MACHINE LEARNING ASSIGNMENT 4

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Video Link :
https://drive.google.com/file/d/1EPiKW39dVB9Ba3fdDAKKyB1A-ZNguEhN/view?usp=share_link
GitHub Link :
https://github.com/AshokSai1999/Machine-Learning.git

Q1) Pandas

1. Read the provided CSV file 'data.csv'.

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

Out[1]:

	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

2. Show the basic statistical description about the data.

In [5]:
```
#shows statastical description of data
data.describe()
```

Out[5]:

	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

3. Check if the data has null values.

```
In [6]: #Check if the data has null values
        data.isnull().any()
```

```
Out[6]: Duration    False
        Pulse       False
        Maxpulse    False
        Calories     True
        dtype: bool
```

a. Replace the null values with the mean

```
In [7]: #Replace the null values with the mean
        data.fillna(data.mean(), inplace=True)
        data.isnull().any()
```

```
Out[7]: Duration    False
        Pulse       False
        Maxpulse    False
        Calories    False
        dtype: bool
```

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

```
In [8]: #Select at least two columns and aggregate the data using: min, max, count, mean
        data.agg({'Maxpulse':['min','max','count','mean'],'Calories':['min','max','count','mean']})
```

Out[8]:

	Maxpulse	Calories
min	100.000000	50.300000
max	184.000000	1860.400000
count	169.000000	169.000000
mean	134.047337	375.790244

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

```
In [9]: #Filter the dataframe to select the rows with calories values between 500 and 1000.
        data.loc[(data['Calories']>500)&(data['Calories']<1000)]
```

Out[9]:

	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

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

In [10]:
```
#Filter the dataframe to select the rows with calories values > 500 and pulse < 100.
data.loc[(data['Calories']>500)&(data['Pulse']<100)]
```

Out[10]:

	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

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

In [11]:
```
#Create a new "df_modified" dataframe that contains all the columns from df except for "Maxpulse"
df_modified = data[['Duration','Pulse','Calories']]
df_modified.head()
```

Out[11]:

	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

8. Delete the "Maxpulse" column from the main df dataframe

In [12]:
```
#Delete the "Maxpulse" column from the main df dataframe
del data['Maxpulse']
```

In [13]:
```
data.head()
```

Out[13]:

	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

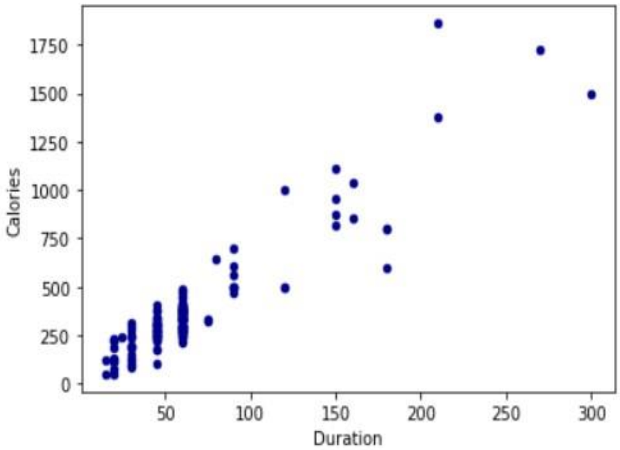
9. Convert the datatype of Calories column to int datatype.

```
In [14]: data.dtypes

Out[14]: Duration      int64
         Pulse         int64
         Calories    float64
         dtype: object
```

```
In [16]: #Convert the datatype of Calories column to int datatype.
         import numpy as np

         data['Calories'] = data['Calories'].astype(np.int64)
         data.dtypes

Out[16]: Duration    int64
         Pulse       int64
         Calories    int64
         dtype: object
```

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

```
In [17]: #Using pandas create a scatter plot for the two columns (Duration and Calories).
         data.plot.scatter(x='Duration',y='Calories',c='DarkBlue')

Out[17]: <Axes: xlabel='Duration', ylabel='Calories'>
```



1. (Titanic Dataset) 1. Find the correlation between 'survived' (target column) and 'sex' column for the Titanic use case in class

In [48]:
```
#1.Titanic dataset
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[48]:

	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 [11]:
```
#correlation between 'survived' (target column) and 'sex' column for the Titanic use case in class.
le = preprocessing.LabelEncoder()
df['Sex'] = le.fit_transform(df.Sex.values)
df['Survived'].corr(df['Sex'])
```

Out[11]: -0.5433513806577547

a. Do you think we should keep this feature?

Ans. No, because the accuracy is just 54% only. So we should not keep this feature.

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

In [56]:
```
# Drop non-numeric columns from the dataframe
df = df.drop(['Name', 'Sex','Ticket','Cabin','Embarked'], axis=1)

#creating corelation matrix
matrix = df.corr()
print(matrix)
```

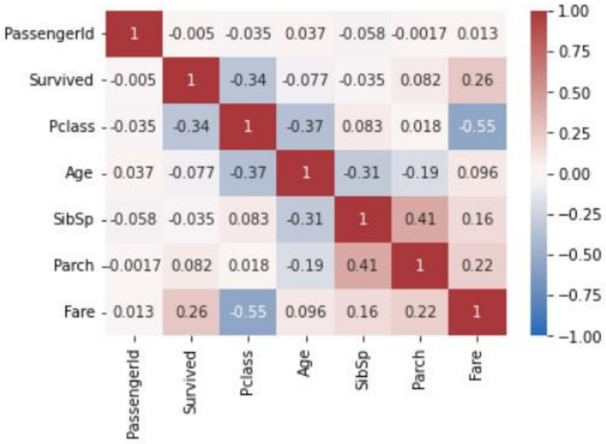
```
             PassengerId  Survived    Pclass       Age     SibSp     Parch  \
PassengerId     1.000000 -0.005007 -0.035144  0.036847 -0.057527 -0.001652
Survived       -0.005007  1.000000 -0.338481 -0.077221 -0.035322  0.081629
Pclass         -0.035144 -0.338481  1.000000 -0.369226  0.083081  0.018443
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 [57]:
```
#visualization 1 of Titanic Dataset
df.corr().style.background_gradient(cmap="Greens")
```

Out[57]:

	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 [52]: #visualization 2 of Titanic Dataset
         sns.heatmap(matrix, annot=True, vmax=1, vmin=-1, center=0, cmap='vlag')
         plt.show()
```



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

```
In [68]: #Naïve Bayes method of Titanic Dataset
         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%
```

2. (Glass Dataset)

Do at least two visualizations to describe or show correlations in the Glass Dataset.

In [69]:
```
#2.Glass Dataset
glass=pd.read_csv("glass.csv")
glass.head()
```

Out[69]:

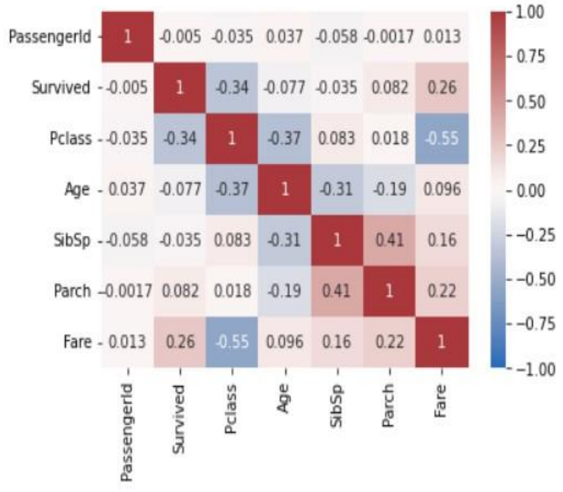
	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
0	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.0	0.0	1
1	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.0	0.0	1
2	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.0	0.0	1
3	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.0	0.0	1
4	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.0	0.0	1

In [70]:
```
#visualization 1 of Glass Dataset
glass.corr().style.background_gradient(cmap="Greens")
```

Out[70]:

	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 [71]:
```
#visualization 2 of Glass Dataset
sns.heatmap(matrix, annot=True, vmax=1, vmin=-1, center=0, cmap='vlag')
plt.show()
```



1. **Implement Naïve Bayes method using scikit-learn library.**

   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)

In [73]:
```
#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
```

1. Implement linear SVM method using scikit library

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)

```
In [76]: #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
```

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

Ans. Naïve Bayes algorithm got better accuracy than Linear SVM algorithm because naïve bayes need small amount of training data Where as Linear SVM need large amount of training data and SVM is more expensive than Naïve bayes algorithm. But it will give output easily.And naïve bayes is good for spam detection and text classification problems So Naïve bayes is better than Linear Svm.