Project Name: Evaluation and Prediction of Recurrence of Thyroid Cancer

Institution Name: Shaheed Sukhdev College of Business Studies

Guidance Under: Dr. Rishi Ranjan Sahay

Course Name: Certificate course on Data Analytics & Business Intelligence

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```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

df=pd.read_csv("Thyroid_Diff.csv")

df.head()
```

```
   Age Gender Smoking Hx Smoking Hx Radiothreapy Thyroid Function  \
0   27      F         No         No              No        Euthyroid
1   34      F         No        Yes              No        Euthyroid
2   30      F         No         No              No        Euthyroid
3   62      F         No         No              No        Euthyroid
4   62      F         No         No              No        Euthyroid

          Physical Examination Adenopathy       Pathology     Focality
Risk  \
0   Single nodular goiter-left         No  Micropapillary    Uni-Focal
Low
1          Multinodular goiter         No  Micropapillary    Uni-Focal
Low
2  Single nodular goiter-right         No  Micropapillary    Uni-Focal
Low
3  Single nodular goiter-right         No  Micropapillary    Uni-Focal
Low
4          Multinodular goiter         No  Micropapillary  Multi-Focal
Low

     T   N   M Stage       Response Recurred
0  T1a  N0  M0     I  Indeterminate       No
1  T1a  N0  M0     I      Excellent       No
```

```
2  T1a  N0  M0     I      Excellent       No
3  T1a  N0  M0     I      Excellent       No
4  T1a  N0  M0     I      Excellent       No
```

```
df.shape
```

```
(383, 17)
```

```
df.columns
```

```
Index(['Age', 'Gender', 'Smoking', 'Hx Smoking', 'Hx Radiothreapy',
       'Thyroid Function', 'Physical Examination', 'Adenopathy',
'Pathology',
       'Focality', 'Risk', 'T', 'N', 'M', 'Stage', 'Response',
'Recurred'],
      dtype='object')
```

```
df.tail()
```

```
     Age Gender Smoking Hx Smoking Hx Radiothreapy           Thyroid
Function  \
378   72      M     Yes        Yes              Yes
Euthyroid
379   81      M     Yes         No              Yes
Euthyroid
380   72      M     Yes        Yes               No
Euthyroid
381   61      M     Yes        Yes              Yes  Clinical
Hyperthyroidism
382   67      M     Yes         No               No
Euthyroid

            Physical Examination Adenopathy     Pathology     Focality
Risk  \
378  Single nodular goiter-right      Right     Papillary    Uni-Focal
High
379          Multinodular goiter  Extensive     Papillary  Multi-Focal
High
380          Multinodular goiter  Bilateral     Papillary  Multi-Focal
High
381          Multinodular goiter  Extensive  Hurthel cell  Multi-Focal
High
382          Multinodular goiter  Bilateral     Papillary  Multi-Focal
High

       T    N   M Stage               Response Recurred
378  T4b  N1b  M1   IVB  Biochemical Incomplete      Yes
379  T4b  N1b  M1   IVB   Structural Incomplete      Yes
380  T4b  N1b  M1   IVB   Structural Incomplete      Yes
381  T4b  N1b  M0   IVA   Structural Incomplete      Yes
382  T4b  N1b  M0   IVA   Structural Incomplete      Yes
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 383 entries, 0 to 382
Data columns (total 17 columns):
 #   Column                Non-Null Count  Dtype 
---  ------                --------------  ----- 
 0   Age                   383 non-null    int64 
 1   Gender                383 non-null    object
 2   Smoking               383 non-null    object
 3   Hx Smoking            383 non-null    object
 4   Hx Radiothreapy       383 non-null    object
 5   Thyroid Function      383 non-null    object
 6   Physical Examination  383 non-null    object
 7   Adenopathy            383 non-null    object
 8   Pathology             383 non-null    object
 9   Focality              383 non-null    object
 10  Risk                  383 non-null    object
 11  T                     383 non-null    object
 12  N                     383 non-null    object
 13  M                     383 non-null    object
 14  Stage                 383 non-null    object
 15  Response              383 non-null    object
 16  Recurred              383 non-null    object
dtypes: int64(1), object(16)
memory usage: 51.0+ KB
```

```
df.describe()
```

```
              Age
count  383.000000
mean    40.866841
std     15.134494
min     15.000000
25%     29.000000
50%     37.000000
75%     51.000000
max     82.000000
```

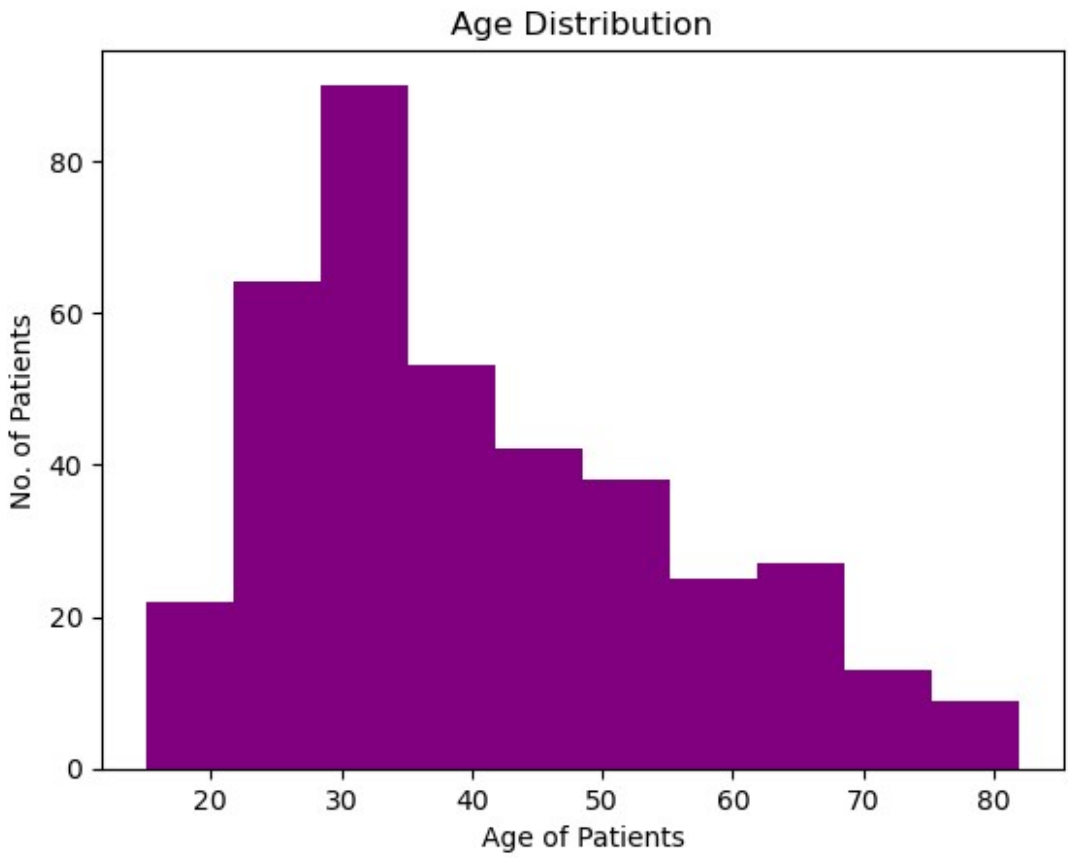
```
df.isnull().sum()
```

```
Age                     0
Gender                  0
Smoking                 0
Hx Smoking              0
Hx Radiothreapy         0
Thyroid Function        0
Physical Examination    0
Adenopathy              0
Pathology               0
```

```
Focality                0
Risk                    0
T                       0
N                       0
M                       0
Stage                   0
Response                0
Recurred                0
dtype: int64
```

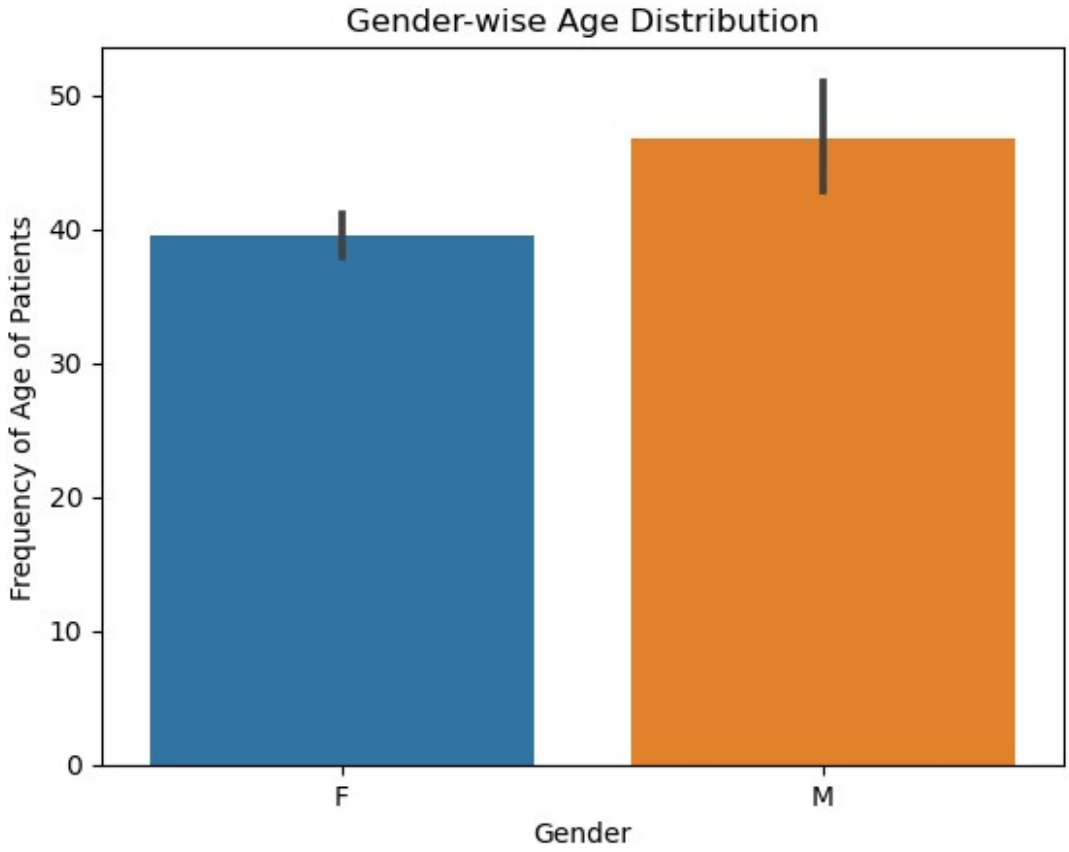
EXPLORATORY DATA ANALYSIS (EDA)

```
# 1. Age Distribution Graph
plt.hist(df['Age'],bins=10, color='purple')
plt.title('Age Distribution')
plt.xlabel('Age of Patients')
plt.ylabel('No. of Patients')
plt.savefig('insight1.png')
plt.show()
```

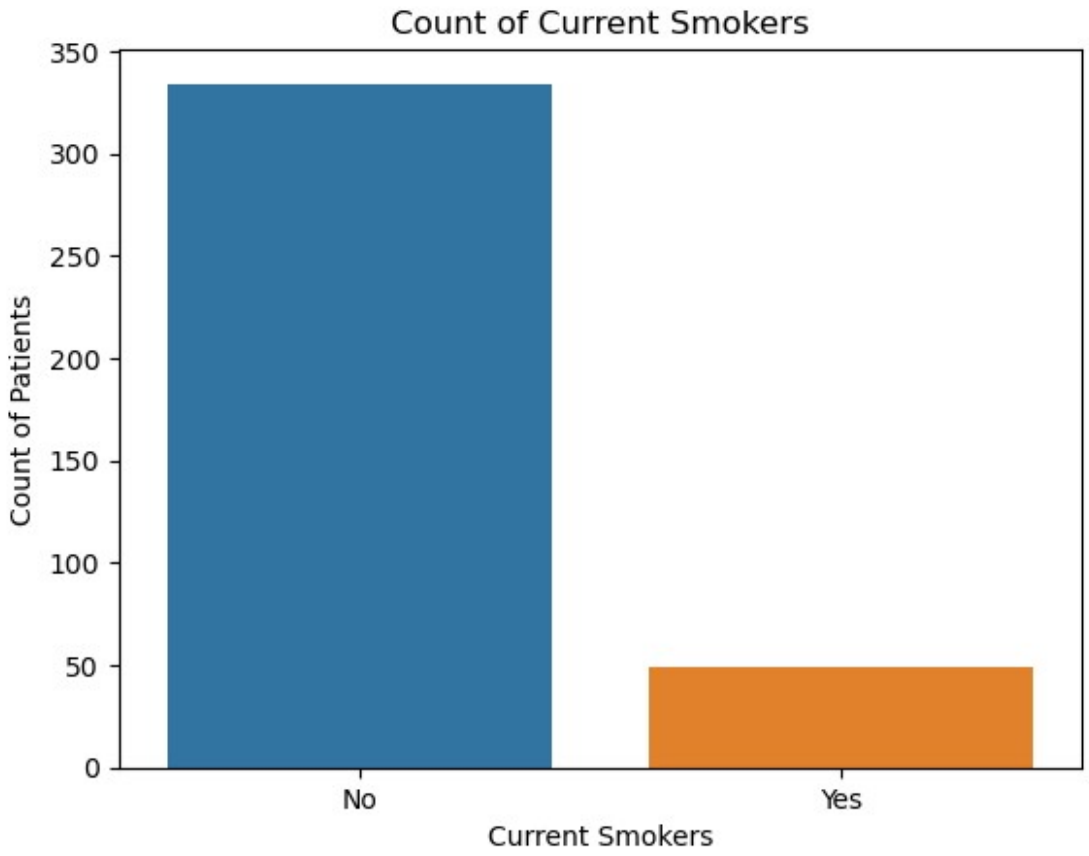



```
# 2. Gender-wise Age Distribution
sns.barplot(x='Gender',y='Age',data=df)
```

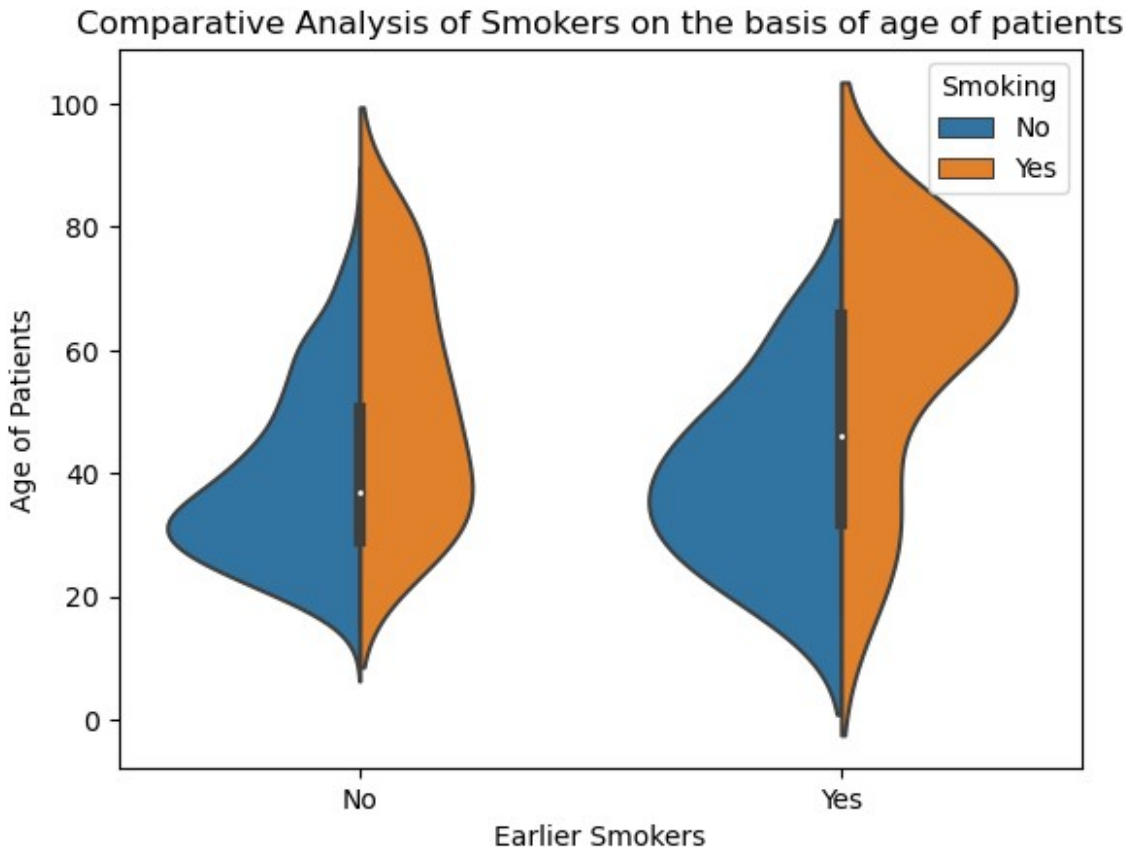
```
plt.title('Gender-wise Age Distribution')
plt.xlabel('Gender')
plt.ylabel('Frequency of Age of Patients')
plt.savefig('insight2.png')
plt.show()
```



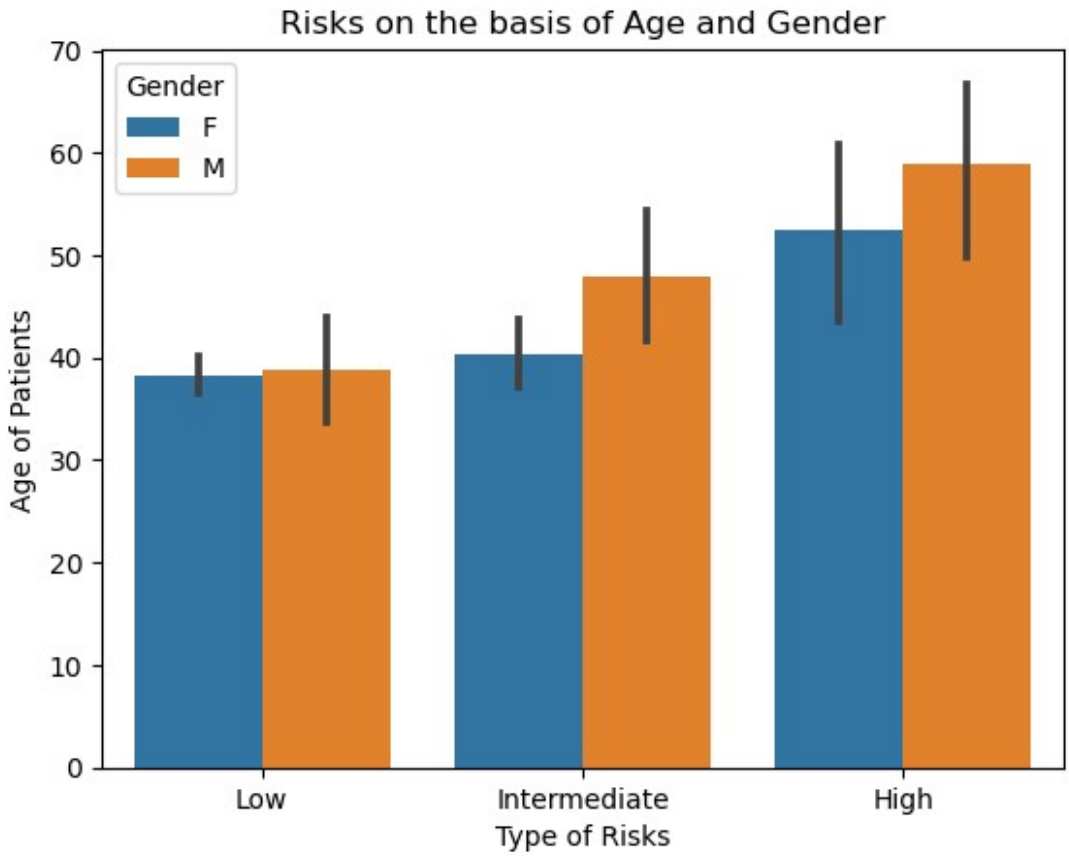

```
# 3.  Count of Current Smokers
sns.countplot(x='Smoking',data=df)
plt.title('Count of Current Smokers')
plt.xlabel('Current Smokers')
plt.ylabel('Count of Patients')
plt.savefig('insight3.png')
plt.show()
```



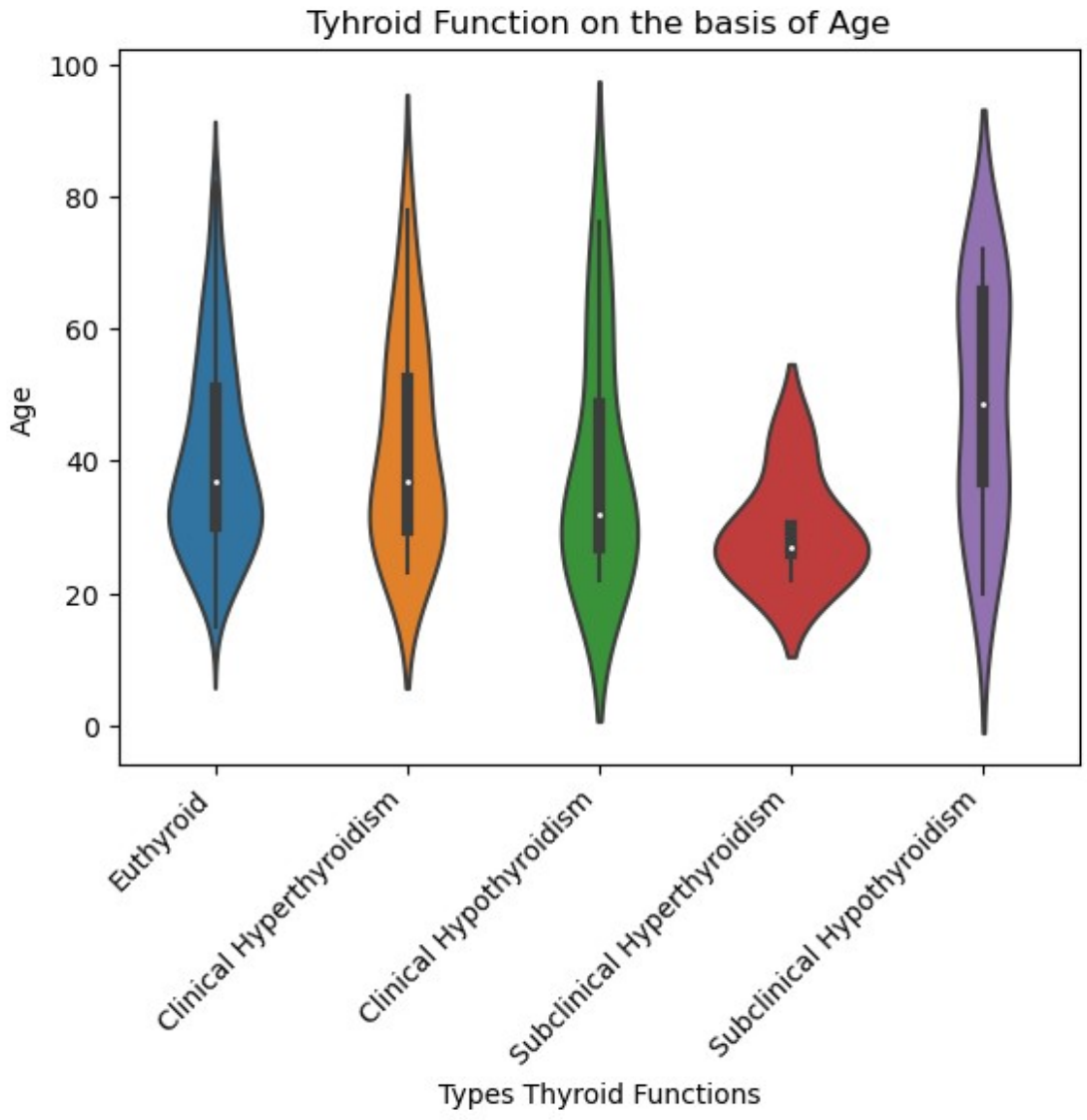

```
# 4. Comparative Analysis of Smokers on the basis of age of patients
sns.violinplot(x='Hx
Smoking',y='Age',data=df,hue='Smoking',split=True)
plt.title('Comparative Analysis of Smokers on the basis of age of
patients')
plt.xlabel('Earlier Smokers')
plt.ylabel('Age of Patients')
plt.savefig('insight4.png')
plt.show()
```



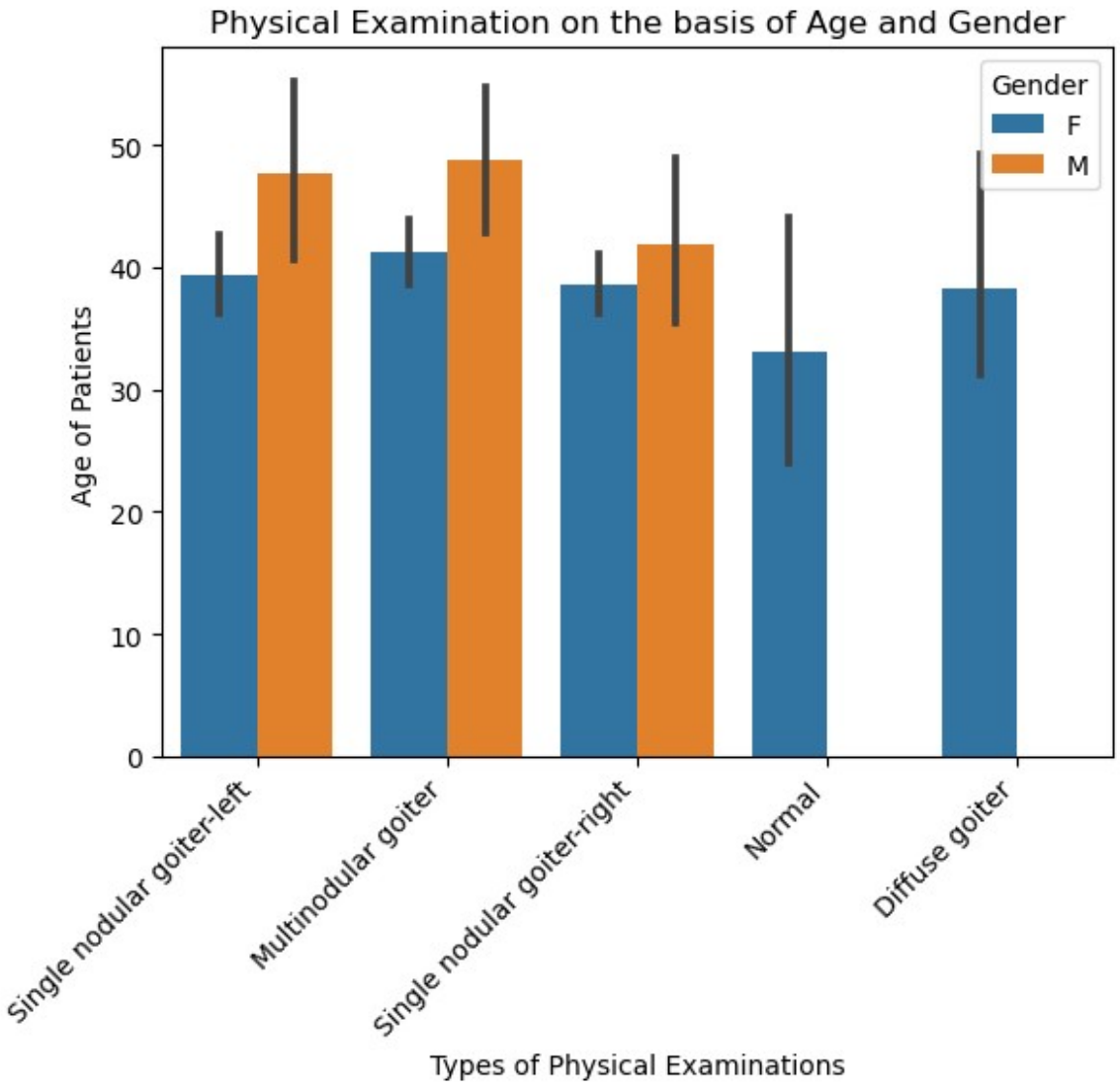

```
# 5.  Risk on the basis of Age and Gender
sns.barplot(x='Risk',y='Age',data=df,hue='Gender')
plt.title('Risks on the basis of Age and Gender')
plt.xlabel('Type of Risks')
plt.ylabel('Age of Patients')
plt.savefig('insight5.png')
plt.show()
```




```
# 6.  Thyroid Function on the basis of Age
sns.violinplot(x='Thyroid Function',y='Age', data=df)
plt.title('Tyhroid Function on the basis of Age')
plt.xlabel('Types Thyroid Functions')
plt.ylabel('Age')
plt.xticks(rotation=45,ha='right')
plt.savefig('insight6.png')
plt.show()
```




```
# 7.  Physical Examination on the basis of Age and Gender
sns.barplot(x='Physical Examination',y='Age',data=df, hue='Gender')
plt.title('Physical Examination on the basis of Age and Gender')
plt.xticks(rotation=45,ha='right')
plt.xlabel('Types of Physical Examinations')
plt.ylabel('Age of Patients')
plt.savefig('insight7.png')
plt.show()
```



CLASSIFICATION

```
# Identify categorical and continuous variables
categorical = ['Gender','Smoking','Hx Smoking','Hx
Radiothreapy','Thyroid Function', 'Physical Examination',
'Adenopathy', 'Pathology',
       'Focality', 'Risk', 'T', 'N', 'M', 'Stage', 'Response',
'Recurred']
continuous = ['Age']

# Convert categorical variables to dummy variables
df = pd.get_dummies(df, columns=categorical, drop_first=True)

df
```

```
     Age  Gender_M  Smoking_Yes  Hx Smoking_Yes  Hx
Radiothreapy_Yes  \
```

```
0     27     False        False           False                  False

1     34     False        False            True                  False

2     30     False        False           False                  False

3     62     False        False           False                  False

4     62     False        False           False                  False

..   ...       ...          ...             ...                    ...

378   72      True         True            True                   True

379   81      True         True           False                   True

380   72      True         True            True                  False

381   61      True         True            True                   True

382   67      True         True           False                  False


     Thyroid Function_Clinical Hypothyroidism  Thyroid
Function_Euthyroid  \
0                                          False
True
1                                          False
True
2                                          False
True
3                                          False
True
4                                          False
True
..                                           ...
...
378                                        False
True
379                                        False
True
380                                        False
True
381                                        False
False
382                                        False
True

     Thyroid Function_Subclinical Hyperthyroidism  \
0                                             False
```

```
1                                                  False
2                                                  False
3                                                  False
4                                                  False
..                                                   ...
378                                                False
379                                                False
380                                                False
381                                                False
382                                                False

     Thyroid Function_Subclinical Hypothyroidism  \
0                                                False
1                                                False
2                                                False
3                                                False
4                                                False
..                                                 ...
378                                              False
379                                              False
380                                              False
381                                              False
382                                              False

     Physical Examination_Multinodular goiter  ...  N_N1b   M_M1
Stage_II  \
0                                          False  ...  False  False
False
1                                           True  ...  False  False
False
2                                          False  ...  False  False
False
3                                          False  ...  False  False
False
4                                           True  ...  False  False
False
..                                           ...  ...    ...    ...
...
378                                        False  ...   True   True
False
379                                         True  ...   True   True
False
380                                         True  ...   True   True
False
381                                         True  ...   True  False
False
382                                         True  ...   True  False
False

     Stage_III  Stage_IVA  Stage_IVB  Response_Excellent  \
```

```
0        False      False      False                False
1        False      False      False                 True
2        False      False      False                 True
3        False      False      False                 True
4        False      False      False                 True
..         ...        ...        ...                  ...
378      False      False       True                False
379      False      False       True                False
380      False      False       True                False
381      False       True      False                False
382      False       True      False                False

     Response_Indeterminate  Response_Structural Incomplete
Recurred_Yes
0                      True                            False
False
1                     False                            False
False
2                     False                            False
False
3                     False                            False
False
4                     False                            False
False
..                      ...                              ...
...
378                   False                            False
True
379                   False                             True
True
380                   False                             True
True
381                   False                             True
True
382                   False                             True
True

[383 rows x 41 columns]
```

```
# changing the data type for getting the interger values
df = df.astype(int)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 383 entries, 0 to 382
Data columns (total 41 columns):
 #   Column                                              Non-Null Count
Dtype
---  ------                                              --------------
-----
```

```
 0   Age                                                 383 non-null
int32
 1   Gender_M                                            383 non-null
int32
 2   Smoking_Yes                                         383 non-null
int32
 3   Hx Smoking_Yes                                      383 non-null
int32
 4   Hx Radiothreapy_Yes                                 383 non-null
int32
 5   Thyroid Function_Clinical Hypothyroidism            383 non-null
int32
 6   Thyroid Function_Euthyroid                          383 non-null
int32
 7   Thyroid Function_Subclinical Hyperthyroidism        383 non-null
int32
 8   Thyroid Function_Subclinical Hypothyroidism         383 non-null
int32
 9   Physical Examination_Multinodular goiter            383 non-null
int32
 10  Physical Examination_Normal                         383 non-null
int32
 11  Physical Examination_Single nodular goiter-left     383 non-null
int32
 12  Physical Examination_Single nodular goiter-right    383 non-null
int32
 13  Adenopathy_Extensive                                383 non-null
int32
 14  Adenopathy_Left                                     383 non-null
int32
 15  Adenopathy_No                                       383 non-null
int32
 16  Adenopathy_Posterior                                383 non-null
int32
 17  Adenopathy_Right                                    383 non-null
int32
 18  Pathology_Hurthel cell                              383 non-null
int32
 19  Pathology_Micropapillary                            383 non-null
int32
 20  Pathology_Papillary                                 383 non-null
int32
 21  Focality_Uni-Focal                                  383 non-null
int32
 22  Risk_Intermediate                                   383 non-null
int32
 23  Risk_Low                                            383 non-null
int32
 24  T_T1b                                               383 non-null
```

```
int32
 25  T_T2                                                  383 non-null
int32
 26  T_T3a                                                 383 non-null
int32
 27  T_T3b                                                 383 non-null
int32
 28  T_T4a                                                 383 non-null
int32
 29  T_T4b                                                 383 non-null
int32
 30  N_N1a                                                 383 non-null
int32
 31  N_N1b                                                 383 non-null
int32
 32  M_M1                                                  383 non-null
int32
 33  Stage_II                                              383 non-null
int32
 34  Stage_III                                             383 non-null
int32
 35  Stage_IVA                                             383 non-null
int32
 36  Stage_IVB                                             383 non-null
int32
 37  Response_Excellent                                    383 non-null
int32
 38  Response_Indeterminate                                383 non-null
int32
 39  Response_Structural Incomplete                        383 non-null
int32
 40  Recurred_Yes                                          383 non-null
int32
dtypes: int32(41)
memory usage: 61.5 KB
```

```
#splitting the dataset into training and testing
from sklearn.model_selection import train_test_split
# Splitting the dataset into training and testing sets
x = df.drop('Recurred_Yes', axis=1)
y = df['Recurred_Yes']
x_train, x_test, y_train, y_test = train_test_split(x, y,
test_size=0.2, random_state=20)

x_train
```

```
     Age  Gender_M  Smoking_Yes  Hx Smoking_Yes  Hx
Radiothreapy_Yes  \
0     27         0            0               0                     0
```

```
228   20          1             0                0                       0
373   31          1             1                0                       1
346   32          1             0                1                       0
148   33          0             0                0                       0
..   ...        ...           ...              ...                     ...
331   51          0             0                0                       0
218   48          1             0                0                       0
223   56          0             0                0                       0
271   45          0             0                0                       0
355   32          0             0                0                       0

     Thyroid Function_Clinical Hypothyroidism  Thyroid
Function_Euthyroid  \
0                                           0
1
228                                         0
1
373                                         0
1
346                                         0
1
148                                         0
1
..                                        ...
...
331                                         0
1
218                                         0
1
223                                         0
1
271                                         0
1
355                                         0
1

     Thyroid Function_Subclinical Hyperthyroidism  \
0                                                 0
228                                               0
373                                               0
```

```
346                                                   0
148                                                   0
..                                                  ...
331                                                   0
218                                                   0
223                                                   0
271                                                   0
355                                                   0

     Thyroid Function_Subclinical Hypothyroidism  \
0                                                     0
228                                                   0
373                                                   0
346                                                   0
148                                                   0
..                                                  ...
331                                                   0
218                                                   0
223                                                   0
271                                                   0
355                                                   0

     Physical Examination_Multinodular goiter  ...  N_N1a  N_N1b  M_M1
\
0                                               0  ...      0      0     0

228                                             0  ...      0      1     0

373                                             0  ...      0      1     1

346                                             1  ...      0      1     0

148                                             1  ...      0      0     0

..                                            ...  ...    ...    ...   ...

331                                             0  ...      0      0     0

218                                             0  ...      1      0     0

223                                             0  ...      0      0     0

271                                             0  ...      0      0     0

355                                             0  ...      0      0     0


     Stage_II  Stage_III  Stage_IVA  Stage_IVB  Response_Excellent  \
0           0          0          0          0                   0
228         0          0          0          0                   0
373         1          0          0          0                   0
```

```
346         0          0          0          0                    0
148         0          0          0          0                    1
..        ...        ...        ...        ...                  ...
331         0          0          0          0                    0
218         0          0          0          0                    0
223         0          0          0          0                    0
271         0          0          0          0                    1
355         0          0          0          0                    1

     Response_Indeterminate  Response_Structural Incomplete
0                         1                               0
228                       0                               1
373                       0                               1
346                       0                               1
148                       0                               0
..                      ...                             ...
331                       0                               1
218                       1                               0
223                       0                               1
271                       0                               0
355                       0                               0

[306 rows x 40 columns]

y_train

0      0
228    1
373    1
346    1
148    0
      ..
331    1
218    0
223    1
271    0
355    0
Name: Recurred_Yes, Length: 306, dtype: int32

x_test

     Age  Gender_M  Smoking_Yes  Hx Smoking_Yes  Hx
Radiothreapy_Yes  \
303   73         0            0               0                    0

145   29         0            0               0                    0

160   28         0            0               0                    0

174   50         0            0               0                    0
```

```
239   33         1            0               0                      0

..   ...       ...          ...             ...                    ...

312   27         1            0               0                      0

115   37         0            0               0                      0

104   33         0            0               0                      0

254   31         1            1               1                      0

322   63         1            1               0                      0


     Thyroid Function_Clinical Hypothyroidism  Thyroid
Function_Euthyroid  \
303                                          0
1
145                                          0
1
160                                          1
0
174                                          0
1
239                                          0
1
..                                         ...
...
312                                          0
1
115                                          0
1
104                                          1
0
254                                          0
1
322                                          0
1

     Thyroid Function_Subclinical Hyperthyroidism  \
303                                             0
145                                             0
160                                             0
174                                             0
239                                             0
..                                            ...
312                                             0
115                                             0
104                                             0
```

```
254                                                  0
322                                                  0

     Thyroid Function_Subclinical Hypothyroidism  \
303                                                  0
145                                                  0
160                                                  0
174                                                  0
239                                                  0
..                                                 ...
312                                                  0
115                                                  0
104                                                  0
254                                                  0
322                                                  0

     Physical Examination_Multinodular goiter  ...  N_N1a  N_N1b  M_M1
\
303                                         1  ...      0      0     0

145                                         0  ...      0      0     0

160                                         0  ...      0      0     0

174                                         1  ...      0      0     0

239                                         1  ...      0      0     0

..                                        ...  ...    ...    ...   ...

312                                         1  ...      0      1     0

115                                         0  ...      0      0     0

104                                         0  ...      0      0     0

254                                         0  ...      0      0     0

322                                         0  ...      0      1     0


     Stage_II  Stage_III  Stage_IVA  Stage_IVB  Response_Excellent  \
303         1          0          0          0                   0
145         0          0          0          0                   1
160         0          0          0          0                   1
174         0          0          0          0                   0
239         0          0          0          0                   0
..        ...        ...        ...        ...                 ...
312         0          0          0          0                   0
115         0          0          0          0                   1
104         0          0          0          0                   1
```

```
254          0           0           0           0                    0
322          1           0           0           0                    0

     Response_Indeterminate  Response_Structural Incomplete
303                       0                               1
145                       0                               0
160                       0                               0
174                       1                               0
239                       0                               1
..                      ...                             ...
312                       0                               1
115                       0                               0
104                       0                               0
254                       1                               0
322                       0                               1

[77 rows x 40 columns]
```

```
y_test
```

```
303    1
145    0
160    0
174    0
239    1
      ..
312    1
115    0
104    0
254    0
322    1
Name: Recurred_Yes, Length: 77, dtype: int32
```

```
from sklearn.metrics import accuracy_score, precision_score,
recall_score, f1_score, confusion_matrix
```

Logistic Regression

```
from sklearn.linear_model import LogisticRegression

model1=LogisticRegression()

model1.fit(x_train,y_train)
```

```
C:\Users\KRITI\anaconda3\Lib\site-packages\sklearn\linear_model\
_logistic.py:460: 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(
```

```
LogisticRegression()
```

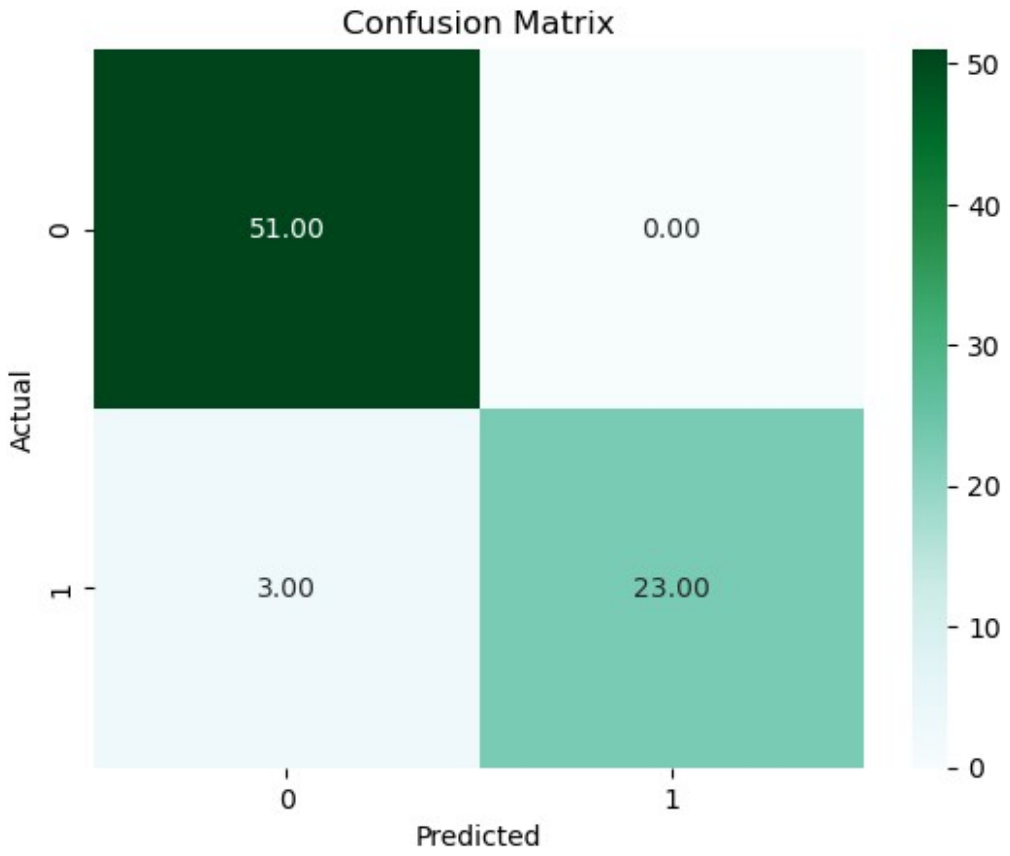
```
y_pred = model1.predict(x_test)
y_pred
```

```
array([1, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 0, 0,
0,
       1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0,
0,
       0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0,
1,
       0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1])
```

```
cm = confusion_matrix(y_test, y_pred)
print(cm)
print("Accuracy score is",accuracy_score(y_test, y_pred))
print("Precision score is",precision_score(y_test, y_pred))
print("Recall score is",recall_score(y_test, y_pred))
print("F1 score is",f1_score(y_test, y_pred))
```

```
[[51  0]
 [ 3 23]]
Accuracy score is 0.961038961038961
Precision score is 1.0
Recall score is 0.8846153846153846
F1 score is 0.9387755102040816
```

```
# Plot the confusion matrix as a heatmap
sns.heatmap(cm, annot=True, fmt=".2f", cmap="BuGn")
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.savefig('ConfusionLogistic.png')
plt.show()
```



K-Nearest Neighbors Classifier

```
from sklearn.preprocessing import StandardScaler

# Feature scaling
scaler = StandardScaler()
x_train = scaler.fit_transform(x_train)
x_test = scaler.transform(x_test)

from sklearn.neighbors import KNeighborsClassifier
model2 = KNeighborsClassifier(n_neighbors = 5, metric = 'minkowski', p
= 2)
model2.fit(x_train, y_train)
```

```
KNeighborsClassifier()
```

```
y_pred = model2.predict(x_test)
```

```
y_pred
```

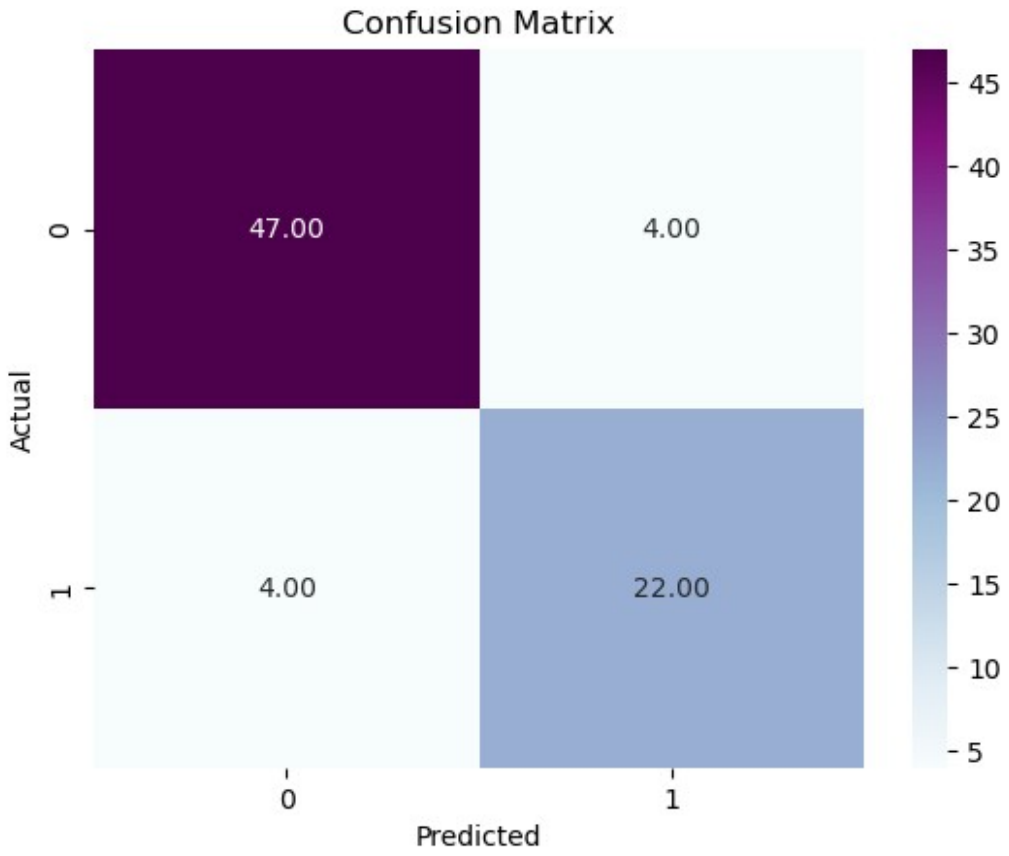
```
array([0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0,
0,
       1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0,
0,
```

```
       0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0,
1,
       0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1])

cm = confusion_matrix(y_test, y_pred)
print(cm)
print("Accuracy score is",accuracy_score(y_test, y_pred))
print("Precision score is",precision_score(y_test, y_pred))
print("Recall score is",recall_score(y_test, y_pred))
print("F1 score is",f1_score(y_test, y_pred))
```

```
[[47  4]
 [ 4 22]]
Accuracy score is 0.8961038961038961
Precision score is 0.8461538461538461
Recall score is 0.8461538461538461
F1 score is 0.8461538461538461
```

```
# Plot the confusion matrix as a heatmap
sns.heatmap(cm, annot=True, fmt=".2f", cmap="BuPu")
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.savefig('ConfusionKNN.png')
plt.show()
```



Support Vector Machine

```
from sklearn.svm import SVC

model3 = SVC(kernel = 'rbf', random_state = 20)
model3.fit(x_train, y_train)

SVC(random_state=20)

y_pred = model3.predict(x_test)

y_pred

array([1, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0,
0,
       1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0,
0,
       0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1,
1,
       1, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1])

cm = confusion_matrix(y_test, y_pred)
print(cm)
print("Accuracy score is",accuracy_score(y_test, y_pred))
```

```
print("Precision score is",precision_score(y_test, y_pred))
print("Recall score is",recall_score(y_test, y_pred))
print("F1 score is",f1_score(y_test, y_pred))
```

```
[[49  2]
 [ 1 25]]
Accuracy score is 0.961038961038961
Precision score is 0.9259259259259259
Recall score is 0.9615384615384616
F1 score is 0.9433962264150944
```

```
# Plot the confusion matrix as a heatmap
sns.heatmap(cm, annot=True, fmt=".2f", cmap="GnBu")
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.savefig('ConfusionSVM.png')
plt.show()
```