Loading Dataset

In [1]:

```python
import pandas as p
import numpy as np

data=p.read_csv('brcal.csv')
data
```

Out[1]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	concavity_mean	concave points_mean	...	texture_worst	perimeter_worst	area_worst	smoothness_worst	compactness_worst	concavity_
0	842302	M	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.30010	0.14710	...	17.33	184.60	2019.0	0.16220	0.66560	0.
1	842517	M	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.08690	0.07017	...	23.41	158.80	1956.0	0.12380	0.18660	0.
2	84300903	M	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.19740	0.12790	...	25.53	152.50	1709.0	0.14440	0.42450	0.
3	84348301	M	11.42	20.38	77.58	386.1	0.14250	0.28390	0.24140	0.10520	...	26.50	98.87	567.7	0.20980	0.86630	0.
4	84358402	M	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.19800	0.10430	...	16.67	152.20	1575.0	0.13740	0.20500	0.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
564	926424	M	21.56	22.39	142.00	1479.0	0.11100	0.11590	0.24390	0.13890	...	26.40	166.10	2027.0	0.14100	0.21130	0.
565	926682	M	20.13	28.25	131.20	1261.0	0.09780	0.10340	0.14400	0.09791	...	38.25	155.00	1731.0	0.11660	0.19220	0.
566	926954	M	16.60	28.08	108.30	858.1	0.08455	0.10230	0.09251	0.05302	...	34.12	126.70	1124.0	0.11390	0.30940	0.
567	927241	M	20.60	29.33	140.10	1265.0	0.11780	0.27700	0.35140	0.15200	...	39.42	184.60	1821.0	0.16500	0.86810	0.
568	92751	B	7.76	24.54	47.92	181.0	0.05263	0.04362	0.00000	0.00000	...	30.37	59.16	268.6	0.08996	0.06444	0.

569 rows × 33 columns

In [2]:

```python
data.info()
data.describe()
data.dropna()
data.isnull().sum()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 33 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   id                       569 non-null    int64  
 1   diagnosis                569 non-null    object 
 2   radius_mean              569 non-null    float64
 3   texture_mean             569 non-null    float64
 4   perimeter_mean           569 non-null    float64
 5   area_mean                569 non-null    float64
 6   smoothness_mean          569 non-null    float64
 7   compactness_mean         569 non-null    float64
 8   concavity_mean           569 non-null    float64
 9   concave points_mean      569 non-null    float64
 10  symmetry_mean            569 non-null    float64
 11  fractal_dimension_mean   569 non-null    float64
 12  radius_se                569 non-null    float64
 13  texture_se               569 non-null    float64
 14  perimeter_se             569 non-null    float64
 15  area_se                  569 non-null    float64
 16  smoothness_se            569 non-null    float64
 17  compactness_se           569 non-null    float64
 18  concavity_se             569 non-null    float64
 19  concave points_se        569 non-null    float64
 20  symmetry_se              569 non-null    float64
 21  fractal_dimension_se     569 non-null    float64
 22  radius_worst             569 non-null    float64
 23  texture_worst            569 non-null    float64
 24  perimeter_worst          569 non-null    float64
 25  area_worst               569 non-null    float64
 26  smoothness_worst         569 non-null    float64
 27  compactness_worst        569 non-null    float64
 28  concavity_worst          569 non-null    float64
 29  concave points_worst     569 non-null    float64
 30  symmetry_worst           569 non-null    float64
 31  fractal_dimension_worst  569 non-null    float64
 32  Unnamed: 32              0 non-null      float64
dtypes: float64(31), int64(1), object(1)
memory usage: 146.8+ KB
```

Out[2]:

```
id                           0
diagnosis                    0
radius_mean                  0
texture_mean                 0
perimeter_mean               0
area_mean                    0
smoothness_mean              0
compactness_mean             0
concavity_mean               0
concave points_mean          0
symmetry_mean                0
fractal_dimension_mean       0
radius_se                    0
texture_se                   0
perimeter_se                 0
area_se                      0
smoothness_se                0
compactness_se               0
concavity_se                 0
concave points_se            0
symmetry_se                  0
fractal_dimension_se         0
radius_worst                 0
texture_worst                0
perimeter_worst              0
area_worst                   0
smoothness_worst             0
compactness_worst            0
concavity_worst              0
concave points_worst         0
symmetry_worst               0
fractal_dimension_worst      0
Unnamed: 32                569
dtype: int64
```

In [3]:

```python
data.drop(["id"],axis=1,inplace=True)
data
```

Out[3]:

	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	concavity_mean	concave points_mean	symmetry_mean	...	texture_worst	perimeter_worst	area_worst	smoothness_worst	compactness_worst	conc
0	M	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.30010	0.14710	0.2419	...	17.33	184.60	2019.0	0.16220	0.66560	
1	M	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.08690	0.07017	0.1812	...	23.41	158.80	1956.0	0.12380	0.18660	
2	M	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.19740	0.12790	0.2069	...	25.53	152.50	1709.0	0.14440	0.42450	
3	M	11.42	20.38	77.58	386.1	0.14250	0.28390	0.24140	0.10520	0.2597	...	26.50	98.87	567.7	0.20980	0.86630	
4	M	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.19800	0.10430	0.1809	...	16.67	152.20	1575.0	0.13740	0.20500	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
564	M	21.56	22.39	142.00	1479.0	0.11100	0.11590	0.24390	0.13890	0.1726	...	26.40	166.10	2027.0	0.14100	0.21130	
565	M	20.13	28.25	131.20	1261.0	0.09780	0.10340	0.14400	0.09791	0.1752	...	38.25	155.00	1731.0	0.11660	0.19220	
566	M	16.60	28.08	108.30	858.1	0.08455	0.10230	0.09251	0.05302	0.1590	...	34.12	126.70	1124.0	0.11390	0.30940	
567	M	20.60	29.33	140.10	1265.0	0.11780	0.27700	0.35140	0.15200	0.2397	...	39.42	184.60	1821.0	0.16500	0.86810	
568	B	7.76	24.54	47.92	181.0	0.05263	0.04362	0.00000	0.00000	0.1587	...	30.37	59.16	268.6	0.08996	0.06444	

569 rows × 32 columns

In [4]:

```python
data.diagnosis.value_counts()
```

Out[4]:

```
diagnosis
B    357
M    212
Name: count, dtype: int64
```

In [5]:

```python
from sklearn.model_selection import train_test_split
diag_map={'M':1,'B':0}
data['diagnosis']=data['diagnosis'].map(diag_map)
```

In [6]:

```python
x = data.iloc[:, 1:]
x = x.drop(columns=["Unnamed: 32"])
y=data[['diagnosis']]
```

In [7]:

```python
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=30)
```

In [8]:

```python
from sklearn.neighbors import KNeighborsClassifier
```

In [10]:

```python
knn=KNeighborsClassifier()
knn.fit(x_train,y_train)
knn_pred=knn.predict(x_test)

# warnings removing
import warnings
warnings.filterwarnings('ignore', category=DeprecationWarning)
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\neighbors\_classification.py:238: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samp
les,), for example using ravel().
  return self._fit(X, y)
```

In [11]:

```python
from sklearn.metrics import confusion_matrix , accuracy_score
cm=confusion_matrix(knn_pred,y_test)
print(np.array(cm))
print('K Neighbors Classifier accuracy score is ',accuracy_score(knn_pred,y_test))
```

```
[[106  10]
 [  3  52]]
K Neighbors Classifier accuracy score is  0.9239766081871345
```

In [24]:

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

Model - Logistic regression

In [26]:

```python
lr=LogisticRegression()
lr.fit(x_train,y_train)
lr_pred=lr.predict(x_test)

import warnings
warnings.filterwarnings('ignore', category=DeprecationWarning)

warnings.filterwarnings('ignore', category=DeprecationWarning)
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\utils\validation.py:1300: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ),
for example using ravel().
  y = column_or_1d(y, warn=True)
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\linear_model\_logistic.py:469: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
```

Accuracy score and confusion matrix for Logistic regression

In [15]:

```python
cm=confusion_matrix(lr_pred,y_test)
print(np.array(cm))
print('Logistic regression accuracy score is ',accuracy_score(lr_pred,y_test))
```

```
[[104   8]
 [  5  54]]
Logistic regression accuracy score is  0.9239766081871345
```

Model - Gnn(Naive Bayes)

In [17]:

```python
from sklearn.naive_bayes import GaussianNB
gnb = GaussianNB()
gnb.fit(x_train, y_train)
gnb_pred=gnb.predict(x_test)
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\utils\validation.py:1300: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ),
for example using ravel().
  y = column_or_1d(y, warn=True)
```

In [18]:

```python
cm=confusion_matrix(gnb_pred,y_test)
print(np.array(cm))
print('Naive Bayes accuracy score is ',accuracy_score(gnb_pred,y_test))
```

```
[[104   7]
 [  5  55]]
Naive Bayes accuracy score is  0.9298245614035088
```

In [19]:

```python
from sklearn.model_selection import cross_val_score
```

In [20]:

```python
acc_all=[]
csv_all=[]
score=cross_val_score(knn,x_train,y_train,cv=100)
acc_all.append(accuracy_score(knn_pred,y_test))
csv_all.append(np.mean(score))
print('Accuracy of KNN',acc_all)
print('K cross validation scores  of KNN',csv_all)
# warnings removing
import warnings
warnings.filterwarnings('ignore', category=DeprecationWarning)
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\neighbors\_classification.py:238: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samp
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Accuracy of KNN [0.9239766081871345]
K cross validation scores  of KNN [0.9366666666666668]
```

Accuracy score and confusion matrix for Naive Bayes

In [21]:

```python
acc_all=[]
csv_all=[]
score=cross_val_score(lr,x_train,y_train,cv=10)
acc_all.append(accuracy_score(lr_pred,y_test))
csv_all.append(np.mean(score))
print('Accuracy of Logistic regression',acc_all)
print('K cross validation scores  of Logistic regression',csv_all)

# warnings removing
import warnings
warnings.filterwarnings('ignore', category=DeprecationWarning)
```

```
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\utils\validation.py:1300: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ),
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  y = column_or_1d(y, warn=True)
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\linear_model\_logistic.py:469: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
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K cross validation scores  of Logistic regression [0.9522435897435898]
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```

K-Fold Cross Validation

In [22]:

```python
acc_all=[]
csv_all=[]
score=cross_val_score(gnb,x_train,y_train,cv=10)
acc_all.append(accuracy_score(gnb_pred,y_test))
csv_all.append(np.mean(score))
print('Accuracy of Naive Bayes',acc_all)
print('K cross validation scores  of Naive Bayes',csv_all)
```

```
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  y = column_or_1d(y, warn=True)
Accuracy of Naive Bayes [0.9298245614035088]
K cross validation scores  of Naive Bayes [0.9421794871794871]
C:\ProgramData\anaconda3\Lib\site-packages\sklearn\utils\validation.py:1300: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ),
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```

```
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```

```
In [ ]:
```