CAB 203: DATA VISUALISATION

```
    **CA:2       PROJECT REPORT**
```

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SECTION: D2411[G1]

Project : Visualisations on the data of Riots and Protests in India btw 2016 - 2022 here we get to know about the most affect areas of the country and the types of poeople involved in the events and most important part is the type of event occueing be it a peacful event or the burst of anger and agoney among the citizens

Imports essential libraries for data manipulation, visualization, and mapping.

In [1]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import folium
import seaborn as sns

import warnings
warnings.filterwarnings("ignore")  # Ignore all warnings
pd.set_option('display.max_columns', None)

import folium
from folium.plugins import HeatMap

from folium.plugins import MarkerCluster
```

In [2]:
```python
ca=pd.read_csv("2016-2022.csv")
ca.head()
```

Out[2]:

	data_id	iso	event_id_cnty	event_id_no_cnty	event_date	year	time_precision	event_type	sub_event_type	actor1	assoc
0	8912977	356	IND107923	107923.0	18-Mar-22	2022	1	Riots	Mob violence	Rioters (India)	Singra Grou Raj
1	8912990	356	IND107846	107846.0	18-Mar-22	2022	1	Protests	Peaceful protest	Protesters (India)	Labo
2	8913012	356	IND107941	107941.0	18-Mar-22	2022	1	Protests	Peaceful protest	Protesters (India)	
3	8913089	356	IND107842	107842.0	18-Mar-22	2022	1	Protests	Peaceful protest	Protesters (India)	Health
4	8913091	356	IND107850	107850.0	18-Mar-22	2022	1	Riots	Mob violence	Rioters (India)	Gover Indi

In [3]:

```
ca.info
```

Out[3]:

```
<bound method DataFrame.info of         data_id  iso event_id_cnty  event_id_no_cnty event_date  year  \
0       8912977  356     IND107923          107923.0  18-Mar-22  2022   
1       8912990  356     IND107846          107846.0  18-Mar-22  2022   
2       8913012  356     IND107941          107941.0  18-Mar-22  2022   
3       8913089  356     IND107842          107842.0  18-Mar-22  2022   
4       8913091  356     IND107850          107850.0  18-Mar-22  2022   
...         ...  ...           ...               ...        ...   ...   
107685  5494159  356          IND9               9.0  01-Jan-16  2016   
107686  5603486  356      IND51303           51303.0  01-Jan-16  2016   
107687  6072644  356      IND49232           49232.0  01-Jan-16  2016   
107688  6257234  356         IND10              10.0  01-Jan-16  2016   
107689  8543376  356      IND49233           49233.0  01-Jan-16  2016   

        time_precision event_type    sub_event_type  \
0                    1      Riots      Mob violence   
1                    1   Protests  Peaceful protest   
2                    1   Protests  Peaceful protest   
3                    1   Protests  Peaceful protest   
4                    1      Riots      Mob violence   
...                ...        ...               ...   
107685               1   Protests  Peaceful protest   
107686               1    Battles       Armed clash   
107687               1   Protests  Peaceful protest   
107688               1    Battles       Armed clash   
107689               1   Protests  Peaceful protest   

                                         actor1  \
0                              Rioters (India)   
1                           Protesters (India)   
2                           Protesters (India)   
3                           Protesters (India)   
4                              Rioters (India)   
...                                         ...   
107685                      Protesters (India)   
107686      NDFB: National Democratic Front of Boroland   
107687                      Protesters (India)   
107688  CPI (Maoist): Communist Party of India (Maoist)   
107689                      Protesters (India)   

                                       assoc_actor_1  inter1  \
0       Singraur Caste Group (India); Rajput Caste Gro...       5   
1                                Labour Group (India)       6   
2                                                 NaN       6   
3                              Health Workers (India)       6   
4                          Government of India (2014-)       5   
```

```
...                                                   ...     ...
107685                               Labour Group (India)       6
107686                                                NaN       2
107687                                                NaN       6
107688                                                NaN       2
107689                                                NaN       6

                                             actor2  \
0                                   Rioters (India)
1                                               NaN
2                                               NaN
3                                               NaN
4                                 Civilians (India)
...                                             ...
107685                                          NaN
107686  NDFB: National Democratic Front of Boroland
107687                                          NaN
107688               Police Forces of India (2014-)
107689                                          NaN

                                            assoc_actor_2  inter2  \
0       Sonkar Caste Group (India); Dalit Caste Group ...       5
1                                                     NaN       0
2                                                     NaN       0
3                                                     NaN       0
4                      Former Government of India (2014-)       7
...                                                   ...     ...
107685                                                NaN       0
107686                                                NaN       2
107687                                                NaN       0
107688                                                NaN       1
107689                                                NaN       0

        interaction      region country             admin1       admin2  \
0                55  South Asia   India      Uttar Pradesh     Fatehpur
1                60  South Asia   India        Maharashtra  Mumbai City
2                60  South Asia   India             Punjab      Sangrur
3                60  South Asia   India     Madhya Pradesh       Indore
4                57  South Asia   India     Madhya Pradesh        Bhind
...             ...         ...     ...                ...          ...
107685           60  South Asia   India             Punjab     Ludhiana
107686           22  South Asia   India              Assam    Kokrajhar
107687           60  South Asia   India  Jammu and Kashmir      Pulwama
107688           12  South Asia   India       Chhattisgarh   Narayanpur
107689           60  South Asia   India  Jammu and Kashmir     Srinagar

                admin3             location  latitude  longitude  \
0                Khaga            Kishanpur   25.6422    81.0244
1          Mumbai City  Mumbai - Azad Maidan   18.9388    72.8321
2           Malerkotla            Ahmedgarh   30.6785    75.8272
3               Indore               Indore   22.7179    75.8333
4                Bhind              Kanavar   26.5622    78.9797
...                ...                  ...       ...        ...
107685   Ludhiana East             Ludhiana   30.9120    75.8537
107686       Kokrajhar            Kokrajhar   26.4016    90.2665
107687         Pulwama              Pulwama   33.8741    74.9001
107688      Narayanpur           Narayanpur   19.7179    81.2443
107689  Srinagar South             Srinagar   34.0857    74.8056

        geo_precision                                             source  \
0                   1                                         Amar Ujala
1                   1                           Asian News International
2                   1                                 Chandigarh Tribune
3                   1                         Free Press Journal (India)
4                   1                         Free Press Journal (India)
...               ...                                                ...
107685              1                                 Chandigarh Tribune
107686              1                        South Asia Terrorism Portal
107687              2  Jammu Kashmir Coalition of Civil Society, Srin...
107688              2                                 Chandigarh Tribune
107689              1  Jammu Kashmir Coalition of Civil Society, Srin...

               source_scale  \
0               Subnational
1                  National
2                  National
3                  National
4                  National
...                     ...
107685          Subnational
107686                Other
107687  Local partner-Other
107688             National
```

```
107689  Local partner-Other

                                                    notes  fatalities  \
0       On 18 March 2022, members of two caste groups ...           0   
1       On 18 March 2022, aircraft technicians, employ...           0   
2       On 18 March 2022, activists of various organis...           0   
3       On 18 March 2022, doctors staged a protest at ...           0   
4       On 18 March 2022, around half a dozen persons,...           1   
...                                                   ...         ...   
107685  On 1 Jan, members of the Punjab Government Con...           0   
107686  On January 1, one surrendered NDFB cadre was k...           1   
107687  On January 1, a protest took place in Pulwama ...           0   
107688  On 1 Jan, two Naxals were gunned down and thre...           2   
107689  On January 1, a protest took place in Srinagar...           0   

         timestamp iso3  
0       1647961433  IND  
1       1647961433  IND  
2       1647961433  IND  
3       1647961433  IND  
4       1647961433  IND  
...            ...  ...  
107685  1618556592  IND  
107686  1563366777  IND  
107687  1571164565  IND  
107688  1572403706  IND  
107689  1631660908  IND  

[107690 rows x 31 columns]>
```

In [4]:

```
ca.dtypes
```

Out[4]:

```
data_id               int64
iso                   int64
event_id_cnty        object
event_id_no_cnty    float64
event_date           object
year                  int64
time_precision        int64
event_type           object
sub_event_type       object
actor1               object
assoc_actor_1        object
inter1                int64
actor2               object
assoc_actor_2        object
inter2                int64
interaction           int64
region               object
country              object
admin1               object
admin2               object
admin3               object
location             object
latitude            float64
longitude           float64
geo_precision         int64
source               object
source_scale         object
notes                object
fatalities            int64
timestamp             int64
iso3                 object
dtype: object
```

In [5]:

```
ca.rename(columns={'admin1':'State',
                   'admin2':'District',
                   'admin3':'local_area',
                   'event_date':'Date',
                    'iso':'Country_code',
                    'actor1':'Main_actor',
                    'assoc_actor_1':'associated_actor_1',
                    'source':'Report_source',
                    'source_scale':'Source_coverage',
                    'notes':'event_description',
                    'iso3':'country_code_alpha',
                'event_id_no_cnty':'event_id_local'},inplace=True)
```

In [6]:

```
ca.columns
```

```
Out[6]: Index(['data_id', 'Country_code', 'event_id_cnty', 'event_id_local', 'Date',
               'year', 'time_precision', 'event_type', 'sub_event_type', 'Main_actor',
               'associated_actor_1', 'inter1', 'actor2', 'assoc_actor_2', 'inter2',
               'interaction', 'region', 'country', 'State', 'District', 'local_area',
               'location', 'latitude', 'longitude', 'geo_precision', 'Report_source',
               'Source_coverage', 'event_description', 'fatalities', 'timestamp',
               'country_code_alpha'],
              dtype='object')
```

PREPROCESSING OF THE DATA SET

```
In [7]: ca.isnull().sum()
```

```
Out[7]: data_id                   0
        Country_code              0
        event_id_cnty             0
        event_id_local            0
        Date                      0
        year                      0
        time_precision            0
        event_type                0
        sub_event_type            0
        Main_actor                0
        associated_actor_1    30773
        inter1                    0
        actor2                76315
        assoc_actor_2         96179
        inter2                    0
        interaction               0
        region                    0
        country                   0
        State                     0
        District                 18
        local_area             2239
        location                  0
        latitude                  0
        longitude                 0
        geo_precision             0
        Report_source             0
        Source_coverage           0
        event_description         0
        fatalities                0
        timestamp                 0
        country_code_alpha        0
        dtype: int64
```

Fills missing values in District and local_area with "UNKNOWN" to handle nulls.

```
In [8]: ca['District'].fillna('UNKNOWN', inplace=True)
        ca['local_area'].fillna('UNKNOWN', inplace=True)
        #District column was having 18 null values
        #local_area column was having 2239 null values
        # that`s why UNKNOWN  value has been filled
```

Assigns default value for missing actor2 where event type is "Protests"

```
In [9]: ca.loc[(ca['actor2'].isna()) & (ca['event_type'] == 'Protests'), 'actor2'] = 'Civilians (India)'
```

```
In [10]: ca.loc[(ca['assoc_actor_2'].isna()) & (ca['actor2'].notna()), 'assoc_actor_2'] = 'Related to ' + ca['actor2']
```

```
In [11]: ca.isnull().sum()
```

Out[11]:

```
data_id                   0
Country_code              0
event_id_cnty             0
event_id_local            0
Date                      0
year                      0
time_precision            0
event_type                0
sub_event_type            0
Main_actor                0
associated_actor_1    30773
inter1                    0
actor2                 1950
assoc_actor_2          1950
inter2                    0
interaction               0
region                    0
country                   0
State                     0
District                  0
local_area                0
location                  0
latitude                  0
longitude                 0
geo_precision             0
Report_source             0
Source_coverage           0
event_description         0
fatalities                0
timestamp                 0
country_code_alpha        0
dtype: int64
```

Removes all remaining rows with missing values.

In [12]:

```
dv = ca.dropna()
```

Creating a new column Protest_theme to Categorize sub-event types

In [13]:

```
def categorize_sub_event(row):
    if 'student' in row.lower():
        return 'Student'
    elif 'farmer' in row.lower():
        return 'Farmers'
    elif 'religious' in row.lower() or 'hindu' in row.lower() or 'muslim' in row.lower():
        return 'Religious'
    elif 'political' in row.lower():
        return 'Political'
    else:
        return 'Other'

dv['protest_theme'] = dv['Report_source'].apply(categorize_sub_event)
```

In [14]:

```
dv.isnull().sum()
```

Out[14]:

```
data_id                0
Country_code           0
event_id_cnty          0
event_id_local         0
Date                   0
year                   0
time_precision         0
event_type             0
sub_event_type         0
Main_actor             0
associated_actor_1     0
inter1                 0
actor2                 0
assoc_actor_2          0
inter2                 0
interaction            0
region                 0
country                0
State                  0
District               0
local_area             0
location               0
latitude               0
longitude              0
geo_precision          0
Report_source          0
Source_coverage        0
event_description      0
fatalities             0
timestamp              0
country_code_alpha     0
protest_theme          0
dtype: int64
```

Extract month name, month number and year from a date column

In [15]:

```python
dv["Date"]=pd.to_datetime(dv["Date"],errors='coerce')

dv['month'] = dv['Date'].dt.month_name()
dv['month_num'] = dv['Date'].dt.month
dv['year'] = dv['Date'].dt.year
```

Sets the default theme for seaborn plots.

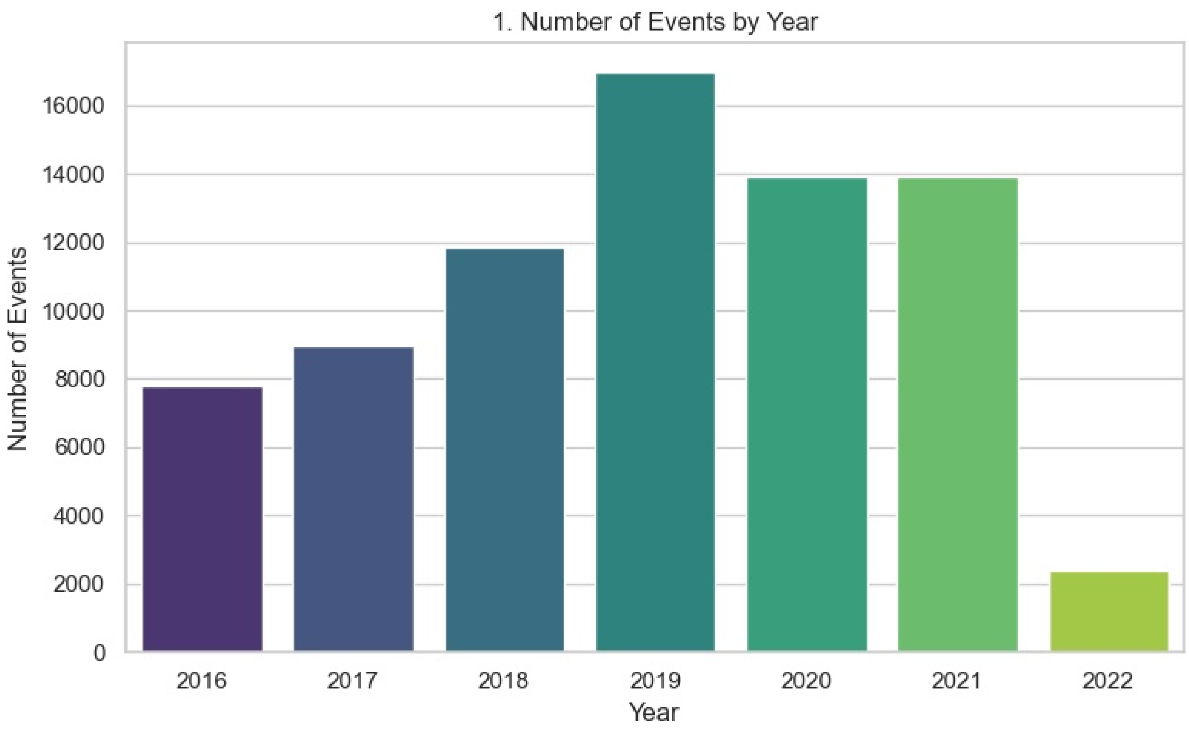
In [16]:

```python
sns.set_theme(style="whitegrid")
```

a bar chart showing the number of events per year. It uses Seaborn to visualize yearly trends in event frequency, helping identify patterns or spikes over time.

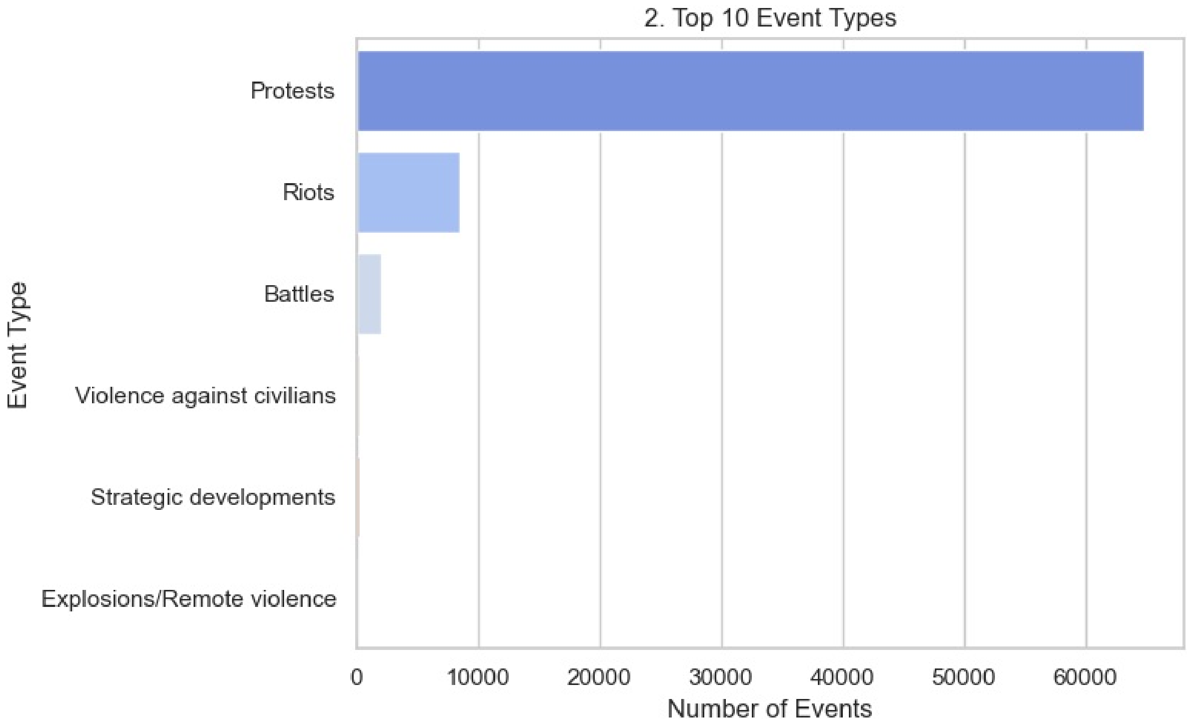
In [17]:

```python
plt.figure(figsize=(8, 5))
sns.countplot(x='year', data=dv, palette='viridis')
plt.title('1. Number of Events by Year')
plt.xlabel('Year')
plt.ylabel('Number of Events')
plt.tight_layout()
plt.show()
```



- horizontal bar chart showing top 10 most common event types. It highlights which type of event occurred frequently in the dataset.*

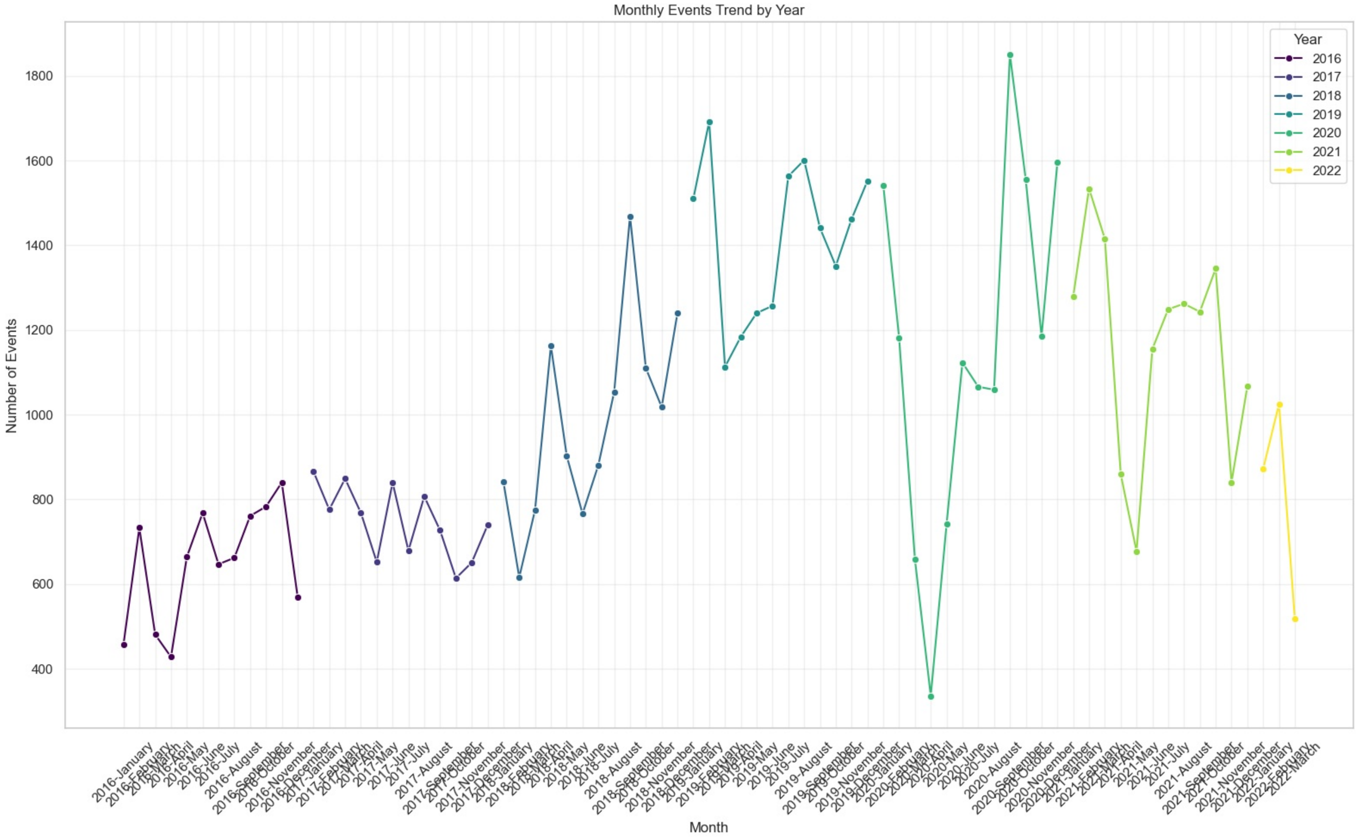
In [18]:
```
plt.figure(figsize=(8, 5))
top_event_types = dv['event_type'].value_counts().nlargest(10)
sns.barplot(x=top_event_types.values, y=top_event_types.index, palette='coolwarm')
plt.title('2. Top 10 Event Types')
plt.xlabel('Number of Events')
plt.ylabel('Event Type')
plt.tight_layout()
plt.show()
```



Shows monthly event trends over time with yearly comparison.

In [19]:
```
# Group by year and month, then count events
monthly_events = dv.groupby(['year', 'month_num', 'month']).size().reset_index(name='count')

# Sort by year and month number to ensure proper ordering
monthly_events = monthly_events.sort_values(['year', 'month_num'])

# Create a combined label for x-axis (Year-Month)
monthly_events['year_month'] = monthly_events['year'].astype(str) + '-' + monthly_events['month']

plt.figure(figsize=(16, 10))
```

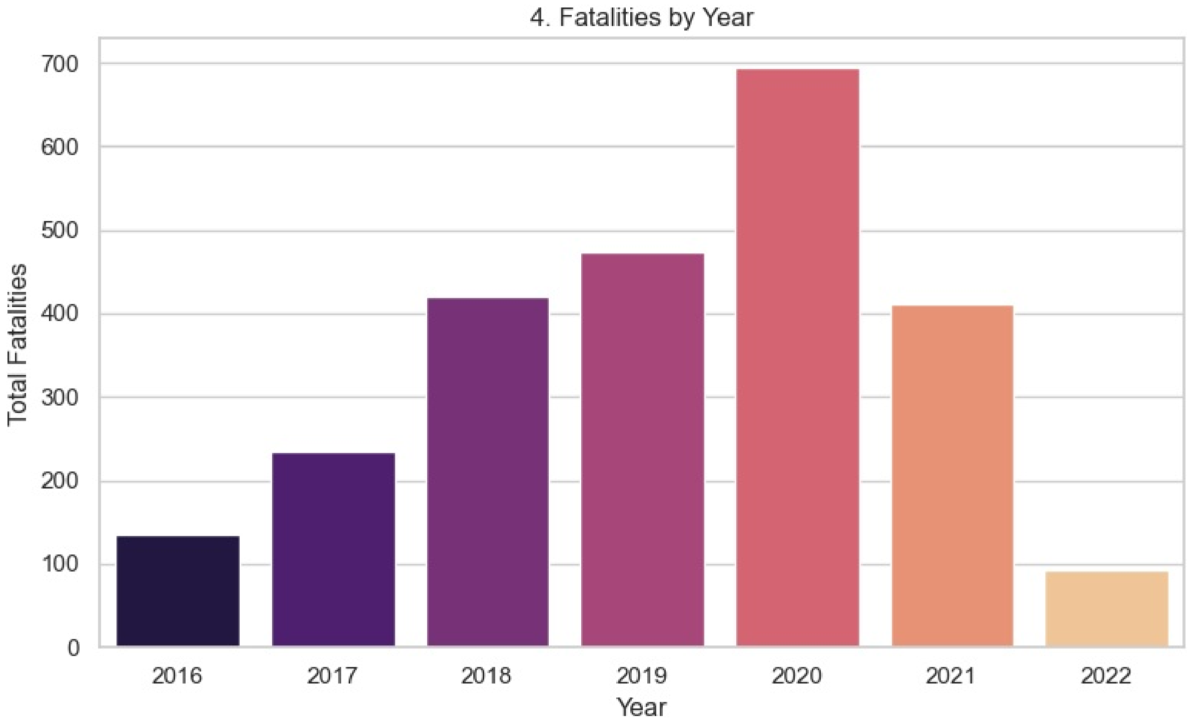
```
sns.lineplot(
    data=monthly_events,
    x='year_month',
    y='count',
    hue='year',  # Color by year
    marker='o',
    palette='viridis'  # Different color for each year
)


plt.title('Monthly Events Trend by Year')
plt.xlabel('Month')
plt.ylabel('Number of Events')
plt.xticks(rotation=45)
plt.grid(True, alpha=0.3)
plt.tight_layout()


plt.legend(title='Year')

plt.show()
```



Bar plot showing total number of deaths resulting from each recorded incident/event

In [20]:

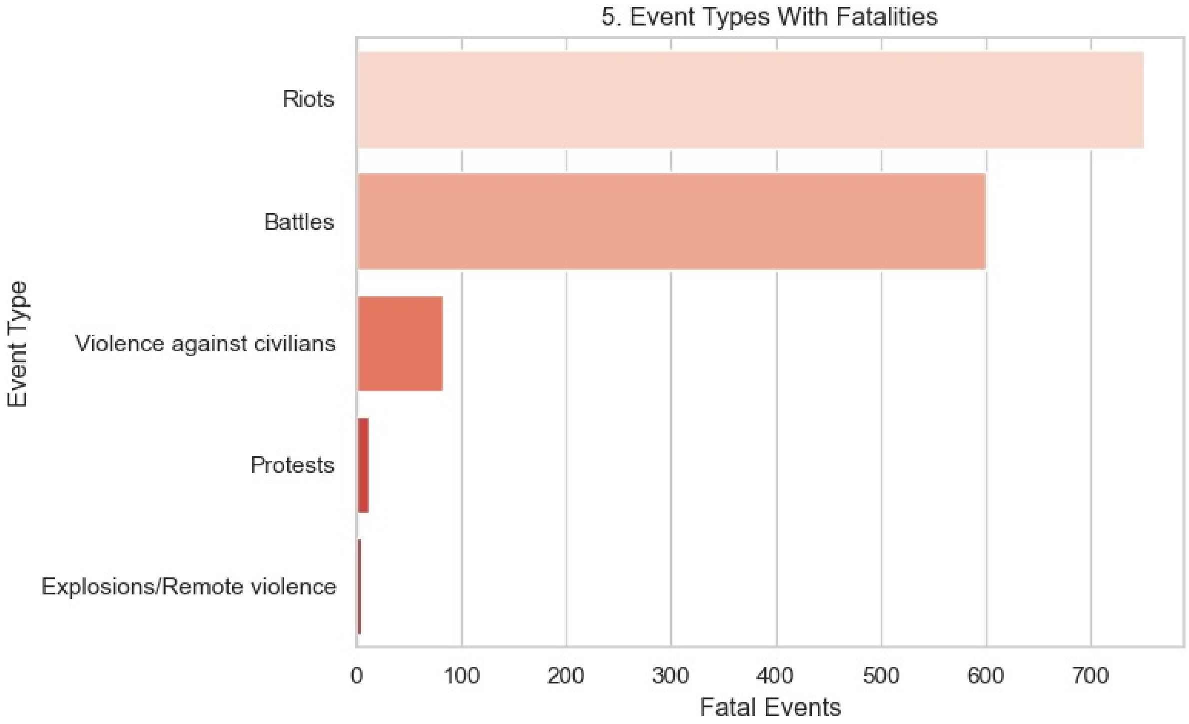
```
# 4. Fatalities per Year
fatal_by_year = dv.groupby('year')['fatalities'].sum()
plt.figure(figsize=(8, 5))
sns.barplot(x=fatal_by_year.index, y=fatal_by_year.values, palette='magma')
plt.title('4. Fatalities by Year')
plt.xlabel('Year')
plt.ylabel('Total Fatalities')
plt.tight_layout()
plt.show()
```



Shows distribution of event types that resulted in fatalities.

In [21]:

```
# 5. Distribution of Event Types with Fatalities > 0
fatal_events = dv[dv['fatalities'] > 0]
fatal_event_types = fatal_events['event_type'].value_counts()
plt.figure(figsize=(8, 5))
sns.barplot(x=fatal_event_types.values, y=fatal_event_types.index, palette='Reds')
plt.title('5. Event Types With Fatalities')
plt.xlabel('Fatal Events')
plt.ylabel('Event Type')
plt.tight_layout()
plt.show()
```



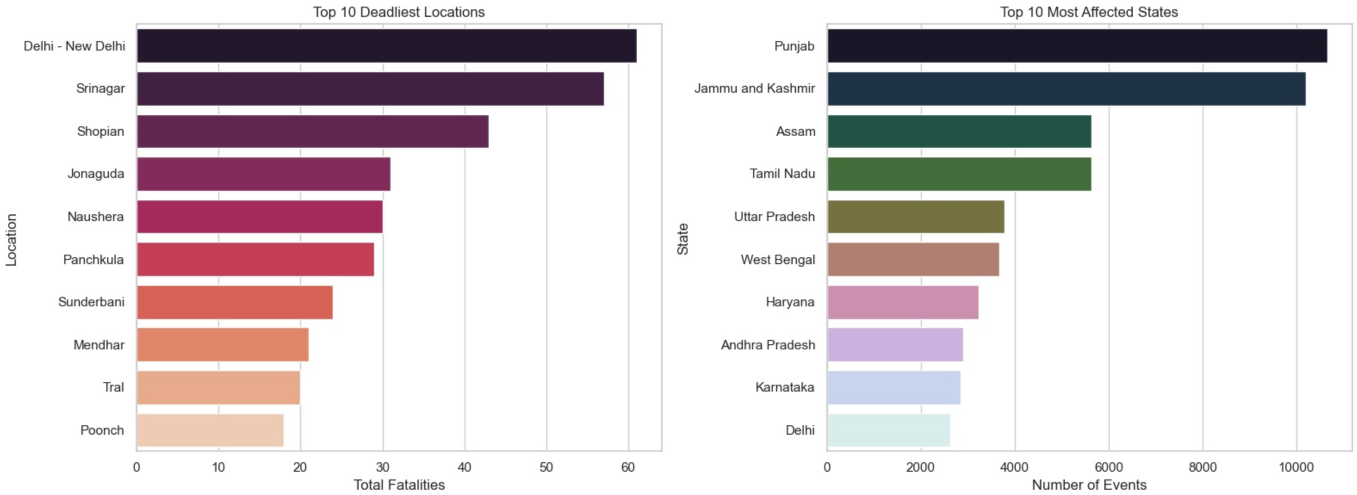
Left: Locations with highest fatalities

Right: States with most events

In [22]:

```
# Data
top_deadly_locs = dv.groupby('location')['fatalities'].sum().nlargest(10)
top_states = dv['State'].value_counts().nlargest(10)

# Plotting
plt.figure(figsize=(16, 6))
```

```
# Subplot 1: Top Deadliest Locations
plt.subplot(1, 2, 1)
sns.barplot(x=top_deadly_locs.values, y=top_deadly_locs.index, palette='rocket')
plt.title('Top 10 Deadliest Locations')
plt.xlabel('Total Fatalities')
plt.ylabel('Location')

# Subplot 2: Top Affected States
plt.subplot(1, 2, 2)
sns.barplot(x=top_states.values, y=top_states.index, palette='cubehelix')
plt.title('Top 10 Most Affected States')
plt.xlabel('Number of Events')
plt.ylabel('State')

plt.tight_layout()
plt.show()
```



Creates an interactive heatmap showing event density across geographic locations.

In [23]:

```
m = folium.Map(location=[20.5937, 78.9629], zoom_start=6)

# Prepare heatmap data (latitude, longitude)
heat_data = [[row['latitude'], row['longitude']] for _, row in dv.iterrows()]

# Add heatmap layer
HeatMap(heat_data,
        radius=7,          # Adjust size of heat points
        blur=10,            # Adjust blur intensity
        max_zoom=13         # Maximum zoom level where heat shows
       ).add_to(m)

# Display the map
m
```

Out[23]:

Shows event locations as clustered markers with event details in popups.

In [ ]:

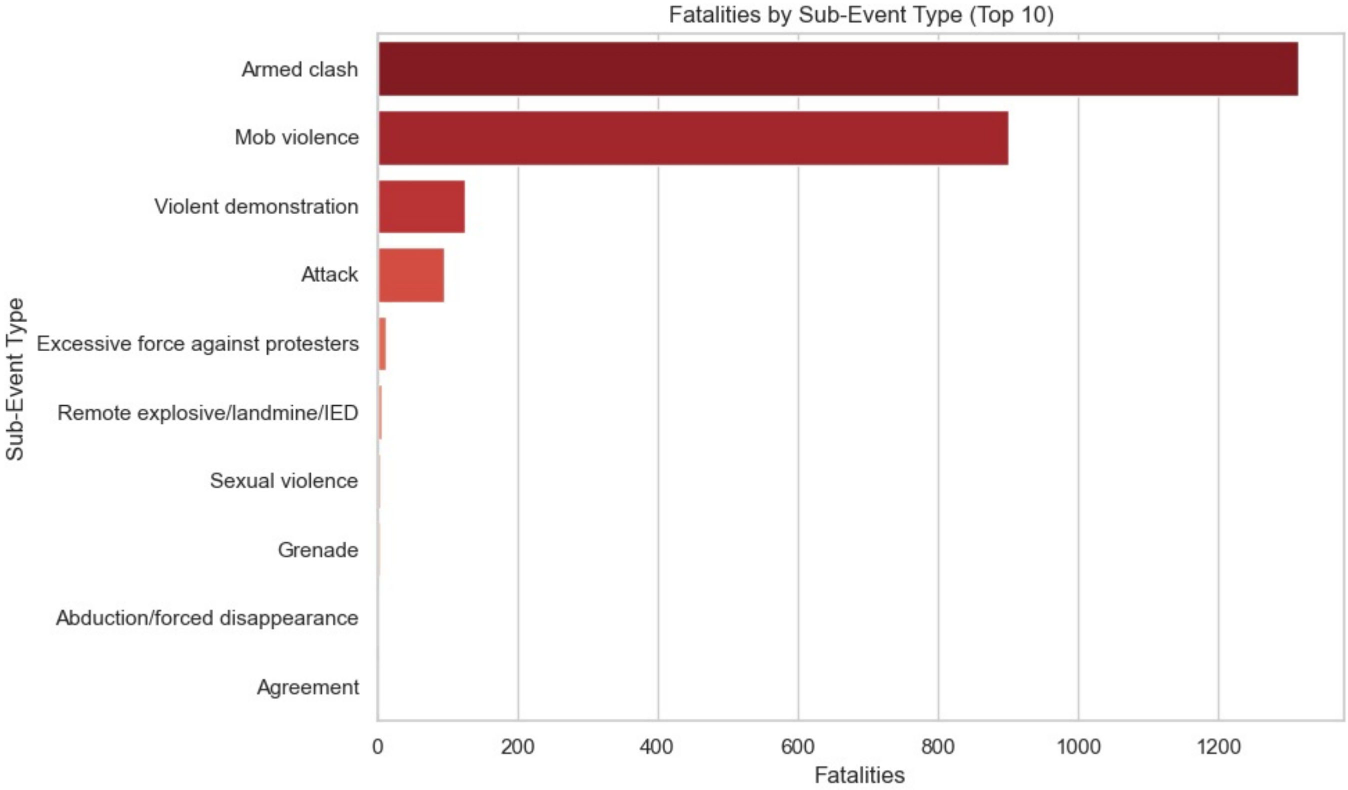
```
d = folium.Map(location=[22.9734, 78.6569], zoom_start=5)
marker_cluster = MarkerCluster().add_to(d)

# Simplify the loop with itertuples
for row in dv.itertuples():
    folium.Marker(
        location=[row.latitude, row.longitude],
        popup=f"{row.event_type}<br>{row.location}"
    ).add_to(marker_cluster)

d
```

![Screenshot 2025-04-13 131614.png](<attachment:Screenshot 2025-04-13 131614.png>)

Visualizes the sub-event types with highest fatality counts.

In [25]:

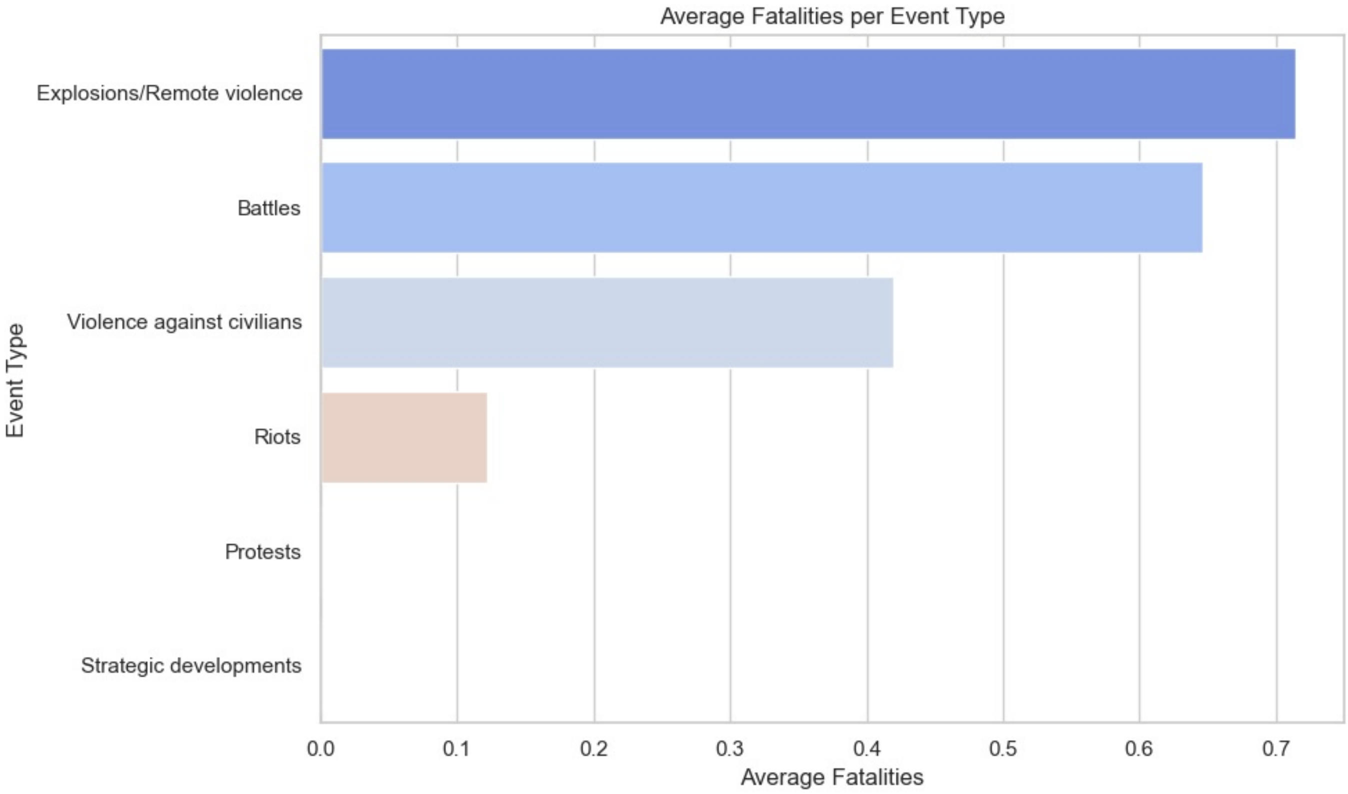
```
fatal_by_sub_event = dv.groupby('sub_event_type')['fatalities'].sum().sort_values(ascending=False)

plt.figure(figsize=(10, 6))
sns.barplot(x=fatal_by_sub_event.values[:10], y=fatal_by_sub_event.index[:10], palette='Reds_r')
plt.title('Fatalities by Sub-Event Type (Top 10)')
plt.xlabel('Fatalities')
plt.ylabel('Sub-Event Type')
plt.tight_layout()
plt.show()
```



Shows the average number of fatalities per event type, sorted from highest to lowest.

In [26]:

```python
avg_fatal_by_type = dv.groupby('event_type')['fatalities'].mean().sort_values(ascending=False)

plt.figure(figsize=(10, 6))
sns.barplot(x=avg_fatal_by_type.values, y=avg_fatal_by_type.index, palette="coolwarm")
plt.title("Average Fatalities per Event Type")
plt.xlabel("Average Fatalities")
plt.ylabel("Event Type")
plt.tight_layout()
plt.show()
```



A map with dots (scatter points), where each dot represents an event from the dv DataFrame.Different colors show different event_types (e.g., protests, battles, etc.).

In [27]:

```python
import plotly.express as px
fig = px.scatter_mapbox(dv, lat="latitude", lon="longitude",
                        color="event_type", zoom=5,
                        mapbox_style="carto-positron", height=500)
```

```
fig.show()
```

Donut chart showing event distribution across top 10 states with percentage breakdown.

In [28]:

```
State_counts = dv['State'].value_counts().nlargest(10)
labels = State_counts.index
sizes = State_counts.values

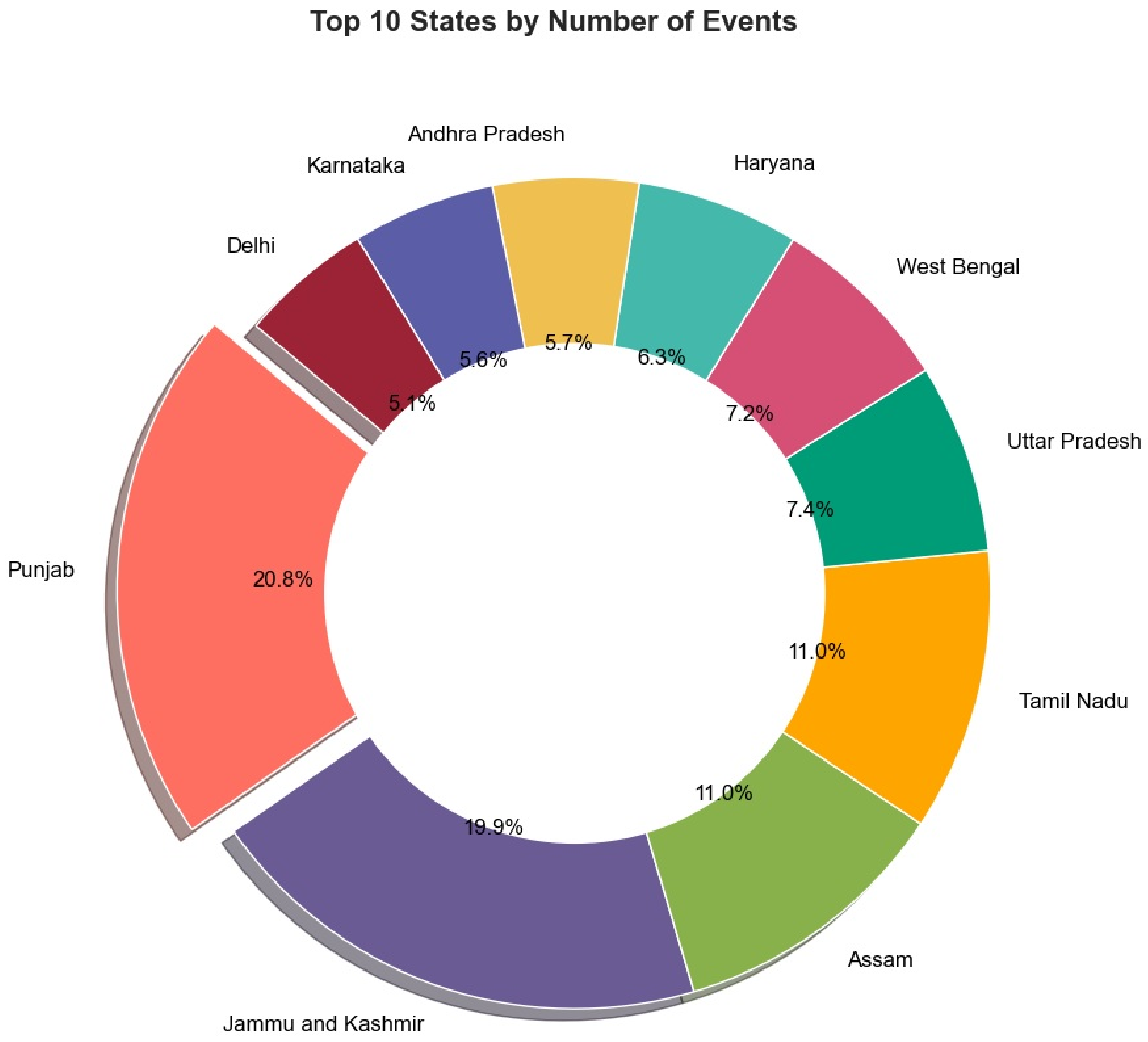
# Custom vibrant color palette
bright_colors = [
    "#FF6F61", "#6B5B95", "#88B04B", "#FFA500", "#009B77",
    "#D65076", "#45B8AC", "#EFC050", "#5B5EA6", "#9B2335"
]

# Explode the largest slice
explode = [0.1 if i == 0 else 0 for i in range(len(sizes))]

# Plot
plt.figure(figsize=(9, 9))
wedges, texts, autotexts = plt.pie(
    sizes,
    labels=labels,
    autopct='%1.1f%%',
    startangle=140,
    colors=bright_colors,
    explode=explode,
    shadow=True,
    textprops={'fontsize': 12, 'color': 'black'}
)

# Donut-style center circle
centre_circle = plt.Circle((0, 0), 0.60, fc='white')
plt.gca().add_artist(centre_circle)

# Title & layout
plt.title("Top 10 States by Number of Events", fontsize=16, fontweight='bold')
plt.axis('equal')
plt.tight_layout()
plt.show()
```



```
In [ ]:
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