Importing Libraries

In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report

from tensorflow.keras import Sequential
from tensorflow.keras.layers import Dense,Dropout
from tensorflow.keras.callbacks import EarlyStopping
```

Loading Data

In [2]:
```
df = pd.read_excel("/content/customer_churn_large_dataset.xlsx")
df.head()
```

Out[2]:

	CustomerID	Name	Age	Gender	Location	Subscription_Length_Months	Monthly_Bill	Total_Usage_GB	Churn
0	1	Customer_1	63	Male	Los Angeles	17	73.36	236	0
1	2	Customer_2	62	Female	New York	1	48.76	172	0
2	3	Customer_3	24	Female	Los Angeles	5	85.47	460	0
3	4	Customer_4	36	Female	Miami	3	97.94	297	1
4	5	Customer_5	46	Female	Miami	19	58.14	266	0

Data Encoding

In [3]:
```
# Ecoded 0 for Femal and 1 for Male
df["Gender"] = df["Gender"].apply(lambda x: 0 if x == "Female" else 1)
df.sample(5)
```

Out[3]:

	CustomerID	Name	Age	Gender	Location	Subscription_Length_Months	Monthly_Bill	Total_Usage_GB	Churn
86607	86608	Customer_86608	56	1	Chicago	21	55.91	83	1
68308	68309	Customer_68309	47	1	Los Angeles	13	65.99	305	1
54253	54254	Customer_54254	50	1	Los Angeles	14	95.26	217	1
96836	96837	Customer_96837	47	0	New York	4	41.45	213	1
56035	56036	Customer_56036	32	0	New York	12	71.66	65	1

In [4]:
```
# Encoding categorial variable ie.Location
from sklearn.preprocessing import OrdinalEncoder
OE = OrdinalEncoder()


df["Location"] = OE.fit_transform(df[["Location"]])
Loc = OE.categories_
Loc
```

Out[4]:
```
[array(['Chicago', 'Houston', 'Los Angeles', 'Miami', 'New York'],
       dtype=object)]
```

In [5]:
```
df.sample(5)
```

Out[5]:

	CustomerID	Name	Age	Gender	Location	Subscription_Length_Months	Monthly_Bill	Total_Usage_GB	Churn
74315	74316	Customer_74316	69	0	4.0	22	73.62	324	0
85621	85622	Customer_85622	37	1	0.0	11	73.83	454	1
50514	50515	Customer_50515	28	0	2.0	11	93.79	364	1
17853	17854	Customer_17854	52	1	4.0	13	40.90	85	1
50203	50204	Customer_50204	46	1	4.0	14	58.18	93	1

Data Segregation

In [6]:
```
X = df.iloc[:,2:-1].values
X
```

Out[6]:
```
array([[ 63.  ,   1.  ,   2.  ,  17.  ,  73.36, 236.  ],
       [ 62.  ,   0.  ,   4.  ,   1.  ,  48.76, 172.  ],
       [ 24.  ,   0.  ,   2.  ,   5.  ,  85.47, 460.  ],
       ...,
       [ 64.  ,   1.  ,   0.  ,  17.  ,  96.11, 251.  ],
       [ 51.  ,   0.  ,   4.  ,  20.  ,  49.25, 434.  ],
       [ 27.  ,   0.  ,   2.  ,  19.  ,  76.57, 173.  ]])
```

In [7]:
```
Y = df.iloc[:,-1].values
Y
```

Out[7]:
```
array([0, 0, 0, ..., 1, 1, 1])
```

Data Scaling

In [8]:
```
from sklearn.preprocessing import StandardScaler
SS = StandardScaler()
X = SS.fit_transform(X)
X
```

Out[8]:
```
array([[ 1.24167039,  1.00432937,  0.00294695,  0.65111499,  0.41060598,
        -0.29428898],
       [ 1.17622625, -0.99568929,  1.41974758, -1.65887854, -0.80537409,
        -0.78485174],
       [-1.31065114, -0.99568929,  0.00294695, -1.08138015,  1.0092043 ,
         1.42268068],
       ...,
       [ 1.30711454,  1.00432937, -1.41385369,  0.65111499,  1.5351404 ,
        -0.17931334],
       [ 0.45634069, -0.99568929,  1.41974758,  1.08423877, -0.78115335,
         1.22338955],
       [-1.11431871, -0.99568929,  0.00294695,  0.93986418,  0.56927655,
        -0.7771867 ]])
```

Data Splitting

In [9]:
```
X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.2,random_state=1)
X_train,X_val,Y_train,Y_val = train_test_split(X_train,Y_train,test_size=0.1,random_state=1)
```

Creating an object of early stopping to save the resources

In [24]:
```
ES = EarlyStopping(monitor='val_loss', mode='min', patience=1000)
```

ANN Modelling

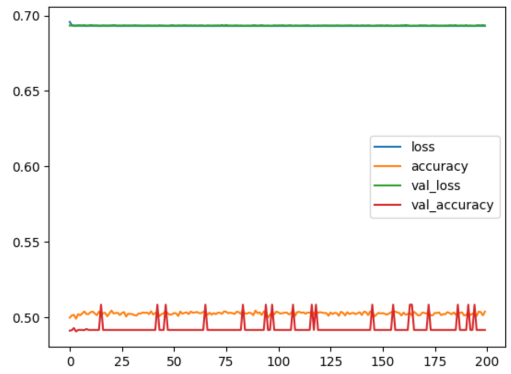
In [25]:
```
# obj of Sequential
ann = Sequential()

# adding input/hidden/dropout layers
ann.add(Dense(128,activation='relu'))
ann.add(Dropout(0.6))

ann.add(Dense(64,activation='relu'))
ann.add(Dropout(0.4))

ann.add(Dense(48,activation='relu'))
ann.add(Dropout(0.4))

# Output layers
ann.add(Dense(1,activation='sigmoid'))

# compiling the model
ann.compile(optimizer='adam',loss='binary_crossentropy',metrics=['accuracy'])

# fitting the model
ann.fit(X_train, Y_train, batch_size = 32, epochs = 200, callbacks=ES, validation_data=(X_val,Y_val))
```

```
Epoch 1/200
2250/2250 [==============================] - 10s 4ms/step - loss: 0.6958 - accuracy: 0.4998 - val_loss: 0.6934 - val_accuracy: 0.4911
Epoch 2/200
2250/2250 [==============================] - 8s 4ms/step - loss: 0.6935 - accuracy: 0.5012 - val_loss: 0.6933 - val_accuracy: 0.4915
Epoch 3/200
2250/2250 [==============================] - 8s 3ms/step - loss: 0.6933 - accuracy: 0.5016 - val_loss: 0.6932 - val_accuracy: 0.4929
Epoch 4/200
2250/2250 [==============================] - 8s 4ms/step - loss: 0.6933 - accuracy: 0.4991 - val_loss: 0.6932 - val_accuracy: 0.4906
Epoch 5/200
2250/2250 [==============================] - 7s 3ms/step - loss: 0.6933 - accuracy: 0.5021 - val_loss: 0.6935 - val_accuracy: 0.4916
Epoch 6/200
2250/2250 [==============================] - 8s 3ms/step - loss: 0.6932 - accuracy: 0.5013 - val_loss: 0.6934 - val_accuracy: 0.4916
Epoch 7/200
2250/2250 [==============================] - 8s 3ms/step - loss: 0.6933 - accuracy: 0.5026 - val_loss: 0.6933 - val_accuracy: 0.4916
Epoch 8/200
2250/2250 [==============================] - 7s 3ms/step - loss: 0.6932 - accuracy: 0.5039 - val_loss: 0.6936 - val_accuracy: 0.4915
Epoch 9/200
2250/2250 [==============================] - 8s 3ms/step - loss: 0.6933 - accuracy: 0.5022 - val_loss: 0.6932 - val_accuracy: 0.4922
Epoch 10/200
```

Visualization of Loss/Accuracy w.r.t Epochs

In [26]:
```python
# as the loss and accuracy goes parallely they will take muchmore time to converge with each other
lossdf = pd.DataFrame(ann.history.history)
lossdf.plot()
```

Out[26]: <Axes: >



In [27]:
```python
Y_pred = ann.predict(X_test)
```

```
625/625 [==============================] - 1s 1ms/step
```

In [28]:
```python
# Set Threshold
Y_pred = np.where(Y_pred>0.5,1,0)
```

In [29]:
```python
Y_pred
```

Out[29]:
```
array([[0],
       [0],
       [0],
       ...,
       [0],
       [0],
       [0]])
```

Classification report

In [30]:
```python
# evaluation
from sklearn.metrics import classification_report
print( classification_report(Y_test,Y_pred) )
```

```
              precision    recall  f1-score   support

           0       0.50      1.00      0.67     10020
           1       0.00      0.00      0.00      9980

    accuracy                           0.50     20000
   macro avg       0.25      0.50      0.33     20000
weighted avg       0.25      0.50      0.33     20000


/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

In [ ]: