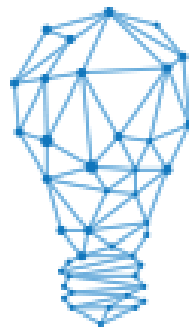White Paper in Support of Visual Dashboard for

Exploratory Analysis of Historical Data on Armed Conflicts

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Summary

Armed conflict has been occurring throughout the Middle East for generations. Armed conflicts within the states are generally political conflicts involving citizens fighting for internal change. It involves a group of people who are armed and ready to fight for the goal of seizing governmental powers. This group may include militias and armed civilians along with the regular armies. These conflicts result in the collapse of state institutions mainly the police and judiciary. The fighting in conflicts are usually intermittent and generally does not occur on well-defined battlefields. The twentieth century saw an upward trend in the fatalities due to armed conflicts.

Our analysis focuses on the effect of fatalities caused by armed conflict in middle eastern countries namely Afghanistan, Iraq, Syria, and Yemen. The basis for visualizations are the violent events recorded in a particular year resulting in the deaths and its effect on the GDP, Mortality, Fertility, Revenue from Natural Resources and other factors. Additionally, we have included additional attributes to provide a framework for subsequent users.

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1. Background

What are Armed Conflicts?

Armed conflicts are defined as political conflicts where the use of armed force by two parties of which at least one is the Government of State results in at least 25 battle-related deaths. A 'major armed conflict' is a war between states and a current political conflict within a State in which armed fighting or clashes between Government forces and its opponents result in at least 1,000 deaths during the conflict. Most of the conflicts happened in the Middle East during the recent years; therefore, we chose the four most affected countries, which includes Afghanistan, Iraq, Syria, and Yemen.

2. Conflict Overview

- Afghanistan was majorly affected by the Taliban Rule and host of Bin Laden in the recent history. Starting from 1979 to 2014, over 1.28 million civilians died through different armed conflicts (Fatalities in Afghanistan conflicts, 2018).

- Iraq had been going through the violent conflicts from 2014 till present, and 67376 civilians had died during the conflict for the past four years, and 1263 civilians had died in 2018 (Civil Death in Iraq war 2013-2018, 2018).

- Syria had mainly ruined by the anti-government force starting from 2011, which now more than 0.35 million had been killed till last year, while the death total is still rising (Syria war has killed more than 350,000 in 7 years, 2018).

- In Yemen, violent conflict started in 2015, and it is still lasting at present. Based on the report by United Nation, exceeds 5000 people dead in the past two and half year (Deutsche

Welle, 2017). Even though Yemen was the least death for all four countries, it is the least time suffering from the war compared with three others

3. Data Sources

Violence Data: [Website details](#).

Violence dataset has been primarily used to indicate the number of fatalities recorded and the other features associated with the same. As the armed conflict results in fatalities, we have indicated the intensity of the incident with the number of people killed. Following are the variables used in the violence dataset:

1. Data Id: Unique id is given to every data row

2. Country Id: Unique given to each country

    - 1 Afghanistan

    - 2 Iraq

    - 3 Syria

    - 4 Yemen

3. Country Code: Short name given to each country

    - AFG Afghanistan

    - IRQ Iraq

    - SYR Syria

    - YEM Yemen

4. Event Date: Date when the incident occurred

5. Year: Year in which the incident occurred

6. Event Type: This field captures the general method of attack and often reflects the broad class of tactics used.

- **Assassination:** An act whose primary objective is to kill one or more specific, prominent individuals. Usually carried out on persons of some note, such as high ranking military officers, government officials, celebrities, etc. Not to include attacks on non-specific members of a targeted group. The killing of a police officer would be an armed assault unless there is a reason to believe the attackers singled out a particularly prominent officer for assassination.

- **Armed Assault:** An attack whose primary objective is to cause physical harm or death directly to human beings by use of a firearm, incendiary, or sharp instrument (knife, etc.). Not to include attacks involving the use of fists, rocks, sticks, or another handheld (less-than-lethal) weapons. Also includes attacks involving certain classes of explosive devices in addition to firearms, incendiaries, or sharp instruments. The explosive device subcategories that are included in this classification are grenades, projectiles, and unknown or other explosive devices that are thrown.

- **Bombing/Explosion:** An attack where the primary effects are caused by an energetically unstable material undergoing rapid decomposition and releasing a pressure wave that causes physical damage to the surrounding environment. Can include either high or low explosives (including a dirty bomb) but does not include a nuclear explosive device that releases energy from fission and/or fusion, or an incendiary device where decomposition takes place at a much slower rate. If an attack involves certain classes of explosive devices along with firearms, incendiaries, or sharp objects, then the attack is coded as an armed assault only. The explosive device subcategories that are included in this

classification are grenades, projectiles, and unknown or other explosive devices that are thrown in which the bombers are also using firearms or incendiary devices.

- **Hijacking:** An act whose primary objective is to take control of a vehicle such as an aircraft, boat, bus, etc. for the purpose of diverting it to an unprogrammed destination, force the release of prisoners, or some other political objective. Obtaining payment of a ransom should not the sole purpose of a Hijacking, but can be one element of the incident so long as additional objectives have also been stated. Hijackings are distinct from Hostage Taking because the target is a vehicle, regardless of whether there are people/passengers in the vehicle.

- **Hostage Taking (Barricade Incident):** An act whose primary objective is to take control of hostages for the purpose of achieving a political objective through concessions or through disruption of normal operations. Such attacks are distinguished from kidnapping since the incident occurs and usually plays out at the target location with little or no intention to hold the hostages for an extended period in a separate clandestine location.

- **Hostage taking (Kidnapping):** An act whose primary objective is to take control of hostages for the purpose of achieving a political objective through concessions or through disruption of normal operations. Kidnappings are distinguished from Barricade Incidents (above) in that they involve moving and holding the hostages in another location.

- **Facility/Infrastructure Attack:** An act, excluding the use of an explosive, whose primary objective is to cause damage to a non-human target, such as a

building, monument, train, pipeline, etc. Such attacks include arson and various forms of sabotage (e.g., sabotaging a train track is a facility/infrastructure attack, even if passengers are killed). Facility/infrastructure attacks can include acts which aim to harm an installation, yet also cause harm to people incidentally (e.g. an arson attack primarily aimed at damaging a building, but causes injuries or fatalities).

- **Unarmed Assault:** An attack whose primary objective is to cause physical harm or death directly to human beings by any means other than explosive, firearm, incendiary, or sharp instrument (knife, etc.). Attacks involving chemical, biological or radiological weapons are considered unarmed assaults.

- **Unknown:** The attack type cannot be determined from the available information

- **Sexual Violence:** An act of sexual assault committed which led to the death

7. **Target**: The target type field captures the general type of target. When a victim is attacked specifically because of his or her relationship to a particular person, such as a prominent figure, the target type reflects that motive. For example, if a family member of a government official is attacked because of his or her relationship to that individual, the type of target is "government."

- **Business**: Businesses are defined as individuals or organizations engaged in commercial or mercantile activity as a means of livelihood. Any attack on a business or private citizen patronizing a business such as a restaurant, gas station, music store, bar, café, etc. This includes attacks carried out against corporate offices or employees of firms like mining companies, or oil

corporations. Furthermore, includes attacks conducted on business people or corporate officers. Included in this value as well are hospitals and chambers of commerce and cooperatives. Does not include attacks carried out in public or quasi-public areas such as "business district or commercial area", or generic business-related individuals such as "businessmen" (these attacks are captured under "Private Citizens and Property", see below.) Also, does not include attacks against generic business-related individuals such as "businessmen." Unless the victims were targeted because of their specific business affiliation, these attacks belong in "Private Citizens and Property."

- **Government (General)**: Any attack on a government building; government member, former members, including members of political parties in official capacities, their convoys, or events sponsored by political parties; political movements; or a government-sponsored institution where the attack is expressly carried out to harm the government. This value includes attacks on judges, public attorneys (e.g., prosecutors), courts and court systems, politicians, royalty, head of state, government employees (unless police or military), election-related attacks, or intelligence agencies and spies. This value does not include attacks on political candidates for office or members of political parties that do not hold an elected office (these attacks are captured in "Private Citizens and Property").

- **Police**: This value includes attacks on members of the police force or police installations; this includes police boxes, patrols headquarters, academies, cars,

checkpoints, etc. Includes attacks against jails or prison facilities, or jail or prison staff or guards.

- **Military**: Includes attacks against military units, patrols, barracks, convoys, jeeps, and aircraft. Also includes attacks on recruiting sites, and soldiers engaged in internal policing functions such as at checkpoints and in anti-narcotics activities. This category also includes peacekeeping units that conduct military operations (e.g., AMISOM). Excludes attacks against non-state militias and guerrillas, these types of attacks are coded as "Terrorist/Non-state Militias" see below.

- **Airports & Aircrafts:** An attack that was carried out either against an aircraft or against an airport. Attacks against airline employees while on board are also included in this value. Includes attacks conducted against airport business offices and executives. Military aircraft are not included.

- **Government (Diplomatic):** Attacks carried out against foreign missions, including embassies, consulates, etc. This value includes cultural centers that have diplomatic functions and attacks against diplomatic staff and their families (when the relationship is relevant to the motive of the attack) and property. The United Nations is a diplomatic target.

- **Educational Institution:** Attacks against schools, teachers, or guards protecting school sites. Includes attacks against university professors, teaching staff and school buses. Moreover, includes attacks against religious schools in this value.

- **Food or Water Supply:** Attacks on food or water supplies or reserves are included in this value. This generally includes attacks aimed at the infrastructure related to food and water for human consumption.

- **Journalists and Media:** Includes, attacks on reporters, news assistants, photographers, publishers, as well as attacks on media headquarters and offices.

- **Maritime (Includes Ports and Maritime Facilities):** Includes civilian maritime: attacks against fishing ships, oil tankers, ferries, yachts, etc.

- **NGO:** Includes attacks on offices and employees of non-governmental organizations (NGOs). NGOs here include large multinational non-governmental organizations such as the Red Cross and Doctors without Borders, as well as domestic organizations.

- **Other:** This value includes acts of terrorism committed against targets which do not fit into other categories. Some examples include ambulances, firefighters, refugee camps, and international demilitarized zones.

- **Private Citizens and Property:** This value includes attacks on individuals, the public in general or attacks in public areas including markets, commercial streets, busy intersections and pedestrian malls. Also includes ambiguous cases where the target/victim was a named individual, or where the target/victim of an attack could be identified by name, age, occupation, gender or nationality. This value also includes ceremonial events, such as weddings and funerals.

- **Religious Figures/Institutions:** his value includes attacks on religious leaders, (Imams, priests, bishops, etc.), religious institutions (mosques, churches), religious places or objects (shrines, relics, etc.). This value also includes attacks

on organizations that are affiliated with religious entities that are not NGOs, businesses or schools.

- **Telecommunication:** This includes attacks on facilities and infrastructure for the transmission of information. More specifically this value includes things like cell phone towers, telephone booths, television transmitters, radio, and microwave towers.

- **Terrorists/Non-state Militias:** Terrorists or members of identified terrorist groups within the GTD are included in this value. Membership is broadly defined and includes informants for terrorist groups, but excludes former or surrendered terrorists. This value also includes cases involving the targeting of militias and guerillas.

- **Tourists:** This value includes the targeting of tour buses, tourists, or "tours." Tourists are persons who travel primarily for the purposes of leisure or amusement. Government tourist offices are included in this value. The attack must clearly target tourists, not just an assault on a business or transportation system used by tourists. Travel agencies are coded as business targets.

- **Transportation:** Attacks on public transportation systems are included in this value. This can include efforts to assault public buses, minibusses, trains, metro/subways, highways (if the highway itself is the target of the attack), bridges, roads, etc.

- **Unknown:** The target type cannot be determined from the available information.

- **Utilities:** This value pertains to facilities for the transmission or generation of energy. For example, power lines, oil pipelines, electrical transformers, high tension lines, gas and electric substations, are all included in this value. This value also includes lampposts or street lights. Attacks on officers, employees or facilities of utility companies excluding the type of facilities above are coded as a business.

- **Violent Political Parties:** This value pertains to entities that are both political parties (and thus, coded as "government" in this coding scheme) and terrorists.

8. **Perpetrators**: A Perpetrator is a person who has been determined to have caused or knowingly allowed an incident.

9. **Weapon type**: It refers to the type of weapon that is used in the incident

   - **Chemical**: A weapon produced from toxic chemicals that are contained in a delivery system and dispersed as a liquid, vapor, or aerosol. This category includes chemical weapons delivered via the explosive device.

   - **Explosives/Bombs/Dynamite**: A weapon composed of energetically unstable material undergoing rapid decomposition and releasing a pressure wave that causes physical damage to the surrounding environment. Note that chemical weapons delivered via explosive are classified as "Chemical" with weapon subtype "Explosives."

   - **Firearms**: A weapon which is capable of firing a projectile using an explosive charge as a propellant.

   - **Incendiary**: A weapon that is capable of catching fire, causing fire, or burning readily and produces intensely hot fire when exploded.

- **Melee**: A weapon—targeting people rather than property—that does not involve a projectile in which the user and target are in contact with it simultaneously.

- **Other**: A weapon that has been identified but does not fit into one of the above categories

- **Sabotage Equipment**: A weapon that is used in the demolition or destruction of property (e.g., removing bolts from a train track).

- **Unknown**: The weapon type cannot be determined from the available information.

10. **Nationality of target**: This is the nationality of the target that was attacked, and is not necessarily the same as the country in which the incident occurred, although in most cases it is. For hijacking incidents, the nationality of the plane is recorded and not that of the passengers.

11. **Country**: Refers to the country where the incident occurred

12. **State**: Refers to the state of a country where the incident occurred

13. **City**: refers to the city of a country where the incident occurred

14. **Latitude**: This field records the latitude (based on WGS1984 standards) of the city in which the event occurred.

15. **Longitude**: This field records the longitude (based on WGS1984 standards) of the city in which the event occurred

16. **Fatalities**: Refers to the number of people killed in the incident

Non-Violence Data: Site1;Site 2 ;Site 3;Site 4;Site 5

1. Data id: Unique id for every row

2. Country Code: Short name given to each country

- AFG Afghanistan

- IRQ Iraq

- SYR Syria

- YEM Yemen

3. Year: Calendar year about the data

4. Country: Name of the country

5. GDP: Gross Domestic Product in scaled log values

6. Mortality: Number of deaths reported (scaled by the population size)

7. Fertility: Number of children born per 1000 woman

8. Population: Population of a country in 1000

9. Trade Import: Revenue in dollars

10. Trade Export: Revenue in dollars

4. How to Use the Dashboard

About. The first page, "About", includes an introduction to Northeastern University's Armed Conflict Dashboard and a link to download our data file on the lower left side of the page. To download the data, click on the link, ensure the file is saved as a CSV file (e.g., in the file name field: name of data.csv). Also, we can download the data by clicking the Download Data button on the lower left side of the page.
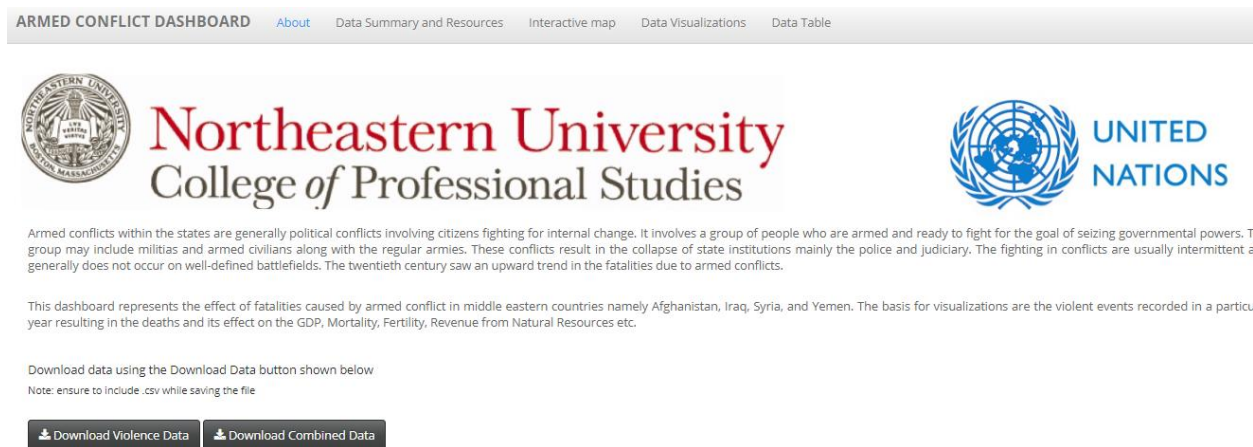
Figure 1: About

Data Summary and Resources Page. The second page, "Data Summary and Resources Page", includes links to the websites where the data was mined from as well as a summary of the data.

Figure 2: Data Summary and Sources

Interactive Map. The third page, "Interactive Map", includes an interactive zoom function.
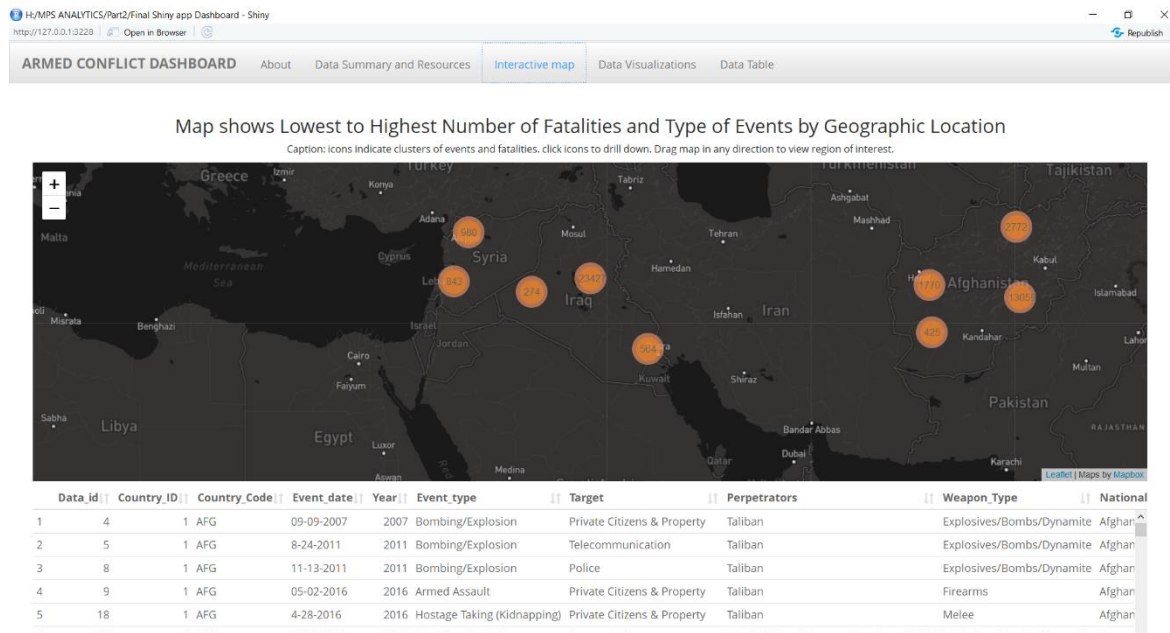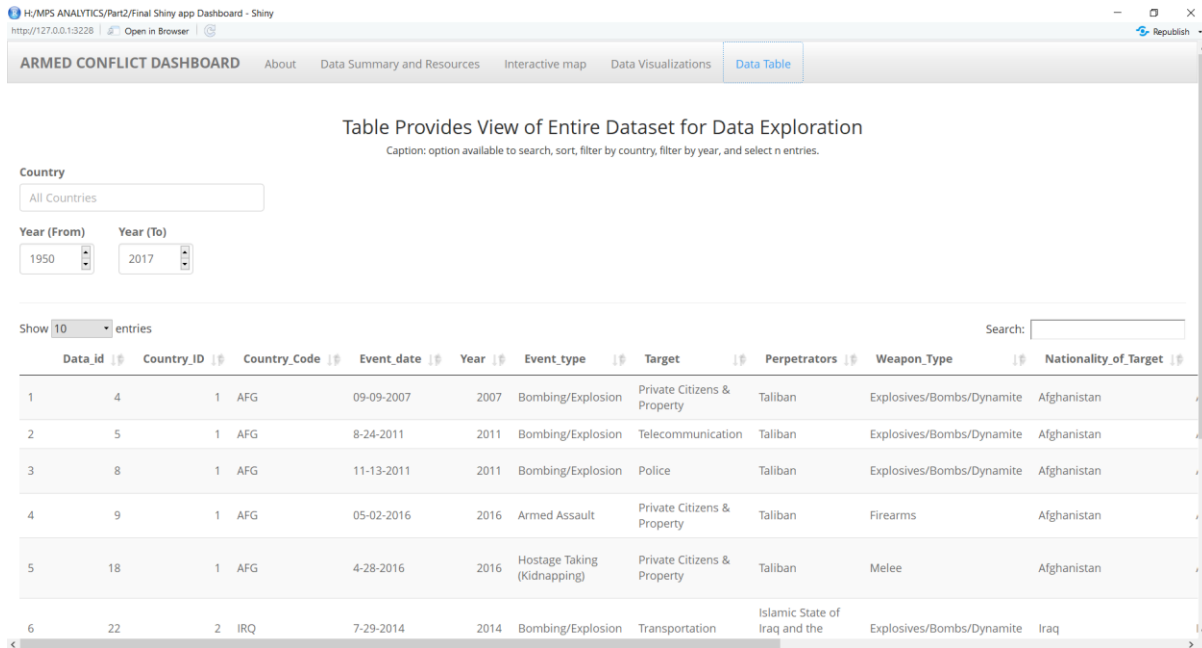
Figure 3: Interactive Map

Zoom Function. Using the zoom function, the interactive map will take you from a higher number of fatality to a smaller number of fatalities, which is represented by the size orange circles (i.e., the large the circle the more fatalities). The orange circles also indicate the location of the event. When the zoom-in function is used to the maximum scale of the map, a blue mark represents a single fatality event.

Sorting Button. Using the sorting button, the data variables can be sorted based on the following: Date, Year, Event Type, Target, Perpetrators, Weapon, Nationality, Country, State, City, Latitude, Longitude, and Fatalities. For example, to see the earliest event in our dataset, use the sorting button of the year column the dataset will realign the data to 1979 and show the particulars of the assassination in Iraq.

Data Table. The fourth page, "Data Table", includes links access to explore the data file. On this page, you can explore the data using the "search box" by country, event, year, event type, target, preparators, weapon type, the nationality of the target, etc. You can use the "show entries" button to view the data lines.

Figure 4: Violence Data Table

Data Visualization. The third page, "Data Visualizations", includes a Trend Graph, Density Plots, a Scatter Plot, a Correlation Matrix, a Boxplot and Sankey diagram.

  Trend Graph. The trend graph (figure 4) indicates the trends between the selected measures changes such as GDP, Mortality, Fertility Population, Trade Export and Total Violent Fatalities based on time for different countries. For example, if you want to see the trend of mortality in Afghanistan from the year 1960 to the year 2015, by selecting country " Afghanistan" on the left side of the search box with the measure " mortality", the trend graph will show as the X-axis indicate the time of year and the Y-axis is the range of mortality rate. In this graph, the

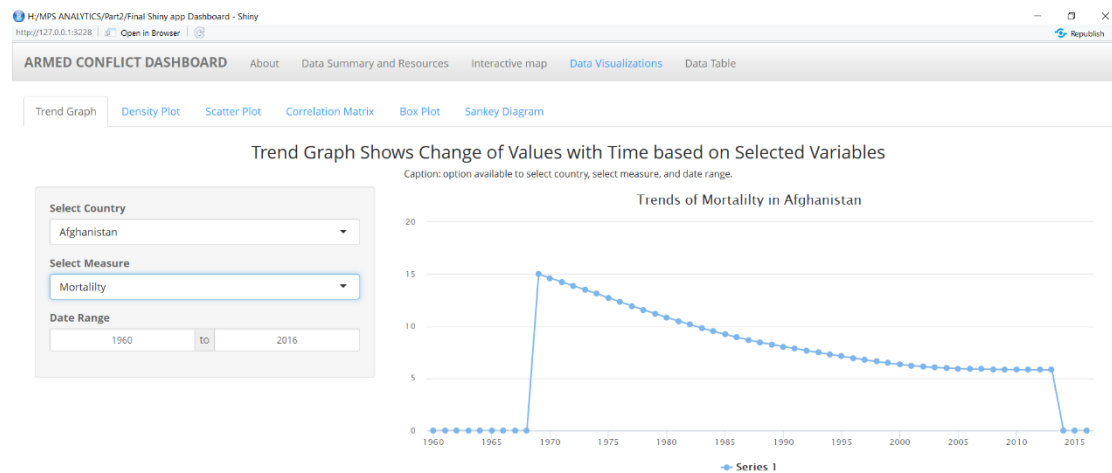mortality of Afghanistan has been increased dramatically from the year 1968 and getting smooth down until 2014.

Figure 5: Trend Graph

Density Plot. The density plot indicates the distribution of the data based on selected variables. By simply selecting the country on the left side of the search box, green shades of the area will indicate the data we have been collected. You will notice some data points are missing, which is due to random missing data. For example, in 1989, Yemen's data is missing at random; however, after 2010, the availability of the data has increased dramatically. In one way the incompleteness of data might just due to the lack of collection, or in other hand is some event has happened; thus, we have created a framework for additional data to be added for subsequent users and future analyses
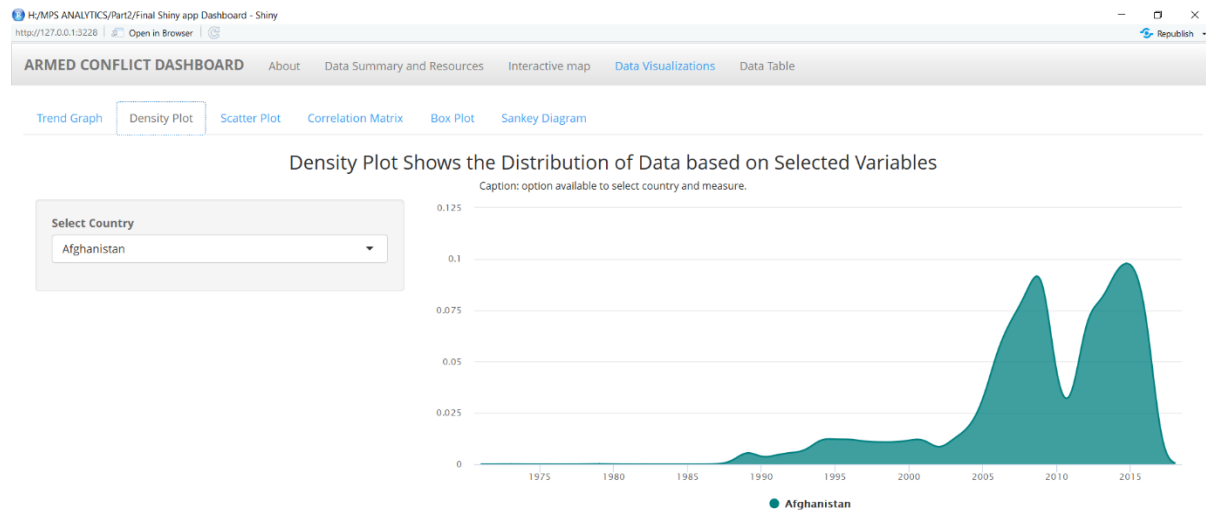
Figure 6: Density Plot

Scatter Plot. The scatter plot includes the relation of total violent fatalities on the X-axis as an independent variable with dependent variables like GDP, mortality, fertility shows on the Y-axis. Different countries can be filtered. When you put your cursor to the top right side of the correlation graph, it will automatically display a toolbar which includes multiple functions like download plot as a .png file, zoom in and zoom out, box select, auto scale. For example, if you want to investigate the total violent fatalities compared to the GDP at a specific point, use the "box select" to choose the triangle (data points) you want to investigate. By clicking the "show closet data on hover " and " compare data on hover," the number of total violent fatalities with GDP will show near the triangle you have been chosen. The blue line in the scatter plot is the best-fit line or also termed as trend line which best represents the data. The data points which are located close to the trend line and located within the shaded region (confidence interval) indicates that it has a strong relation with the variable represented on the x-axis.
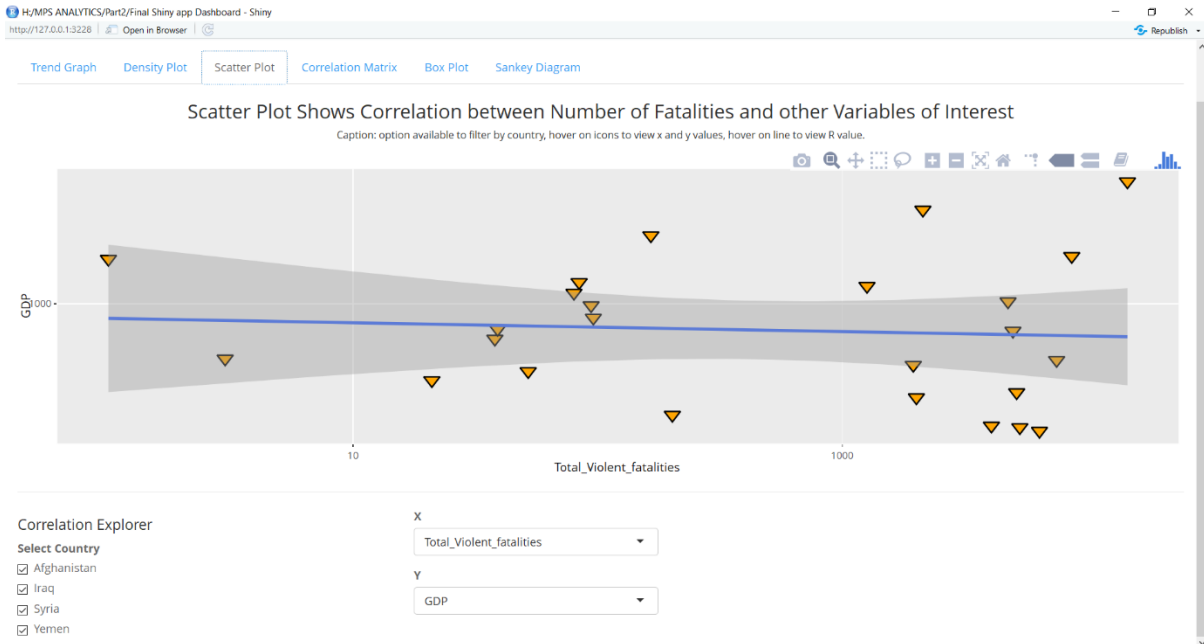
Figure 7: Scatter Plot

Correlation Matrix: The correlation matrix (figure 7) has been used to show the relation between variables and their correlations with one or all the variables. The variables that have been used to represent correlations are GDP, Mortality, Fertility, Population, Trade Import, Trade Export, Total Violent Fatalities. The color of the boxes determines the sign of the correlation, whether it's positive, negative, high, medium or low. In this case, blue for positive and red for negative correlations. The lack of correlation is represented in white.
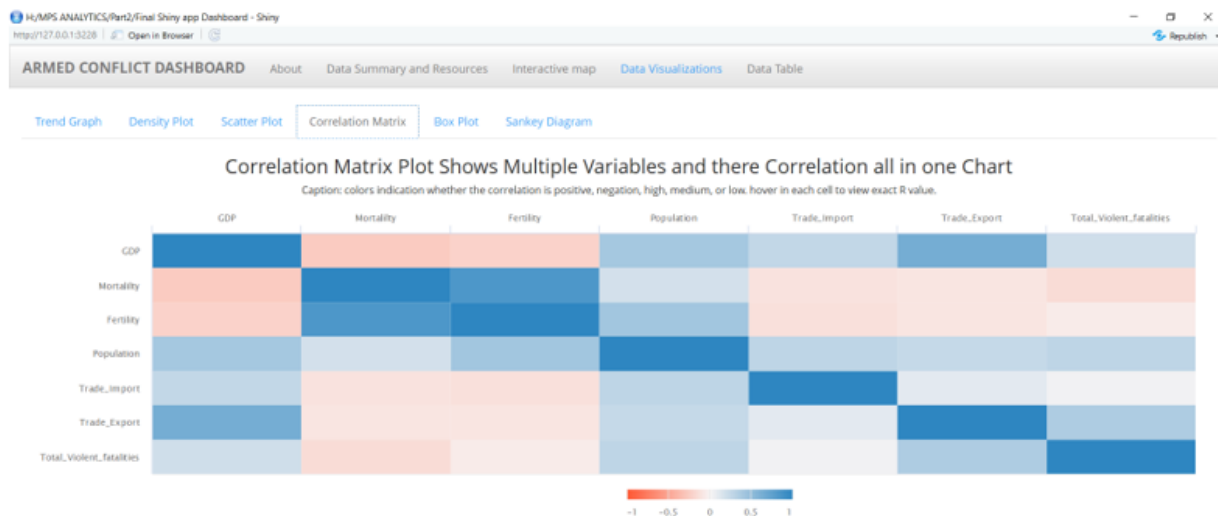
Box Plot. Using the bottom left corner, you can select different countries. Using the search box on the lower right side, you can choose the dependent and independent variables. Each event type is labeled by a different color. Each type includes a function toolbar, which can be seen in the upper right corner of the graph. For example, in the figure of fatalities with the event type, the sexual violence is showed with a bunch of outliers beyond the upper fence. The top quartile shows 0.95 which means there are 25 % of data are greater than this value. Compare the top quartile and bottom quartile, the median 0.54 is closer to the bottom quartile 0.30, which indicates the box plot of sexual violence is positively skewed.
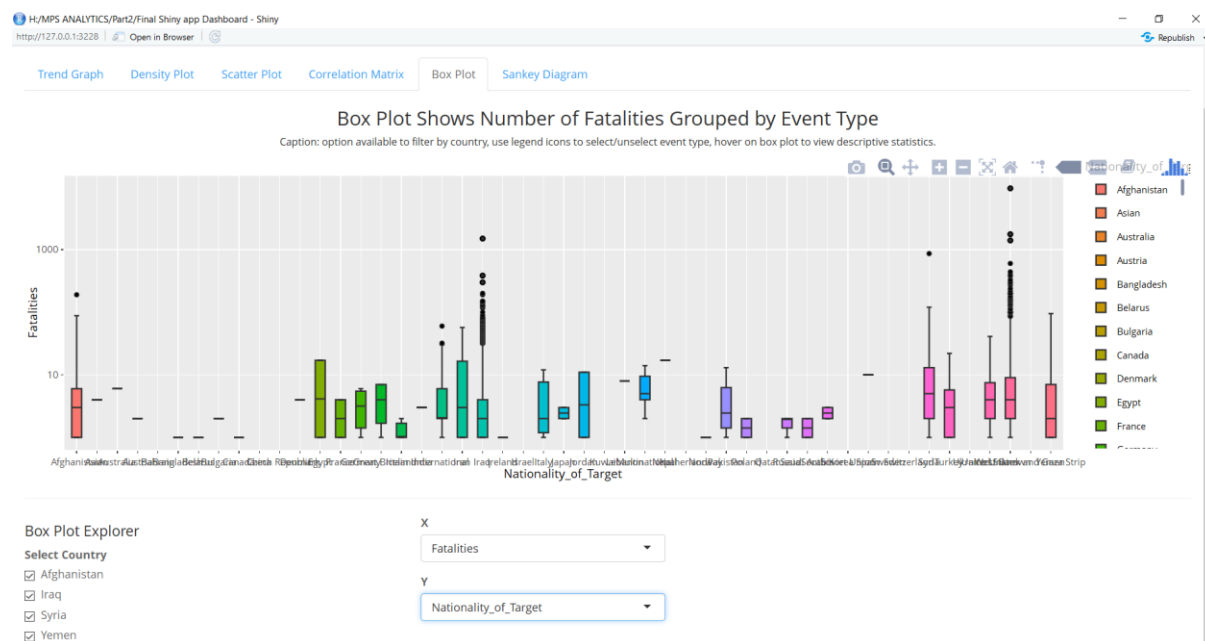

Figure 9: Box Plot

Sankey Diagram. The Sankey diagram shows the strength of connections or involvement between two events. In our Sankey diagram, the three columns represent three variables in our data which are countries, targets and event types. The sizes of the links between each couple of

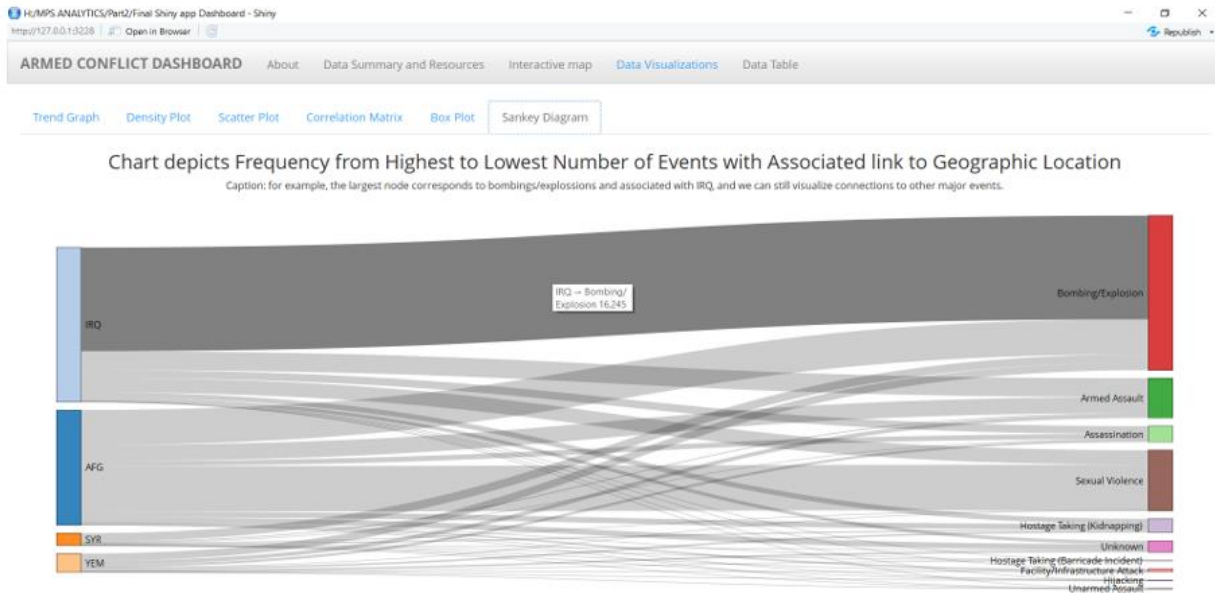nodes are defined based on the total number of the happened event which involved these two specific variables.

Figure 10: Sankey Diagram

5. References

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Bahgat, Karim; Ragnhild Nordås, and Gudrun Østby (2016). Geocoded SVAC Dataset (GEO-SVAC) version 1.0. Peace Research Institute Oslo (PRIO).

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