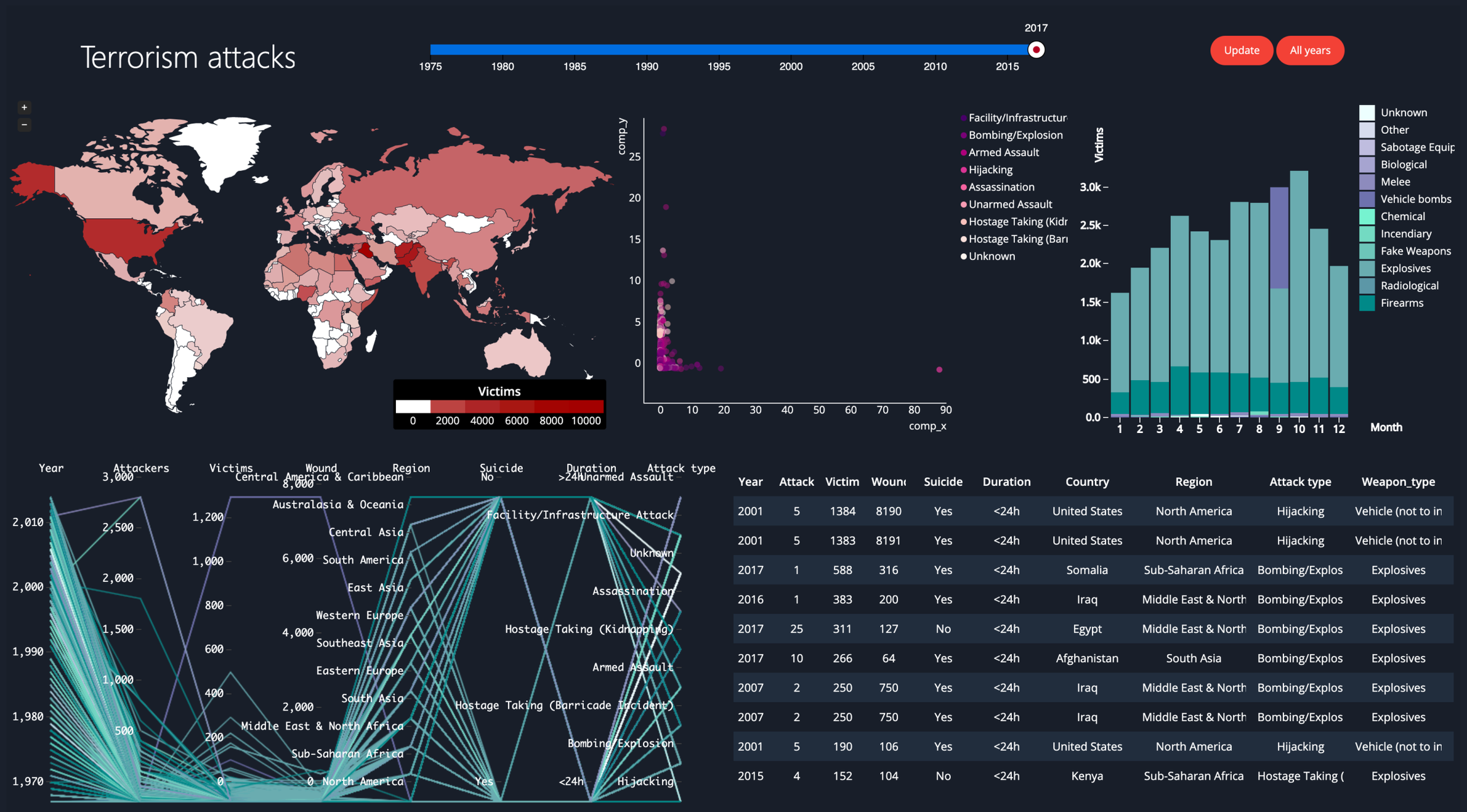
Visual Analytics on Terrorism Attacks

Marco Lupia
Francesca Fraioli

Introduction

- Acts of terrorism across the globe to further a political cause have increased noticeably in recent decades
- Increasing terrorism attacks → increasing attention among population
- Bring awareness to people
- Easy tools to visualise data

Introduction



Year	Attack	Victim	Wound	Suicide	Duration	Country	Region	Attack type	Weapon_type
2001	5	1384	8190	Yes	<24h	United States	North America	Hijacking	Vehicle (not to in
2001	5	1383	8191	Yes	<24h	United States	North America	Hijacking	Vehicle (not to in
2017	1	588	316	Yes	<24h	Somalia	Sub-Saharan Africa	Bombing/Explos	Explosives
2016	1	383	200	Yes	<24h	Iraq	Middle East & North	Bombing/Explos	Explosives
2017	25	311	127	No	<24h	Egypt	Middle East & North	Bombing/Explos	Explosives
2017	10	266	64	Yes	<24h	Afghanistan	South Asia	Bombing/Explos	Explosives
2007	2	250	750	Yes	<24h	Iraq	Middle East & North	Bombing/Explos	Explosives
2007	2	250	750	Yes	<24h	Iraq	Middle East & North	Bombing/Explos	Explosives
2001	5	190	106	Yes	<24h	United States	North America	Hijacking	Vehicle (not to in
2015	4	152	104	No	<24h	Kenya	Sub-Saharan Africa	Hostage Taking (	Explosives

Dataset

- Global Terrorism Database, from 1975 to 2017
- 10.000 tuples
- 20 attributes (both categorial and numerical)
- AS index: **200.000**

Source: https://www.kaggle.com/START-UMD/gtd

Interface

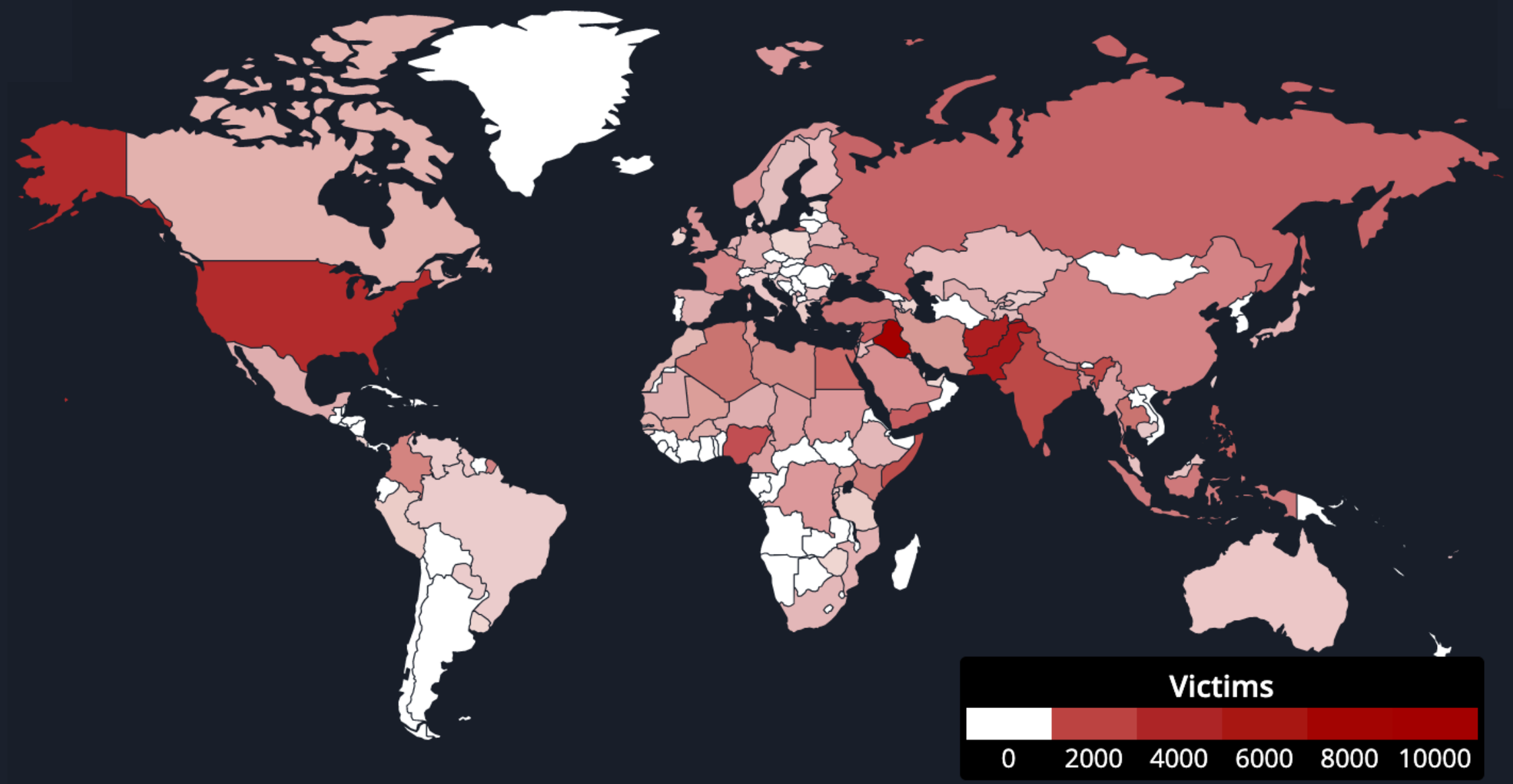
- 5 coordinated views: map, scatterplot, stacked barchart, parallel coordinates
- Year slider to select specific year
- *Update* bottom and *All years* bottom
- Events fired from user interaction update every view

Map

- Countries on the map are colored based on number of victims
- This value is represent by a color blind safe red scale, where darker red means more victims
- The user can zoom on specific countries
- Hovering on a country will show a tip with the number of victims
- Clicking on one or more countries will update all the other graphs

Source: http://colorbrewer2.org

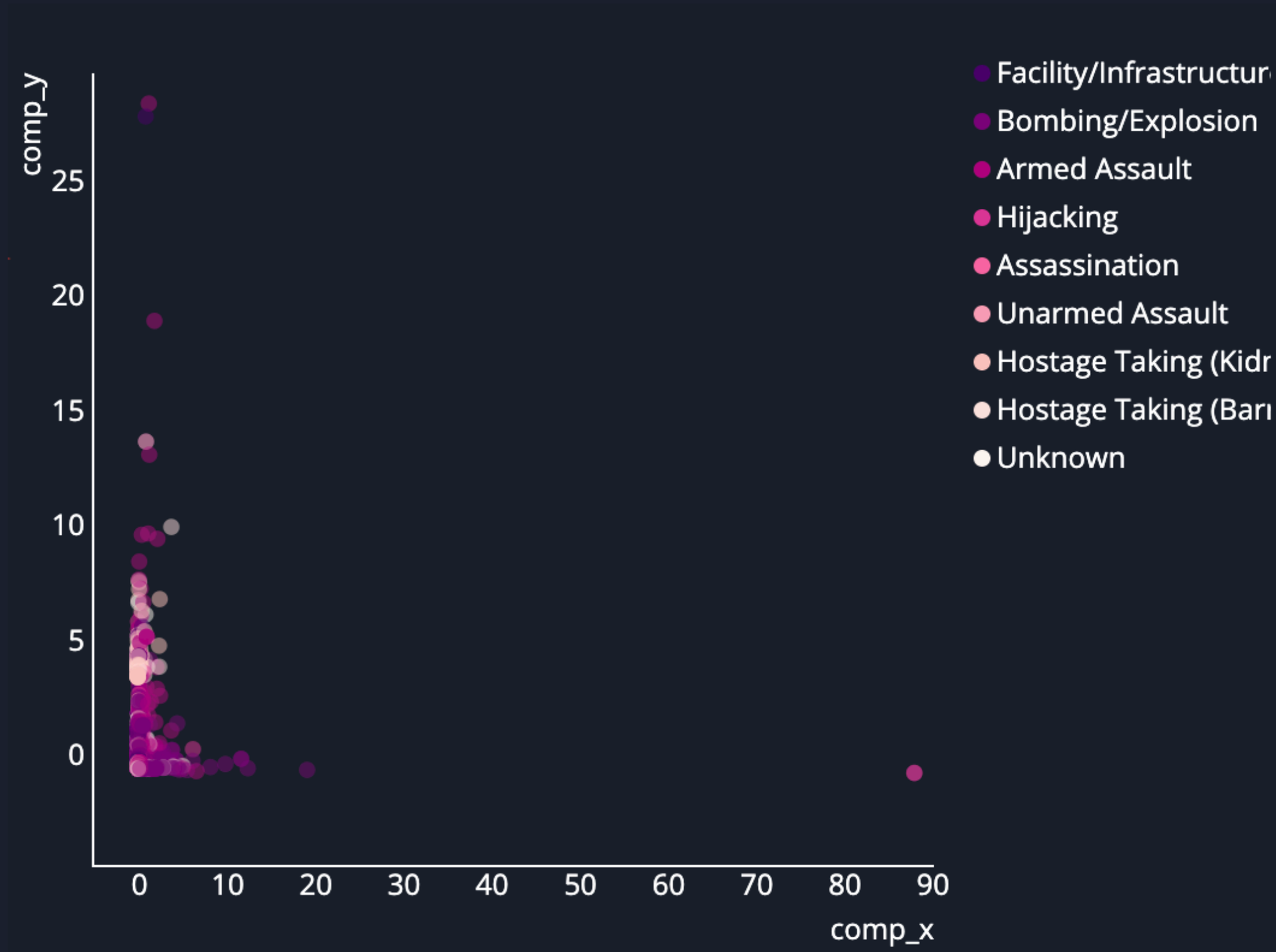
Map



Scatterplot

- Represents the first two components computed by PCA, in order to compute a dimensional reduction of the database
- The color encodes the classification of each of the 9 attacks type
- Allows the user to identify clusters in different selected countries or/and years
- The user can zoom on a specific point
- Clicking a point will be shown a popup with the description of the relative attack

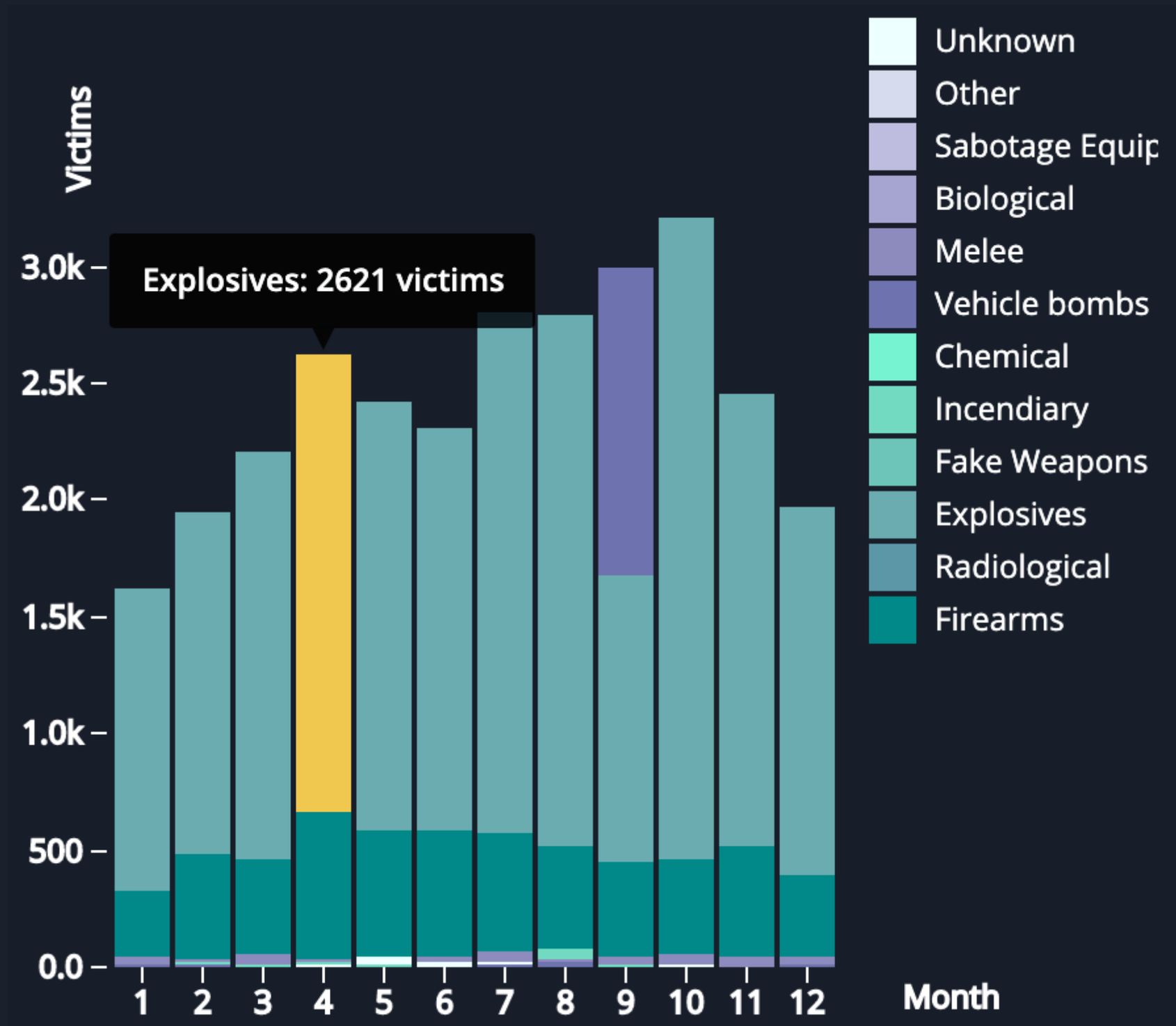
Scatterplot



Stacked Barchart

- X-axis reports the number of victims, Y-axis reports months
- 10 possible colored sub-columns for each column, based on the used weapon type and sorted by the number of victims.
- Hovering a sub-column it is highlighted and a tip shows up
- Interaction with the legend
- Clicking a sub-column will update all the other graphs

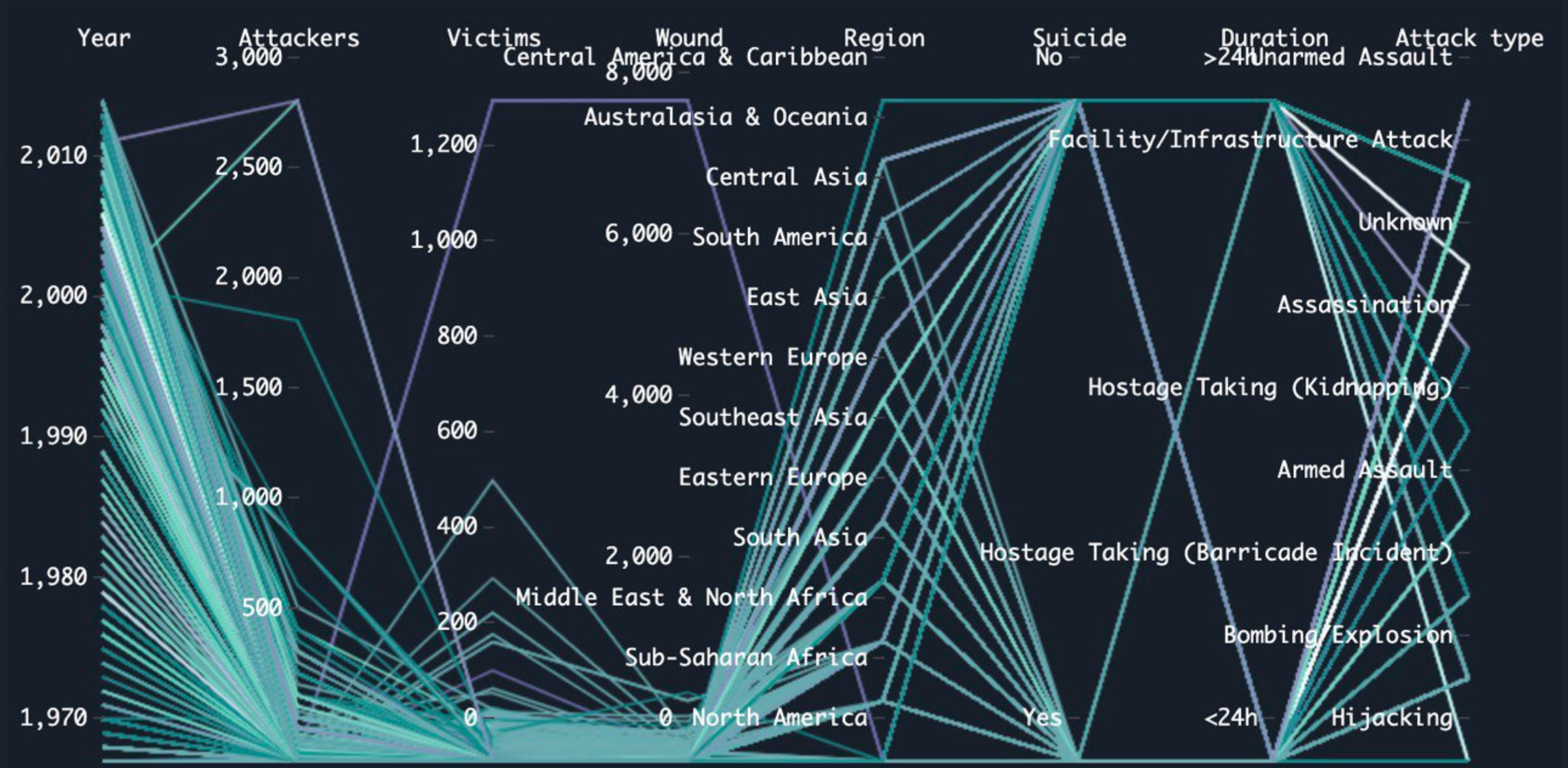
Stacked Barchart



Parallel Coordinates

- 8 axis to represent the most interesting database attributes
- Each line represents an attack
- Same color encoding used in the stacked barchart, based on weapon type
- Axis can be moved to exchange the order
- Axis can be brushed to apply filters

Parallel Coordinates



Table

- Shows 10 most deadliest attacks based on number of victims
- On *mouseover*, row is highlighted together with the corresponding line in parallel
- On *click*, it will show the 5 most similar attacks, of the same type, using cosine similarity.

Table

Year	Attack	Victim	Wound	Suicide	Duration	Country	Region	Attack type	Weapon_type
2001	5	1384	8190	Yes	<24h	United States	North America	Hijacking	Vehicle (not to in
2001	5	1383	8191	Yes	<24h	United States	North America	Hijacking	Vehicle (not to in
2017	1	588	316	Yes	<24h	Somalia	Sub-Saharan Africa	Bombing/Explos	Explosives
2016	1	383	200	Yes	<24h	Iraq	Middle East & North	Bombing/Explos	Explosives
2017	25	311	127	No	<24h	Egypt	Middle East & North	Bombing/Explos	Explosives
2017	10	266	64	Yes	<24h	Afghanistan	South Asia	Bombing/Explos	Explosives
2007	2	250	750	Yes	<24h	Iraq	Middle East & North	Bombing/Explos	Explosives
2007	2	250	750	Yes	<24h	Iraq	Middle East & North	Bombing/Explos	Explosives
2001	5	190	106	Yes	<24h	United States	North America	Hijacking	Vehicle (not to in
2015	4	152	104	No	<24h	Kenya	Sub-Saharan Africa	Hostage Taking (	Explosives

Cosine similarity

- Measure of similarity between vectors based on the angle:

  smaller the angle, higher the similarity

- Calculated using *Scipy* python library

- 5 attacks most similar to the chosen one are displayed in table

Cosine similarity

Attack	Victim:	Wound	Suicide	Country	Attack typ	spacial_distance
2	105	245	Yes	Turkey	Bombing/	0.999928
1	37	85	Yes	Iraq	Bombing/	0.999883
1	56	134	Yes	Afghanista	Bombing/	0.999823
1	42	100	Yes	Pakistan	Bombing/	0.999809
1	57	123	Yes	Pakistan	Bombing/	0.999803

Analytics

- Set up a Python web server *Flask* running locally
- Use *Pandas* Library for calculations, data filtering and data for map and other graphs
- All the choice the user makes activate the server with a *getJson()* request
- This options are passed as parameters to python program, the results is written on csv files
- The response is sent to the views and all are updated

Conclusion

- This tool can be useful to everybody as an informative system
- Easy to understand and pleasant to see
- Easily visualise how the type of weapons, the number of attacks and victims are changed during the years