21BDS0207 Jatin Pareek

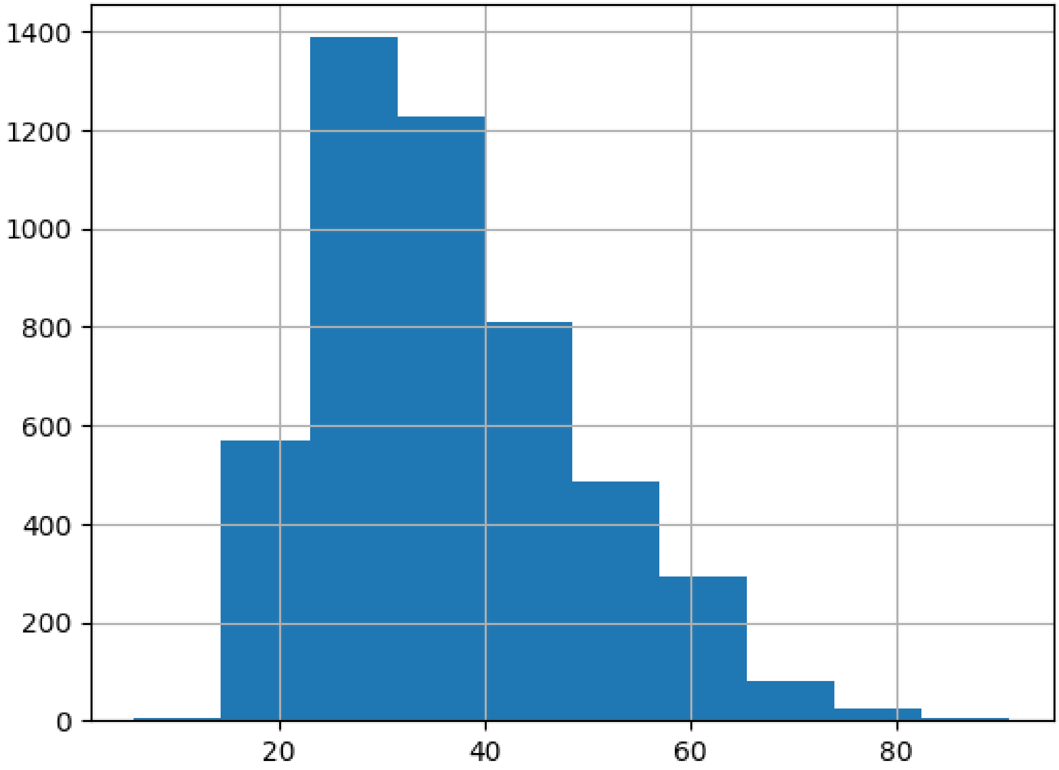
Digital Assessment - 1

Module 1: Exploratory Data Analysis (EDA)

```python
# Import necessary libraries
import pandas as pd
import numpy as np

# Load the dataset
df = pd.read_csv("C:\\Users\\Jatin\\Desktop\\shootings.csv")

# Steps in EDA: Basic Data Overview
df.info()  # Check data types and missing values
df.describe()  # Summary statistics for numerical data

# Handling categorical data (nominal and ordinal data)
print(df['armed'].value_counts())

# Example of EDA for discrete (count) and continuous data (e.g., age)
df['age'].hist()  # Plot a histogram for continuous data
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4895 entries, 0 to 4894
Data columns (total 15 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   id                       4895 non-null   int64  
 1   name                     4895 non-null   object 
 2   date                     4895 non-null   object 
 3   manner_of_death          4892 non-null   object 
 4   armed                    4895 non-null   object 
 5   age                      4895 non-null   float64
 6   gender                   4895 non-null   object 
 7   race                     4893 non-null   object 
 8   city                     4895 non-null   object 
 9   state                    4895 non-null   object 
 10  signs_of_mental_illness  4895 non-null   bool   
 11  threat_level             4895 non-null   object 
 12  flee                     4895 non-null   object 
 13  body_camera              4895 non-null   object 
 14  arms_category            4893 non-null   object 
dtypes: bool(1), float64(1), int64(1), object(12)
memory usage: 540.3+ KB
armed
gun                       2755
```

```
knife                          708
unknown                        418
unarmed                        348
toy weapon                     171
                              ...
air pistol                       1
baseball bat and knife           1
vehicle and machete              1
ice pick                         1
car, knife and mace              1
Name: count, Length: 89, dtype: int64

<Axes: >
```



Module 2: Data Transformation

```
# Data Deduplication
df.drop_duplicates(inplace=True)

# Handling missing data (e.g., age or other columns with NaN)
df.fillna(value={'age': df['age'].median()}, inplace=True)

# Replacing Values (Example: converting 'body_camera' to Boolean)
df['body_camera'] = df['body_camera'].map({'FALSE': False, 'TRUE':
True})
```

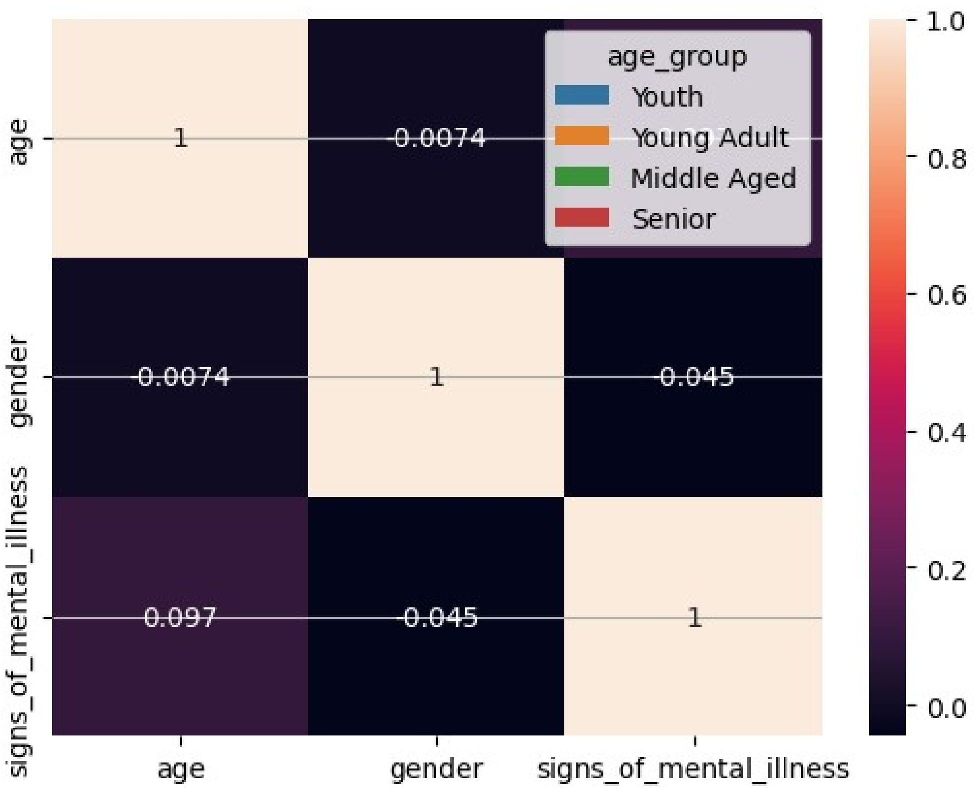
```
# Binning the 'age' column into categories
df['age_group'] = pd.cut(df['age'], bins=[0, 18, 35, 55, 100],
labels=['Youth', 'Young Adult', 'Middle Aged', 'Senior'])

# Print the updated dataset after data transformation
print("Updated dataset after Module 2 - Data Transformation:")
print(df.head())
```

```
Updated dataset after Module 2 - Data Transformation:
   id                name      date   manner_of_death       armed
age  \
0   3          Tim Elliot  02/01/15              shot         gun
53.0
1   4    Lewis Lee Lembke  02/01/15              shot         gun
47.0
2   5  John Paul Quintero  03/01/15  shot and Tasered     unarmed
23.0
3   8     Matthew Hoffman  04/01/15              shot  toy weapon
32.0
4   9   Michael Rodriguez  04/01/15              shot    nail gun
39.0

  gender      race           city state  signs_of_mental_illness
threat_level  \
0      M     Asian        Shelton    WA                     True
attack
1      M     White          Aloha    OR                    False
attack
2      M  Hispanic        Wichita    KS                    False
other
3      M     White  San Francisco    CA                     True
attack
4      M  Hispanic          Evans    CO                    False
attack

          flee body_camera          arms_category   binned_age
age_group
0  Not fleeing         NaN                   Guns        adult  Middle
Aged
1  Not fleeing         NaN                   Guns        adult  Middle
Aged
2  Not fleeing         NaN                Unarmed  young adult  Young
Adult
3  Not fleeing         NaN  Other unusual objects  young adult  Young
Adult
4  Not fleeing         NaN       Piercing objects        adult  Middle
Aged
```

Module 3: Correlation Analysis

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

# Univariate Analysis (age distribution)
df['age'].hist()

# Bivariate Analysis (age vs manner_of_death)
sns.countplot(x='manner_of_death', hue='age_group', data=df)

# Multivariate Analysis (correlation between age, gender, and signs of
mental illness)
df_corr = df[['age', 'gender', 'signs_of_mental_illness']].copy()

# Encoding categorical columns for correlation
df_corr['gender'] = df_corr['gender'].map({'M': 1, 'F': 0})
df_corr['signs_of_mental_illness'] =
df_corr['signs_of_mental_illness'].map({True: 1, False: 0})
sns.heatmap(df_corr.corr(), annot=True)

# Print the updated dataset after correlation and time series analysis
print("Module 3 - Correlation:")
print(df.head())
```

```
Module 3 - Correlation:
            id                name   manner_of_death       armed   age
gender  \
date

2015-01-02   3          Tim Elliot              shot         gun  53.0
M
2015-01-02   4    Lewis Lee Lembke              shot         gun  47.0
M
2015-01-03   5  John Paul Quintero  shot and Tasered     unarmed  23.0
M
2015-01-04   8     Matthew Hoffman              shot  toy weapon  32.0
M
2015-01-04   9   Michael Rodriguez              shot    nail gun  39.0
M

                race           city state  signs_of_mental_illness  \
date
2015-01-02     Asian        Shelton    WA                     True
2015-01-02     White          Aloha    OR                    False
2015-01-03  Hispanic        Wichita    KS                    False
2015-01-04     White  San Francisco    CA                     True
2015-01-04  Hispanic          Evans    CO                    False

           threat_level         flee body_camera
arms_category  \
date

2015-01-02        attack  Not fleeing         NaN
Guns
2015-01-02        attack  Not fleeing         NaN
Guns
2015-01-03         other  Not fleeing         NaN
Unarmed
2015-01-04        attack  Not fleeing         NaN  Other unusual
objects
2015-01-04        attack  Not fleeing         NaN       Piercing
objects

             binned_age    age_group
date
2015-01-02        adult  Middle Aged
2015-01-02        adult  Middle Aged
2015-01-03  young adult  Young Adult
2015-01-04  young adult  Young Adult
2015-01-04        adult  Middle Aged
```



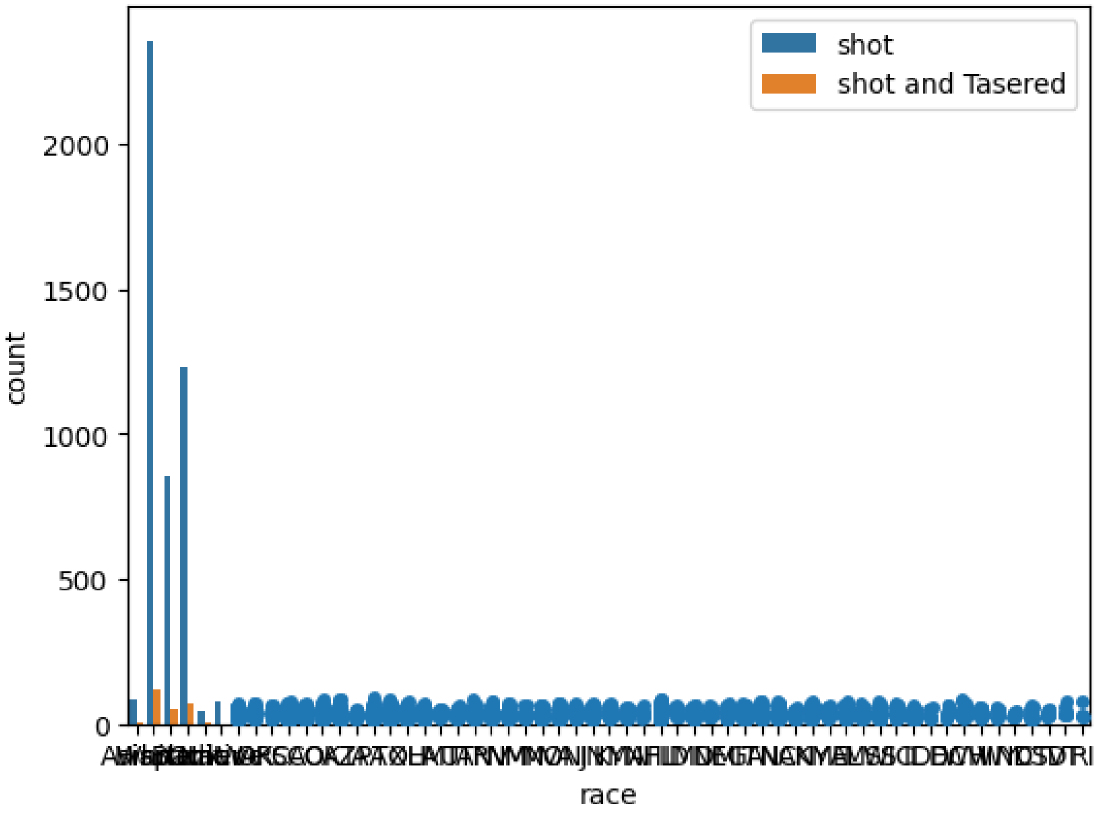
Module 4: Data Summarization and Visualization

```
# 1D Statistical summary (age)
print(df['age'].describe())
```

```
# 2D Data analysis: contingency table for manner_of_death and
arms_category
contingency_table = pd.crosstab(df['manner_of_death'],
df['arms_category'])
print(contingency_table)

# Visualization (bar plot of manner_of_death by race)
sns.countplot(x='race', hue='manner_of_death', data=df)

# Dot chart (age distribution across states)
sns.stripplot(x='state', y='age', data=df)

# Print the updated dataset after data summarization and visualization
print("Module 4 - Data Summarization and Visualization:")
print(df.head())
```

```
count    4888.000000
mean       36.555651
std        12.700321
min         6.000000
25%        27.000000
50%        35.000000
75%        45.000000
max        91.000000
Name: age, dtype: float64
arms_category     Blunt instruments  Electrical devices  Explosives
Guns  \
manner_of_death

shot                            105                  17           4
2720
shot and Tasered                 17                   7           0
38

arms_category     Hand tools  Multiple  Other unusual objects  \
manner_of_death
shot                       0        50                    183
shot and Tasered           1         4                      9

arms_category     Piercing objects  Sharp objects  Unarmed  Unknown
Vehicles
manner_of_death

shot                            23            702      308      407
121
shot and Tasered                 6            116       39       11
0
Module 4 - Data Summarization and Visualization:
            id                name   manner_of_death       armed   age
```

```
gender  \
date

2015-01-02   3          Tim Elliot              shot         gun  53.0
M
2015-01-02   4    Lewis Lee Lembke              shot         gun  47.0
M
2015-01-03   5  John Paul Quintero  shot and Tasered     unarmed  23.0
M
2015-01-04   8     Matthew Hoffman              shot  toy weapon  32.0
M
2015-01-04   9   Michael Rodriguez              shot    nail gun  39.0
M

                race           city state  signs_of_mental_illness  \
date
2015-01-02     Asian        Shelton    WA                     True
2015-01-02     White          Aloha    OR                    False
2015-01-03  Hispanic        Wichita    KS                    False
2015-01-04     White  San Francisco    CA                     True
2015-01-04  Hispanic          Evans    CO                    False

           threat_level         flee body_camera
arms_category  \
date

2015-01-02       attack  Not fleeing         NaN
Guns
2015-01-02       attack  Not fleeing         NaN
Guns
2015-01-03        other  Not fleeing         NaN
Unarmed
2015-01-04       attack  Not fleeing         NaN  Other unusual
objects
2015-01-04       attack  Not fleeing         NaN       Piercing
objects

             binned_age    age_group
date
2015-01-02        adult  Middle Aged
2015-01-02        adult  Middle Aged
2015-01-03  young adult  Young Adult
2015-01-04  young adult  Young Adult
2015-01-04        adult  Middle Aged
```

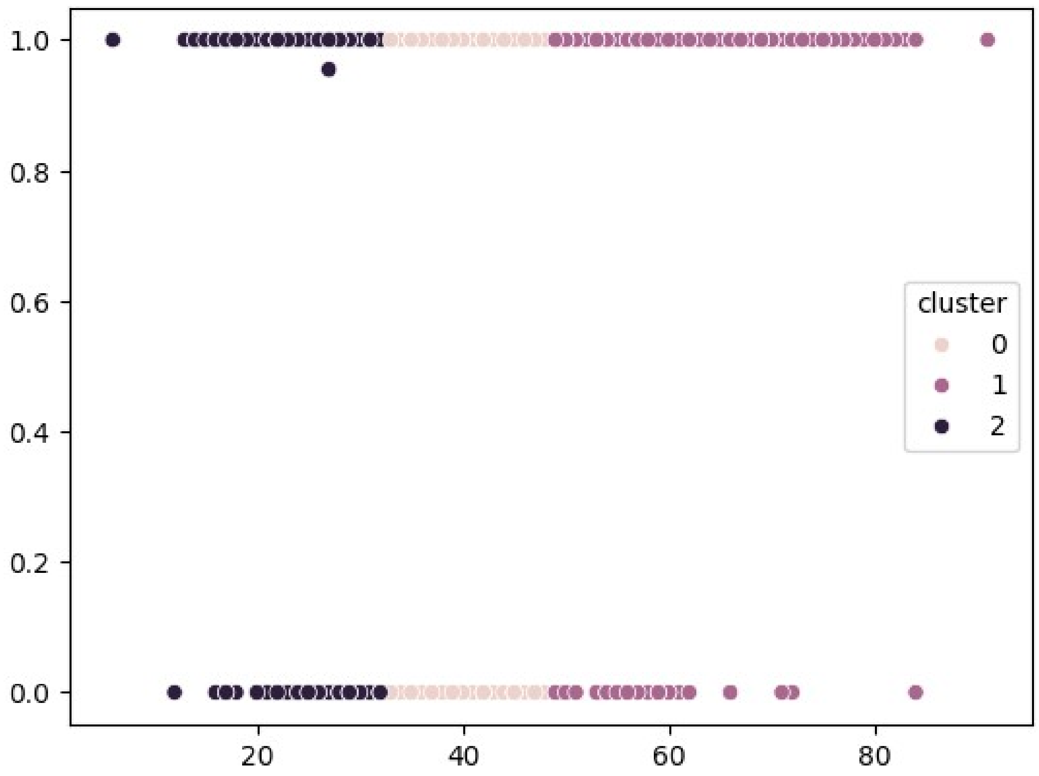


Module 5: Clustering Algorithms

```
from sklearn.impute import SimpleImputer

# Impute missing values in the clustering features (age, gender,
signs_of_mental_illness)
imputer = SimpleImputer(strategy='mean')  # Use mean to fill missing
values
df_clustering_imputed = imputer.fit_transform(df_clustering)

# Perform KMeans clustering on the imputed data
kmeans = KMeans(n_clusters=3)
df['cluster'] = kmeans.fit_predict(df_clustering_imputed)

# Visualize the clusters
sns.scatterplot(x=df_clustering_imputed[:, 0],
y=df_clustering_imputed[:, 1], hue=df['cluster'])

# Print the updated dataset after clustering
print("Updated dataset after handling missing values and applying
KMeans:")
print(df.head())
```

```
Updated dataset after handling missing values and applying KMeans:
            id                name   manner_of_death       armed   age
```

```
gender  \
date

2015-01-02   3          Tim Elliot              shot         gun  53.0
M
2015-01-02   4    Lewis Lee Lembke              shot         gun  47.0
M
2015-01-03   5  John Paul Quintero  shot and Tasered     unarmed  23.0
M
2015-01-04   8     Matthew Hoffman              shot  toy weapon  32.0
M
2015-01-04   9   Michael Rodriguez              shot    nail gun  39.0
M

                race           city state  signs_of_mental_illness  \
date
2015-01-02     Asian        Shelton    WA                     True
2015-01-02     White          Aloha    OR                    False
2015-01-03  Hispanic        Wichita    KS                    False
2015-01-04     White  San Francisco    CA                     True
2015-01-04  Hispanic          Evans    CO                    False

           threat_level         flee body_camera
arms_category  \
date

2015-01-02       attack  Not fleeing         NaN
Guns
2015-01-02       attack  Not fleeing         NaN
Guns
2015-01-03        other  Not fleeing         NaN
Unarmed
2015-01-04       attack  Not fleeing         NaN  Other unusual
objects
2015-01-04       attack  Not fleeing         NaN       Piercing
objects

              binned_age    age_group  cluster
date
2015-01-02         adult  Middle Aged        1
2015-01-02         adult  Middle Aged        0
2015-01-03   young adult  Young Adult        2
2015-01-04   young adult  Young Adult        2
2015-01-04         adult  Middle Aged        0
```

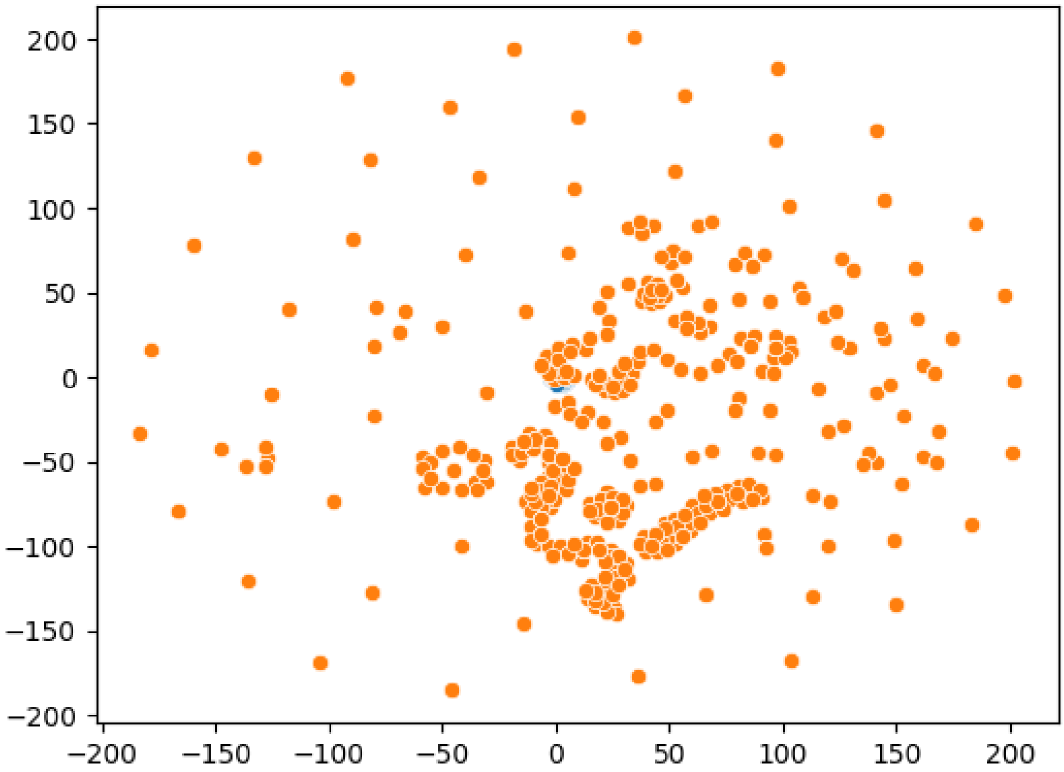


Module 6 - Dimensionality Reduction

```
from sklearn.impute import SimpleImputer
from sklearn.decomposition import PCA
from sklearn.manifold import TSNE
import seaborn as sns

# Impute missing values in the clustering features using mean
imputer = SimpleImputer(strategy='mean')
df_clustering_imputed = imputer.fit_transform(df_clustering_scaled)

# PCA for Dimensionality Reduction (using the imputed data)
pca = PCA(n_components=2)
df_pca = pca.fit_transform(df_clustering_imputed)

# Visualizing the results of PCA
sns.scatterplot(x=df_pca[:, 0], y=df_pca[:, 1])

# t-SNE for non-linear dimensionality reduction (optional)
tsne = TSNE(n_components=2)
df_tsne = tsne.fit_transform(df_clustering_imputed)

# Visualizing the results of t-SNE
sns.scatterplot(x=df_tsne[:, 0], y=df_tsne[:, 1])

# Print the updated dataset
```

```python
print("Updated dataset after performing PCA and t-SNE:")
print(df.head())
```

```
Updated dataset after performing PCA and t-SNE:
            id                name   manner_of_death       armed   age
gender  \
date

2015-01-02   3           Tim Elliot              shot          gun  53.0
M
2015-01-02   4    Lewis Lee Lembke              shot          gun  47.0
M
2015-01-03   5  John Paul Quintero  shot and Tasered     unarmed  23.0
M
2015-01-04   8     Matthew Hoffman              shot  toy weapon  32.0
M
2015-01-04   9   Michael Rodriguez              shot    nail gun  39.0
M

                race           city state  signs_of_mental_illness  \
date
2015-01-02     Asian        Shelton    WA                     True
2015-01-02     White          Aloha    OR                    False
2015-01-03  Hispanic        Wichita    KS                    False
2015-01-04     White  San Francisco    CA                     True
2015-01-04  Hispanic          Evans    CO                    False

           threat_level         flee body_camera
arms_category  \
date

2015-01-02       attack  Not fleeing         NaN
Guns
2015-01-02       attack  Not fleeing         NaN
Guns
2015-01-03        other  Not fleeing         NaN
Unarmed
2015-01-04       attack  Not fleeing         NaN  Other unusual
objects
2015-01-04       attack  Not fleeing         NaN       Piercing
objects

             binned_age    age_group  cluster
date
2015-01-02        adult  Middle Aged        1
2015-01-02        adult  Middle Aged        0
2015-01-03  young adult  Young Adult        2
2015-01-04  young adult  Young Adult        2
2015-01-04        adult  Middle Aged        0
```



Module 7 - Model Development and Evaluation

```python
from sklearn.impute import SimpleImputer
from sklearn.linear_model import LinearRegression

# Impute missing values in X_train using mean
imputer = SimpleImputer(strategy='mean')
X_train_imputed = imputer.fit_transform(X_train)

# Impute missing values in X_test
X_test_imputed = imputer.transform(X_test)

# Linear Regression Model
lr = LinearRegression()
lr.fit(X_train_imputed, y_train)

# Predictions and Accuracy
y_pred = lr.predict(X_test_imputed)

# Evaluate performance (e.g., with R-squared)
from sklearn.metrics import r2_score
print(f'R-squared: {r2_score(y_test, y_pred)}')
```

```
R-squared: 0.018776707218411404
```