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CRN-23921

Assignment 4

GitHub Link: https://github.com/MallulaGowtham/Assignment4

Video Link: https://drive.google.com/file/d/1VikFCTA_p3_geSKjSyrWR89NnWQ_Fpv3/view?usp=share_link

1. Read the provided CSV file 'data.csv'. https://drive.google.com/drive/folders/1h8C3mLsso-R-sIOLsvoYwPLzy2fJ4IOF?usp=sharing

2. Show the basic statistical description about the data.

3. Check if the data has null values. a. Replace the null values with the mean

4. Select at least two columns and aggregate the data using: min, max, count, mean.

5. Filter the dataframe to select the rows with calories values between 500 and 1000.

6. Filter the dataframe to select the rows with calories values > 500 and pulse < 100.

7. Create a new "df_modified" dataframe that contains all the columns from df except for "Maxpulse". 8. Delete the "Maxpulse" column from the main df dataframe

9. Convert the datatype of Calories column to int datatype.

10. Using pandas create a scatter plot for the two columns (Duration and Calories).

1. Find the correlation between 'survived' (target column) and 'sex' column for the Titanic use case inclass. a. Do you think we should keep this feature?

2. Do at least two visualizations to describe or show correlations.

3. Implement Naïve Bayes method using scikit-learn library and report the accuracy.

2. (Glass Dataset) 1. Implement Naïve Bayes method using scikit-learn library.

a. Use the glass dataset available in Link also provided in your assignment.

b. Use train_test_split to create training and testing part.

2. Evaluate the model on testing part using score and classification_report(y_true, y_pred)

1. Implement linear SVM method using scikit library a. Use the glass dataset available in Link also provided in your assignment. b. Use train_test_split to create training and testing part.

2. Evaluate the model on testing part using score and Do at least two visualizations to describe or show correlations in the Glass Dataset.

Which algorithm you got better accuracy? Can you justify why?

In [1]:
```
import pandas as pd
# Read the provided CSV file 'data.csv'
data = pd.read_csv('data.csv')
```

In [2]:
```
print(data.describe(), '\n')
```

```
         Duration       Pulse    Maxpulse     Calories
count  169.000000  169.000000  169.000000   164.000000
mean    63.846154  107.461538  134.047337   375.790244
std     42.299949   14.510259   16.450434   266.379919
min     15.000000   80.000000  100.000000    50.300000
25%     45.000000  100.000000  124.000000   250.925000
50%     60.000000  105.000000  131.000000   318.600000
75%     60.000000  111.000000  141.000000   387.600000
max    300.000000  159.000000  184.000000  1860.400000
```

In [3]:
```
# Check if the data has null values.
print("Null values in the data: \n", data.isnull().sum(), '\n')
```

```
Null values in the data:
 Duration    0
Pulse       0
Maxpulse    0
Calories    5
dtype: int64
```

In [4]:
```
# a. Replace the null values with the mean
data.fillna(data.mean(), inplace=True)
print("Null values in the data after replacing with mean: \n", data.isnull().sum(), '\n')
print(data, '\n')
```

```
Null values in the data after replacing with mean:
 Duration    0
Pulse       0
Maxpulse    0
Calories    0
dtype: int64

     Duration  Pulse  Maxpulse  Calories
0          60    110       130     409.1
1          60    117       145     479.0
2          60    103       135     340.0
3          45    109       175     282.4
4          45    117       148     406.0
..        ...    ...       ...       ...
164        60    105       140     290.8
165        60    110       145     300.0
166        60    115       145     310.2
167        75    120       150     320.4
168        75    125       150     330.4

[169 rows x 4 columns]
```

In [5]:
```
# Select at least two columns and aggregate the data using: min, max, count, mean
# selecting two columns pulse and calories
print("Aggregating the data using min, max, count, mean: \n", data[['Pulse', 'Calories']].agg(['min', 'max', 'count', 'mean']), '\n')
```

```
Aggregating the data using min, max, count, mean:
              Pulse     Calories
min      80.000000    50.300000
max     159.000000  1860.400000
count   169.000000   169.000000
mean    107.461538   375.790244
```

In [6]:
```
# Filter the dataframe to select the rows with calories values between 500 and 1000
print("Filtering the dataframe to select the rows with calories values between 500 and 1000: \n", data[(data['Calories'] > 500) & (data['
```

```
Filtering the dataframe to select the rows with calories values between 500 and 1000:
      Duration  Pulse  Maxpulse  Calories
51          80    123       146     643.1
62         160    109       135     853.0
65         180     90       130     800.4
66         150    105       135     873.4
67         150    107       130     816.0
72          90    100       127     700.0
73         150     97       127     953.2
75          90     98       125     563.2
78         120    100       130     500.4
90         180    101       127     600.1
99          90     93       124     604.1
103         90     90       100     500.4
106        180     90       120     800.3
108         90     90       120     500.3
```

In [7]:
```
# Filter the dataframe to select the rows with calories values > 500 and pulse < 100
print("Filtering the dataframe to select the rows with calories values > 500 and pulse < 100: \n", data[(data['Calories'] > 500) & (data[
```

```
Filtering the dataframe to select the rows with calories values > 500 and pulse < 100:
      Duration  Pulse  Maxpulse  Calories
65         180     90       130     800.4
70         150     97       129    1115.0
73         150     97       127     953.2
75          90     98       125     563.2
99          90     93       124     604.1
103         90     90       100     500.4
106        180     90       120     800.3
108         90     90       120     500.3
```

In [8]:
```
# Create a new "df_modified" dataframe that contains all the columns from df except for "Maxpulse"
df_modified = data.drop('Maxpulse', axis=1)
print("New dataframe after dropping Maxpulse column: \n", df_modified, '\n')
```

```
New dataframe after dropping Maxpulse column:
      Duration  Pulse  Calories
0           60    110     409.1
1           60    117     479.0
2           60    103     340.0
3           45    109     282.4
4           45    117     406.0
..         ...    ...       ...
164         60    105     290.8
165         60    110     300.0
166         60    115     310.2
167         75    120     320.4
168         75    125     330.4

[169 rows x 3 columns]
```

In [9]:
```
# Delete the "Maxpulse" column from the main df dataframe
data.drop('Maxpulse', axis=1, inplace=True)
print("Dataframe after dropping Maxpulse column: \n", data, '\n')
```

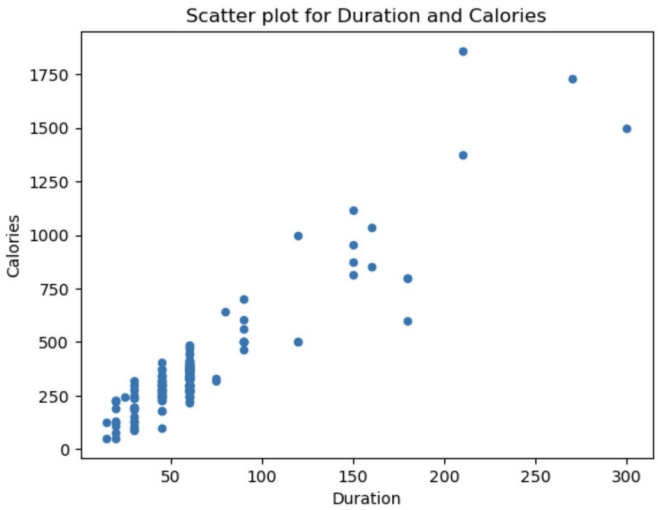
```
Dataframe after dropping Maxpulse column:
      Duration  Pulse  Calories
0           60    110     409.1
1           60    117     479.0
2           60    103     340.0
3           45    109     282.4
4           45    117     406.0
..         ...    ...       ...
164         60    105     290.8
165         60    110     300.0
166         60    115     310.2
167         75    120     320.4
168         75    125     330.4

[169 rows x 3 columns]
```

In [10]:
```
# Convert the datatype of Calories column to int datatype
data['Calories'] = data['Calories'].astype(int)
print("Data types of all columns after converting Calories to int: \n", data.dtypes, '\n')
```

```
Data types of all columns after converting Calories to int:
 Duration    int64
Pulse       int64
Calories    int64
dtype: object
```

In [12]:

```
from matplotlib import pyplot as plt
# Using pandas create a scatter plot for the two columns (Duration and Calories)
data.plot.scatter(x='Duration', y='Calories', title='Scatter plot for Duration and Calories')
plt.show()
```



In [13]:

```
import pandas as pd
import seaborn as sns
from sklearn import preprocessing
import matplotlib.pyplot as plt

df=pd.read_csv("train.csv")
df.head()
```

Out[13]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123	S
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	NaN	S

In [14]:

```
le = preprocessing.LabelEncoder()
df['Sex'] = le.fit_transform(df.Sex.values)
df['Survived'].corr(df['Sex'])
```

Out[14]:

```
-0.5433513806577546
```

In [15]:
```
df = df.drop(['Name', 'Sex','Ticket','Cabin','Embarked'], axis=1)
```

In [16]:
```
matrix = df.corr()
print(matrix)
```

```
             PassengerId  Survived    Pclass       Age     SibSp     Parch  \
PassengerId     1.000000 -0.005007 -0.035144  0.036847 -0.057527 -0.001652
Survived       -0.005007  1.000000 -0.338481 -0.077221 -0.035322  0.081629
Pclass         -0.035144 -0.338481  1.000000 -0.369226  0.083081  0.018443
Age             0.036847 -0.077221 -0.369226  1.000000 -0.308247 -0.189119
SibSp          -0.057527 -0.035322  0.083081 -0.308247  1.000000  0.414838
Parch          -0.001652  0.081629  0.018443 -0.189119  0.414838  1.000000
Fare            0.012658  0.257307 -0.549500  0.096067  0.159651  0.216225

                 Fare
PassengerId  0.012658
Survived     0.257307
Pclass      -0.549500
Age          0.096067
SibSp        0.159651
Parch        0.216225
Fare         1.000000
```

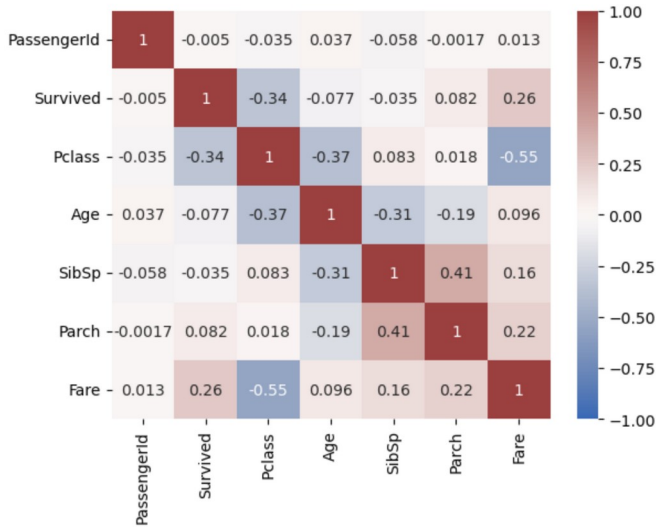
In [16]:
```
df.corr().style.background_gradient(cmap="Greens")
```

Out[16]:

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
PassengerId	1.000000	-0.005007	-0.035144	0.036847	-0.057527	-0.001652	0.012658
Survived	-0.005007	1.000000	-0.338481	-0.077221	-0.035322	0.081629	0.257307
Pclass	-0.035144	-0.338481	1.000000	-0.369226	0.083081	0.018443	-0.549500
Age	0.036847	-0.077221	-0.369226	1.000000	-0.308247	-0.189119	0.096067
SibSp	-0.057527	-0.035322	0.083081	-0.308247	1.000000	0.414838	0.159651
Parch	-0.001652	0.081629	0.018443	-0.189119	0.414838	1.000000	0.216225
Fare	0.012658	0.257307	-0.549500	0.096067	0.159651	0.216225	1.000000

In [18]:

```
sns.heatmap(matrix, annot=True, vmax=1, vmin=-1, center=0, cmap='vlag')
plt.show()
```



In [19]:

```
import pandas as pd
from sklearn.naive_bayes import GaussianNB
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.impute import SimpleImputer

# Load the dataset
df = pd.read_csv("train.csv")

# Select features and target
features = ['Age', 'Embarked', 'Fare', 'Parch', 'Pclass', 'Sex', 'SibSp']
target = 'Survived'

# Preprocess categorical variables
df['Sex'] = df['Sex'].replace(["female", "male"], [0, 1])
df['Embarked'] = df['Embarked'].replace(['S', 'C', 'Q'], [1, 2, 3])

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(df[features], df[target], test_size=0.2, random_state=42)

# Impute missing values with the mean
imputer = SimpleImputer(strategy='mean')
X_train_imputed = imputer.fit_transform(X_train)
X_test_imputed = imputer.transform(X_test)

# Train the Naive Bayes model
model = GaussianNB()
model.fit(X_train_imputed, y_train)

# Make predictions on the test set
y_pred = model.predict(X_test_imputed)

# Calculate the accuracy of the model
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy: {:.2f}%".format(accuracy * 100))
```

```
Accuracy: 77.65%
```

In [19]:
```
glass=pd.read_csv("glass.csv")
glass.head()
```

Out[19]:

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
0	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.0	0.0	1
1	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.0	0.0	1
2	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.0	0.0	1
3	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.0	0.0	1
4	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.0	0.0	1

In [20]:
```
glass.corr().style.background_gradient(cmap="Greens")
```

Out[20]:

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
RI	1.000000	-0.191885	-0.122274	-0.407326	-0.542052	-0.289833	0.810403	-0.000386	0.143010	-0.164237
Na	-0.191885	1.000000	-0.273732	0.156794	-0.069809	-0.266087	-0.275442	0.326603	-0.241346	0.502898
Mg	-0.122274	-0.273732	1.000000	-0.481799	-0.165927	0.005396	-0.443750	-0.492262	0.083060	-0.744993
Al	-0.407326	0.156794	-0.481799	1.000000	-0.005524	0.325958	-0.259592	0.479404	-0.074402	0.598829
Si	-0.542052	-0.069809	-0.165927	-0.005524	1.000000	-0.193331	-0.208732	-0.102151	-0.094201	0.151565
K	-0.289833	-0.266087	0.005396	0.325958	-0.193331	1.000000	-0.317836	-0.042618	-0.007719	-0.010054
Ca	0.810403	-0.275442	-0.443750	-0.259592	-0.208732	-0.317836	1.000000	-0.112841	0.124968	0.000952
Ba	-0.000386	0.326603	-0.492262	0.479404	-0.102151	-0.042618	-0.112841	1.000000	-0.058692	0.575161
Fe	0.143010	-0.241346	0.083060	-0.074402	-0.094201	-0.007719	0.124968	-0.058692	1.000000	-0.188278
Type	-0.164237	0.502898	-0.744993	0.598829	0.151565	-0.010054	0.000952	0.575161	-0.188278	1.000000

In [21]:
```
sns.heatmap(matrix, annot=True, vmax=1, vmin=-1, center=0, cmap='vlag')
plt.show()
```

In [22]:
```
#Naïve Bayes method of Glass Dataset
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import classification_report

# Load the dataset
glass_data = pd.read_csv('glass.csv')

# Separate the target variable
X = glass_data.drop(['Type'], axis=1)
y = glass_data['Type']

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Train the Naive Bayes model
model = GaussianNB()
model.fit(X_train, y_train)

# Make predictions on the testing set
y_pred = model.predict(X_test)

# Evaluate the model
score = model.score(X_test, y_test)
report = classification_report(y_test, y_pred)

print("Accuracy Score: {:.2f}%".format(score * 100))
print("\nClassification Report:\n", report)
```

```
Accuracy Score: 55.81%
```

```
Classification Report:
              precision    recall  f1-score   support

           1       0.41      0.64      0.50        11
           2       0.43      0.21      0.29        14
           3       0.40      0.67      0.50         3
           5       0.50      0.25      0.33         4
           6       1.00      1.00      1.00         3
           7       0.89      1.00      0.94         8

    accuracy                           0.56        43
   macro avg       0.60      0.63      0.59        43
weighted avg       0.55      0.56      0.53        43
```

In [23]:
```
#Linear SVM method of Glass Dataset
import warnings
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.svm import LinearSVC
from sklearn.metrics import classification_report
#To avoid warnings
warnings.filterwarnings("ignore")

# Load the dataset
glass_data = pd.read_csv('glass.csv')

# Separate the target variable
X = glass_data.drop(['Type'], axis=1)
y = glass_data['Type']

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Train the Linear SVM model
model = LinearSVC(random_state=42)
model.fit(X_train, y_train)

# Make predictions on the testing set
y_pred = model.predict(X_test)

# Evaluate the model
score = model.score(X_test, y_test)
report = classification_report(y_test, y_pred)

print("Accuracy Score: {:.2f}%".format(score * 100))
print("\nClassification Report:\n", report)
```

```
Accuracy Score: 51.16%

Classification Report:
              precision    recall  f1-score   support

           1       0.37      1.00      0.54        11
           2       0.00      0.00      0.00        14
           3       0.00      0.00      0.00         3
           5       1.00      0.75      0.86         4
           6       0.00      0.00      0.00         3
           7       0.80      1.00      0.89         8

    accuracy                           0.51        43
   macro avg       0.36      0.46      0.38        43
weighted avg       0.34      0.51      0.38        43
```