Initial Set-Up

In [5]:
```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import matplotlib.pyplot as plt # data visualization
import seaborn as sns # statistical data visualization


# Input data files are available in the "../input/" directory.
# For example, running this (by clicking run or pressing Shift+Enter) will list

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# Any results you write to the current directory are saved as output.
```

In [6]:
```
# ignore warnings
import warnings
warnings.filterwarnings("ignore")
```

Read dataset

In [7]:
```
# load and preview data
df = pd.read_csv(r"C:\Users\lenovo\Desktop\NIT FILES\Breast Cancer Prediction Da
df.head()
```

Out[7]:

	mean_radius	mean_texture	mean_perimeter	mean_area	mean_smoothness	diagnos
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	

View summary of dataset

In [8]:
```
# view summary of dataset
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 distribution of target variable

In [9]:
```
# check the distribution of the target variable
df['diagnosis'].value_counts()
```

Out[9]:
```
diagnosis
1    357
0    212
Name: count, dtype: int64
```

Declare feature vector and target variable

In [10]:
```
X = df[['mean_radius','mean_texture','mean_perimeter','mean_area','mean_smoothne
y = df['diagnosis']
```

Split dataset into training and test set

In [11]:
```
# split the dataset into the training set and test set
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, randc
```

LightGBM Model Development and Training

- We need to convert our training data into LightGBM dataset format(this is mandatory for LightGBM training).
- After creating the necessary dataset, we created a python dictionary with parameters and their values.
- Accuracy of the model depends on the values we provide to the parameters.
- In the end block of code, we simply trained model with 100 iterations.

In [12]:
```
# build the lightgbm model
import lightgbm as lgb
clf = lgb.LGBMClassifier()
clf.fit(X_train, y_train)
```

```
[LightGBM] [Info] Number of positive: 249, number of negative: 149
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing
was 0.000745 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 665
[LightGBM] [Info] Number of data points in the train set: 398, number of used fea
tures: 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
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[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

Out[12]:

```
▾ LGBMClassifier
LGBMClassifier()
```

Model Prediction

In [13]:
```
# predict the results
y_pred=clf.predict(X_test)
```

View Accuracy

In [14]:
```
# view accuracy
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_
```

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

In [19]:
```
# Here, y_test are the true class labels and y_pred are the predicted class labe
```

Compare train and test set accuracy

Now, I will compare the train-set and test-set accuracy to check for overfitting.

In [15]:
```
y_pred_train = clf.predict(X_train)
```

In [16]:
```
print('Training-set accuracy score: {0:0.4f}'. format(accuracy_score(y_train, y_
```

```
Training-set accuracy score: 1.0000
```

Check for Overfitting

In [17]:
```
# print the scores on training and test set

print('Training set score: {:.4f}'.format(clf.score(X_train, y_train)))

print('Test set score: {:.4f}'.format(clf.score(X_test, y_test)))
```

```
Training set score: 1.0000
Test set score: 0.9298
```

In [18]:
```
# The training and test set accuracy are quite comparable. So, we cannot say the
```

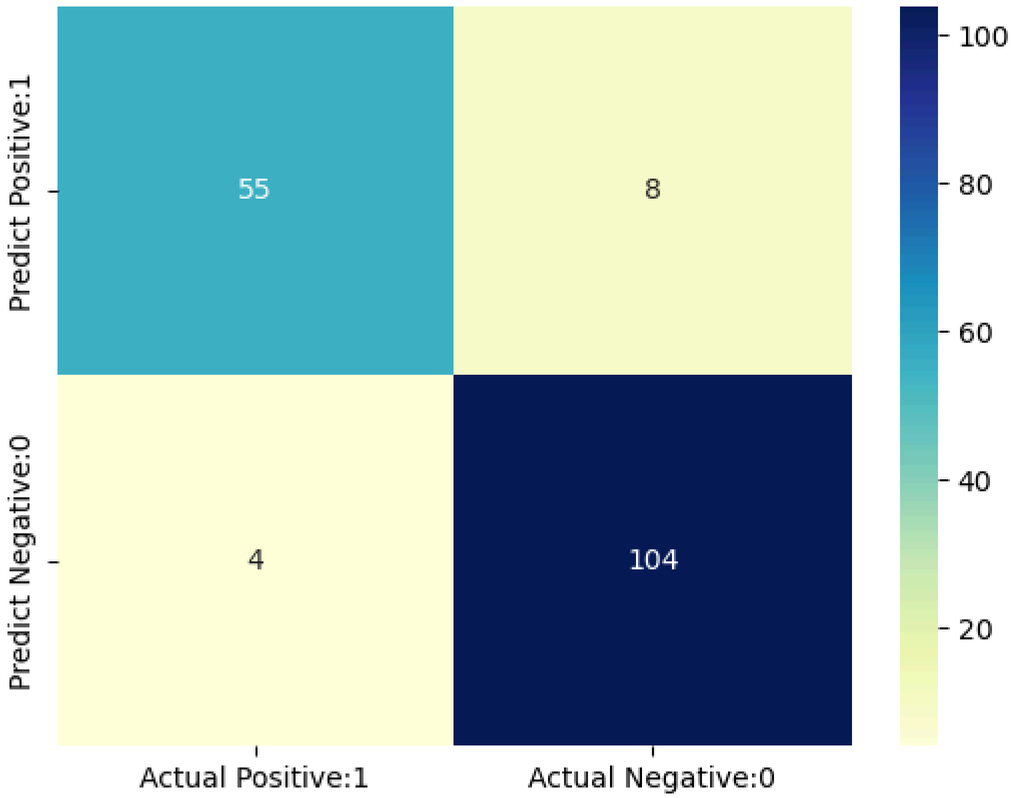
Confusion-matrix

In [20]:
```
# view confusion-matrix
# Print the Confusion Matrix and slice it into four pieces

from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_pred)
print('Confusion matrix\n\n', cm)
print('\nTrue Positives(TP) = ', cm[0,0])
print('\nTrue Negatives(TN) = ', cm[1,1])
print('\nFalse Positives(FP) = ', cm[0,1])
print('\nFalse Negatives(FN) = ', cm[1,0])
```

```
Confusion matrix

 [[ 55   8]
 [  4 104]]

True Positives(TP) =  55

True Negatives(TN) =  104

False Positives(FP) =  8

False Negatives(FN) =  4
```

In [21]:
```
# visualize confusion matrix with seaborn heatmap

cm_matrix = pd.DataFrame(data=cm, columns=['Actual Positive:1', 'Actual Negative
                                 index=['Predict Positive:1', 'Predict Negative:

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

Out[21]: <Axes: >



Classification Metrices

In [22]:
```
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
```