



# MONASH University



FIT5147: Data Visualization

Tutor: Vahan Yoghourdjian

Name: Aayush Kapoor

ID: 28980875

## Introduction

Global Terrorism Dashboard provides a comprehensive summary of the key global trends and patterns in terrorism from 1970 to 2016. The research presented in this report highlights a complex and rapidly changing set of dynamics in global terrorism. While on the one hand the top-line statistics highlight an improvement in the levels of global terrorism, the continued intensification of terrorism in some countries is a cause for serious concern and highlights the fluid nature of modern terrorist activity.

### Audience

Using this dashboard enforcement agencies, researchers and students studying journalism can gain insight on terrorism by country and region perspective.

### Intended Message

The main positive finding shows a global decline in the number of fatalities from terrorist attacks to 25,673 people, which is a 22 per cent improvement from the peak in 2014. Terrorism has fallen significantly in the epicenters of Syria, Pakistan, Afghanistan and Nigeria, which are four of the five countries most affected by terrorism.

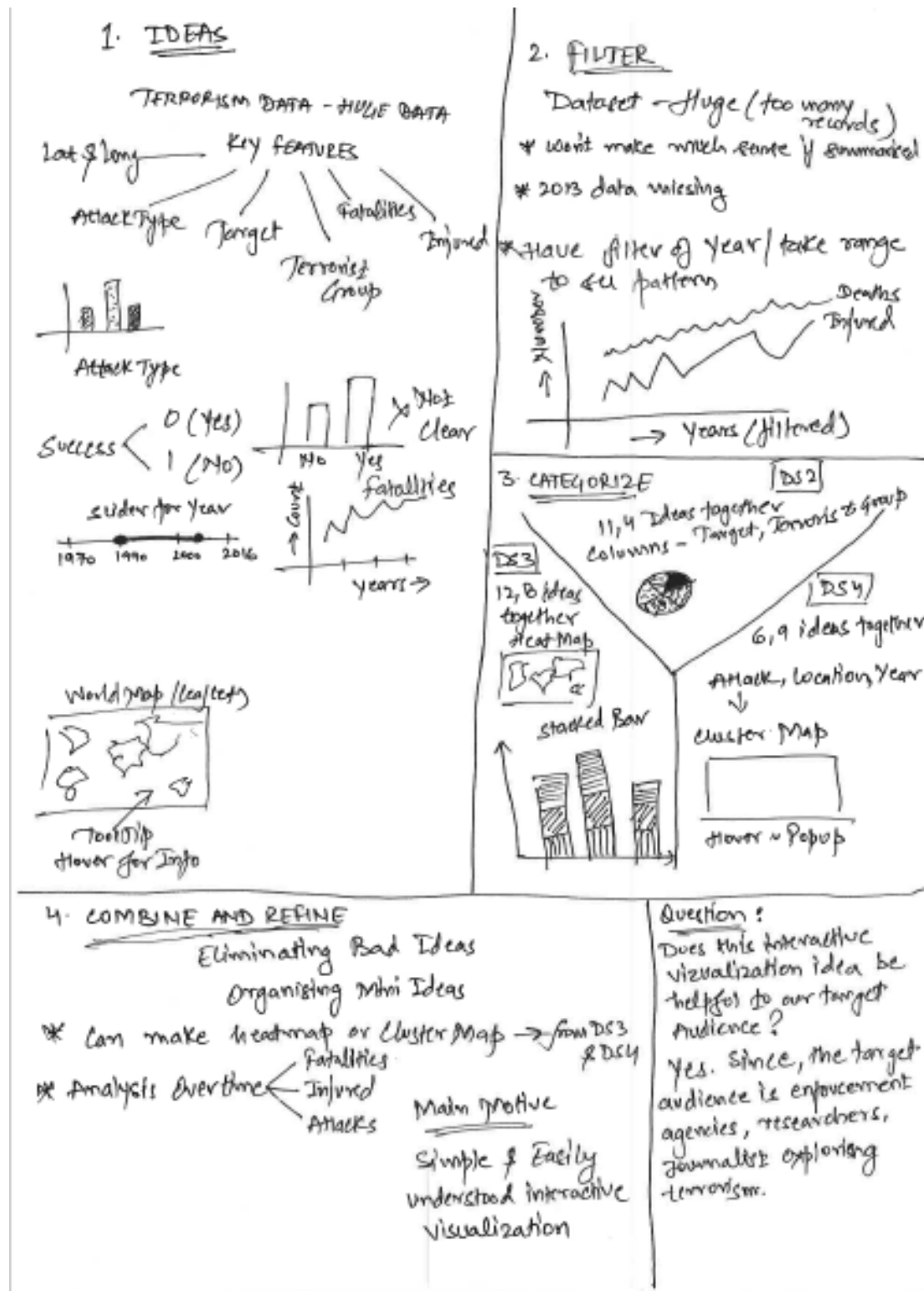
The narrative visualization gives general introduction on how terrorism is rooted at country level further giving information on number of fatalities, number of incidents and number of injured in selected timeline. The leaflet provides overlay information and cluster the area's most predominant of terrorist attacks.

The visualization further explores terrorism from regional point of view citing information related to Targets, Attack Type and Fatalities.

## Design

The five sheet design methodology is given below in snapshots.

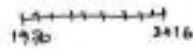
(SHEET 1)



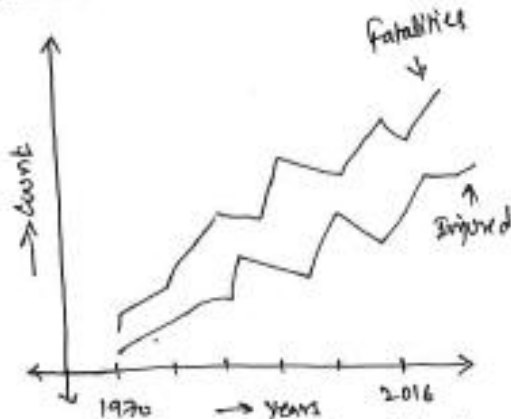
(SHEET 2)

Layout:

Timeline:



Country:



\* Data Filtered based on selected timeline & country

Focus: will produce

Information Related to that particular year (all-attacks)

# No. of Incidents: 1234

# No. of Fatalities: 1234

# No. of Deaths: 1234

# Worst Attack of Year

↳ Further Information

→ like Terrorist Group

→ Location

→ Summary

→ Catastrophy

Title → Five sheet Design

Author → AAYUSH KAPOOR

Date → 30-05-2018

Sheet → 02

Task → Terrorism Global Database

Operations

- \* User has to select country from dropdown.
- \* User also needs to select timeline both lower & upper limit.
- \* Line charts gets generated for selected country & selected timeline.
- \* Hovering on line chart brings up a tooltip with count & year information

Discussion:

Positives

- \* Very simple to understand.
- \* Gives an overview of pattern for a country in given timeline.
- \* Further clicking on tooltips gives info. of all attack that happened in particular year.

Negatives

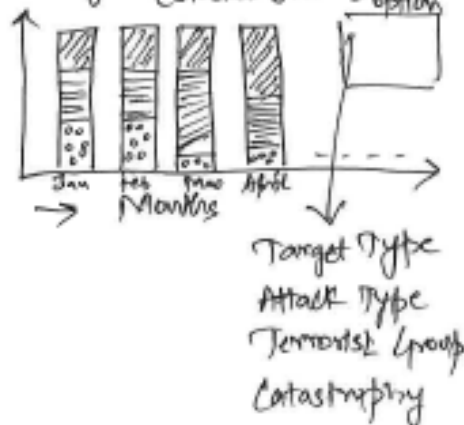
- \* The visualization doesn't reveal underlying patterns & relationship.

### LAYOUT:

CHOROPLETH  
WORLD MAP (HEAT MAP)



Dropdown  
Clicking on Country will give  
(stacked Bar) option



Focus: Will further zoom  
into country, markers  
placed for attacks



1) hovering will give info.

2) A layer to differentiate  
or color of marker to differentiate  
different terrorist group.

TITLE: FDS

Author: AAYUSH KAPOOR

Date: 30/05/2018

Sheet: 03

Task: Terrorism Global Database

### Operations:

- \* User have option to select Year
- \* After selecting a year, they can click on any country, a ~~table~~ choropleth map is already created
- \* When the country is clicked a stacked bar pops out with option to select different available variables like Target Type, Attack Type, Terrorist Group, Catastrophing by month further justifying data.
- \* If the popup is closed, country map will have all markers differing wished based on Terrorist Group
- \* Option to select Gang Name/Terrorist Group which will show only attacks by that terrorist group.

### Discussion

#### +ve

- \* Too much information in one visualization
- \* Adding filter of Terrorist group on map will show the areas where group are active.
- \* The stacked bar chart provides drill down analysis going by month.

#### -ve

- \* Lots of graph on one page
- \* User might find it difficult

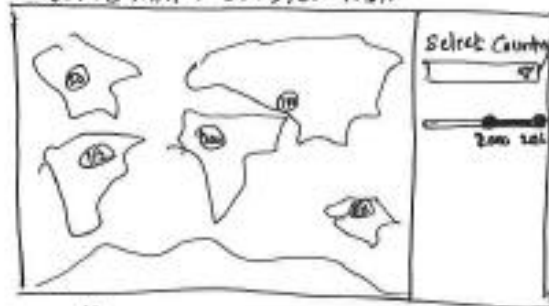
### LAYOUT:

Terrorism Analysis | HEAT MAP | CLUSTER MAP

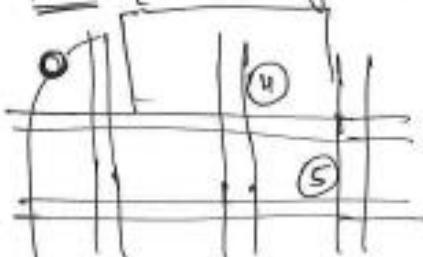
WORLD MAP: HEAT MAP



WORLD MAP: CLUSTER MAP



Focus (on zooming Cluster Map)



Tool Tip  
Single Incident (Not clustered)

Date: 20/08/1998  
Terrorist Group: ISIL  
Fatal/Injured: 0/4  
Summary: Group of  
volunteers attacked

Title: FDS

Author: AAYUSH KAPOOR

Date: 29-05-2018

Sheet: 04

Task: Global Terrorism Database

### Operations

- \* We have two tabs one with heat map & another cluster Map
- \* The user has option to select country & year range and map changes accordingly.

- \* Similarly cluster map gives the count of incidents in each region.

- \* The user has option to magnify the map to get info of terrorist attack at that particular location & other useful information related to that attack.

### Discussion

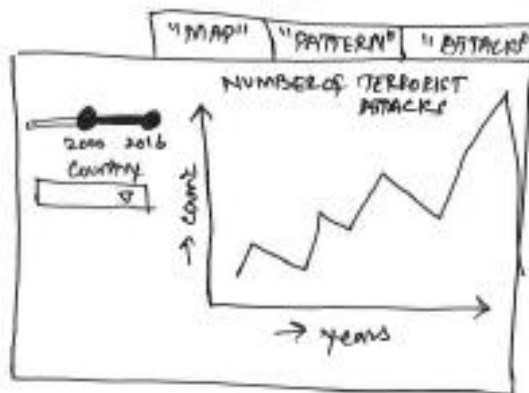
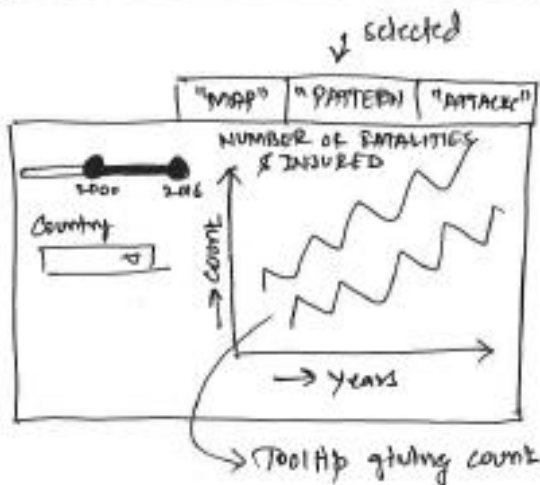
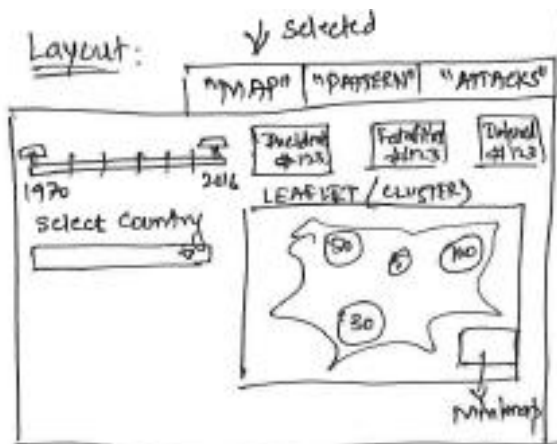
#### Pro

- \* Shows area with extensive options on map
- \* Clearly shows count of terrorist attack at each location.
- \* High Interactive visualization.

#### Con

- \* Complex & hard to implement
- \* Does not provide detailed statistics of each type of terrorist attack.

Layout:



Title : Five sheet Design

Author : AYUSH KAPOOR

Date : 30-05-2018

Sheet : 05

Task : Global Terrorism Data

Operations

- \* The layout will have 3 tabbed panels. Users once select a year range & country.
- \* The all 3 tabbed panels gets updated based on selection & input.
- \* The cluster leaflet can be further explored for terrorist attacks.
- \* Markers have popup that display useful information.

DETAILS

Time to Build

\* 1 - 1.5 Week

DATASET

Global Terrorism Database

→ Maintained by University of Maryland

TOOLS

R shiny

## Implementation

For designing Global terrorism dashboard Shiny R is used which helps in creating web based applications. The libraries used for completion of task are below:

1. shiny – To create web-based application.
2. shinythemes – To add themes to the application (I choose cosmo).
3. ggplot2 – Library to create visualization by adding layers of information as needed (bar, line, point).
4. plotly – Library that gives option of Modern Visualization in R. giving features like – hovering, tooltip, zoom filter, plot save etc.
5. plyr – Library used for data manipulations. I have used this library for group\_by and summaries function.
6. DT - To add table data in application.
7. Leaflet - The leading open-source JavaScript library for mobile-friendly interactive maps.
8. Reshape – Library used for manipulating and melting data frames
9. Shinydashboard – I have only used this library to create value box at the top of leaflet.

The initial plan was to create a choropleth map of world with play button showing how the countries got consumed in terrorism, the change would mean something happened and left un-noticed. The reason Iraq faced/faces more terrorist attacks in last 13 years is because of invasion of USA.

The implementation of web application started with leaflet, the global terrorism data is spatial and temporal now utilizing the fact that I have two options to work on. Firstly, use temporal information and secondly portray this information in such a way that if someone need to have overview of what happened in previous years or in any year the information can be easily transited through visualization.

Circle markers are added on leaflet representing terrorist attack which gives useful information like Date, Attack Type, Dead/Injured Count, Group involved (terrorist group) and summary. The provider tile chosen for leaflet is very informative as we can utilize the option of zoom and have an overview of area where the attack happened.

**Note:** Not all attacks have summary information available.

The value box created on top are very informative as they give overview of countries condition in terms of number of attacks, fatalities and injured.

The second tab panel in main navigation bar of Country gives trend of Number of fatalities and number of injured for the country in selected time. For someone who wants to have an overview of performance of terrorism in country this graph will be self-explanatory and realizing the trend over the period.

The third tab panel in main navigation bar of Country gives information on number of terrorist attacks, the second panel shows intensity of attacks, while the third shows continuous presence/absence of terrorism. The absence is probably caused as the terrorists are not home grown while the in previous case they are.



The second tab-panel in navigation bar gives information by region. The first tab-panel inside it gives information on percentage of attacks by target type. Now, this information is very useful as gives idea about how the targets are chosen in different continents and how the pattern changed over the years. MENA and sub-Saharan Africa civilian attacks accounted for 60 and 56 per cent of attacks respectively in 2016, this information can be easily analyzed using the given visualization. Percentage is taken on scale as number won't be able to provide overview and instant analysis, different topography and demography of region attribute to different characteristics of target.

The second tab-panel in region gives information about attack type as in the methodology of spreading terrorism, i.e., Armed Assault, Bombing and Explosion, Facility/Infrastructure Attack, Hostage taking/assassination, Other. Globally, bombings and explosions accounted for 54 per cent of attacks in 2016. Armed assaults were the next most common form of attack in accounting for 18 per cent followed by hostage takings and assassinations at 17 per cent each. The graph created in previous tab-panel, this graph is very intuitive and gives instant analysis of situation. The default chosen year is 2016 and when you open the tab-set you will see (MENA – Middle East and North Africa) region have most terrorist attack in which terrorist uses Bombing/Explosion large scale destruction of property and life. The terrorist group of these regions are more trained in combat skills and military warfare.

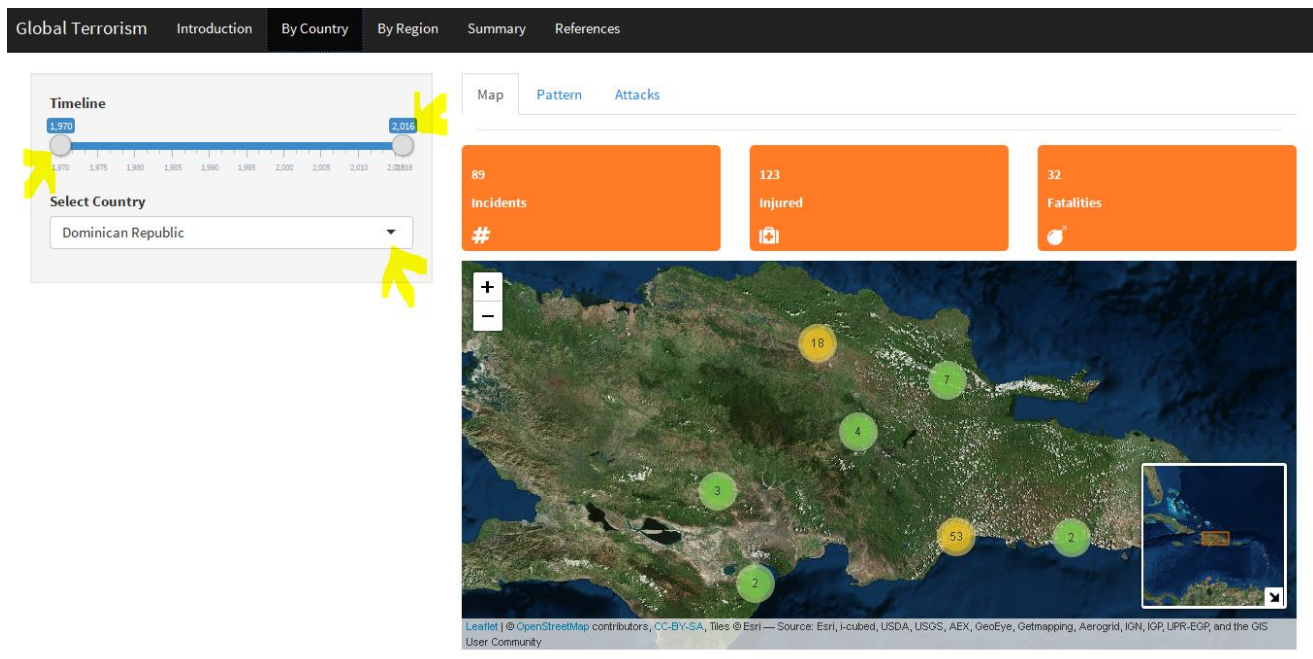
The third tab-set panel gives count of fatalities vs number of attacks in region. The MENA region witnessed the largest number of both attacks and fatalities. However, sub-Saharan Africa has been the deadliest region in terms of fatalities per attack with an average of 4.8 deaths per attack in 2016. The graph gives overview of number of fatalities vs number of attacks for a region.

## User Guide

The application can be opened in browser of your choice after clicking the button Run application and then clicking open in browser. The first page of visualization is static and provides overview of upcoming information in navigation panel.

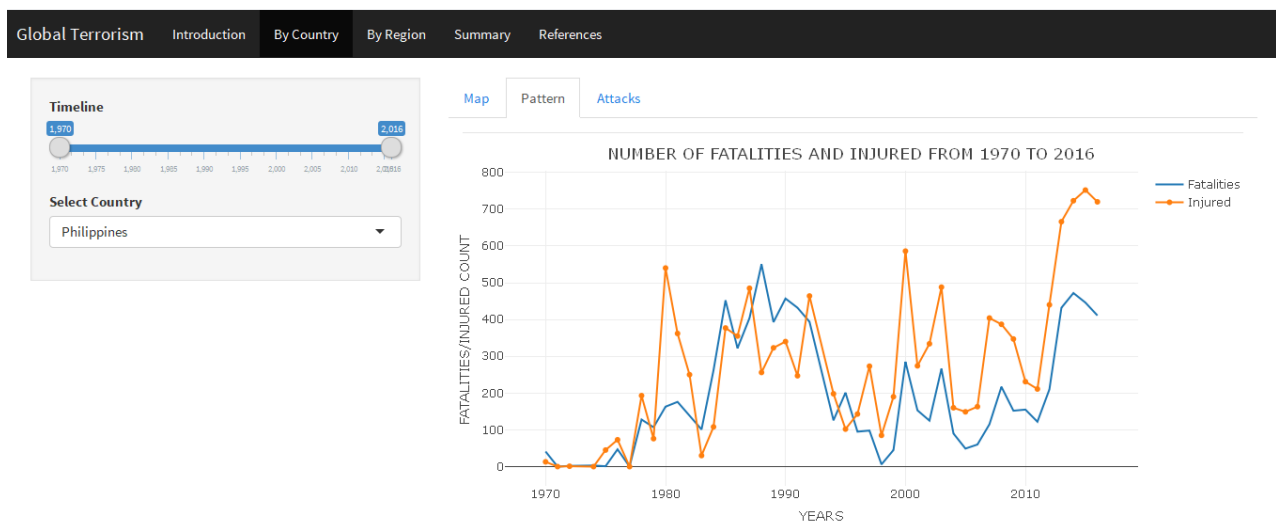
### **1. Introduction**





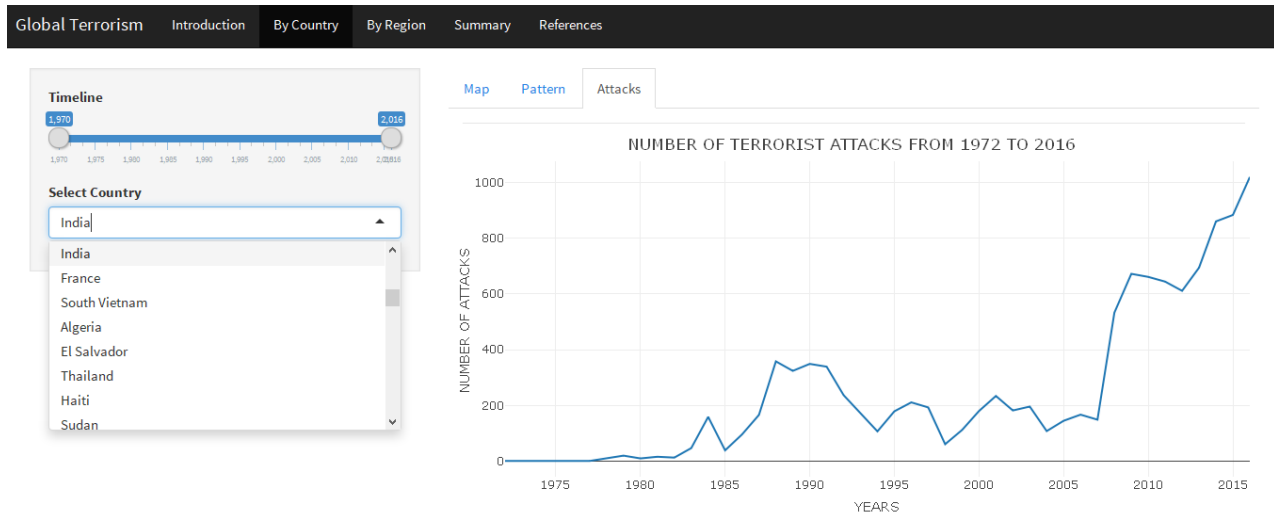
(Image 2)

- **Pattern** – The tab-set panel in country gives number in fatalities vs injured in given selected period, the option of tooltip gives exact count of fatalities and injured for a specific year.



(Image 3)

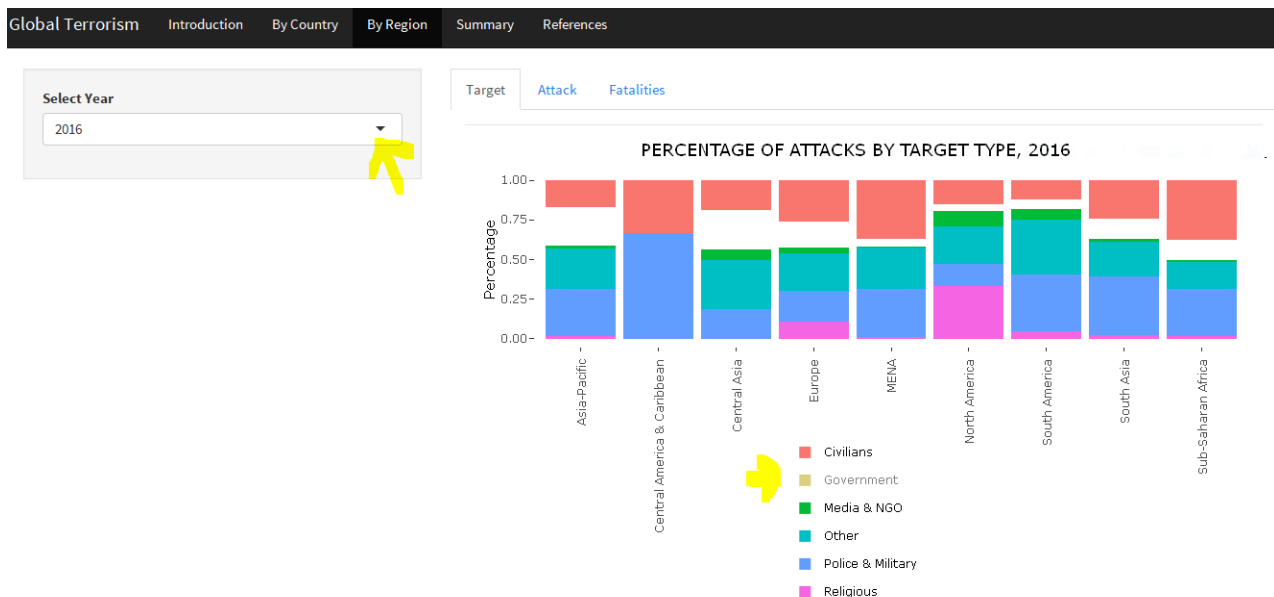
- **Attacks** – The third tab-set panel in country gives line chart of number of attacks for a country in selected year range. The tooltip features give the exact count for the year which works as an added advantage.



(Image 4)

### 3. By Region

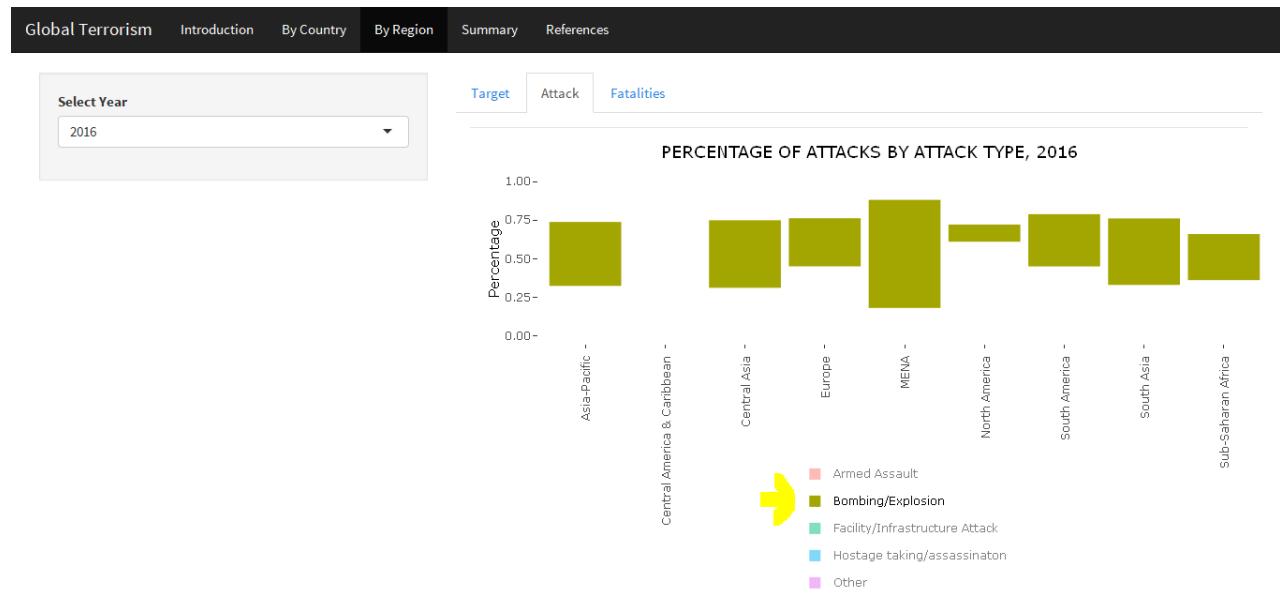
- Target** - The third navigation panel gives information by region. The first tab-set panel is about Target types, the common targets that terrorist ply. It's fascinating to see that pattern is different for every region based on demography. The user will have option to select a year and after selecting a year the proportional map will be updated. Default year taken in consideration is 2016.



(Image 5)

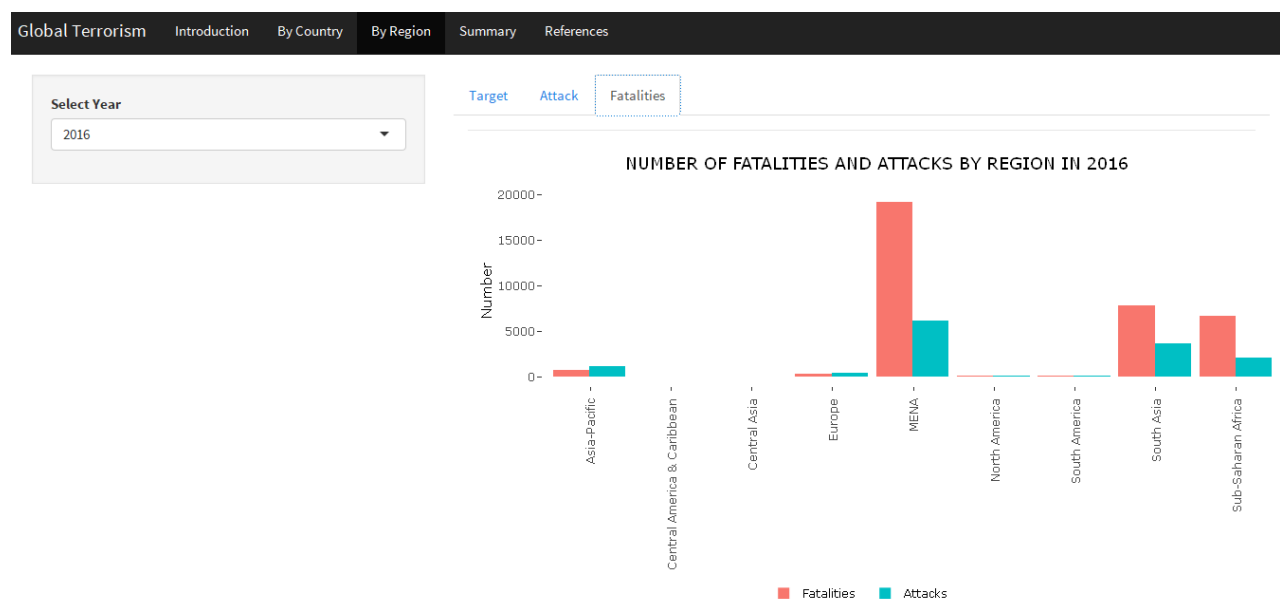
User have option of hovering over the stacked bar chart to get the percentage values. Also, they have option to de-select the unwanted legend and only review that seems fit for analysis, as done in Image 5.

- **Attack** – The tab-set panel gives information about type of attack used by terrorist group in given region, a pattern can be seen by changing years. The graph provides us with feature of filtering as done in Image 6 to compare different regions and their attack type.



(Image 6)

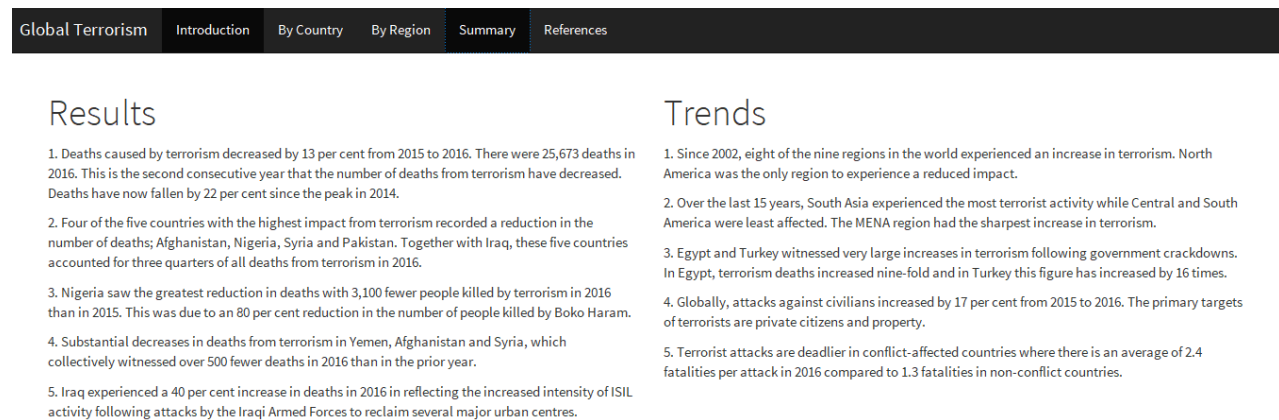
- **Fatalities** – The tab-set panel gives information about number of fatalities vs number of attacks in region for the selected year. Users have option to hover over bar chart and they will see a tooltip with information related to that bar. Filter can be applied on this graph to view only required information. Like, only Fatalities or Attacks count.



(Image 7)

#### 4. Summary

The fourth Navigation panel is static one only gives information like trends and results that could be concluded from report.



(Image 8)

## Conclusion

After working on the data visualization project, I realized that R shiny is very powerful tool for creating amazing dashboard and representing your data in modern way. If you can imagine something it could probably be done or has been done by someone around the globe. The dashboard created using Shiny Ui and server is very intuitive and simple in terms of visualization per say but it will make more sense for someone who is looking to explore terrorism trend around the world. It's interactive and simple to use.

## Reflection

Working on R visualization project was great experience with huge scope to learn new things, it opened many closed doors I faced while writing codes, luckily internet came to help multiple times. I learnt various aspects of Shiny R and interactive visualization that could be applied on varieties of charts and graphs.

Extensive hands on leaflet specially adding clusters and popup. The dataset was huge with 170350 rows at hand, small subsets were created and then passed on R to create visualization.

### Challenges

1. Creating animated choropleth world map to show the change in terrorism over various years.
2. Not everything is available on internet, I spent a lot more time just so that I could make my axis bold in ggplotly function, but all those efforts failed miserably.
3. I tried finding shiny code to create such visualization but failed terribly as there are no proper tutorial guiding you through the process.

### Things could have done differently

1. D3 could have given better results but time was limited D3 requires much more practice to be implemented.
2. Usage of plotly, html and CSS to make visualizations more appealing.

## References

1. <https://rstudio.github.io/leaflet/shiny.html>
2. <https://plot.ly/r/>
3. <https://shiny.rstudio.com/gallery/>
4. <https://rstudio.github.io/leaflet/basemaps.html>
5. <http://economicsandpeace.org/wp-content/uploads/2016/11/Global-Terrorism-Index-2016.2.pdf>