MACHINE **LEARNING PROJECT**

AIM: K-nearest neighbour algorithm is used to predict whether is patient is having cancer (Malignant tumour) or not (Benign tumour).

Implementation of KNN algorithm for classification.

Code: Importing Libraries

```
# performing linear algebra
import numpy as np

# data processing
import pandas as pd

# visualisation
import matplotlib.pyplot as plt
```

Code: Loading dataset

```
df = pd.read_csv("..\\breast-cancer-wisconsin-data\\data.csv")

print (data.head)
```

Output:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	concavity_mean	concave points_mean	...
0	842302	M	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.3001	0.14710	...
1	842517	M	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.0869	0.07017	...
2	84300903	M	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.1974	0.12790	...
3	84348301	M	11.42	20.38	77.58	386.1	0.14250	0.28390	0.2414	0.10520	...
4	84358402	M	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.1980	0.10430	...

Code: Data Info

```
df.info()
```

Output:

```
RangeIndex: 569 entries, 0 to 568
Data columns (total 33 columns):
id                         569 non-null int64
diagnosis                  569 non-null object
radius_mean                569 non-null float64
texture_mean               569 non-null float64
perimeter_mean             569 non-null float64
area_mean                  569 non-null float64
smoothness_mean            569 non-null float64
compactness_mean           569 non-null float64
concavity_mean             569 non-null float64
concave points_mean        569 non-null float64
symmetry_mean              569 non-null float64
fractal_dimension_mean     569 non-null float64
radius_se                  569 non-null float64
texture_se                 569 non-null float64
perimeter_se               569 non-null float64
area_se                    569 non-null float64
smoothness_se              569 non-null float64
compactness_se             569 non-null float64
concavity_se               569 non-null float64
concave points_se          569 non-null float64
symmetry_se                569 non-null float64
fractal_dimension_se       569 non-null float64
radius_worst               569 non-null float64
texture_worst              569 non-null float64
perimeter_worst            569 non-null float64
area_worst                 569 non-null float64
smoothness_worst           569 non-null float64
compactness_worst          569 non-null float64
concavity_worst            569 non-null float64
```

```
concave points_worst        569 non-null float64
symmetry_worst              569 non-null float64
fractal_dimension_worst     569 non-null float64
Unnamed: 32                 0 non-null float64
dtypes: float64(31), int64(1), object(1)
memory usage: 146.8+ KB
```

Code: We are dropping columns – 'id' and 'Unnamed: 32' as they have no role in prediction

```
df.drop(['Unnamed: 32', 'id'], axis = 1)
print(df.shape)
```

Output:

```
(569, 31)
```

Code: Converting the diagnosis value of M and B to a numerical value where M (Malignant) = 1 and B (Benign) = 0

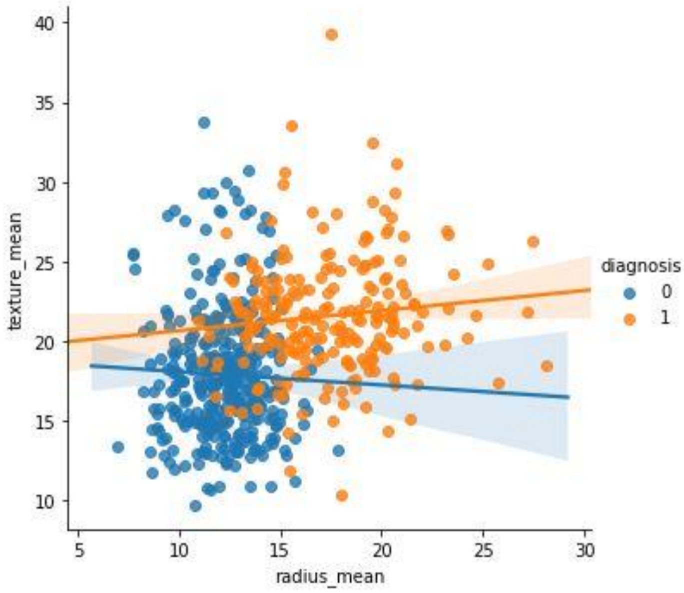
```
def diagnosis_value(diagnosis):
    if diagnosis == 'M':
        return 1
    else:
        return 0

df['diagnosis'] = df['diagnosis'].apply(diagnosis_value)
```

Code:

```
sns.lmplot(x = 'radius_mean', y = 'texture_mean', hue =
'diagnosis', data = df)
```

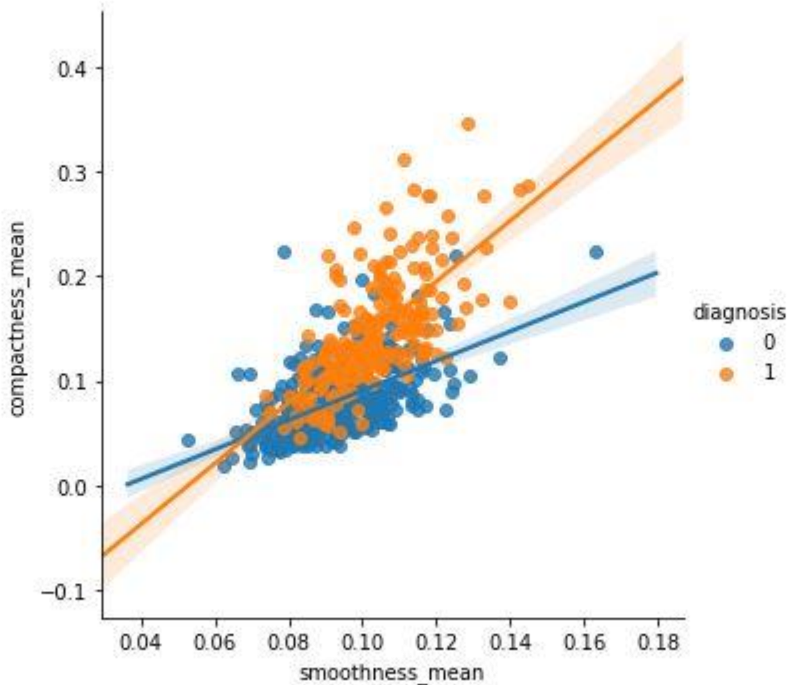
Output:



Code:

```
sns.lmplot(x ='smoothness_mean', y = 'compactness_mean',
           data = df, hue = 'diagnosis')
```

Output:



Code: Input and Output data

```
X = np.array(df.iloc[:, 1:])
y = np.array(df['diagnosis'])
```

Code: Splitting data to training and testing

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size = 0.33, random_state = 42)
```

Code: Using Sklearn

```
knn = KNeighborsClassifier(n_neighbors = 13)
knn.fit(X_train, y_train)
```

Output:

```
KNeighborsClassifier(algorithm='auto', leaf_size=30,
              metric='minkowski', metric_params=None,
              n_jobs=None, n_neighbors=13, p=2,
              weights='uniform')
```

Code: Prediction Score

```
knn.score(X_test, y_test)
```

Output:

```
0.9627659574468085
```

<u>Code:</u> Performing Cross Validation

```
neighbors = []
cv_scores = []

from sklearn.model_selection import cross_val_score
# perform 10 fold cross validation
for k in range(1, 51, 2):
    neighbors.append(k)
    knn = KNeighborsClassifier(n_neighbors = k)
    scores = cross_val_score(
        knn, X_train, y_train, cv = 10, scoring = 'accuracy')
    cv_scores.append(scores.mean())
```

<u>Code:</u> Misclassification error versus k

```
MSE = [1-x for x in cv_scores]

# determining the best k
optimal_k = neighbors[MSE.index(min(MSE))]
print('The optimal number of neighbors is % d ' % optimal_k)

# plot misclassification error versus k
plt.figure(figsize = (10, 6))
plt.plot(neighbors, MSE)
plt.xlabel('Number of neighbors')
plt.ylabel('Misclassification Error')
plt.show()
```

<u>Output:</u>

```
The optimal number of neighbors is 13
```