/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5213 - accuracy: 0.7448 - val\_loss: 0.6844 - val\_accuracy: 0.5584

Epoch 66/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5219 - accuracy: 0.7461 - val\_loss: 0.6840 - val\_accuracy: 0.5584

Epoch 67/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5246 - accuracy: 0.7422 - val\_loss: 0.6836 - val\_accuracy: 0.5584

Epoch 68/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5222 - accuracy: 0.7396 - val\_loss: 0.6832 - val\_accuracy: 0.5584

Epoch 69/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5229 - accuracy: 0.7396 - val\_loss: 0.6830 - val\_accuracy: 0.5584

Epoch 70/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5212 - accuracy: 0.7383 - val\_loss: 0.6825 - val\_accuracy: 0.5584

Epoch 71/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5177 - accuracy: 0.7422 - val\_loss: 0.6824 - val\_accuracy: 0.5584

Epoch 72/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5214 - accuracy: 0.7383 - val\_loss: 0.6822 - val\_accuracy: 0.5195

Epoch 73/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5248 - accuracy: 0.7344 - val\_loss: 0.6817 - val\_accuracy: 0.5065

Epoch 74/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5227 - accuracy: 0.7396 - val\_loss: 0.6814 - val\_accuracy: 0.5195

Epoch 75/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5220 - accuracy: 0.7240 - val\_loss: 0.6810 - val\_accuracy: 0.5065

Epoch 76/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5191 - accuracy: 0.7383 - val\_loss: 0.6804 - val\_accuracy: 0.5325

Epoch 77/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5221 - accuracy: 0.7318 - val\_loss: 0.6804 - val\_accuracy: 0.5325

Epoch 78/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5211 - accuracy: 0.7344 - val\_loss: 0.6802 - val\_accuracy: 0.5325

Epoch 79/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5251 - accuracy: 0.7279 - val\_loss: 0.6798 - val\_accuracy: 0.5325

Epoch 80/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5234 - accuracy: 0.7344 - val\_loss: 0.6795 - val\_accuracy: 0.5325

10/15/24, 3:30 PM Assignment7ml

Epoch 81/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5118 - accuracy: 0.7526 - val\_loss: 0.6792 - val\_accuracy: 0.5584

Epoch 82/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5099 - accuracy: 0.7565 - val\_loss: 0.6788 - val\_accuracy: 0.5584

Epoch 83/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5155 - accuracy: 0.7344 - val\_loss: 0.6785 - val\_accuracy: 0.5584

Epoch 84/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5088 - accuracy: 0.7448 - val\_loss: 0.6783 - val\_accuracy: 0.5714

Epoch 85/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5140 - accuracy: 0.7448 - val\_loss: 0.6779 - val\_accuracy: 0.5844

Epoch 86/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5303 - accuracy: 0.7227 - val\_loss: 0.6779 - val\_accuracy: 0.5844

Epoch 87/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5261 - accuracy: 0.7370 - val\_loss: 0.6775 - val\_accuracy: 0.5844

Epoch 88/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5108 - accuracy: 0.7357 - val\_loss: 0.6771 - val\_accuracy: 0.5844

Epoch 89/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5140 - accuracy: 0.7422 - val\_loss: 0.6769 - val\_accuracy: 0.5844

Epoch 90/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5082 - accuracy: 0.7357 - val\_loss: 0.6768 - val\_accuracy: 0.5844

Epoch 91/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5083 - accuracy: 0.7552 - val\_loss: 0.6766 - val\_accuracy: 0.5844

Epoch 92/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5105 - accuracy: 0.7344 - val\_loss: 0.6764 - val\_accuracy: 0.5844

Epoch 93/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5057 - accuracy: 0.7487 - val\_loss: 0.6762 - val\_accuracy: 0.5974

Epoch 94/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5112 - accuracy: 0.7370 - val\_loss: 0.6760 - val\_accuracy: 0.5974

Epoch 95/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5042 - accuracy: 0.7487 - val\_loss: 0.6758 - val\_accuracy: 0.5974

Epoch 96/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5055 - accuracy: 0.7461 - val\_loss: 0.6754 - val\_accuracy: 0.5974

Epoch 97/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5065 - accuracy: 0.7474 - val\_loss: 0.6752 - val\_accuracy: 0.5974

Epoch 98/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5075 - accuracy: 0.7474 - val\_loss: 0.6752 - val\_accuracy: 0.5974

Epoch 99/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5053 - accuracy: 0.7461 - val\_loss: 0.6750 - val\_accuracy: 0.5974

Epoch 100/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5002 - accuracy: 0.7474 - val\_loss: 0.6749 - val\_accuracy: 0.5974

10/15/24, 3:30 PM Assignment7ml

Epoch 101/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5015 - accuracy: 0.7669 - val\_loss: 0.6749 - val\_accuracy: 0.6104

Epoch 102/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5127 - accuracy: 0.7435 - val\_loss: 0.6748 - val\_accuracy: 0.6104

Epoch 103/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5332 - accuracy: 0.7266 - val\_loss: 0.6744 - val\_accuracy: 0.6104

Epoch 104/300

16/16 [==============================] - 0s 6ms/step - loss: 0.5029 - accuracy: 0.7578 - val\_loss: 0.6742 - val\_accuracy: 0.6104

Epoch 105/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5004 - accuracy: 0.7695 - val\_loss: 0.6742 - val\_accuracy: 0.6104

Epoch 106/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5040 - accuracy: 0.7461 - val\_loss: 0.6738 - val\_accuracy: 0.6104

Epoch 107/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4965 - accuracy: 0.7604 - val\_loss: 0.6737 - val\_accuracy: 0.6104

Epoch 108/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5004 - accuracy: 0.7513 - val\_loss: 0.6737 - val\_accuracy: 0.6104

Epoch 109/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5205 - accuracy: 0.7331 - val\_loss: 0.6735 - val\_accuracy: 0.6104

Epoch 110/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5035 - accuracy: 0.7513 - val\_loss: 0.6731 - val\_accuracy: 0.6104

Epoch 111/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5064 - accuracy: 0.7565 - val\_loss: 0.6735 - val\_accuracy: 0.6104

Epoch 112/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5020 - accuracy: 0.7448 - val\_loss: 0.6737 - val\_accuracy: 0.6104

Epoch 113/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5225 - accuracy: 0.7292 - val\_loss: 0.6727 - val\_accuracy: 0.6104

Epoch 114/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5040 - accuracy: 0.7357 - val\_loss: 0.6725 - val\_accuracy: 0.6104

Epoch 115/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4999 - accuracy: 0.7422 - val\_loss: 0.6728 - val\_accuracy: 0.6104

Epoch 116/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4982 - accuracy: 0.7487 - val\_loss: 0.6727 - val\_accuracy: 0.6104

Epoch 117/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5224 - accuracy: 0.7292 - val\_loss: 0.6725 - val\_accuracy: 0.6104

Epoch 118/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5021 - accuracy: 0.7474 - val\_loss: 0.6723 - val\_accuracy: 0.6104

Epoch 119/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4913 - accuracy: 0.7643 - val\_loss: 0.6724 - val\_accuracy: 0.6104

Epoch 120/300

16/16 [==============================] - 0s 7ms/step - loss: 0.4949 - accuracy: 0.7552 - val\_loss: 0.6719 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

Epoch 121/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4995 - accuracy: 0.7461 - val\_loss: 0.6718 - val\_accuracy: 0.6104

Epoch 122/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4984 - accuracy: 0.7539 - val\_loss: 0.6721 - val\_accuracy: 0.6104

Epoch 123/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4979 - accuracy: 0.7539 - val\_loss: 0.6720 - val\_accuracy: 0.6104

Epoch 124/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4959 - accuracy: 0.7513 - val\_loss: 0.6719 - val\_accuracy: 0.6104

Epoch 125/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4918 - accuracy: 0.7565 - val\_loss: 0.6718 - val\_accuracy: 0.6104

Epoch 126/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4905 - accuracy: 0.7565 - val\_loss: 0.6716 - val\_accuracy: 0.6104

Epoch 127/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4877 - accuracy: 0.7578 - val\_loss: 0.6717 - val\_accuracy: 0.6104

Epoch 128/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4849 - accuracy: 0.7474 - val\_loss: 0.6720 - val\_accuracy: 0.6104

Epoch 129/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4938 - accuracy: 0.7526 - val\_loss: 0.6717 - val\_accuracy: 0.6104

Epoch 130/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4926 - accuracy: 0.7539 - val\_loss: 0.6713 - val\_accuracy: 0.6104

Epoch 131/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4905 - accuracy: 0.7604 - val\_loss: 0.6712 - val\_accuracy: 0.6104

Epoch 132/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4948 - accuracy: 0.7591 - val\_loss: 0.6712 - val\_accuracy: 0.6104

Epoch 133/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5104 - accuracy: 0.7461 - val\_loss: 0.6713 - val\_accuracy: 0.6104

Epoch 134/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4953 - accuracy: 0.7604 - val\_loss: 0.6716 - val\_accuracy: 0.6104

Epoch 135/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4909 - accuracy: 0.7552 - val\_loss: 0.6714 - val\_accuracy: 0.6104

Epoch 136/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4898 - accuracy: 0.7552 - val\_loss: 0.6711 - val\_accuracy: 0.6104

Epoch 137/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4850 - accuracy: 0.7448 - val\_loss: 0.6715 - val\_accuracy: 0.6104

Epoch 138/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4857 - accuracy: 0.7669 - val\_loss: 0.6713 - val\_accuracy: 0.6104

Epoch 139/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4868 - accuracy: 0.7578 - val\_loss: 0.6715 - val\_accuracy: 0.6104

Epoch 140/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4922 - accuracy: 0.7578 - val\_loss: 0.6714 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

Epoch 141/300

16/16 [==============================] - 0s 5ms/step - loss: 0.5093 - accuracy: 0.7266 - val\_loss: 0.6715 - val\_accuracy: 0.6104

Epoch 142/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4896 - accuracy: 0.7604 - val\_loss: 0.6708 - val\_accuracy: 0.6104

Epoch 143/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4852 - accuracy: 0.7656 - val\_loss: 0.6712 - val\_accuracy: 0.6104

Epoch 144/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4792 - accuracy: 0.7682 - val\_loss: 0.6710 - val\_accuracy: 0.6104

Epoch 145/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4849 - accuracy: 0.7721 - val\_loss: 0.6708 - val\_accuracy: 0.6104

Epoch 146/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4989 - accuracy: 0.7500 - val\_loss: 0.6714 - val\_accuracy: 0.6104

Epoch 147/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4814 - accuracy: 0.7604 - val\_loss: 0.6712 - val\_accuracy: 0.6104

Epoch 148/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4816 - accuracy: 0.7773 - val\_loss: 0.6708 - val\_accuracy: 0.6104

Epoch 149/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4989 - accuracy: 0.7474 - val\_loss: 0.6716 - val\_accuracy: 0.6104

Epoch 150/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4812 - accuracy: 0.7799 - val\_loss: 0.6715 - val\_accuracy: 0.6104

Epoch 151/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4786 - accuracy: 0.7695 - val\_loss: 0.6714 - val\_accuracy: 0.6104

Epoch 152/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4904 - accuracy: 0.7656 - val\_loss: 0.6720 - val\_accuracy: 0.6104

Epoch 153/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4902 - accuracy: 0.7526 - val\_loss: 0.6713 - val\_accuracy: 0.6104

Epoch 154/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4916 - accuracy: 0.7604 - val\_loss: 0.6716 - val\_accuracy: 0.6104

Epoch 155/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4977 - accuracy: 0.7539 - val\_loss: 0.6713 - val\_accuracy: 0.6104

Epoch 156/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4892 - accuracy: 0.7565 - val\_loss: 0.6711 - val\_accuracy: 0.6104

Epoch 157/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4901 - accuracy: 0.7487 - val\_loss: 0.6713 - val\_accuracy: 0.6104

Epoch 158/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4845 - accuracy: 0.7552 - val\_loss: 0.6714 - val\_accuracy: 0.6104

Epoch 159/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4788 - accuracy: 0.7630 - val\_loss: 0.6714 - val\_accuracy: 0.6104

Epoch 160/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4835 - accuracy: 0.7630 - val\_loss: 0.6719 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

Epoch 161/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4739 - accuracy: 0.7747 - val\_loss: 0.6723 - val\_accuracy: 0.6104

Epoch 162/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4763 - accuracy: 0.7773 - val\_loss: 0.6721 - val\_accuracy: 0.6104

Epoch 163/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4768 - accuracy: 0.7760 - val\_loss: 0.6720 - val\_accuracy: 0.6104

Epoch 164/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4856 - accuracy: 0.7409 - val\_loss: 0.6719 - val\_accuracy: 0.6104

Epoch 165/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4732 - accuracy: 0.7799 - val\_loss: 0.6720 - val\_accuracy: 0.6104

Epoch 166/300

16/16 [==============================] - 0s 7ms/step - loss: 0.4775 - accuracy: 0.7656 - val\_loss: 0.6721 - val\_accuracy: 0.6104

Epoch 167/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4764 - accuracy: 0.7682 - val\_loss: 0.6729 - val\_accuracy: 0.6104

Epoch 168/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4789 - accuracy: 0.7578 - val\_loss: 0.6719 - val\_accuracy: 0.6104

Epoch 169/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4775 - accuracy: 0.7734 - val\_loss: 0.6726 - val\_accuracy: 0.6104

Epoch 170/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4844 - accuracy: 0.7578 - val\_loss: 0.6730 - val\_accuracy: 0.6104

Epoch 171/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4750 - accuracy: 0.7786 - val\_loss: 0.6728 - val\_accuracy: 0.6104

Epoch 172/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4692 - accuracy: 0.7878 - val\_loss: 0.6727 - val\_accuracy: 0.6104

Epoch 173/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4776 - accuracy: 0.7526 - val\_loss: 0.6728 - val\_accuracy: 0.6104

Epoch 174/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4720 - accuracy: 0.7812 - val\_loss: 0.6736 - val\_accuracy: 0.6104

Epoch 175/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4859 - accuracy: 0.7721 - val\_loss: 0.6734 - val\_accuracy: 0.6104

Epoch 176/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4762 - accuracy: 0.7591 - val\_loss: 0.6730 - val\_accuracy: 0.6104

Epoch 177/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4756 - accuracy: 0.7682 - val\_loss: 0.6730 - val\_accuracy: 0.6104

Epoch 178/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4699 - accuracy: 0.7799 - val\_loss: 0.6738 - val\_accuracy: 0.6104

Epoch 179/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4687 - accuracy: 0.7721 - val\_loss: 0.6737 - val\_accuracy: 0.6104

Epoch 180/300

16/16 [==============================] - 0s 9ms/step - loss: 0.4667 - accuracy: 0.7773 - val\_loss: 0.6740 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

Epoch 181/300

16/16 [==============================] - 0s 9ms/step - loss: 0.4745 - accuracy: 0.7799 - val\_loss: 0.6742 - val\_accuracy: 0.6104

Epoch 182/300

16/16 [==============================] - 0s 7ms/step - loss: 0.4704 - accuracy: 0.7721 - val\_loss: 0.6742 - val\_accuracy: 0.6104

Epoch 183/300

16/16 [==============================] - 0s 13ms/step - loss: 0.4688 - accuracy:

0.7839 - val\_loss: 0.6747 - val\_accuracy: 0.6104 Epoch 184/300

16/16 [==============================] - 0s 10ms/step - loss: 0.4740 - accuracy:

0.7721 - val\_loss: 0.6749 - val\_accuracy: 0.6104 Epoch 185/300

16/16 [==============================] - 0s 11ms/step - loss: 0.4693 - accuracy:

0.7643 - val\_loss: 0.6750 - val\_accuracy: 0.6104 Epoch 186/300

16/16 [==============================] - 0s 8ms/step - loss: 0.4661 - accuracy: 0.7786 - val\_loss: 0.6749 - val\_accuracy: 0.6104

Epoch 187/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4753 - accuracy: 0.7773 - val\_loss: 0.6752 - val\_accuracy: 0.6104

Epoch 188/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4650 - accuracy: 0.7839 - val\_loss: 0.6751 - val\_accuracy: 0.6104

Epoch 189/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4732 - accuracy: 0.7682 - val\_loss: 0.6748 - val\_accuracy: 0.6104

Epoch 190/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4701 - accuracy: 0.7812 - val\_loss: 0.6753 - val\_accuracy: 0.6104

Epoch 191/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4676 - accuracy: 0.7773 - val\_loss: 0.6754 - val\_accuracy: 0.6104

Epoch 192/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4631 - accuracy: 0.7865 - val\_loss: 0.6756 - val\_accuracy: 0.6104

Epoch 193/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4631 - accuracy: 0.7773 - val\_loss: 0.6761 - val\_accuracy: 0.6104

Epoch 194/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4677 - accuracy: 0.7760 - val\_loss: 0.6765 - val\_accuracy: 0.6104

Epoch 195/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4657 - accuracy: 0.7773 - val\_loss: 0.6766 - val\_accuracy: 0.6104

Epoch 196/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4643 - accuracy: 0.7839 - val\_loss: 0.6761 - val\_accuracy: 0.6104

Epoch 197/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4670 - accuracy: 0.7799 - val\_loss: 0.6765 - val\_accuracy: 0.6104

Epoch 198/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4740 - accuracy: 0.7682 - val\_loss: 0.6771 - val\_accuracy: 0.6104

Epoch 199/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4729 - accuracy: 0.7630 - val\_loss: 0.6774 - val\_accuracy: 0.6104

Epoch 200/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4656 - accuracy: 0.7917 - val\_loss: 0.6779 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

Epoch 201/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4694 - accuracy: 0.7839 - val\_loss: 0.6778 - val\_accuracy: 0.6104

Epoch 202/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4601 - accuracy: 0.7917 - val\_loss: 0.6774 - val\_accuracy: 0.6104

Epoch 203/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4621 - accuracy: 0.7799 - val\_loss: 0.6773 - val\_accuracy: 0.6104

Epoch 204/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4953 - accuracy: 0.7734 - val\_loss: 0.6789 - val\_accuracy: 0.6104

Epoch 205/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4812 - accuracy: 0.7500 - val\_loss: 0.6793 - val\_accuracy: 0.6104

Epoch 206/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4736 - accuracy: 0.7643 - val\_loss: 0.6792 - val\_accuracy: 0.6104

Epoch 207/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4730 - accuracy: 0.7578 - val\_loss: 0.6783 - val\_accuracy: 0.6104

Epoch 208/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4666 - accuracy: 0.7734 - val\_loss: 0.6786 - val\_accuracy: 0.6104

Epoch 209/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4659 - accuracy: 0.7773 - val\_loss: 0.6783 - val\_accuracy: 0.6104

Epoch 210/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4854 - accuracy: 0.7734 - val\_loss: 0.6793 - val\_accuracy: 0.6104

Epoch 211/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4732 - accuracy: 0.7669 - val\_loss: 0.6795 - val\_accuracy: 0.6104

Epoch 212/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4569 - accuracy: 0.7852 - val\_loss: 0.6808 - val\_accuracy: 0.6104

Epoch 213/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4636 - accuracy: 0.7682 - val\_loss: 0.6803 - val\_accuracy: 0.6104

Epoch 214/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4551 - accuracy: 0.7878 - val\_loss: 0.6814 - val\_accuracy: 0.6104

Epoch 215/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4691 - accuracy: 0.7630 - val\_loss: 0.6807 - val\_accuracy: 0.6104

Epoch 216/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4593 - accuracy: 0.7891 - val\_loss: 0.6821 - val\_accuracy: 0.6104

Epoch 217/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4693 - accuracy: 0.7708 - val\_loss: 0.6820 - val\_accuracy: 0.6104

Epoch 218/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4620 - accuracy: 0.7812 - val\_loss: 0.6822 - val\_accuracy: 0.6104

Epoch 219/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4572 - accuracy: 0.7917 - val\_loss: 0.6819 - val\_accuracy: 0.6104

Epoch 220/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4532 - accuracy: 0.7839 - val\_loss: 0.6822 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

Epoch 221/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4633 - accuracy: 0.7760 - val\_loss: 0.6825 - val\_accuracy: 0.6104

Epoch 222/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4660 - accuracy: 0.7656 - val\_loss: 0.6828 - val\_accuracy: 0.6104

Epoch 223/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4581 - accuracy: 0.7917 - val\_loss: 0.6832 - val\_accuracy: 0.6104

Epoch 224/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4714 - accuracy: 0.7604 - val\_loss: 0.6846 - val\_accuracy: 0.6104

Epoch 225/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4729 - accuracy: 0.7812 - val\_loss: 0.6840 - val\_accuracy: 0.6104

Epoch 226/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4743 - accuracy: 0.7539 - val\_loss: 0.6838 - val\_accuracy: 0.6104

Epoch 227/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4545 - accuracy: 0.7891 - val\_loss: 0.6840 - val\_accuracy: 0.6104

Epoch 228/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4543 - accuracy: 0.7852 - val\_loss: 0.6843 - val\_accuracy: 0.6104

Epoch 229/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4583 - accuracy: 0.7773 - val\_loss: 0.6844 - val\_accuracy: 0.6104

Epoch 230/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4592 - accuracy: 0.7839 - val\_loss: 0.6847 - val\_accuracy: 0.6104

Epoch 231/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4551 - accuracy: 0.7773 - val\_loss: 0.6855 - val\_accuracy: 0.6104

Epoch 232/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4560 - accuracy: 0.7773 - val\_loss: 0.6855 - val\_accuracy: 0.6104

Epoch 233/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4536 - accuracy: 0.7839 - val\_loss: 0.6862 - val\_accuracy: 0.6104

Epoch 234/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4556 - accuracy: 0.7826 - val\_loss: 0.6859 - val\_accuracy: 0.6104

Epoch 235/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4556 - accuracy: 0.7826 - val\_loss: 0.6872 - val\_accuracy: 0.6104

Epoch 236/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4600 - accuracy: 0.7865 - val\_loss: 0.6871 - val\_accuracy: 0.6104

Epoch 237/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4797 - accuracy: 0.7643 - val\_loss: 0.6866 - val\_accuracy: 0.6104

Epoch 238/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4932 - accuracy: 0.7604 - val\_loss: 0.6869 - val\_accuracy: 0.6104

Epoch 239/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4672 - accuracy: 0.7526 - val\_loss: 0.6863 - val\_accuracy: 0.6104

Epoch 240/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4571 - accuracy: 0.7812 - val\_loss: 0.6872 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

Epoch 241/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4634 - accuracy: 0.7852 - val\_loss: 0.6871 - val\_accuracy: 0.6104

Epoch 242/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4604 - accuracy: 0.7786 - val\_loss: 0.6880 - val\_accuracy: 0.6104

Epoch 243/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4553 - accuracy: 0.7865 - val\_loss: 0.6890 - val\_accuracy: 0.6104

Epoch 244/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4496 - accuracy: 0.7917 - val\_loss: 0.6888 - val\_accuracy: 0.6104

Epoch 245/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4519 - accuracy: 0.7943 - val\_loss: 0.6892 - val\_accuracy: 0.6104

Epoch 246/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4544 - accuracy: 0.7878 - val\_loss: 0.6896 - val\_accuracy: 0.6104

Epoch 247/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4483 - accuracy: 0.7799 - val\_loss: 0.6896 - val\_accuracy: 0.6104

Epoch 248/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4475 - accuracy: 0.7943 - val\_loss: 0.6904 - val\_accuracy: 0.6104

Epoch 249/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4480 - accuracy: 0.7865 - val\_loss: 0.6902 - val\_accuracy: 0.6104

Epoch 250/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4490 - accuracy: 0.7799 - val\_loss: 0.6917 - val\_accuracy: 0.6104

Epoch 251/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4492 - accuracy: 0.7891 - val\_loss: 0.6909 - val\_accuracy: 0.6104

Epoch 252/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4504 - accuracy: 0.7839 - val\_loss: 0.6914 - val\_accuracy: 0.6104

Epoch 253/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4475 - accuracy: 0.7917 - val\_loss: 0.6918 - val\_accuracy: 0.6104

Epoch 254/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4455 - accuracy: 0.7878 - val\_loss: 0.6923 - val\_accuracy: 0.6104

Epoch 255/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4424 - accuracy: 0.7956 - val\_loss: 0.6928 - val\_accuracy: 0.6104

Epoch 256/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4460 - accuracy: 0.7917 - val\_loss: 0.6935 - val\_accuracy: 0.6104

Epoch 257/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4498 - accuracy: 0.7891 - val\_loss: 0.6942 - val\_accuracy: 0.6104

Epoch 258/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4475 - accuracy: 0.7865 - val\_loss: 0.6938 - val\_accuracy: 0.6104

Epoch 259/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4502 - accuracy: 0.7826 - val\_loss: 0.6942 - val\_accuracy: 0.6104

Epoch 260/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4509 - accuracy: 0.7773 - val\_loss: 0.6949 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

Epoch 261/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4492 - accuracy: 0.7904 - val\_loss: 0.6956 - val\_accuracy: 0.6104

Epoch 262/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4499 - accuracy: 0.7826 - val\_loss: 0.6963 - val\_accuracy: 0.6104

Epoch 263/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4478 - accuracy: 0.7799 - val\_loss: 0.6959 - val\_accuracy: 0.6104

Epoch 264/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4477 - accuracy: 0.7799 - val\_loss: 0.6970 - val\_accuracy: 0.6104

Epoch 265/300

16/16 [==============================] - 0s 6ms/step - loss: 0.4424 - accuracy: 0.7865 - val\_loss: 0.6968 - val\_accuracy: 0.6104

Epoch 266/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4418 - accuracy: 0.7982 - val\_loss: 0.6969 - val\_accuracy: 0.6104

Epoch 267/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4399 - accuracy: 0.7969 - val\_loss: 0.6972 - val\_accuracy: 0.6104

Epoch 268/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4466 - accuracy: 0.7826 - val\_loss: 0.6974 - val\_accuracy: 0.6104

Epoch 269/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4447 - accuracy: 0.7904 - val\_loss: 0.6990 - val\_accuracy: 0.6104

Epoch 270/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4476 - accuracy: 0.7878 - val\_loss: 0.6991 - val\_accuracy: 0.6104

Epoch 271/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4442 - accuracy: 0.7904 - val\_loss: 0.6997 - val\_accuracy: 0.6104

Epoch 272/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4400 - accuracy: 0.7956 - val\_loss: 0.6999 - val\_accuracy: 0.6104

Epoch 273/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4436 - accuracy: 0.7865 - val\_loss: 0.7003 - val\_accuracy: 0.6104

Epoch 274/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4437 - accuracy: 0.8021 - val\_loss: 0.7012 - val\_accuracy: 0.6104

Epoch 275/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4388 - accuracy: 0.8034 - val\_loss: 0.7021 - val\_accuracy: 0.6104

Epoch 276/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4472 - accuracy: 0.7721 - val\_loss: 0.7025 - val\_accuracy: 0.6104

Epoch 277/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4388 - accuracy: 0.7865 - val\_loss: 0.7020 - val\_accuracy: 0.6104

Epoch 278/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4382 - accuracy: 0.7904 - val\_loss: 0.7037 - val\_accuracy: 0.6104

Epoch 279/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4425 - accuracy: 0.7852 - val\_loss: 0.7032 - val\_accuracy: 0.6104

Epoch 280/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4357 - accuracy: 0.7982 - val\_loss: 0.7040 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

Epoch 281/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4400 - accuracy: 0.7878 - val\_loss: 0.7038 - val\_accuracy: 0.6104

Epoch 282/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4445 - accuracy: 0.7917 - val\_loss: 0.7044 - val\_accuracy: 0.6104

Epoch 283/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4441 - accuracy: 0.7839 - val\_loss: 0.7065 - val\_accuracy: 0.6104

Epoch 284/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4351 - accuracy: 0.7786 - val\_loss: 0.7043 - val\_accuracy: 0.6104

Epoch 285/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4402 - accuracy: 0.7969 - val\_loss: 0.7052 - val\_accuracy: 0.6104

Epoch 286/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4496 - accuracy: 0.7812 - val\_loss: 0.7061 - val\_accuracy: 0.6104

Epoch 287/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4395 - accuracy: 0.7799 - val\_loss: 0.7075 - val\_accuracy: 0.6104

Epoch 288/300

16/16 [==============================] - 0s 7ms/step - loss: 0.4394 - accuracy: 0.7930 - val\_loss: 0.7064 - val\_accuracy: 0.6104

Epoch 289/300

16/16 [==============================] - 0s 7ms/step - loss: 0.4505 - accuracy: 0.7891 - val\_loss: 0.7066 - val\_accuracy: 0.6104

Epoch 290/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4408 - accuracy: 0.7865 - val\_loss: 0.7081 - val\_accuracy: 0.6104

Epoch 291/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4434 - accuracy: 0.7969 - val\_loss: 0.7075 - val\_accuracy: 0.6104

Epoch 292/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4456 - accuracy: 0.7865 - val\_loss: 0.7088 - val\_accuracy: 0.6104

Epoch 293/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4344 - accuracy: 0.7995 - val\_loss: 0.7098 - val\_accuracy: 0.6104

Epoch 294/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4346 - accuracy: 0.7995 - val\_loss: 0.7106 - val\_accuracy: 0.6104

Epoch 295/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4384 - accuracy: 0.7865 - val\_loss: 0.7120 - val\_accuracy: 0.6104

Epoch 296/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4464 - accuracy: 0.7695 - val\_loss: 0.7113 - val\_accuracy: 0.6104

Epoch 297/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4481 - accuracy: 0.7852 - val\_loss: 0.7110 - val\_accuracy: 0.6104

Epoch 298/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4457 - accuracy: 0.8021 - val\_loss: 0.7113 - val\_accuracy: 0.6104

Epoch 299/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4336 - accuracy: 0.7891 - val\_loss: 0.7128 - val\_accuracy: 0.6104

Epoch 300/300

16/16 [==============================] - 0s 5ms/step - loss: 0.4352 - accuracy: 0.8034 - val\_loss: 0.7133 - val\_accuracy: 0.6104

10/15/24, 3:30 PM Assignment7ml

In [18]:

losses **=** pd**.**DataFrame(model**.**history**.**history) losses**.**plot()

Out[18]:

In [19]:

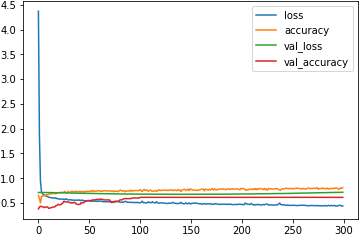
Out[19]:

In [20]:

In [21]:

y\_pred

<AxesSubplot:>



model**.**evaluate(x,y)

24/24 [==============================] - 0s 2ms/step - loss: 0.4277 - accuracy:

0.8099

[0.42774689197540283, 0.8098958134651184]

y\_pred **=** model**.**predict(X\_test)

10/15/24, 3:30 PM Assignment7ml

|  |  |
| --- | --- |
| Out[21]: | array([[0.29241186], |
|  | [0.25659525], |
|  | [0.2345556 ], |
|  | [0.25635856], |
|  | [0.2683779 ], |
|  | [0.26534295], |
|  | [0.24615443], |
|  | [0.18696874], |
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|  | [0.26499653], |
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|  | [0.19693151], |
|  | [0.2525043 ], |
|  | [0.2924193 ], |
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|  | [0.24926525], |
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|  | [0.30027997], |
|  | [0.26890767], |
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|  | [0.27719277], |
|  | [0.23296693], |
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|  | [0.23384169], |
|  | [0.26180875], |
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|  | [0.1814619 ], |
|  | [0.17811224], |
|  | [0.22696063], |
|  | [0.23095623], |
|  | [0.24577609], |
|  | [0.21299466], |
|  | [0.25943238], |
|  | [0.26748422], |
|  | [0.28173897], |
|  | [0.21895227], |
|  | [0.25581098], |
|  | [0.2772973 ], |
|  | [0.26322144], |
|  | [0.27639455], |
|  | [0.2651384 ], |
|  | [0.29406345], |
|  | [0.19382304], |
|  | [0.24121556], |
|  | [0.2256059 ], |
|  | [0.2787133 ], |
|  | [0.28141072], |
|  | [0.22622645], |
|  | [0.30917984], |
|  | [0.23824352], |
|  | [0.25481486], |

10/15/24, 3:30 PM Assignment7ml

[0.25906867],

[0.2787506 ],

[0.20846003],

[0.2344867 ],

[0.27582753],

[0.24831259],

[0.29489657],

[0.26952785],

[0.26609173],

[0.26449886],

[0.3253206 ],

[0.20729351],

[0.27737445],

[0.27037466],

[0.2857654 ],

[0.21922398],

[0.2420043 ]], dtype=float32)