Assignment-4

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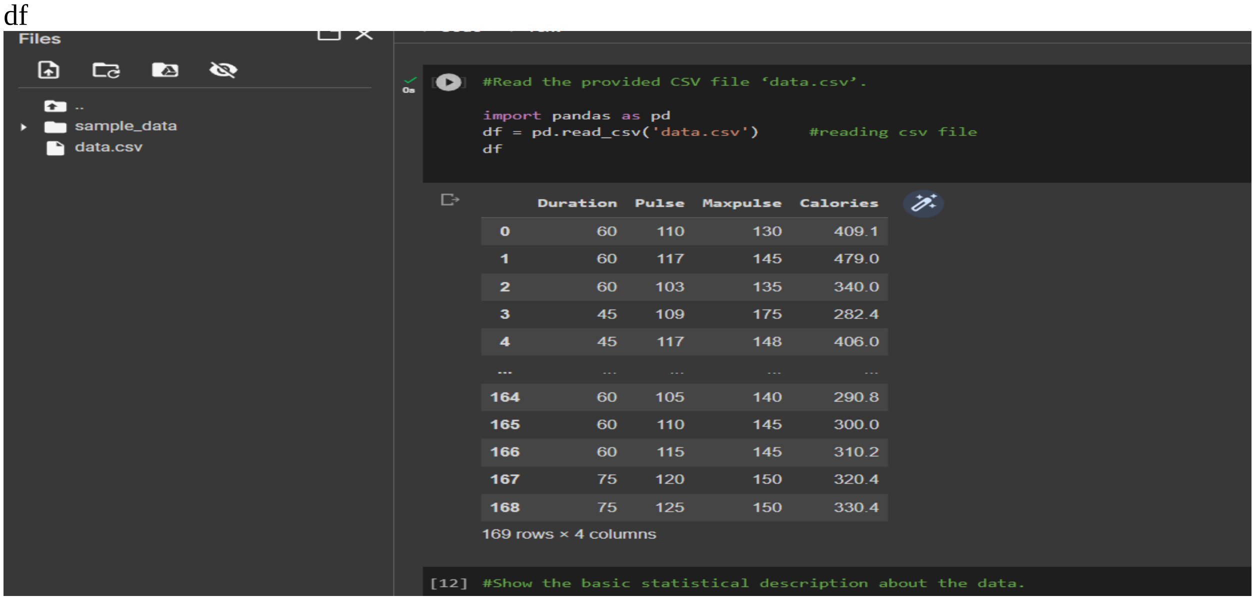
Github link: https://github.com/saicharan255/Assignment-4.git
Video link:
https://drive.google.com/file/d/1cMXw24kMs2DH8yu_97WDIiJF0QQS4Eku/view?usp=sharing

1. PANDAS

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

```
#Read the provided CSV file 'data.csv'.
import pandas as pd
df = pd.read_csv('data.csv')     #reading csv file
df
```



	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 × 4 columns

[12] #Show the basic statistical description about the data.

Description:
Importing pandas libraries, Reading dataset locally by using df = pd.read_csv('data.csv').

2. Show the basic statistical description about the data.

```
#Show the basic statistical description about the data.
df.describe()
 #describe() results statistical description of data in data frame
```

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df.describe()
 #describe() results statistical description of data in data frame
```

	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

Description:

By using df.describe() function it shows the basic statistical description about the data

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

#Check if the data has null values.
df.isnull().any()
 #check any column has null values
#Replace the null values with the mean
mean=df['Calories'].mean()
df['Calories'].fillna(value=mean, inplace=True)
#replacing Nan values with particular columns mean value
df.isnull().any()

```
#Check if the data has null values.

df.isnull().any()
 #check any column has null values
```

```
Duration     False
Pulse        False
Maxpulse     False
Calories      True
dtype: bool
```

```
[15] #Replace the null values with the mean

     mean=df['Calories'].mean()
     df['Calories'].fillna(value=mean, inplace=True)
     #replacing Nan values with particular columns mean value
```

```
df.isnull().any()
```

```
Duration     False
Pulse        False
Maxpulse     False
Calories     False
dtype: bool
```

Description:

Firstly we are going to check the null values then we gonna replace the null values with the mean as shown in above.

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

#Select at least two columns and aggregate the data using: min, max, count, mean.
df.agg({'Pulse' : ['min', 'max', 'count', 'mean'], 'Maxpulse' : ['min', 'max', 'count', 'mean'],
 'Calories' : ['min', 'max', 'count', 'mean'] })
#agg method to aggreate operation on the dataframe

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

df.agg({'Pulse' : ['min', 'max', 'count', 'mean'], 'Maxpulse' : ['min', 'max', 'count', 'mean'],
         'Calories' : ['min', 'max', 'count', 'mean'] })
#agg method to aggreate operation on the dataframe
```

	Pulse	Maxpulse	Calories
min	80.000000	100.000000	50.300000
max	159.000000	184.000000	1860.400000
count	169.000000	169.000000	169.000000
mean	107.461538	134.047337	375.790244

Description:
In this we are going to do the aggregate the data using min, max, count and mean by using df.agg() function.

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

#Filter the dataframe to select the rows with calories values between 500 and 1000.
df[(df['Calories'] >= 500) & (df['Calories'] <= 1000)]
 #'&' operator to filter the dataframe

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df[(df['Calories'] >= 500) & (df['Calories'] <= 1000)]
  #'&' operator to filter the dataframe
```

	Duration	Pulse	Calories
51	80	123	643
62	160	109	853
65	180	90	800
66	150	105	873
67	150	107	816
72	90	100	700
73	150	97	953
75	90	98	563
78	120	100	500
83	120	100	500
87	120	100	1000
90	180	101	600
99	90	93	604
101	90	90	500
102	90	90	500
103	90	90	500
106	180	90	800
108	90	90	500

Description:
From the data frame we are going to select the rows with calories values between 500 and 1000 in this process we using & operator to filter the dataframe.

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

#Filter the dataframe to select the rows with calories values > 500 and pulse < 100.
df[(df['Calories'] > 500) & (df['Pulse'] < 100)]
 # '&' operator is used to filter the data

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

df[(df['Calories'] > 500) & (df['Pulse'] < 100)]
 # '&' operator is used to filter the data
```

	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

Description:

From the data frame we are going to select the rows with calories values >500 and <1000 in this process we using & operator to filter the dataframe.

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

#Create a new “df_modified” dataframe that contains all the columns from df except for “Maxpulse”.
df_modified = df[['Duration', 'Pulse', 'Calories']].copy()
 #copy method to create an another data frome with specified columns from the original dataframe.
df_modified

```
#Create a new “df_modified” dataframe that contains all the columns from df except for “Maxpulse”.

df_modified = df[['Duration', 'Pulse', 'Calories']].copy()
 #copy method to create an another data frome with specified columns from the original dataframe.
df_modified
```

	Duration	Pulse	Calories
0	60	110	409.1
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...	...	...	...
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 × 3 columns

Description:
Created a new dataframe that contains all columns wxcept maxpulse by using the copy().

8. Delete the “Maxpulse” column from the main df dataframe

# Delete the “Maxpulse” column from the main df dataframe
df.pop('Maxpulse')
 #pop method to remove a column from the data frame
Df

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df.pop('Maxpulse')
 #pop method to remove a column from the data frame
df
```

	Duration	Pulse	Calories
0	60	110	409.1
1	60	117	479.0
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...	...	...	...
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 × 3 columns

Description:

From the newly created dataframe deleted the Maxpulse by using POP method.

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

#Convert the datatype of Calories column to int datatype.
df['Calories'] = df['Calories'].astype(int)
#astype function converts one data type into another
df.dtypes

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df['Calories'] = df['Calories'].astype(int)
#astype function converts one data type into another
df.dtypes
```

```
Duration    int64
Pulse       int64
Calories    int64
dtype: object
```

Description:

In this we are going to convert calories column datatype to int datatype .

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

#Using pandas create a scatter plot for the two columns (Duration and Calories).
df.plot.scatter(x='Duration', y='Calories')

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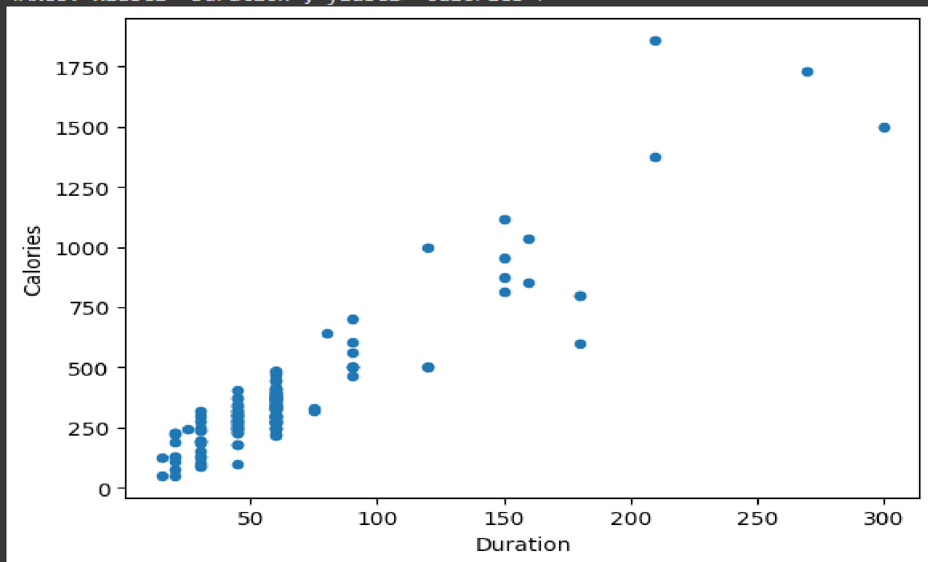
df.plot.scatter(x='Duration', y='Calories')
```

```
/usr/local/lib/python3.9/dist-packages/pandas/plotting/_matplotlib/core.py:1114: UserWarnin
  scatter = ax.scatter(
<Axes: xlabel='Duration', ylabel='Calories'>
```



Description:

By using pandas we created a scatter plot that gives data for 2 columns duration and calories.

1. Titanic Dataset

1. Find the correlation between ‘survived’ (target column) and ‘sex’ column for the Titanic use case inclass.

```
#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()
#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'])
```

```
#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()
```

	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

```
[56] #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'])

-0.5433513806577555
```

Description:

We imported pandas, seaborn libraries then imported train dataset from local. We found the correlation between survived and sex columns.

a. Do you think we should keep this feature?

As correlation results shows that males were strongly negatively correlated, and females were Strongly positively correlated with their survival. Males are inversely proportional, and females are directly proportional to their survival. So, we need this feature to analysis.

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

#visualization 1 of Titanic Dataset
df.corr().style.background_gradient(cmap="Greens")

```
[59] #visualization 1 of Titanic Dataset
df.corr().style.background_gradient(cmap="Greens")
```

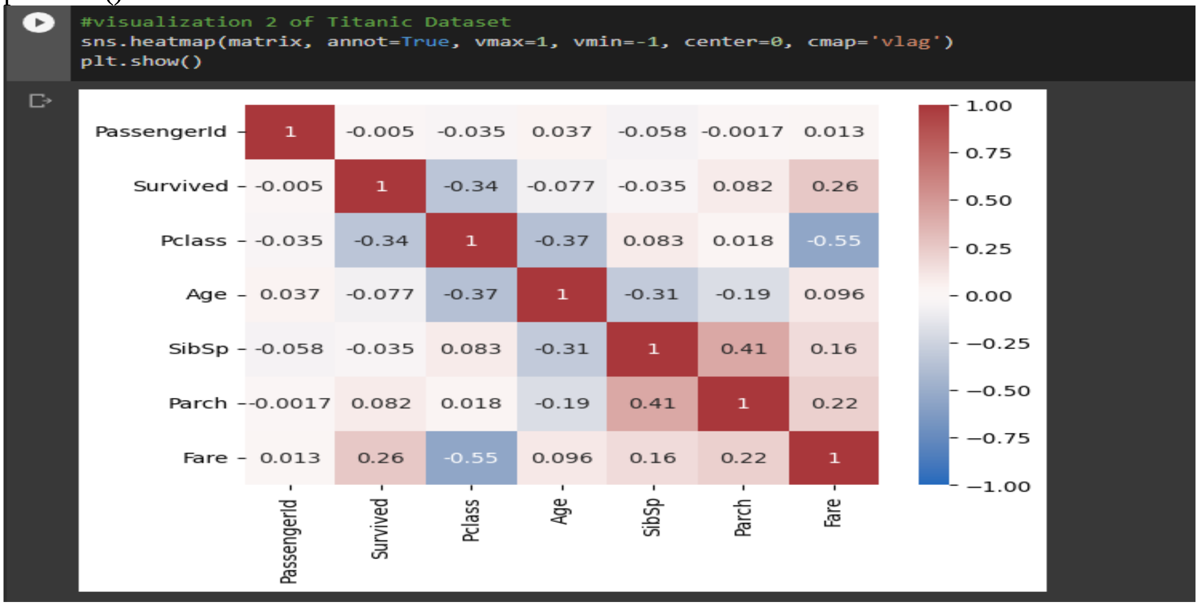
	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
PassengerId	1.000000	-0.005007	-0.035144	0.036847	-0.057527	-0.001652	0.012658
Survived	-0.005007	1.000000	-0.338481	-0.077221	-0.035322	0.081629	0.257307
Pclass	-0.035144	-0.338481	1.000000	-0.369226	0.083081	0.018443	-0.549500
Age	0.036847	-0.077221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

Description:

Visualization 1 for titanic dataset

#visualization 2 of Titanic Dataset

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



Description:

Visualization 1 for titanic dataset

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

```
#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))

```
#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%
```

Description:

We are using Naïve Bayes method for this dataset, loaded the datset selected the features and target and preprocessed the categorical variables, splited the data into testing and training datasets and treated the missing valuesby using Naïve Bayes model and made prediction and accuracy of the model is calculated.

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

```
#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)
```

```python
#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
```

Description:

Glass dataset is loaded then separated the target variables, split the data into testing and training datasets by Naive Bayes model, made predictions on the training set and accuracy is calculated.

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

```python
#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)
```

```
#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
```

Description:

Glass dataset is loaded then separated the target variables, split the data into testing and training datasets by Linear SVM model, made predictions on the training set and accuracy is calculated.

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

#visualization 1 of Glass Dataset
glass.corr().style.background_gradient(cmap="Greens")

```
#visualization 1 of Glass Dataset
glass.corr().style.background_gradient(cmap="Greens")
```

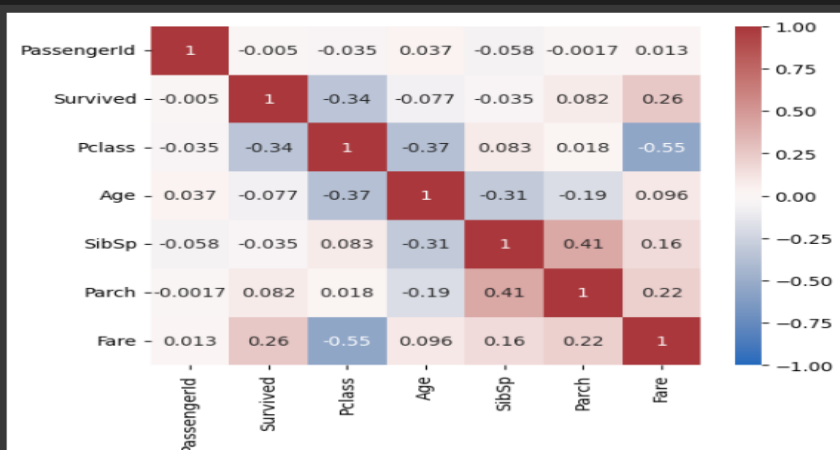
	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
RI	1.000000	-0.191885	-0.122274	-0.407326	-0.542052	-0.289833	0.810403	-0.000386	0.143010	-0.164237
Na	-0.191885	1.000000	-0.273732	0.156794	-0.069809	-0.266087	-0.275442	0.326603	-0.241346	0.502898
Mg	-0.122274	-0.273732	1.000000	-0.481799	-0.165927	0.005396	-0.443750	-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

Description:

Visualization 1 for galss dataset

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

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



Description:

Visualization 1 for class dataset

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

Among Naïve Bayes and Support vector machine algorithms, naïve bayes got better accuracy than the SVM. Naïve Bayes gives better results than SVM for this data set. we may get better results using SVM than naïve bayes when we work with another data set. In this glass data set, types of glass are independent predictors. When there are any independent predictors present in the data set naïve bayes perform better than other models.