AI project on cancer

In [1]:

```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
import matplotlib.pyplot as plt
import seaborn as sns
```

In [3]:

```
df = pd.read_csv('CancerData.csv')

df.describe()
```

Out[3]:

	ID	Radius_Mean	Tex_Mean	Peri_Mean	Area_Mean	Smooth_Mean	Compa
count	5.690000e+02	569.000000	569.000000	569.000000	569.000000	569.000000	56
mean	3.037183e+07	14.127292	19.289649	91.969033	654.889104	0.096360	
std	1.250206e+08	3.524049	4.301036	24.298981	351.914129	0.014064	
min	8.670000e+03	6.981000	9.710000	43.790000	143.500000	0.052630	
25%	8.692180e+05	11.700000	16.170000	75.170000	420.300000	0.086370	
50%	9.060240e+05	13.370000	18.840000	86.240000	551.100000	0.095870	
75%	8.813129e+06	15.780000	21.800000	104.100000	782.700000	0.105300	
max	9.113205e+08	28.110000	39.280000	188.500000	2501.000000	0.163400	

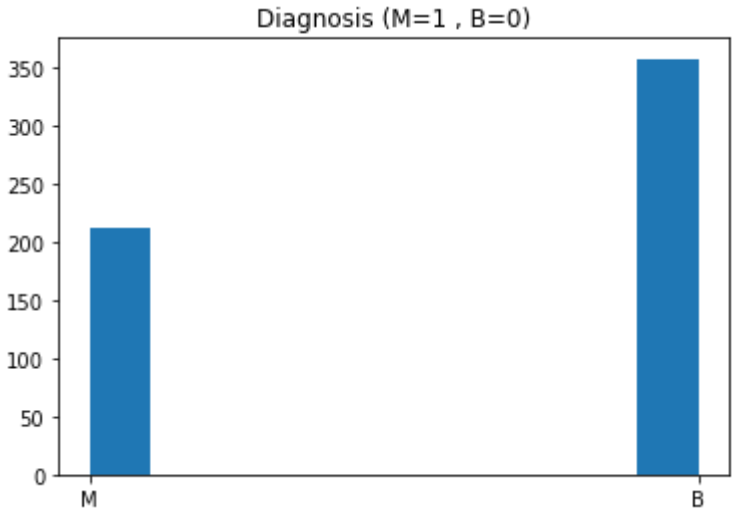
8 rows × 31 columns

In [4]:

```
plt.hist(df['Diagnosis'])
plt.title('Diagnosis (M=1 , B=0)')
plt.show()

# Separating the dependent and independent variable
y = df['Diagnosis']
X = df.drop('Diagnosis', axis = 1)
X = X.drop('ID', axis = 1)

# Splitting the data into training and testing data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.3, random_state
```



Model Creation & Scoring of the Dataset

In [5]:

```
K = []
training = []
test = []
scores = {}
for k in range(2, 21):
    clf = KNeighborsClassifier(n_neighbors = k)
    clf.fit(X_train, y_train)

    training_score = clf.score(X_train, y_train)
    test_score = clf.score(X_test, y_test)
    K.append(k)

    training.append(training_score)
    test.append(test_score)
    scores[k] = [training_score, test_score]
```

In [6]:

```
for keys, values in scores.items():
    print(keys, ':', values)
```

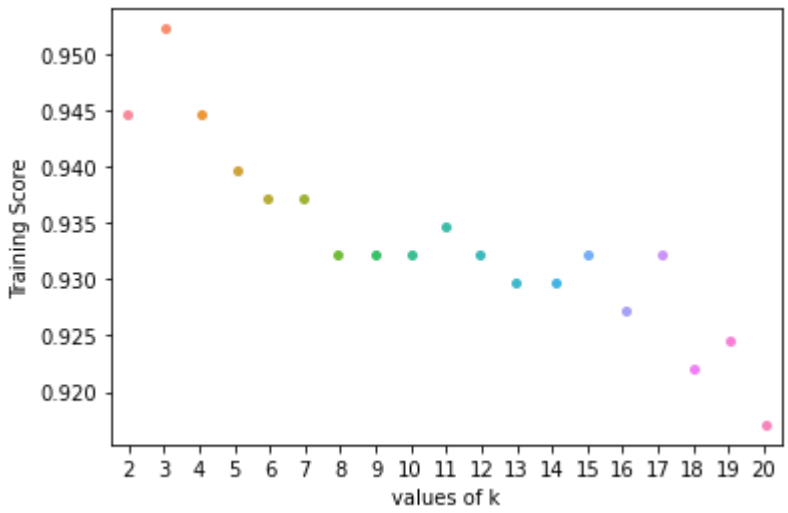
```
2 : [0.9447236180904522, 0.9298245614035088]
3 : [0.9522613065326633, 0.9181286549707602]
4 : [0.9447236180904522, 0.9298245614035088]
5 : [0.9396984924623115, 0.9473684210526315]
6 : [0.9371859296482412, 0.9473684210526315]
7 : [0.9371859296482412, 0.9532163742690059]
8 : [0.9321608040201005, 0.9532163742690059]
9 : [0.9321608040201005, 0.9590643274853801]
10 : [0.9321608040201005, 0.9649122807017544]
11 : [0.9346733668341709, 0.9649122807017544]
12 : [0.9321608040201005, 0.9649122807017544]
13 : [0.9296482412060302, 0.9649122807017544]
14 : [0.9296482412060302, 0.9649122807017544]
15 : [0.9321608040201005, 0.9649122807017544]
16 : [0.9271356783919598, 0.9649122807017544]
17 : [0.9321608040201005, 0.9649122807017544]
18 : [0.9221105527638191, 0.9649122807017544]
19 : [0.9246231155778895, 0.9649122807017544]
20 : [0.9170854271356784, 0.9649122807017544]
```

In [7]:

```
ax = sns.stripplot(K, training);
ax.set(xlabel ='values of k', ylabel ='Training Score')

plt.show()
# function to show plot
```

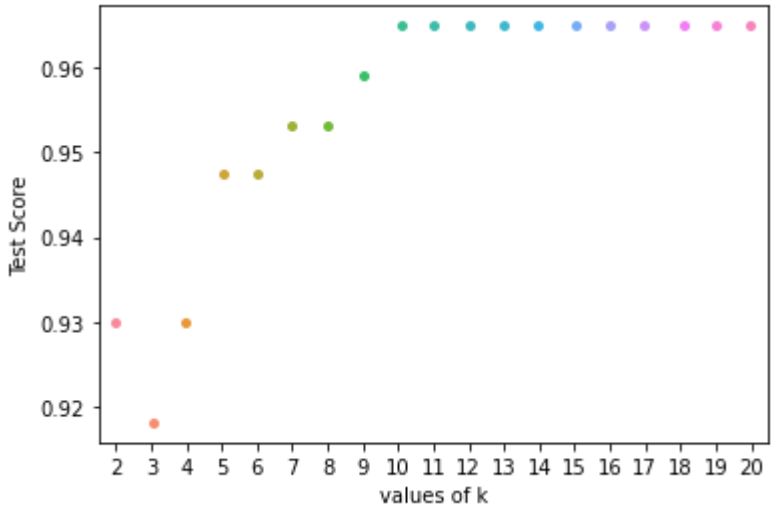
```
C:\Users\HP\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWar
ning: Pass the following variables as keyword args: x, y. From version 0.12,
the only valid positional argument will be `data`, and passing other argumen
ts without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```



In [8]:

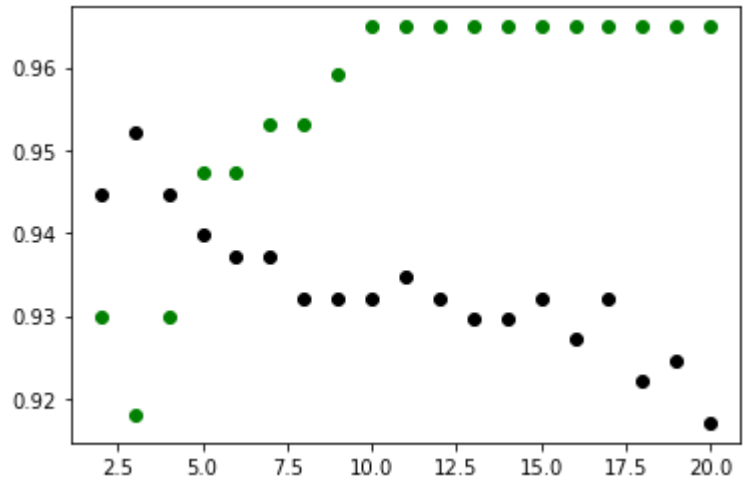
```
ax = sns.stripplot(K, test);
ax.set(xlabel ='values of k', ylabel ='Test Score')
plt.show()
```

```
C:\Users\HP\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWar
ning: Pass the following variables as keyword args: x, y. From version 0.12,
the only valid positional argument will be `data`, and passing other argumen
ts without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```



In [9]:

```
plt.scatter(K, training, color ='k')
plt.scatter(K, test, color ='g')
plt.show()
# For overlapping scatter plots
```



In [10]:

```
# Prediction

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

Out[10]:

```
array(['M', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'M', 'B', 'M', 'M', 'M', 'M', 'M', 'B', 'B', 'M', 'B',
       'B', 'B', 'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B',
       'M', 'M', 'B', 'M', 'B', 'B', 'M', 'B', 'B', 'B', 'M', 'M', 'B',
       'M', 'B', 'B', 'B', 'B', 'B', 'B', 'M', 'M', 'M', 'B', 'B', 'M',
       'B', 'M', 'M', 'M', 'B', 'B', 'M', 'B', 'B', 'M', 'B', 'B', 'B',
       'B', 'B', 'M', 'M', 'M', 'B', 'M', 'B', 'B', 'B', 'M', 'M', 'B',
       'M', 'B', 'M', 'B', 'B', 'M', 'B', 'B', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'M', 'B', 'M', 'M', 'B', 'M', 'M', 'B', 'B', 'B', 'M',
       'B', 'B', 'B', 'B', 'B', 'B', 'B', 'M', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'B', 'B', 'B', 'B', 'B', 'M', 'M', 'B', 'B', 'B', 'M',
       'B', 'B', 'M', 'B', 'M', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'M',
       'B', 'M', 'B', 'M', 'M', 'B', 'B', 'M', 'B', 'M', 'M', 'M', 'B',
       'B', 'B'], dtype=object)
```

In [11]:

```
# Accuracy Score

from sklearn.metrics import accuracy_score
accuracy_score(y_pred,y_test)*100
```

Out[11]:

```
96.49122807017544
```

In [12]:

```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_pred,y_test)
cm
```

Out[12]:

```
array([[106,   4],
       [  2,  59]], dtype=int64)
```

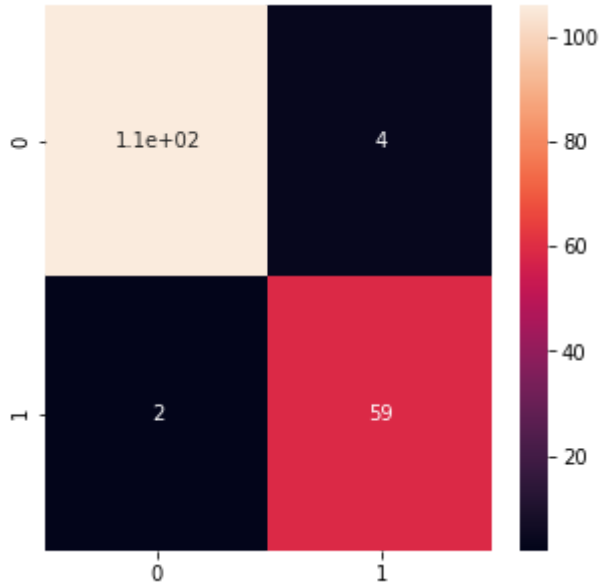
In [13]:

```
# HEATMAP

import matplotlib.pyplot as plt
plt.figure(figsize=(5,5))
import seaborn as sns
sns.heatmap(cm, annot = True)
```

Out[13]:

<AxesSubplot:>



In [14]:

```
from sklearn.metrics import classification_report
print(classification_report(y_pred,y_test))
```

```
              precision    recall  f1-score   support

           B       0.98      0.96      0.97       110
           M       0.94      0.97      0.95        61

    accuracy                           0.96       171
   macro avg       0.96      0.97      0.96       171
weighted avg       0.97      0.96      0.97       171
```

In [17]:

```
import inspect
from sklearn.utils.testing import all_estimators
for name, clf in all_estimators(type_filter='classifier'):
    if 'sample_weight' in inspect.getargspec(clf.fit)[0]:
        print(name)
```

```
C:\Users\HP\anaconda3\lib\site-packages\sklearn\utils\deprecation.py:143: Fu
tureWarning: The sklearn.utils.testing module is  deprecated in version 0.22
and will be removed in version 0.24. The corresponding classes / functions s
hould instead be imported from sklearn.utils. Anything that cannot be import
ed from sklearn.utils is now part of the private API.
  warnings.warn(message, FutureWarning)

AdaBoostClassifier
BaggingClassifier
BernoulliNB
CalibratedClassifierCV
CategoricalNB
ComplementNB
DecisionTreeClassifier
DummyClassifier
ExtraTreeClassifier
ExtraTreesClassifier
GaussianNB
GradientBoostingClassifier
HistGradientBoostingClassifier
LinearSVC
LogisticRegression
LogisticRegressionCV
MultiOutputClassifier
MultinomialNB
NuSVC
Perceptron
RandomForestClassifier
RidgeClassifier
RidgeClassifierCV
SGDClassifier
SVC
StackingClassifier
VotingClassifier

<ipython-input-17-7ef36e6e7daa>:4: DeprecationWarning: inspect.getargspec()
is deprecated since Python 3.0, use inspect.signature() or inspect.getfullar
gspec()
  if 'sample_weight' in inspect.getargspec(clf.fit)[0]:
```

Implementation of Bagging and Boosting using Decision Tree Classifier as Base Estimator

In [22]:

```
# to create the DT model - base estimator (entropy)
from sklearn.tree import DecisionTreeClassifier
DTC = DecisionTreeClassifier(criterion='entropy')

# train the classifier on training data
DTC.fit(X_train, y_train)
```

Out[22]:

```
DecisionTreeClassifier(criterion='entropy')
```

In [24]:

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

Out[24]:

```
array(['M', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'M', 'B', 'M', 'M', 'M', 'M', 'M', 'B', 'B', 'M', 'B',
       'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B',
       'M', 'M', 'B', 'M', 'B', 'B', 'M', 'B', 'B', 'B', 'M', 'M', 'M',
       'M', 'B', 'B', 'B', 'B', 'B', 'B', 'M', 'M', 'M', 'B', 'B', 'M',
       'B', 'M', 'M', 'M', 'B', 'B', 'M', 'B', 'B', 'M', 'B', 'B', 'B',
       'B', 'B', 'M', 'M', 'M', 'B', 'M', 'B', 'B', 'B', 'M', 'M', 'B',
       'B', 'B', 'M', 'B', 'B', 'M', 'B', 'B', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'M', 'B', 'M', 'M', 'B', 'M', 'M', 'B', 'B', 'B', 'B',
       'B', 'B', 'B', 'B', 'B', 'M', 'B', 'M', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'B', 'B', 'B', 'B', 'B', 'M', 'M', 'B', 'B', 'B', 'M',
       'B', 'B', 'M', 'B', 'M', 'B', 'B', 'B', 'B', 'B', 'M', 'B', 'M',
       'B', 'M', 'B', 'M', 'M', 'B', 'M', 'M', 'B', 'M', 'M', 'M', 'B',
       'B', 'B'], dtype=object)
```

Boosting Model

In [25]:

```
# to create boosting model

from sklearn.ensemble import AdaBoostClassifier
AdaBoost = AdaBoostClassifier(base_estimator = DTC, n_estimators = 400, learning_rate =

boostmodel = AdaBoost.fit(X_train, y_train)
```

In [26]:

```
y_boostpred = boostmodel.predict(X_test)
y_boostpred
```

Out[26]:

```
array(['M', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'M', 'B', 'M', 'M', 'M', 'M', 'M', 'B', 'B', 'M', 'B',
       'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B',
       'M', 'M', 'B', 'M', 'B', 'B', 'M', 'B', 'M', 'B', 'M', 'M', 'M',
       'B', 'B', 'B', 'B', 'B', 'B', 'M', 'M', 'M', 'M', 'B', 'B', 'M',
       'B', 'M', 'M', 'M', 'B', 'M', 'M', 'B', 'B', 'M', 'B', 'B', 'B',
       'B', 'B', 'M', 'M', 'M', 'B', 'M', 'B', 'B', 'B', 'M', 'M', 'B',
       'M', 'M', 'M', 'B', 'B', 'M', 'B', 'B', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'M', 'B', 'M', 'B', 'B', 'M', 'M', 'M', 'B', 'B', 'B',
       'B', 'B', 'B', 'B', 'B', 'M', 'B', 'M', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'B', 'B', 'B', 'B', 'B', 'M', 'M', 'B', 'B', 'B', 'M',
       'B', 'B', 'M', 'B', 'M', 'B', 'B', 'B', 'B', 'B', 'M', 'B', 'M',
       'B', 'M', 'B', 'M', 'M', 'B', 'M', 'M', 'B', 'M', 'M', 'M', 'B',
       'B', 'B'], dtype=object)
```

In [27]:

```
#accuracy of boosted model
from sklearn.metrics import accuracy_score
accuracy_score(y_boostpred, y_test)*100
```

Out[27]:

```
93.56725146198829
```

In [28]:

```
#confusion matrix for boosted model
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_boostpred,y_test)
cm
```

Out[28]:

```
array([[100,   3],
       [  8,  60]], dtype=int64)
```

In [29]:

```
#performance report for boosted model
from sklearn.metrics import classification_report
print(classification_report(y_boostpred,y_test))
```

```
              precision    recall  f1-score   support

           B       0.93      0.97      0.95       103
           M       0.95      0.88      0.92        68

    accuracy                           0.94       171
   macro avg       0.94      0.93      0.93       171
weighted avg       0.94      0.94      0.94       171
```

Bagging Model

In [30]:

```
# to create bagging model

from sklearn.ensemble import BaggingClassifier
Bag = BaggingClassifier(base_estimator = DTC, n_estimators = 400, max_samples = 0.8, oo

Bag.fit(X_train, y_train)
```

Out[30]:

```
BaggingClassifier(base_estimator=DecisionTreeClassifier(criterion='entrop
y'),
                  max_samples=0.8, n_estimators=400, oob_score=True,
                  random_state=0)
```

In [32]:

```
y_bagpred = Bag.predict(X_test)
y_bagpred
```

Out[32]:

```
array(['M', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'M', 'B', 'M', 'M', 'M', 'M', 'M', 'B', 'B', 'M', 'B',
       'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B', 'M', 'B',
       'M', 'M', 'B', 'M', 'B', 'B', 'M', 'B', 'B', 'B', 'M', 'M', 'M',
       'M', 'B', 'B', 'B', 'B', 'B', 'B', 'M', 'M', 'M', 'B', 'B', 'M',
       'B', 'M', 'M', 'M', 'B', 'B', 'M', 'B', 'B', 'M', 'B', 'B', 'B',
       'B', 'B', 'M', 'M', 'M', 'B', 'M', 'B', 'B', 'B', 'M', 'M', 'B',
       'B', 'B', 'M', 'B', 'B', 'M', 'B', 'B', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'M', 'B', 'B', 'M', 'B', 'M', 'M', 'B', 'B', 'B', 'B',
       'B', 'B', 'B', 'B', 'B', 'M', 'B', 'M', 'B', 'B', 'B', 'B', 'B',
       'M', 'B', 'B', 'B', 'B', 'B', 'B', 'B', 'M', 'B', 'B', 'B', 'M',
       'B', 'B', 'M', 'B', 'B', 'B', 'B', 'B', 'M', 'B', 'B', 'B', 'M',
       'B', 'M', 'B', 'M', 'M', 'B', 'B', 'M', 'B', 'M', 'M', 'M', 'B',
       'B', 'B'], dtype=object)
```

In [34]:

```
#for bagging model
accuracy_score(y_bagpred, y_test)*100
```

Out[34]:

```
95.90643274853801
```

In [35]:

```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_bagpred,y_test)
cm
```

Out[35]:

```
array([[106,   5],
       [  2,  58]], dtype=int64)
```

In [36]:

```
from sklearn.metrics import classification_report
print(classification_report(y_bagpred,y_test))
```

```
              precision    recall  f1-score   support

           B       0.98      0.95      0.97       111
           M       0.92      0.97      0.94        60

    accuracy                           0.96       171
   macro avg       0.95      0.96      0.96       171
weighted avg       0.96      0.96      0.96       171
```

THANK YOU