Importing Libraries

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

import warnings
warnings.filterwarnings('ignore')
```

Import Dataset

In [2]:
```
df = pd.read_csv(r"E:\FSDS With GEN AI_NIT\Breast_cancer_data.csv")
df.head()
```

Out[2]:

	mean_radius	mean_texture	mean_perimeter	mean_area	mean_smoothness	diagnosis
0	17.99	10.38	122.80	1001.0	0.11840	0
1	20.57	17.77	132.90	1326.0	0.08474	0
2	19.69	21.25	130.00	1203.0	0.10960	0
3	11.42	20.38	77.58	386.1	0.14250	0
4	20.29	14.34	135.10	1297.0	0.10030	0

In [3]:
```
df.shape
```

Out[3]:
```
(569, 6)
```

View Summary of the dataset

In [4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 6 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   mean_radius      569 non-null    float64
 1   mean_texture     569 non-null    float64
 2   mean_perimeter   569 non-null    float64
 3   mean_area        569 non-null    float64
 4   mean_smoothness  569 non-null    float64
 5   diagnosis        569 non-null    int64  
dtypes: float64(5), int64(1)
memory usage: 26.8 KB
```

Check the Summary of the Tagert veriable

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

Out[5]:
```
mean_radius        569
mean_texture       569
mean_perimeter     569
mean_area          569
mean_smoothness    569
diagnosis          569
dtype: int64
```

In [6]:
```
df['diagnosis'].value_counts()
```

Out[6]:
```
diagnosis
1    357
0    212
Name: count, dtype: int64
```

- The target variable is diagnosis. It contains 2 values - 0 and 1.
-

0 is for Negative prediction and 1 for Positive predictio.+

We can see that the problem is binary classification task.

Declare Feature Vector and Target Variable

In [8]:
```
X = df[['mean_radius','mean_texture','mean_perimeter','mean_area','mean_smoothness']]
y = df['diagnosis']
```

In [11]:
```
X
```

Out[11]:

	mean_radius	mean_texture	mean_perimeter	mean_area	mean_smoothness
0	17.99	10.38	122.80	1001.0	0.11840
1	20.57	17.77	132.90	1326.0	0.08474
2	19.69	21.25	130.00	1203.0	0.10960
3	11.42	20.38	77.58	386.1	0.14250
4	20.29	14.34	135.10	1297.0	0.10030
...	...	...	...	...	...
564	21.56	22.39	142.00	1479.0	0.11100
565	20.13	28.25	131.20	1261.0	0.09780
566	16.60	28.08	108.30	858.1	0.08455
567	20.60	29.33	140.10	1265.0	0.11780
568	7.76	24.54	47.92	181.0	0.05263

569 rows × 5 columns

In [12]:
```
y
```

Out[12]:
```
0      0
1      0
2      0
3      0
4      0
      ..
564    0
565    0
566    0
567    0
568    1
Name: diagnosis, Length: 569, dtype: int64
```

Split the data into train and test split

In [9]:
```
from sklearn.model_selection import train_test_split

X_train,X_test,y_train,y_test = train_test_split(X,y,test_size = 0.3, random_state = 0)
```

Built a LGBM classifier Model

In [11]:
```
import lightgbm as lgb

cls = lgb.LGBMClassifier()
cls.fit(X_train,y_train)
```

```
[LightGBM] [Info] Number of positive: 249, number of negative: 149
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.000118 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 665
[LightGBM] [Info] Number of data points in the train set: 398, number of used features: 5
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.625628 -> initscore=0.513507
[LightGBM] [Info] Start training from score 0.513507
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
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[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

Out[11]:

```
▾ LGBMClassifier
LGBMClassifier()
```

Model Prediction based on test data

In [12]:

```
y_pred = cls.predict(X_test)
```

Compute Accuracy

In [13]:

```
from sklearn.metrics import accuracy_score
accuracy=accuracy_score(y_pred, y_test)
print('LightGBM Model accuracy score: {0:0.4f}'.format(accuracy_score(y_test, y_pred)))
```

```
LightGBM Model accuracy score: 0.9298
```

Compare the train and test score accuracy

In [16]:
```
y_pred_train = cls.predict(X_train)

print('Traing set accuracy is: {0:0.4f}'.format(accuracy_score(y_train,y_pred_train)))
```

```
Traing set accuracy is: 1.0000
```

Check for Overfitting

In [18]:
```
print('Training set accuracy (Bias): {0:0.4f}'.format(cls.score(X_train, y_train)))
print('Testing set accuracy (Variance): {0:0.4f}'.format(cls.score(X_test, y_test)))
```

```
Training set accuracy (Bias): 1.0000
Testing set accuracy (Variance): 0.9298
```

The training and test set accuracy are quite comparable. So, we cannot say there is overfitting.

Compute Confusion Matrix

In [21]:
```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test,y_pred)
print('Confusion Matrix\n\n', cm)
print('\n True Positive (TP):', cm[0,0])
print('\n True Negative (TN):', cm[1,1])
print('\n False Positive (FP):', cm[0,1])
print('\n False Negative (FN):', cm[1,0])
```

```
Confusion Matrix

 [[ 55   8]
 [  4 104]]

 True Positive (TP): 55

 True Negative (TN): 104

 False Positive (FP): 8

 False Negative (FN): 4
```

Classification Metrics

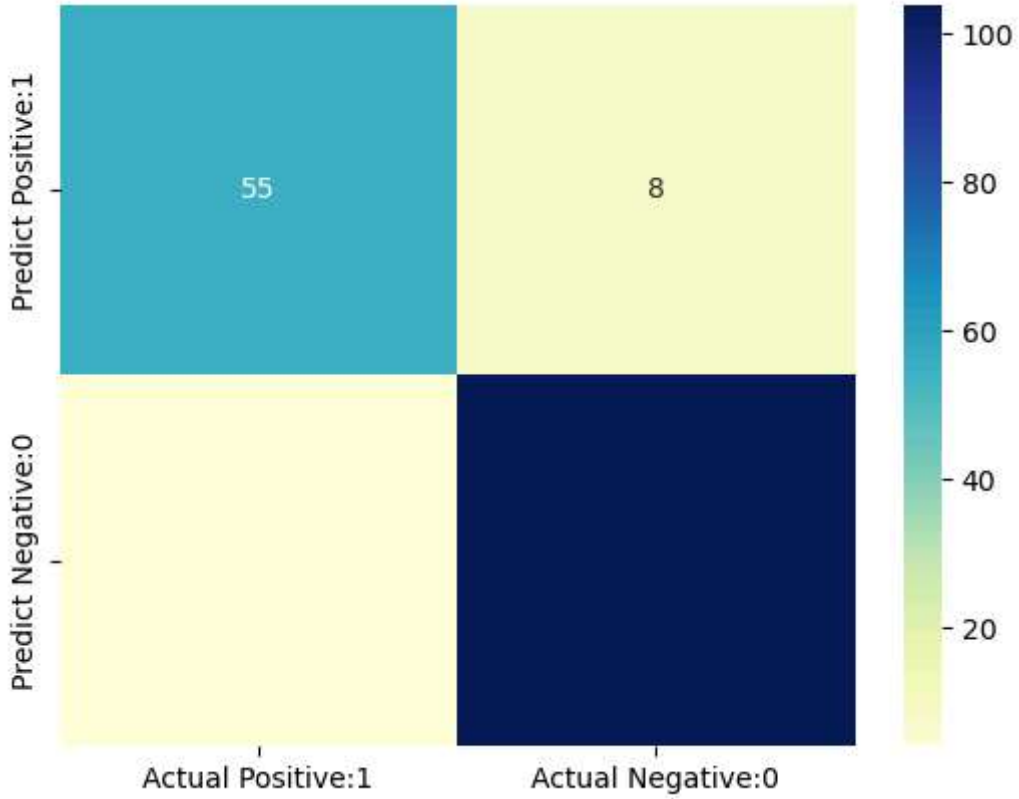
In [24]:
```
from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.93      0.87      0.90        63
           1       0.93      0.96      0.95       108

    accuracy                           0.93       171
   macro avg       0.93      0.92      0.92       171
weighted avg       0.93      0.93      0.93       171
```

visualize confusion matrix with seaborn heatmap

In [22]:
```
cm_matrix = pd.DataFrame(data=cm, columns=['Actual Positive:1', 'Actual Negative:0'],
                                 index=['Predict Positive:1', 'Predict Negative:0'])

sns.heatmap(cm_matrix, annot=True, fmt='d', cmap='YlGnBu')
```

Out[22]: <Axes: >


Predict Positive:1
Predict Negative:0
55
8
Actual Positive:1
Actual Negative:0
100
80
60
40
20