```
# performing linear algebra
import numpy as np

# data processing
import pandas as pd

# visualisation
import matplotlib.pyplot as plt
```

```
df = pd.read_csv("/content/data.csv")
```

```
df.head()
```

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

5 rows × 33 columns

```
df.isnull().sum()
```

```
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
```

```
df.info()
```

```
<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
```

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

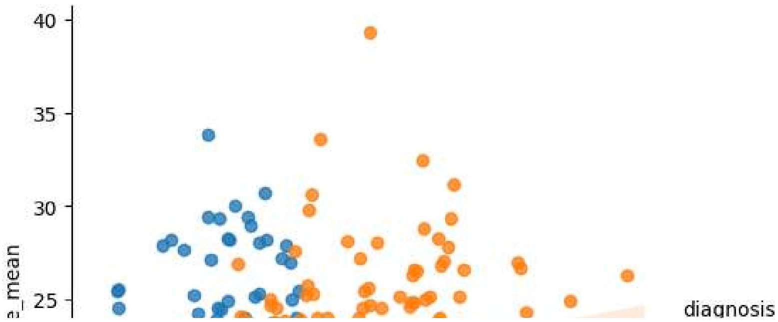
```
(569, 33)
```

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

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

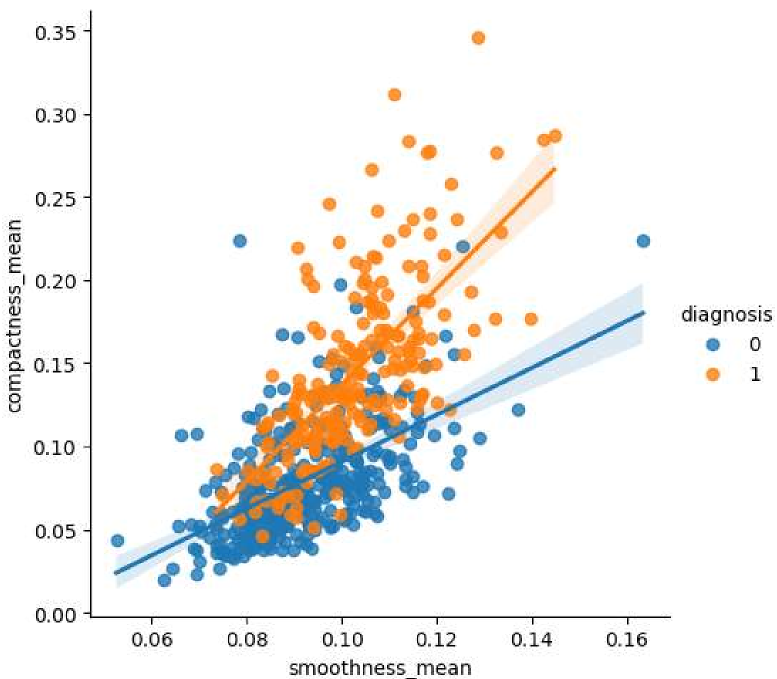
```
import seaborn as sns
sns.lmplot(x = 'radius_mean', y = 'texture_mean', hue = 'diagnosis', data = df)
```

```
<seaborn.axisgrid.FacetGrid at 0x7a380f7b2290>
```




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

```
<seaborn.axisgrid.FacetGrid at 0x7a380ecd9db0>
```




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

```
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)
```

```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.impute import SimpleImputer
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score
```

```
# Handle missing values by imputing with mean
imputer = SimpleImputer(strategy='mean')
X_train = imputer.fit_transform(X_train)
X_test = imputer.transform(X_test)

# Scale features
```

```
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)

# Train the K-nearest neighbors classifier
knn = KNeighborsClassifier(n_neighbors=13)
knn.fit(X_train, y_train)

# Make predictions on the test set
y_pred = knn.predict(X_test)

# Calculate accuracy
accuracy = accuracy_score(y_test, y_pred)
print(f'Accuracy: {accuracy * 100:.2f}%')
```

```
Accuracy: 99.47%
```

```
from sklearn.neighbors import KNeighborsClassifier

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

```
▾ KNeighborsClassifier
KNeighborsClassifier(n_neighbors=13)
```

```
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())
```

```
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()
```

```
The optimal number of neighbors is  1
```