In [69]:

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [70]:

```python
import os, types
import pandas as pd
from botocore.client import Config
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
cos_client = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='Vq2uXhLPD6XjkGUZc9xTAHmLJ5vYz3fbFDhNao67a0Og',
    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')

bucket = 'universityadmiteligibilitypredict-donotdelete-pr-xtisjugekzp5yj'
object_key = 'Admission_Predict.csv'

body = cos_client.get_object(Bucket=bucket,Key=object_key)['Body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType( __iter__, body )

df = pd.read_csv(body)
df.head()
```

Out[70]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	1	337	118	4	4.5	4.5	9.65	1	0.92
1	2	324	107	4	4.0	4.5	8.87	1	0.76
2	3	316	104	3	3.0	3.5	8.00	1	0.72
3	4	322	110	3	3.5	2.5	8.67	1	0.80
4	5	314	103	2	2.0	3.0	8.21	0	0.65

In [71]:

```python
df.describe()
```

Out[71]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
count	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000
mean	200.500000	316.807500	107.410000	3.087500	3.400000	3.452500	8.598925	0.547500	0.724350
std	115.614301	11.473646	6.069514	1.143728	1.006869	0.898478	0.596317	0.498362	0.142609
min	1.000000	290.000000	92.000000	1.000000	1.000000	1.000000	6.800000	0.000000	0.340000
25%	100.750000	308.000000	103.000000	2.000000	2.500000	3.000000	8.170000	0.000000	0.640000
50%	200.500000	317.000000	107.000000	3.000000	3.500000	3.500000	8.610000	1.000000	0.730000
75%	300.250000	325.000000	112.000000	4.000000	4.000000	4.000000	9.062500	1.000000	0.830000
max	400.000000	340.000000	120.000000	5.000000	5.000000	5.000000	9.920000	1.000000	0.970000

In [72]:

```
df.drop(["Serial No."],axis=1,inplace=True)
df.head()
```

Out[72]:

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	337	118	4	4.5	4.5	9.65	1	0.92
1	324	107	4	4.0	4.5	8.87	1	0.76
2	316	104	3	3.0	3.5	8.00	1	0.72
3	322	110	3	3.5	2.5	8.67	1	0.80
4	314	103	2	2.0	3.0	8.21	0	0.65

In [73]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 8 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   GRE Score          400 non-null    int64  
 1   TOEFL Score        400 non-null    int64  
 2   University Rating  400 non-null    int64  
 3   SOP                400 non-null    float64
 4   LOR                400 non-null    float64
 5   CGPA               400 non-null    float64
 6   Research           400 non-null    int64  
 7   Chance of Admit    400 non-null    float64
dtypes: float64(4), int64(4)
memory usage: 25.1 KB
```

In [74]:
```
x=df.iloc[:,:-1].values
x
```

Out[74]:
```
array([[337.  , 118.  ,   4.  , ...,   4.5 ,   9.65,   1.  ],
       [324.  , 107.  ,   4.  , ...,   4.5 ,   8.87,   1.  ],
       [316.  , 104.  ,   3.  , ...,   3.5 ,   8.  ,   1.  ],
       ...,
       [330.  , 116.  ,   4.  , ...,   4.5 ,   9.45,   1.  ],
       [312.  , 103.  ,   3.  , ...,   4.  ,   8.78,   0.  ],
       [333.  , 117.  ,   4.  , ...,   4.  ,   9.66,   1.  ]])
```

In [75]:
```
y=df.iloc[:,-1].values
y
```

Out[75]:

```
array([0.92, 0.76, 0.72, 0.8 , 0.65, 0.9 , 0.75, 0.68, 0.5 , 0.45, 0.52,
       0.84, 0.78, 0.62, 0.61, 0.54, 0.66, 0.65, 0.63, 0.62, 0.64, 0.7 ,
       0.94, 0.95, 0.97, 0.94, 0.76, 0.44, 0.46, 0.54, 0.65, 0.74, 0.91,
       0.9 , 0.94, 0.88, 0.64, 0.58, 0.52, 0.48, 0.46, 0.49, 0.53, 0.87,
       0.91, 0.88, 0.86, 0.89, 0.82, 0.78, 0.76, 0.56, 0.78, 0.72, 0.7 ,
       0.64, 0.64, 0.46, 0.36, 0.42, 0.48, 0.47, 0.54, 0.56, 0.52, 0.55,
       0.61, 0.57, 0.68, 0.78, 0.94, 0.96, 0.93, 0.84, 0.74, 0.72, 0.74,
       0.64, 0.44, 0.46, 0.5 , 0.96, 0.92, 0.92, 0.94, 0.76, 0.72, 0.66,
       0.64, 0.74, 0.64, 0.38, 0.34, 0.44, 0.36, 0.42, 0.48, 0.86, 0.9 ,
       0.79, 0.71, 0.64, 0.62, 0.57, 0.74, 0.69, 0.87, 0.91, 0.93, 0.68,
       0.61, 0.69, 0.62, 0.72, 0.59, 0.66, 0.56, 0.45, 0.47, 0.71, 0.94,
       0.94, 0.57, 0.61, 0.57, 0.64, 0.85, 0.78, 0.84, 0.92, 0.96, 0.77,
       0.71, 0.79, 0.89, 0.82, 0.76, 0.71, 0.8 , 0.78, 0.84, 0.9 , 0.92,
       0.97, 0.8 , 0.81, 0.75, 0.83, 0.96, 0.79, 0.93, 0.94, 0.86, 0.79,
       0.8 , 0.77, 0.7 , 0.65, 0.61, 0.52, 0.57, 0.53, 0.67, 0.68, 0.81,
       0.78, 0.65, 0.64, 0.64, 0.65, 0.68, 0.89, 0.86, 0.89, 0.87, 0.85,
       0.9 , 0.82, 0.72, 0.73, 0.71, 0.71, 0.68, 0.75, 0.72, 0.89, 0.84,
       0.93, 0.93, 0.88, 0.9 , 0.87, 0.86, 0.94, 0.77, 0.78, 0.73, 0.73,
       0.7 , 0.72, 0.73, 0.72, 0.97, 0.97, 0.69, 0.57, 0.63, 0.66, 0.64,
       0.68, 0.79, 0.82, 0.95, 0.96, 0.94, 0.93, 0.91, 0.85, 0.84, 0.74,
       0.76, 0.75, 0.76, 0.71, 0.67, 0.61, 0.63, 0.64, 0.71, 0.82, 0.73,
       0.74, 0.69, 0.64, 0.91, 0.88, 0.85, 0.86, 0.7 , 0.59, 0.6 , 0.65,
       0.7 , 0.76, 0.63, 0.81, 0.72, 0.71, 0.8 , 0.77, 0.74, 0.7 , 0.71,
       0.93, 0.85, 0.79, 0.76, 0.78, 0.77, 0.9 , 0.87, 0.71, 0.7 , 0.7 ,
       0.75, 0.71, 0.72, 0.73, 0.83, 0.77, 0.72, 0.54, 0.49, 0.52, 0.58,
       0.78, 0.89, 0.7 , 0.66, 0.67, 0.68, 0.8 , 0.81, 0.8 , 0.94, 0.93,
       0.92, 0.89, 0.82, 0.79, 0.58, 0.56, 0.56, 0.64, 0.61, 0.68, 0.76,
       0.86, 0.9 , 0.71, 0.62, 0.66, 0.65, 0.73, 0.62, 0.74, 0.79, 0.8 ,
       0.69, 0.7 , 0.76, 0.84, 0.78, 0.67, 0.66, 0.65, 0.54, 0.58, 0.79,
       0.8 , 0.75, 0.73, 0.72, 0.62, 0.67, 0.81, 0.63, 0.69, 0.8 , 0.43,
       0.8 , 0.73, 0.75, 0.71, 0.73, 0.83, 0.72, 0.94, 0.81, 0.81, 0.75,
       0.79, 0.58, 0.59, 0.47, 0.49, 0.47, 0.42, 0.57, 0.62, 0.74, 0.73,
       0.64, 0.63, 0.59, 0.73, 0.79, 0.68, 0.7 , 0.81, 0.85, 0.93, 0.91,
       0.69, 0.77, 0.86, 0.74, 0.57, 0.51, 0.67, 0.72, 0.89, 0.95, 0.79,
       0.39, 0.38, 0.34, 0.47, 0.56, 0.71, 0.78, 0.73, 0.82, 0.62, 0.96,
       0.96, 0.46, 0.53, 0.49, 0.76, 0.64, 0.71, 0.84, 0.77, 0.89, 0.82,
       0.84, 0.91, 0.67, 0.95])
```

In [76]:

```
x.shape
```

Out[76]:

```
(400, 7)
```

In [77]:

```
y.shape
```

Out[77]:

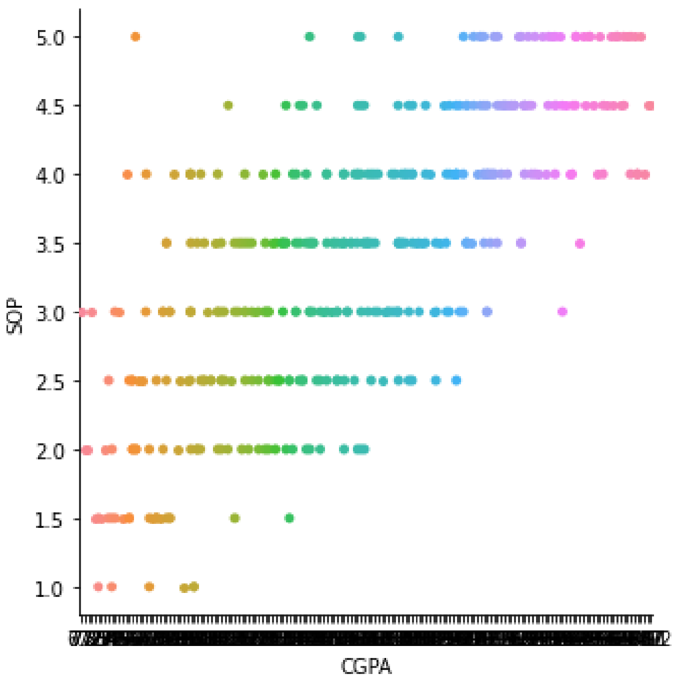
```
(400,)
```

In [78]:

```
sns.catplot(x="CGPA",y="SOP",data=df)
```

Out[78]:

```
<seaborn.axisgrid.FacetGrid at 0x7f7905923130>
```



In [79]:

```python
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test = train_test_split(x,y,test_size=0.2,random_state=10)
```

In [80]:

```python
y_train=(y_train>0.5)
```

In [81]:

```python
y_test=(y_test>0.5)
```

In [82]:

```python
from sklearn.linear_model import LogisticRegression
```

In [83]:

```python
from sklearn.tree import DecisionTreeClassifier
```

In [84]:

```python
reg1=DecisionTreeClassifier(random_state=0)
```

In [85]:

```python
reg=LogisticRegression(random_state=0,max_iter=1000)
```

In [86]:

```python
pred=reg.fit(X_train,y_train)
```

In [87]:

```python
pred1=reg1.fit(X_train,y_train)
```

In [88]:

```python
y_pred=pred.predict(X_test)
```

```
In [89]: y_predtree=pred1.predict(X_test)
```

```
In [90]: y_pred
```

```
Out[90]: array([ True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True, False,  True,
                 True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True, False])
```

```
In [91]: y_predtree
```

```
Out[91]: array([ True,  True,  True,  True, False,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True, False,  True,
                 True,  True,  True,  True,  True,  True,  True,  True, False,
                 True,  True,  True,  True, False,  True,  True, False,  True,
                 True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True, False,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True,  True,  True,
                 True,  True,  True,  True,  True,  True,  True,  True])
```

```
In [92]: from sklearn.metrics import accuracy_score,recall_score,roc_auc_score,confusion_matrix
         print("Accuracy Score (logistic regression):%f"%(accuracy_score(y_test,y_pred)*100))
         print("Recall score(logistic regression):%f"%(recall_score(y_test,y_pred)*100))
         print("roc (logistic regression):%f"%(roc_auc_score(y_test,y_pred)*100))
         print(confusion_matrix(y_test,y_pred))
```

```
Accuracy Score (logistic regression):96.250000
Recall score(logistic regression):100.000000
roc (logistic regression):70.000000
[[ 2  3]
 [ 0 75]]
```

```
In [93]: print("Accuracy Score (decision tree):%f"%(accuracy_score(y_test,y_predtree)*100))
         print("Recall score (decision tree):%f"%(recall_score(y_test,y_predtree)*100))
         print("roc (decision tree):%f"%(roc_auc_score(y_test,y_predtree)*100))
         print(confusion_matrix(y_test,y_predtree))
```

```
Accuracy Score (decision tree):88.750000
Recall score (decision tree):93.333333
roc (decision tree):56.666667
[[ 1  4]
 [ 5 70]]
```

```
In [94]: from sklearn.ensemble import RandomForestClassifier
```

```
rfc=RandomForestClassifier(n_estimators=10,criterion='entropy',random_state=42)
pred2=rfc.fit(X_train,y_train)
y_predrfc=pred2.predict(X_test)
y_predrfc
```

Out[94]:

```
array([ True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True, False,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True])
```

In [95]:

```
print("Accuracy Score (Random forest):%f"%(accuracy_score(y_test,y_predrfc)*100))
print("Recall score (Random forest):%f"%(recall_score(y_test,y_predrfc)*100))
print("roc (Random forest):%f"%(roc_auc_score(y_test,y_predrfc)*100))
print(confusion_matrix(y_test,y_predrfc))
```

```
Accuracy Score (Random forest):95.000000
Recall score (Random forest):100.000000
roc (Random forest):60.000000
[[ 1  4]
 [ 0 75]]
```

In [96]:

```
from sklearn.neighbors import KNeighborsClassifier
reg3= KNeighborsClassifier(n_neighbors=5, metric='minkowski', p=2 )
pred3=reg3.fit(X_train, y_train)
```

In [97]:

```
y_predknn=pred3.predict(X_test)
```

In [98]:

```
y_predknn
```

Out[98]:

```
array([ True,  True, False,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True, False,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True,  True,
        True,  True,  True,  True,  True,  True,  True,  True])
```

In [99]:

```
print("Accuracy Score (k nearest neighbour):%f"%(accuracy_score(y_test,y_predknn)*100))
print("Recall score (k nearest neighbour)):%f"%(recall_score(y_test,y_predknn)*100))
print("roc (k nearest neighbour):%f"%(roc_auc_score(y_test,y_predknn)*100))
print(confusion_matrix(y_test,y_predknn))
```

```
Accuracy Score (k nearest neighbour):93.750000
Recall score (k nearest neighbour)):98.666667
roc (k nearest neighbour):59.333333
[[ 1  4]
 [ 1 74]]
```

In [100…

```
from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
X_train=sc.fit_transform(X_train)
X_test=sc.fit_transform(X_test)
```

In [101…

```
import keras
from keras.models import Sequential
from keras.layers import Dense, Dropout
```

In [102…

```
classifier = Sequential()
```

In [103…

```
classifier.add(Dense(kernel_initializer='uniform', activation='relu', input_dim=7,units=7))
classifier.add(Dropout(rate=0.1))
```

In [104…

```
classifier.add(Dense(kernel_initializer='uniform', activation='relu', input_dim=7,units=7))
classifier.add(Dropout(rate=0.1))
```

In [105…

```
classifier.add(Dense(kernel_initializer='uniform', activation='relu', input_dim=7,units=7))
classifier.add(Dropout(rate=0.1))
```

In [106…

```
classifier.add(Dense(activation="sigmoid", units=1, kernel_initializer="uniform"))
```

In [107…

```
classifier.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])
classifier.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 dense_4 (Dense)             (None, 7)                 56        
                                                                 
 dropout_3 (Dropout)         (None, 7)                 0         
                                                                 
 dense_5 (Dense)             (None, 7)                 56        
                                                                 
 dropout_4 (Dropout)         (None, 7)                 0         
                                                                 
 dense_6 (Dense)             (None, 7)                 56        
                                                                 
 dropout_5 (Dropout)         (None, 7)                 0         
                                                                 
 dense_7 (Dense)             (None, 1)                 8         
                                                                 
=================================================================
Total params: 176
Trainable params: 176
Non-trainable params: 0
_________________________________________________________________
```

In [108…

```
history=classifier.fit(X_train, y_train, batch_size=32,epochs=50)
```

```
Epoch 1/50
10/10 [==============================] - 1s 4ms/step - loss: 0.6912 - accuracy: 0.8906
Epoch 2/50
10/10 [==============================] - 0s 3ms/step - loss: 0.6868 - accuracy: 0.9062
Epoch 3/50
10/10 [==============================] - 0s 2ms/step - loss: 0.6818 - accuracy: 0.9062
Epoch 4/50
10/10 [==============================] - 0s 2ms/step - loss: 0.6761 - accuracy: 0.9062
Epoch 5/50
10/10 [==============================] - 0s 2ms/step - loss: 0.6698 - accuracy: 0.9062
Epoch 6/50
10/10 [==============================] - 0s 2ms/step - loss: 0.6612 - accuracy: 0.9062
Epoch 7/50
10/10 [==============================] - 0s 3ms/step - loss: 0.6498 - accuracy: 0.9062
Epoch 8/50
10/10 [==============================] - 0s 3ms/step - loss: 0.6344 - accuracy: 0.9062
Epoch 9/50
10/10 [==============================] - 0s 2ms/step - loss: 0.6117 - accuracy: 0.9062
Epoch 10/50
10/10 [==============================] - 0s 2ms/step - loss: 0.5811 - accuracy: 0.9062
Epoch 11/50
10/10 [==============================] - 0s 3ms/step - loss: 0.5419 - accuracy: 0.9062
Epoch 12/50
10/10 [==============================] - 0s 2ms/step - loss: 0.4929 - accuracy: 0.9062
Epoch 13/50
10/10 [==============================] - 0s 3ms/step - loss: 0.4420 - accuracy: 0.9062
Epoch 14/50
10/10 [==============================] - 0s 2ms/step - loss: 0.3987 - accuracy: 0.9062
Epoch 15/50
10/10 [==============================] - 0s 2ms/step - loss: 0.3634 - accuracy: 0.9062
Epoch 16/50
10/10 [==============================] - 0s 2ms/step - loss: 0.3313 - accuracy: 0.9062
Epoch 17/50
10/10 [==============================] - 0s 2ms/step - loss: 0.3256 - accuracy: 0.9062
Epoch 18/50
10/10 [==============================] - 0s 3ms/step - loss: 0.3037 - accuracy: 0.9062
Epoch 19/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2981 - accuracy: 0.9062
Epoch 20/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2873 - accuracy: 0.9062
Epoch 21/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2830 - accuracy: 0.9062
Epoch 22/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2742 - accuracy: 0.9062
Epoch 23/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2610 - accuracy: 0.9062
Epoch 24/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2613 - accuracy: 0.9062
Epoch 25/50
```

```
10/10 [==============================] - 0s 2ms/step - loss: 0.2500 - accuracy: 0.9062
Epoch 26/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2522 - accuracy: 0.9062
Epoch 27/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2401 - accuracy: 0.9062
Epoch 28/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2421 - accuracy: 0.9062
Epoch 29/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2409 - accuracy: 0.9062
Epoch 30/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2317 - accuracy: 0.9062
Epoch 31/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2292 - accuracy: 0.9062
Epoch 32/50
10/10 [==============================] - 0s 3ms/step - loss: 0.2256 - accuracy: 0.9062
Epoch 33/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2269 - accuracy: 0.9062
Epoch 34/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2288 - accuracy: 0.9062
Epoch 35/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2262 - accuracy: 0.9062
Epoch 36/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2265 - accuracy: 0.9062
Epoch 37/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2237 - accuracy: 0.9062
Epoch 38/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2168 - accuracy: 0.9062
Epoch 39/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2269 - accuracy: 0.9062
Epoch 40/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2282 - accuracy: 0.9062
Epoch 41/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2166 - accuracy: 0.9062
Epoch 42/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2236 - accuracy: 0.9062
Epoch 43/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2181 - accuracy: 0.9062
Epoch 44/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2206 - accuracy: 0.9062
Epoch 45/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2225 - accuracy: 0.9062
Epoch 46/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2198 - accuracy: 0.9062
Epoch 47/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2177 - accuracy: 0.9062
Epoch 48/50
10/10 [==============================] - 0s 3ms/step - loss: 0.2169 - accuracy: 0.9062
Epoch 49/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2155 - accuracy: 0.9062
```

```
Epoch 50/50
10/10 [==============================] - 0s 2ms/step - loss: 0.2115 - accuracy: 0.9062
```

In [109…

```
y_pred4=classifier.predict(X_test)
y_pred4
```

```
Out[109]: array([[0.7675744 ],
                 [0.99876887],
                 [0.7779143 ],
                 [0.7606007 ],
                 [0.7491059 ],
                 [0.8336744 ],
                 [1.        ],
                 [0.9999989 ],
                 [0.99996966],
                 [0.8379176 ],
                 [0.9953885 ],
                 [0.99996585],
                 [0.9495839 ],
                 [0.8277683 ],
                 [0.9999968 ],
                 [0.9999974 ],
                 [0.7381005 ],
                 [0.99047804],
                 [0.9998194 ],
                 [0.9984891 ],
                 [0.99999297],
                 [0.99930835],
                 [0.9987721 ],
                 [0.9900489 ],
                 [0.9917507 ],
                 [0.9272181 ],
                 [0.7931123 ],
                 [0.9999986 ],
                 [0.8491808 ],
                 [0.9215331 ],
                 [0.9997252 ],
                 [0.9782571 ],
                 [0.98187494],
                 [0.99262536],
                 [0.7726737 ],
                 [0.9999634 ],
                 [0.77670777],
                 [0.87060446],
                 [0.95616186],
                 [0.9993253 ],
                 [0.9999992 ],
                 [0.9996818 ],
                 [0.97339183],
                 [0.84977305],
                 [0.8403559 ],
                 [0.9886937 ],
                 [0.87089634],
                 [0.8042648 ],
                 [0.7998698 ],
       [0.999959  ],
       [0.99994886],
       [0.94191635],
       [0.999999  ],
       [0.99999785],
       [0.757846  ],
       [0.76954365],
       [0.9414363 ],
       [0.8424395 ],
       [0.9058603 ],
       [0.87212825],
       [0.7630016 ],
       [0.99981153],
       [0.9933629 ],
       [0.9981073 ],
       [0.91969347],
       [0.9999854 ],
       [0.9992494 ],
       [0.91427255],
       [0.99999714],
       [0.9622291 ],
       [0.99999905],
       [0.99990135],
       [0.99957085],
       [0.87341464],
       [0.9935809 ],
       [0.8554869 ],
       [0.9999922 ],
       [0.92089814],
       [0.9508474 ],
       [0.7381005 ]], dtype=float32)
```

In [110…

```
score = classifier.evaluate(X_test, y_test, verbose=0)
print('Test loss:', score[0])
print('Test accuracy:', score[1])
```

```
Test loss: 0.15412412583827972
Test accuracy: 0.9375
```

In [111…

```
import pickle
pickle.dump(pred2,open('university.pkl','wb'))
model=pickle.load(open('university.pkl','rb'))
```

In [112…

```
pip install -U ibm-watson-machine-learning
```

```
Requirement already satisfied: ibm-watson-machine-learning in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (1.0.262)
Requirement already satisfied: packaging in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-watson-machine-learning) (21.3)
Requirement already satisfied: requests in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-watson-machine-learning) (2.26.0)
Requirement already satisfied: ibm-cos-sdk==2.11.* in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-watson-machine-learning) (2
11.0)
Requirement already satisfied: tabulate in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-watson-machine-learning) (0.8.9)
Requirement already satisfied: urllib3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-watson-machine-learning) (1.26.7)
Requirement already satisfied: certifi in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-watson-machine-learning) (2022.9.24)
Requirement already satisfied: lomond in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-watson-machine-learning) (0.3.3)
Requirement already satisfied: pandas<1.5.0,>=0.24.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-watson-machine-learning)
(1.3.4)
Requirement already satisfied: importlib-metadata in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-watson-machine-learning) (4.
8.2)
Requirement already satisfied: ibm-cos-sdk-core==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk==2.11.*->ibm-wa
tson-machine-learning) (2.11.0)
Requirement already satisfied: ibm-cos-sdk-s3transfer==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk==2.11.*->
ibm-watson-machine-learning) (2.11.0)
Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk==2.11.*->ibm-wats
on-machine-learning) (0.10.0)
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk-core==2.11.0
->ibm-cos-sdk==2.11.*->ibm-watson-machine-learning) (2.8.2)
Requirement already satisfied: pytz>=2017.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas<1.5.0,>=0.24.2->ibm-watson-machi
ne-learning) (2021.3)
Requirement already satisfied: numpy>=1.17.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas<1.5.0,>=0.24.2->ibm-watson-mach
ine-learning) (1.20.3)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from python-dateutil<3.0.0,>=2.1->ibm-cos-sdk-co
re==2.11.0->ibm-cos-sdk==2.11.*->ibm-watson-machine-learning) (1.15.0)
Requirement already satisfied: charset-normalizer~=2.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->ibm-watson-machi
ne-learning) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->ibm-watson-machine-learning)
(3.3)
Requirement already satisfied: zipp>=0.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from importlib-metadata->ibm-watson-machine-lea
rning) (3.6.0)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from packaging->ibm-watson-machi
ne-learning) (3.0.4)
Note: you may need to restart the kernel to use updated packages.
```

In [113…

```
from ibm_watson_machine_learning import APIClient
wml_credentials = {
                   "url": "https://us-south.ml.cloud.ibm.com",
                   "apikey": "2hl0Dnbl1E4wMzjos2DjZz65xZhEtPqrYTyeub_VYlbi"
}
client = APIClient(wml_credentials)
```

In [114…

```
def guid_from_space_name(client, space_name):
 space = client.spaces.get_details()
 return(next(item for item in space['resources'] if item['entity']["name"] == space_name)['metadata']['id'])
```

```
In [122…  space_uid = guid_from_space_name(client, 'models')
          print("Space UID = "+ space_uid)
```

```
Space UID = e98f8e76-b9d3-441d-91ef-21708cd61c81
```

```
In [123…  client.set.default_space(space_uid)
```

```
Out[123]: 'SUCCESS'
```

```
In [124…  client.software_specifications.list()
```

```
-----------------------------  ------------------------------------  ----
NAME                           ASSET_ID                              TYPE
default_py3.6                  0062b8c9-8b7d-44a0-a9b9-46c416adcbd9  base
kernel-spark3.2-scala2.12      020d69ce-7ac1-5e68-ac1a-31189867356a  base
pytorch-onnx_1.3-py3.7-edt     069ea134-3346-5748-b513-49120e15d288  base
scikit-learn_0.20-py3.6        09c5a1d0-9c1e-4473-a344-eb7b665ff687  base
spark-mllib_3.0-scala_2.12     09f4cff0-90a7-5899-b9ed-1ef348aebdee  base
pytorch-onnx_rt22.1-py3.9      0b848dd4-e681-5599-be41-b5f6fccc6471  base
ai-function_0.1-py3.6          0cdb0f1e-5376-4f4d-92dd-da3b69aa9bda  base
shiny-r3.6                     0e6e79df-875e-4f24-8ae9-62dcc2148306  base
tensorflow_2.4-py3.7-horovod   1092590a-307d-563d-9b62-4eb7d64b3f22  base
pytorch_1.1-py3.6              10ac12d6-6b30-4ccd-8392-3e922c096a92  base
tensorflow_1.15-py3.6-ddl      111e41b3-de2d-5422-a4d6-bf776828c4b7  base
autoai-kb_rt22.2-py3.10        125b6d9a-5b1f-5e8d-972a-b251688ccf40  base
runtime-22.1-py3.9             12b83a17-24d8-5082-900f-0ab31fbfd3cb  base
scikit-learn_0.22-py3.6        154010fa-5b3b-4ac1-82af-4d5ee5abbc85  base
default_r3.6                   1b70aec3-ab34-4b87-8aa0-a4a3c8296a36  base
pytorch-onnx_1.3-py3.6         1bc6029a-cc97-56da-b8e0-39c3880dbbe7  base
kernel-spark3.3-r3.6           1c9e5454-f216-59dd-a20e-474a5cdf5988  base
pytorch-onnx_rt22.1-py3.9-edt  1d362186-7ad5-5b59-8b6c-9d0880bde37f  base
tensorflow_2.1-py3.6           1eb25b84-d6ed-5dde-b6a5-3fbdf1665666  base
spark-mllib_3.2                20047f72-0a98-58c7-9ff5-a77b012eb8f5  base
tensorflow_2.4-py3.8-horovod   217c16f6-178f-56bf-824a-b19f20564c49  base
runtime-22.1-py3.9-cuda        26215f05-08c3-5a41-a1b0-da66306ce658  base
do_py3.8                       295addb5-9ef9-547e-9bf4-92ae3563e720  base
autoai-ts_3.8-py3.8            2aa0c932-798f-5ae9-abd6-15e0c2402fb5  base
tensorflow_1.15-py3.6          2b73a275-7cbf-420b-a912-eae7f436e0bc  base
kernel-spark3.3-py3.9          2b7961e2-e3b1-5a8c-a491-482c8368839a  base
pytorch_1.2-py3.6              2c8ef57d-2687-4b7d-acce-01f94976dac1  base
spark-mllib_2.3                2e51f700-bca0-4b0d-88dc-5c6791338875  base
pytorch-onnx_1.1-py3.6-edt     32983cea-3f32-4400-8965-dde874a8d67e  base
spark-mllib_3.0-py37           36507ebe-8770-55ba-ab2a-eafe787600e9  base
spark-mllib_2.4                390d21f8-e58b-4fac-9c55-d7ceda621326  base
autoai-ts_rt22.2-py3.10        396b2e83-0953-5b86-9a55-7ce1628a406f  base
xgboost_0.82-py3.6             39e31acd-5f30-41dc-ae44-60233c80306e  base
pytorch-onnx_1.2-py3.6-edt     40589d0e-7019-4e28-8daa-fb03b6f4fe12  base
pytorch-onnx_rt22.2-py3.10     40e73f55-783a-5535-b3fa-0c8b94291431  base
default_r36py38                41c247d3-45f8-5a71-b065-8580229facf0  base
autoai-ts_rt22.1-py3.9         4269d26e-07ba-5d40-8f66-2d495b0c71f7  base
autoai-obm_3.0                 42b92e18-d9ab-567f-988a-4240ba1ed5f7  base
pmml-3.0_4.3                   493bcb95-16f1-5bc5-bee8-81b8af80e9c7  base
spark-mllib_2.4-r_3.6          49403dff-92e9-4c87-a3d7-a42d0021c095  base
xgboost_0.90-py3.6             4ff8d6c2-1343-4c18-85e1-689c965304d3  base
pytorch-onnx_1.1-py3.6         50f95b2a-bc16-43bb-bc94-b0bed208c60b  base
autoai-ts_3.9-py3.8            52c57136-80fa-572e-8728-a5e7cbb42cde  base
spark-mllib_2.4-scala_2.11     55a70f99-7320-4be5-9fb9-9edb5a443af5  base
spark-mllib_3.0                5c1b0ca2-4977-5c2e-9439-ffd44ea8ffe9  base
autoai-obm_2.0                 5c2e37fa-80b8-5e77-840f-d912469614ee  base
spss-modeler_18.1              5c3cad7e-507f-4b2a-a9a3-ab53a21dee8b  base
```

```
cuda-py3.8                     5d3232bf-c86b-5df4-a2cd-7bb870a1cd4e  base
runtime-22.2-py3.10-xc         5e8cddff-db4a-5a6a-b8aa-2d4af9864dab  base
autoai-kb_3.1-py3.7            632d4b22-10aa-5180-88f0-f52dfb6444d7  base
-----------------------------  ------------------------------------  ----
Note: Only first 50 records were displayed. To display more use 'limit' parameter.
```

In [125…

```
software_spec_uid = client.software_specifications.get_uid_by_name("default_py3.8")
software_spec_uid
```

Out[125]:

```
'ab9e1b80-f2ce-592c-a7d2-4f2344f77194'
```

In [126…

```
software_spec_uid= client.software_specifications.get_id_by_name('runtime-22.1-py3.9')
software_spec_uid
```

Out[126]:

```
'12b83a17-24d8-5082-900f-0ab31fbfd3cb'
```

In [129…

```
model_props={
client.repository.ModelMetaNames.NAME:'UAEL',
client.repository.ModelMetaNames.TYPE:'scikit-learn_1.0',
client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_spec_uid
}
```

In [131…

```
models_details=client.repository.store_model(
model=rfc,
meta_props=model_props,
training_data=X_train,
training_target=y_train
)
```

In [132…

```
models_details
```

```
Out[132]: {'entity': {'hybrid_pipeline_software_specs': [],
            'label_column': 'l1',
            'schemas': {'input': [{'fields': [{'name': 'f0', 'type': 'float'},
                {'name': 'f1', 'type': 'float'},
                {'name': 'f2', 'type': 'float'},
                {'name': 'f3', 'type': 'float'},
                {'name': 'f4', 'type': 'float'},
                {'name': 'f5', 'type': 'float'},
                {'name': 'f6', 'type': 'float'}],
               'id': '1',
               'type': 'struct'}],
             'output': []},
            'software_spec': {'id': '12b83a17-24d8-5082-900f-0ab31fbfd3cb',
             'name': 'runtime-22.1-py3.9'},
            'training_data_references': [{'id': '1',
              'location': {},
              'schema': {'fields': [{'name': 'f0', 'type': 'float'},
                {'name': 'f1', 'type': 'float'},
                {'name': 'f2', 'type': 'float'},
                {'name': 'f3', 'type': 'float'},
                {'name': 'f4', 'type': 'float'},
                {'name': 'f5', 'type': 'float'},
                {'name': 'f6', 'type': 'float'}],
               'id': '1',
               'type': 'ndarray'},
              'type': 'container'}],
            'type': 'scikit-learn_1.0'},
           'metadata': {'created_at': '2022-12-02T14:30:11.491Z',
            'id': '6a1db2ac-6796-466d-8ecb-ec7ffcea1f61',
            'modified_at': '2022-12-02T14:30:14.918Z',
            'name': 'UAEL',
            'owner': 'IBMid-66400454IR',
            'resource_key': '11d552d9-85a0-42f9-863d-fbb73092fbc7',
            'space_id': 'e98f8e76-b9d3-441d-91ef-21708cd61c81'},
           'system': {'warnings': []}}
```