AIT 664: Project Phase IV

Project Recap of the Information Vizualization for Global Terrorism Involving Suicide Tactics

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Contents

Introduction:

In the endeavor to decode the complexities of global terrorism, this report aims to examine the multifaceted nature of terrorist incidents across the globe. The foundation of this exploration is the meticulous preparation of data from the "Global Terrorism Database 1970 - 2020" provided by START, which has been scrupulously streamlined to enable a robust analysis [1]. This dataset, accessible via the University of Maryland's START initiative, forms the backbone of my empirical analysis. It provides a rich tapestry of data, allowing for an in-depth exploration of each terrorist attack with supplementary information gleaned from news articles and government documents. The primary goal of utilizing this dataset is to dissect the multifaceted nature of global terrorism, focusing particularly on the operational profiles of terrorist attacks, including the prevalence and evolution of suicide tactics.

The objectives are ambitious yet clear-cut: to meticulously outline the data preparation process that assures the robustness of our analysis, and to delve deep into the operational aspects of terrorism. By employing a combination of descriptive analytics, this study sets out to unravel the defining characteristics of the most active terrorist groups, explore the operational nuances across different scales of terrorist organizations and actors, and categorize suicide attacks to understand the role of geographical localization in their execution and impacts.

This endeavor is not without its limitations, which stem from the inherent challenges of data collection and the complexities of terrorism itself. The report candidly addresses these constraints and outlines a vision for future developments, emphasizing the ongoing nature of this analytical journey. From interactive maps that delineate the global spread of terrorism to dynamic dashboards that reveal the nuances of terrorist operations, the project leverages a modern user interface to bring this dataset to life. The research is driven by a series of fundamental questions aimed at understanding the trends, motivations, and countermeasures associated with global terrorism. These include:

1. Considering the various types of terrorist attacks, how have the operational profiles, including the prevalence of suicide tactics, shifted over the years within each category?

2. Can we distinguish the operational and ideological characteristics of the most active terrorist groups, particularly with regard to the strategic use of suicide tactics compared to individual actors in less organized attacks?

3. What distinct operational patterns emerge when comparing suicide attacks orchestrated by large terrorist organizations with those committed by small extremist groups and individual actors?

4. Is it possible to categorize suicide attacks based on their characteristics and identify patterns that are specific to the geographical locations where they occur?

Target Audience:

This research is primarily oriented towards academic scholars, security analysts and intelligence professionals, policymakers and government officials, as well as non-governmental organizations (NGOs) and international bodies focused on conflict resolution and the mitigation of terrorism's societal impacts. Academic professionals in terrorism and political violence studies require empirical data to substantiate theoretical frameworks and analyses. In contrast, security analysts and intelligence operatives necessitate a profound comprehension of terrorist operations to refine threat assessments and strategy formulation. Meanwhile, policymakers and officials within governmental circles seek evidence-based insights to devise robust policies and legislative countermeasures. NGOs and international entities engaged in peacebuilding efforts demand accurate, actionable data to inform their interventions and strategies.

Addressing the intricate needs of this diverse audience, the report is meticulously crafted to facilitate the understanding of complex data through sophisticated yet accessible visual representations. This approach allows for the immediate grasp of elaborate terrorism patterns, making the data comprehensible without necessitating extensive analysis. Insights into the trends and patterns of suicide terrorism are crucial for predicting future trajectories and preparing for emergent threats. Furthermore, the report delineates the operational and ideological traits of terrorist groups, providing actionable intelligence crucial for the development of effective counter-terrorism measures and strategies.

Hypothesis:

Within the Global Terrorism Database (GTD), there is a discernible shift in the operational profiles and prevalence of suicide tactics among different types of terrorist attacks over time. Specifically, it is hypothesized that extremist organizations will display a higher degree of strategic planning, complexity, and adherence to ideological motivations compared to individual actors. This study expects to reveal distinct patterns in the operational characteristics of suicide attacks that correlate with the size and organizational structure of the perpetrating groups—ranging from large, well-organized terrorist organizations to small extremist groups and individual actors. Moreover, the hypothesis suggests that suicide attacks can be categorized and distinguished based on their operational characteristics, such as target selection, amount of perpetrators, choice of weaponry, location, and overall impact, and that these categories will exhibit unique patterns that are influenced by the geographical locations where the attacks occur.

Data Preparation:

The Global Terrorism Database (GTD) was created to comprehensively catalog and analyze terrorist incidents worldwide. The data is unitized at the level of individual terrorist events. Each row represents a unique incident, with variables detailing aspects of the event, such as the originating country and coordinates; type of attack; weapons used; type of target; textual motives

or statements; whether or not it was committed by an individual; and the name of the individual or groups responsible. Initially, it was developed to understand the patterns, tactics, and trends of terrorism globally. The database is the result of extensive data collection efforts from various sources, organized systematically to offer insights into terrorist activities over time. It includes information from a range of efforts like the Anti-Abortion Project, Armenian Website, and more, with the number of events varying significantly across sources [2].

The version of the database I am using was last updated on December 31st, 2020, containing just under 210,000 entries of different terrorist attacks since January 1st, 1970. The entire database was developed through several phases, initially using data collected by the Pinkerton Global Intelligence Service from 1970 to 1997. Subsequently, the Center for Terrorism and Intelligence Studies (CETIS) and the Institute for the Study of Violent Groups (ISVG) contributed to data collection, with START at the University of Maryland taking over in November 2011. The GTD is a comprehensive, event-level database, detailing terrorist attacks globally, maintained with a focus on accuracy, inclusiveness, and transparency. It utilizes both manual and automated data collection methods, including natural language processing and machine learning, to filter and refine media articles and reports [6].

There are many limitations with traditional data sources like police, legal records, and victim surveys when comprehensively capturing terrorism data, highlighting the necessity of machine learning tools for documenting events and processing contradictory reports [6]. This involves filtering from over a million daily media articles worldwide to identify relevant terrorist attacks. Customized keyword filters and sophisticated natural language processing (NLP) and machine learning techniques are employed to refine the results [2]. Each event that satisfies GTD inclusion criteria is manually reviewed and coded. The methodology aims at maximizing the database's comprehensiveness by including a broad and deep pool of media sources globally.

For this analysis, the Global Terrorism Database (GTD) underwent a rigorous data preparation process to ensure accuracy and relevancy. To begin, a copy of the overall database was created, containing only events which resulted in terrorist suicide. Initial structuring involved pruning the dataset using Microsoft Excel to remove extraneous columns that were either irrelevant to the research scope or contained incomplete data. Retained columns include key identifiers, date and location information, attack specifics, and casualty figures—fundamental for analyzing operational profiles and the prevalence of suicide tactics. See these categories and their descriptions by observing the Dataset Descriptions in the Appendices for further analysis [A].

Normalization is accomplished by ensuring internal consistency within the dataset. As the GTD collection methodology has evolved, particularly since 2012, it has harnessed automated and manual strategies to enhance the database's comprehensiveness and accuracy. Sophisticated natural language processing (NLP) and machine learning techniques were employed to sift through a monthly average of 400,000 media articles, distilling them down to relevant reports of terrorist activities [2].

Further, I manually adjusted figures for fatalities and injuries (nkill, nwound) to align with verified information from source headlines. The GTD's rigorous data collection methodology ensures that such adjustments are grounded in validated data. This normalization process also included the calibration of estimated property damage based on event descriptions, assigning categorizations such as 'minor' or 'major' damages, or 'unknown' when estimations were not feasible. I tediously filled in blank cells with some form of data, based on qualitative evidence.

Data normalization is crucial to reduce redundancy and dependency, particularly relevant for integrating the GTD with other datasets or if it forms part of a relational database. For example, 'country' and 'country_txt' provide both numerical codes and textual descriptions, ensuring that data can be analyzed efficiently without needing additional lookup tables within this context. However, fields like gsubname (subnames for groups) contain missing values or are left blank, indicating potential gaps in data collection or events where specific details were not available or applicable. Additionally, fields like summary and motive are text-heavy and may contain subjective interpretations of events, which could introduce bias in qualitative analyses.

Measurements across the dataset are consistent, ensuring that data points are quantifiable and measured uniformly. This includes numerical values for incidents, casualties, and other metrics. Variables like 'nkill' (number of kills), 'nwound' (number of wounded), and 'property' (property damage) provide concrete metrics to assess the impact of terrorist incidents. Unitization of the dataset will be crucial for managing and interpreting the data efficiently. By structuring the retained variables into a coherent format, I've facilitated the examination of trends and patterns within the database. The formatted dataset now allows for granular analysis and the application of statistical methods to answer the research questions posed, particularly those relating to the operational patterns and implications for counter-terrorism strategies.

Exploratory Data Analysis:

My exploratory data analysis was conducted through a combination of manual and automated techniques. Initial data structuring and elementary investigations were performed using Microsoft Excel, which provided a hands-on approach to uncover basic patterns and outliers. For more advanced visual explorations, Python was utilized for its powerful libraries such as Pandas for data manipulation and Matplotlib for visualization. These tools facilitated a deeper dive into correlation discovery and relationship analysis. The visualization process played a crucial role in this exploratory data analysis as it allowed me to transform raw data into a more digestible and insightful format. As I utilized bar graphs, maps, and word clouds, I became closer to understanding the insights which this data has available to me.

The exploratory data analysis was iterative by nature. Each visualization led to new questions and, consequently, further cleaning and refinement of data. Through this cyclical process of graphing and analyzing, I was able to identify additional data requirements and refine initial hypotheses,

laying crucial groundwork for subsequent investigative phases. Each word cloud acts as a distinct analytical tool, illuminating the global landscape of terrorism. Together, these visualizations disclose operational patterns of terrorist groups, their economic impacts through property damage, targeting preferences, and weapon selection. They compile a nuanced visual dataset essential for geopolitical analysis, security studies, and counterterrorism strategy formulation. The analysis of these scripts through word clouds provides insights into the prevalent terms related to sources, targets, motives, responsible groups, and weapons used in terrorist incidents. These visual tools swiftly highlight the primary themes and focal points within the dataset, which is exceptionally useful for synthesizing extensive textual data.

Visualization Foundation:

I created the foundation for an analytics page centering the Global Terrorism Database. This strategic visualization of data underscores the spatial distribution of terrorist attacks globally. This initiative seeks to leverage the inherent geospatial data encapsulated within the dataset, primarily focusing on the longitude and latitude details of each attack to offer a comprehensive, interactive map. This interactive map serves as the nucleus of the visualization, enriched by a dynamic dashboard that categorizes attacks by region, country, and city, thereby facilitating a multi-layered examination of terrorism's global footprint.

The project's code, as revealed through the exploration of index.html and app.py (not directly reviewed but implied through context), embodies a sophisticated web application designed to visualize and interact with data from the Global Terrorism Database. The web application is constructed around a client-server architecture, where the client-side is rendered through HTML, CSS, and JavaScript, offering an interactive user interface. The server-side, managed by Python (app.py), is responsible for data processing, analysis, and serving the client's requests.

The index.html document establishes the structural foundation of the application, embedding essential components such as the interactive map and analytics dashboard. The document is meticulously organized to accommodate dynamic content, primarily through placeholders and containers designated for map visualization, data-driven charts, and summarized details. The application employs CSS for styling, ensuring a responsive and user-friendly interface. The CSS includes provisions for a resizable dashboard, a feature that enhances user interaction by allowing dynamic adjustment of the visual real estate allocated to the map and analytics dashboard.

The client-side logic is driven by JavaScript, leveraging external libraries such as Leaflet for map rendering, jQuery for AJAX requests, and Chart.js for data visualization. This amalgamation of libraries facilitates a rich interactive experience, enabling users to navigate the map, zoom into specific regions, and click on markers to reveal detailed analyses of terrorist events.

- Leaflet: Used for creating and manipulating the interactive map, including the addition of markers to represent terrorist events.

- jQuery: Facilitates AJAX requests to the server for fetching and updating data based on user interaction with the map.
- Chart.js: Powers the dynamic generation of various charts within the dashboard, illustrating the analytical depth of the terrorism data through timelines, bar charts, and pie charts.

While the app.py file's role in the application can be inferred as pivotal for handling data processing, API requests, and serving the client-side components. It likely includes routes and logic for querying the Global Terrorism Database, aggregating and analyzing data, and preparing JSON responses for the client-side to consume and visualize.

Development of Visual Models:

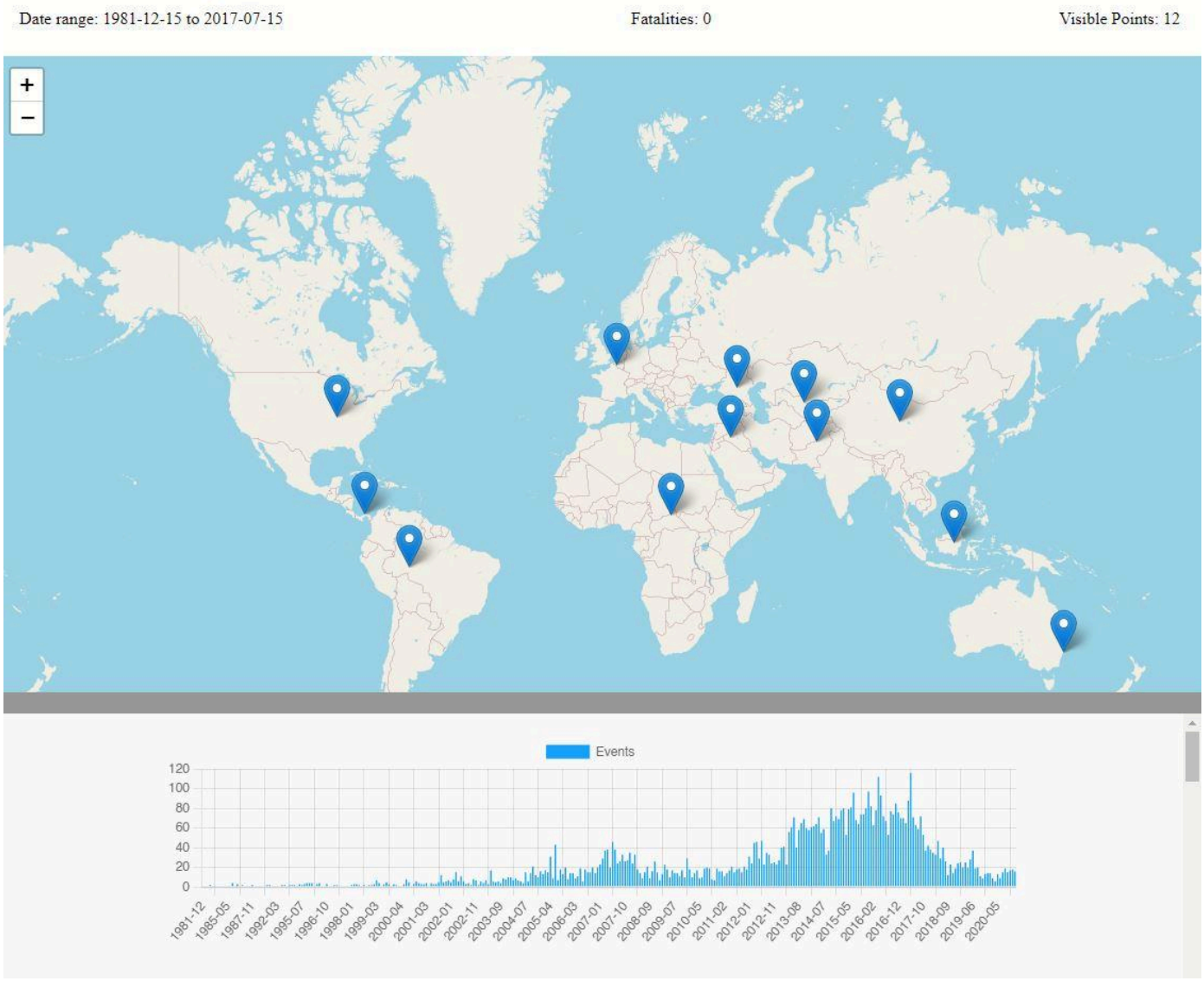
The development of visual models within this analytics page is predicated on the creation of a sophisticated, user-friendly interface that allows for the exploration of terrorist attacks with an unprecedented level of granularity. The interactive map, augmented by the dashboard, is designed to offer a seamless experience where users can drill down from regional groupings of attacks to individual cities, thereby uncovering the intricate patterns of terrorism on a micro level.

The application's interactivity is anchored in its ability to dynamically update visual components based on user actions. This is achieved through event listeners that trigger data fetches and updates, such as:

- Map Interactions: Zooming and panning actions on the map initiate requests to the server to retrieve relevant data within the current viewport.
- Dashboard Updates: Clicking on map markers or adjusting the dashboard triggers updates to the displayed analytics, ensuring that information remains contextual and reflective of the user's focus area.

The project was conceived with the intention of making a comprehensive analysis of global terrorism accessible to a wide audience, from academic researchers to policymakers. The goal for interpreting these visualizations is for users to unveil patterns and trends that are critical for understanding terrorism's dynamics. For instance, the bar graph timeline may reveal periods of intensified activity, suggesting geopolitical or socio-economic triggers. Pie charts, on the other hand, offer a glimpse into the operational preferences and organizational structures of terrorist groups, shedding light on their target selection, attack methods, and ideological motivations. Below are screenshots of the analytics page as it currently stands. There are several intended interactions that still have yet to finish development. I failed to sufficiently plug-in data to its respective graph the way I had hoped to achieve, but I am still motivated to publish updates once I've overcome each hurdle and continued building my skills in analytical webtool development.

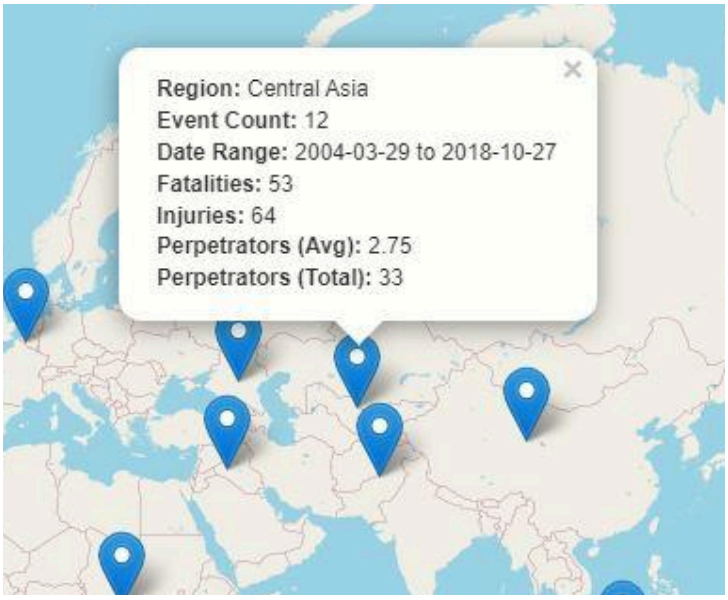
Interactive Map of Suicide Terrorist Attacks With the Dashboard Containing a Timeline



Presented in an interactive format, this map details suicide terrorist attacks over time, incorporating a dashboard with a timeline paragraph and other visualization (still in-development). It integrates Python for data preparation and web-based tools like JQuery, Charts.js, and Leaflet for the map and timeline. Users can explore the temporal spread of events from 1981 to 2020, with the ability to zoom-in on or select event points which reveal specific incidents and their related data such as fatalities and dates directly on the map and dashboard.

The dashboard component of the visual model aims to stand as a testament to the project's analytical depth. It is specifically engineered to display only the data relevant to the user's current view or selection on the interactive map. This dynamic nature of the dashboard, coupled with its ability to display aggregated data such as the span of time for attacks and casualty figures, elevates the user's ability to conduct a targeted analysis of the impact of terrorism within specific regions or time frames.

Interactive Event Point of Suicide Terrorist Attacks Containing Localized Data



The map event points provide localized data such as the date range, event count, fatalities, injuries, and information on perpetrators. It enables users to interact with individual data points to retrieve detailed statistics about terrorist events in various regions, countries, or cities.

Interactive Event Point of Suicide Terrorist Attacks Containing Localized Data in a City

The map event points provide localized data for a specific city, such as the date range, event count, fatalities, injuries, and information on perpetrators; thus, enhancing the user's ability to analyze patterns within a given geopolitical context.

The interactive map, which dynamically loads data for visible or selected markers, stands as a significant achievement. Utilizing technologies such as Leaflet for map rendering and AJAX for data fetching, we successfully created an intuitive interface that allows users to explore terrorist incidents across the globe with geographic precision. The map's capability to adjust based on the viewport and zoom levels ensures that users are not overwhelmed with information, making the data exploration process both efficient and user-friendly. However, this success comes with its limitations. The map's reliance on precise longitude and latitude details means that incidents without this specific geospatial data cannot be visualized. Furthermore, the challenge of effectively clustering markers to represent densely packed incidents without obscuring details or oversimplifying the data complexity remains an area for further improvement.

The development of the dashboard intended to offer a deeper analytical view through various charts and summaries is in progress. The vision for the dashboard is robust, aiming to provide insights into the trends, impacts, and patterns of terrorism incidents based on the user's interaction with the map. Currently, the dashboard's integration with the data is incomplete, highlighting the gap between the interactive map's capabilities and the dashboard's current state. This discrepancy underscores the complexity of translating raw data into meaningful, interactive visual analytics that can adapt in real-time to user interactions.

There are several limitations which stem primarily from the database's inherent structure and the scope of the analytics page. Understanding these limitations is crucial for interpreting the results accurately and for guiding future enhancements of the dashboard and the underlying analytical models. For one, the database captures incidents up to the year 2020, introducing a temporal limitation to our analysis. Additionally, reporting delays and revisions can affect the timeliness and reliability of the data, impacting our ability to conduct real-time or near-real-time analyses.

The interactive map's functionality also hinges on the availability and accuracy of geospatial data for each terrorist incident. However, a significant portion of the database entries lacks precise longitude and latitude details, limiting our ability to visualize and analyze these incidents geographically. This gap can skew our understanding of terrorism's spatial distribution and potentially obscure regional patterns of interest. Another limitation exists in the bias of the source material. The GTD is compiled from open-source materials, which can introduce biases related to media coverage, governmental transparency, and the visibility of certain incidents over others. This can result in underreporting of incidents in regions with restricted media or overemphasis on attacks that receive more international attention.

Not only that, but while the GTD provides a wealth of variables per incident, the consistency and level of detail across records vary. For instance, information on perpetrators, motives, and specific outcomes may be incomplete or missing, challenging the depth of analysis possible for certain queries. Moving forward, the development focus will shift towards realizing the full potential of the dashboard. This includes:

- Addressing the variability in detail and consistency across the dataset by developing standardized protocols for data entry and normalization. This includes automating the classification of unstructured data fields and employing machine learning techniques to predict missing values based on known patterns.
- Developing methodologies to integrate additional data sources can mitigate some of the current gaps. This includes leveraging satellite imagery for geospatial analysis, incorporating data from local governmental and non-governmental organizations, and utilizing social media analytics to gain insights into underreported regions.
- Incorporating more dynamic tools for advanced visualization types such as heat maps for spatial analysis, network graphs to explore the relationships between terrorist groups, and sentiment analysis of news sources to gauge media bias. These tools will enable users to unearth deeper insights into the dynamics of terrorism.
- Enhancing the dashboard's user interface to support more intuitive navigation, customization of visualizations, and interactive tutorials will make the tool more accessible to a broader audience. This involves refining the responsiveness of the interface to user queries and incorporating user feedback mechanisms to guide continuous improvement.
- Continuously identifying and rectifying bugs within the existing codebase while optimizing performance to handle larger datasets and more complex queries without compromising user experience.
- Encouraging the academic and research community to contribute to the project through open-source collaborations. This can help in the validation of data, introduction of new analytical methodologies, and enhancement of the database's comprehensiveness and accuracy.

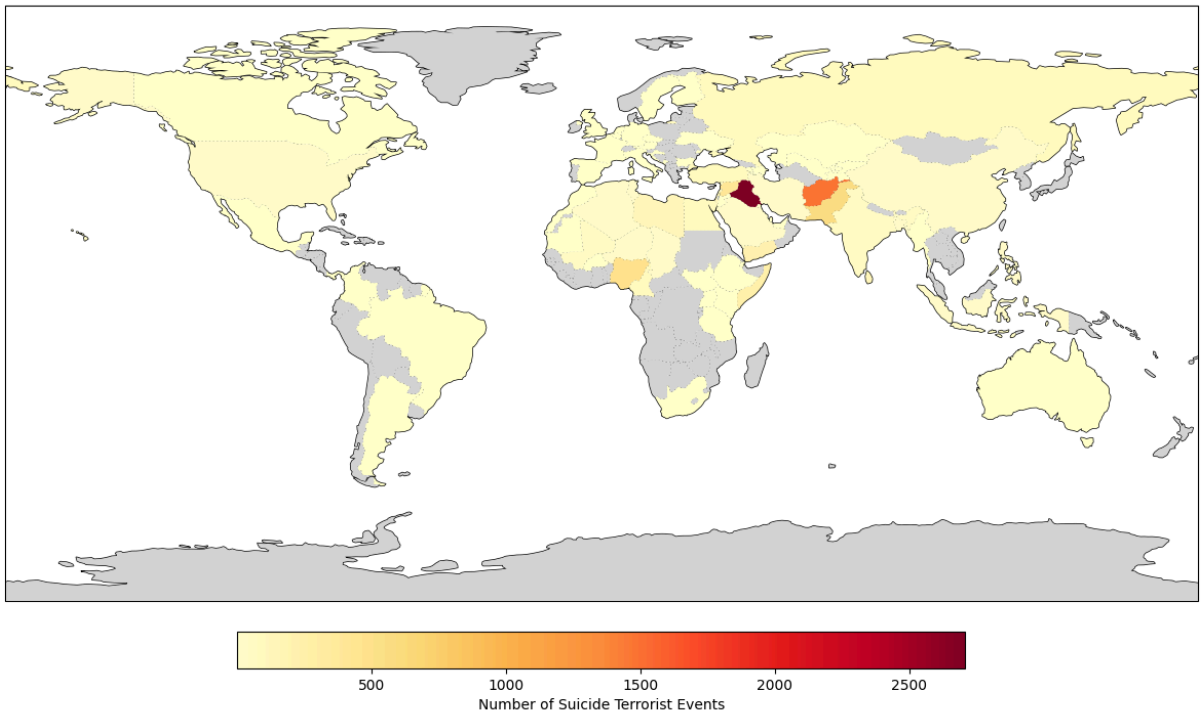
Analysis of Visualizations:

My hypothesis is about the prevalence of characteristics in certain operational profiles of terrorist attacks, such as target selection, amount of perpetrators, choice of weaponry, location, and overall impact. I intend to analyze how my visualization endeavors address my research questions. The analysis is as follows:

1. *Considering the various types of terrorist attacks, how have the operational profiles, including the prevalence of suicide tactics, shifted over the years within each category?*

When I first asked this question, I was observing the categories which determine target selection, the choice of weaponry, and location (‘latitude’, ‘longitude’, 'region_txt', 'country_txt', and 'city'). By leveraging this data, users can analyze the nature of attacks wherever they are concentrated.

Spatial Distribution of Suicide Terrorist Attacks



Data analyzed using Pandas; static map rendered with Matplotlib for visualization and Cartopy for geographical elements; interactive map designed with Plotly Express for dynamic data representation.

Most notably, suicide attacks are concentrated in Iraq, with 2,709 events; followed by Afghanastan with 1,487 attacks; and Pakistan & Nigeria with around 500 recorded events each. Most countries have had fewer than 400 suicide events, with some countries having absolutely no events ever recorded. During my exploratory analysis, I created a similar map to show the results for target nationality, as opposed to location. I found almost no discrepancies between attack location and target nationality; however, I did notice one discrepancy: although there are no recorded suicide attacks in Japan, however one event has been classified with targeting the Japanese nationality. Looking into the database, this attack was actually committed in the United Arab Emirates, with an unknown number of perpetrators. The responsible group is called the Abdullah Azzam Brigades (AAB, a Sunni jihadist group with ties to al-Qa'ida) [16]. According to the Global Terorism Database, the group claimed that the attack was in retaliation for the imprisonment in the US of Omar Abdel Rahman. An explosives-laden maritime vessel was used in the attack; the explosion created a large dent in the hull of a Mitsui OSK Lines (Japanese) tanker, causing major damages. Only one victim claimed an injury, however there were no deaths.

The interactive nature of the map and dashboard lets users "travel" to see details about attacks in all areas, effectively presenting the shift in geographical focus of these attacks. This can show evidence of changing operational profiles in terms of location and intensity. In crafting my interactive visualization tool, a meticulous approach was adopted to ensure data accuracy and relevance. The use of coordinates, as well as 'region_txt', 'country_txt', and 'city' act as primary

markers for data aggregation and display ensures that the visualization remains grounded in the database's hierarchical structure. By implementing a filtration mechanism to exclude data points labeled as "unknown," the integrity and clarity of the visual output are preserved, thus enabling a more focused analysis of geographically pinpointed data. This foundational stage is critical not only for laying out the interactive map's basic framework but also for setting the stage for more detailed and nuanced visual models that delve into the specifics of each terrorist attack. From this visualization, I was not surprised to discover the same patterns during my exploratory analysis.

Interactive Map of Suicide Terrorist Attacks Along Isreal and Palestine

The map event points enables users to interact with suicide terrorist attacks to retrieve detailed statistics about terrorist events in various regions, countries, or cities.

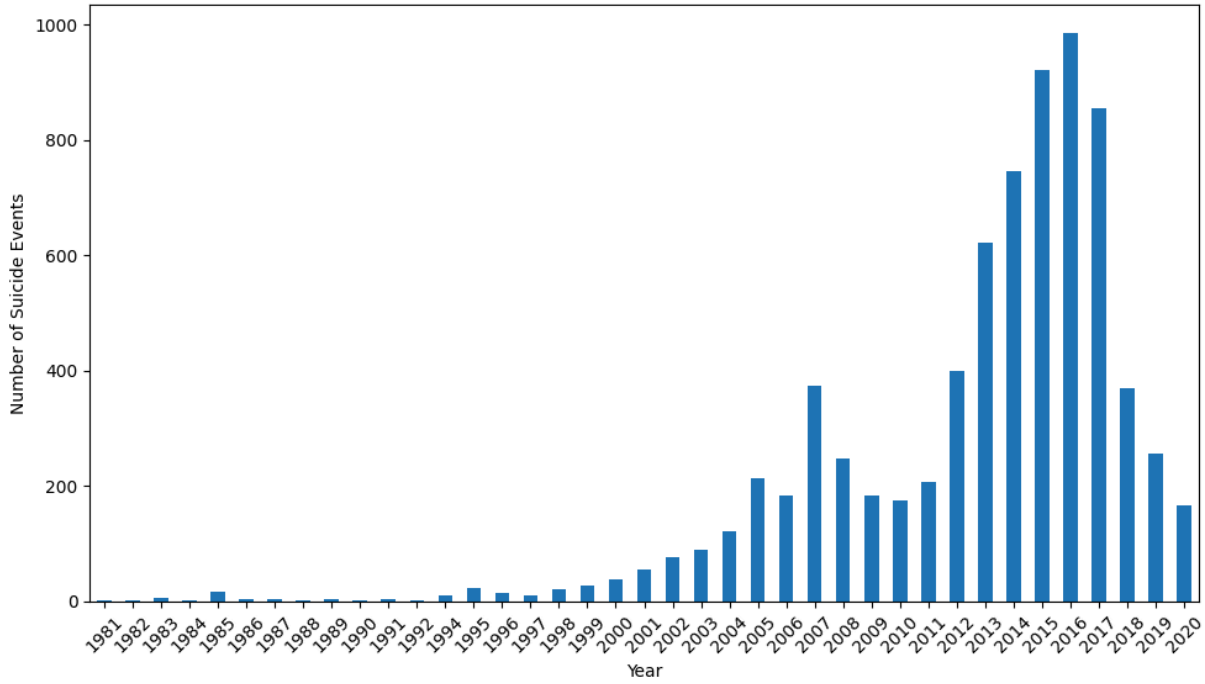
This interactive map is a representation of the Gaza Strip and the bordering areas of Palestine and Israel, which indicates the concentrated occurrence of suicide terrorist events in this region, and underscores the long-standing tensions and violence characterizing the Israeli-Palestinian conflict. Since the dataset only includes events between 1981 and 2020, this analysis will not be mentioning the recent escalating violence, particularly in the West Bank and Israel. However, the event points on the interactive map do reflect a history of upheaval and highlight significant periods of increased violence and military engagement, which often correlate with broader geopolitical developments, strategic targeting, and efforts at peace negotiations that have, to date, failed to resolve the conflict, which long originates before the creation of the GTD. The interactive map aims to provide insights into the recorded peaks of conflict intensity which could potentially be attributed to particular events or policy changes through cross-referencing schemes.

Analytics would be powerful for analyzing the history of conflict in this area, which is deep-rooted, tracing back to the late 19th and early 20th centuries with the rise of Zionism and the arrival of Jewish settlers in Ottoman Palestine. The local Arab population resisted, concerned about displacement and dispossession. The Balfour Declaration of 1917 by Britain, supporting the establishment of a Jewish homeland in Palestine, and the subsequent British Mandate after the Ottoman Empire's fall, further intensified the conflict. These conflicts reached their focal point in

1948, just one day after Israel's declaration as the first Jewish state in over 2,000 years. This is when conflict broke out between Israel, Jordan, Iraq, Syria, Egypt and Lebanon, which ended with Egypt gaining control of the Gaza Strip. Palestinians were displaced from their homes, and later Israel gained control over Gaza during the Six-Day War in 1967. Despite Israel's withdrawal following the Oslo Peace Accords in 2005, the region remains contested, especially after Hamas took control in 2006. Gaza has since seen numerous violent confrontations, including rocket fire and military operations, highlighting the persistent struggle for control [18].

The addition of a dashboard with interactive graphs would allow users looking at groups of events to subsequently visualize trends in the localized data, according to categories such as date, target selection, the choice of weaponry, and location. The dashboard's graphs include a bar graph timeline of visible events, much like the very first bar graph I created during my exploratory data analysis report. This graph ("*Trend of Suicide Terrorist Events*") analyzes the prevelance of suicide attacks, showing how the frequency of suicide attacks has risen almost exponentially with a steep decrease in attacks since 2018. For each year, between 2013 and 2017, over 600 suicide attacks were recorded by the GTD. The amount of suicide attacks peaked in 2016, reaching nearly 1,000 events. This can be helpful to understand trends over time, particularly when observing trends in specific regions or cities.

Trend of Suicide Terrorist Events (1981-2020)

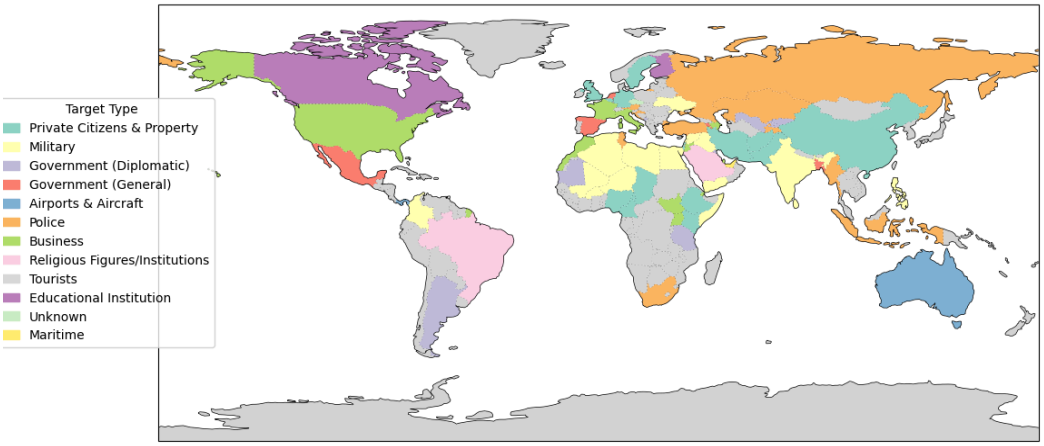


Analysis conducted with Pandas; the trend visualized using Matplotlib, illustrating the rise and fall in the frequency of suicide terrorist events over four decades.

A major concern for the dashboard tools is that they need to communicate nuanced contexts. These nuances, which were observed during my exploratory analysis, should not be generalized to all suicide terrorist events globally. Thus, visualizations must ensure the meticulous parsing of

relevant data, so that it can be easily plotted on any type of visualization. For instance, the below map ("*Spatial Distribution of Predominant Targets in Suicide Terrorist Attacks*"), presents the most common types of targets for terrorist attacks, such as private citizens, military, police, and government institutions. The map illustrates the diversity of targets selected by terrorists, which may reflect the groups' operational objectives, ideological motivations, and capabilities. The following word cloud processes more data columns pertaining to the targets of events to visually emphasize the most frequent targets in the dataset. Ideally, such data would be used to visually represent the main target(s) for suicide terrorism within a single datapoint or a group of events.

Spatial Distribution of Predominant Targets in Suicide Terrorist Attacks



Target types processed through data categorization, displayed on a world map with the Set3 color scale representing varied terrorist attack targets ('targetsubtype'), indicating tactics and motivations.

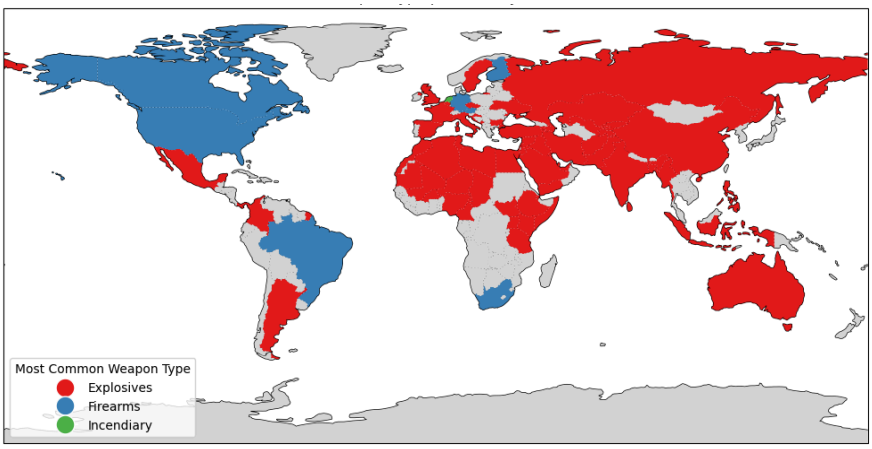
Word Cloud of Target Types in Terrorist Attacks

Generated using the Python WordCloud library, this word cloud represents the frequency of target types mentioned in terrorism data ('corp1', 'corp2', 'corp3', 'target1', 'target2', 'target3'). The script analyzes the dataset, normalizes text entries, and uses size differentiation to visually convey the data.

Another aim is for the dashboard to show trends pertaining to attack type or weapon. There are different approaches I could potentially take. One idea is to separate attacks by the weapon used; however, I found that nearly all terrorist attacks use explosives or firearms. Incendiary devices are

also a prevalent weapon used for suicide attacks. The map presents the methodologies of violence preferred in different regions, which can potentially be linked to the availability of weapons, the nature of conflicts, and other strategic aims.

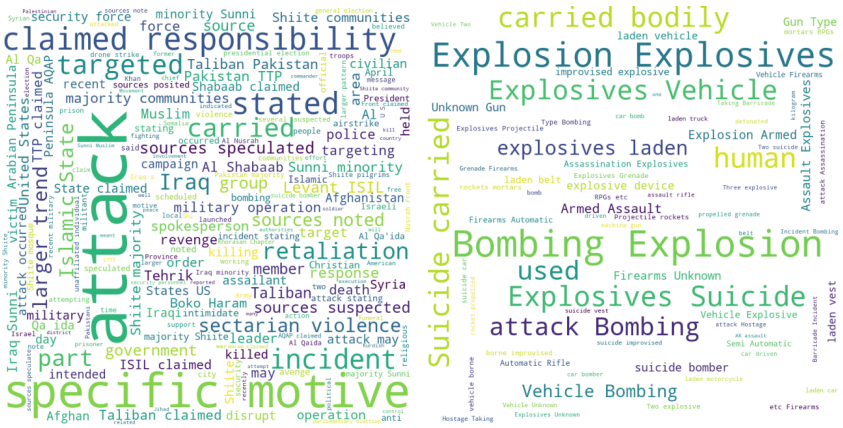
Spatial Distribution of Predominant Weapon Types in Suicide Terrorist Attacks



This map was created with Python, utilizing Matplotlib for plotting and Cartopy for geospatial data representation. It classifies the most common weapons ('weaptype1_txt', 'weaptype2_txt', 'weaptype3_txt') used in terrorist attacks.

Due to the stark division in weapons, I then analyzed specific strategies and motives. Unfortunately, such qualitative data types require more normalization before they can be accurately graphed. The first word cloud selects phrases most commonly parsed within the 'motive' field of the GTD. The second word cloud uses various fields related to the details of the weapons used and the type of attacks. The second cloud seems to have blank spaces, emphasizing the need for further normalization of empty data cells.

Word Clouds of Motivations and Weapon Types



These word clouds were produced using Python's WordCloud library. The first showcases the most frequently cited motivations ('motive') and the second features weapon details ('weaptype1_txt', 'weaptype2_txt', 'weaptype3_txt', 'weapsubtype1_txt', 'weapsubtype2_txt', 'weapsubtype3_txt', 'weapdetail', 'attacktype1_txt', 'attacktype2_txt', and 'attacktype3_txt') in terrorist attacks.

To conclude, the operational profiles of suicide terrorist tactics, have evolved over the years, influenced by changing geopolitical landscapes, technological advancements, and ideological shifts. Initially, such attacks may have been more sporadic and less technologically sophisticated, often aimed at symbolic targets or to cause widespread fear. Over time, with increased global security measures and counterterrorism efforts, these organizations have adapted, sometimes increasing the complexity and lethality of attacks.

The rise of religiously motivated groups in the late 20th and early 21st centuries saw an uptick in suicide bombings, particularly in conflict zones like Iraq, Afghanistan, Pakistan, and Nigeria, where such tactics were employed to maximize casualties and media impact. In recent years, there has been a noticeable shift in terrorist methodologies due to the fragmentation of large groups into smaller, more autonomous cells, and a marked increase in solo-actor attacks, which often utilize easily accessible weapons like firearms rather than explosives. The analysis of data such as target selection, weaponry choice, and location is crucial in understanding these patterns and predicting future shifts in terrorist operations.

2. *Can we distinguish the operational and ideological characteristics of the most active terrorist groups, particularly with regard to the strategic use of suicide tactics compared to individual actors in less organized attacks?*

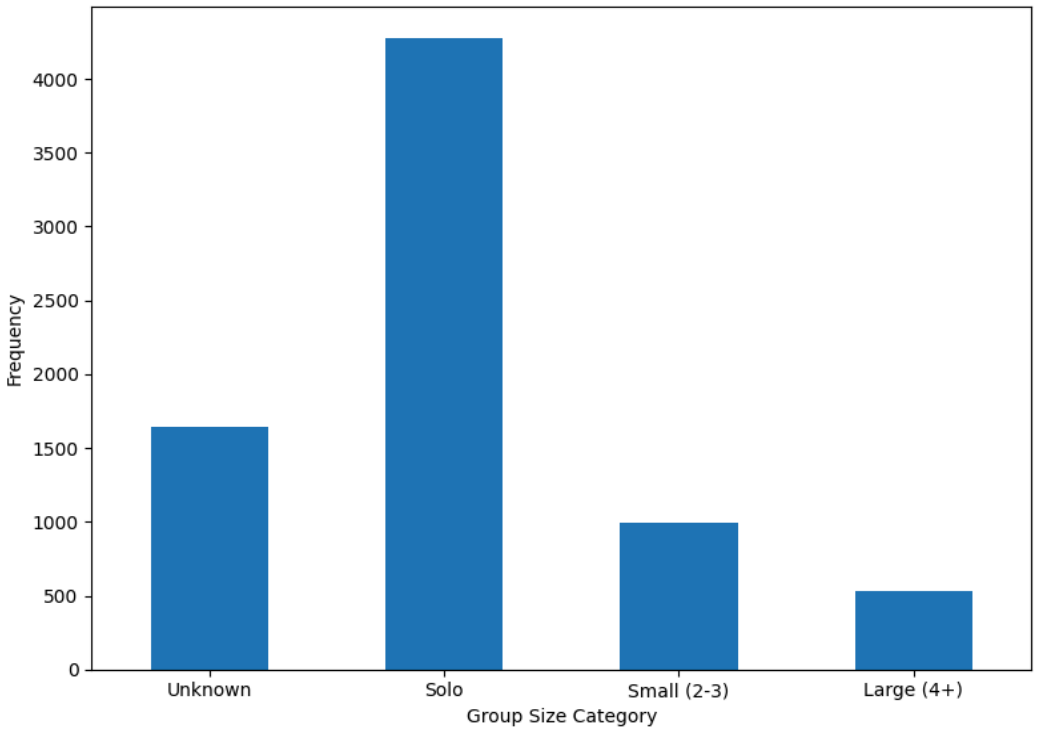
The operational and ideological characteristics of the most active terrorist groups, particularly regarding the strategic use of suicide tactics, can be discerned through a combination of interactive charts. These visualizations would delve into the prevalence, group size, casualty impact, property damage, target selection, and group prominence of suicide terrorist attacks, providing insights into the evolution of terrorist strategies.

Key to this development is the incorporation of marker details that provide a rich tapestry of information for each plotted attack, including the number of events per marker, date range, fatalities ('nkill'), injuries ('nwound'), and details regarding the number of perpetrators ('nperps'). This multifaceted approach ensures that users are not just presented with raw data but also offered a contextual analysis that enriches their understanding of each incident. My reason for focusing on the number of perpetrators is twofold. For one, my hypothesis is that the number of perpetrators is directly related to the strategic impact of terrorist attacks. I also believe that different regions, with varying ideologies, access to weapons, and systematic challenges, will be presented with a differing number of perpetrators. For instance, countries faced with a civil war may result in a higher rate of perpetrator influence, while countries more isolated from such contexts may show a higher rate of individual actors per event.

For this analysis, bar graphs can be created in an attempt to explore the organization of terrorist events, with specific regard to the size of the groups (‘nperps’) which strategize these acts of aggression. During my exploratory analysis, I created two bar charts to illustrate the distribution and casualty-rate of attack group sizes, providing insight into the most common sizes of

perpetrator groups. This first graph ("*Distribution of Suicide Terrorist Attacks and Group Sizes*") ensured that solo attackers, small groups, and groups with four or more members were distinctly categorized, enhancing the clarity of observed trends. When the specific number of perpetrators is unavailable, an "unknown" value is present. Most commonly, suicide attacks are committed by solo offenders.

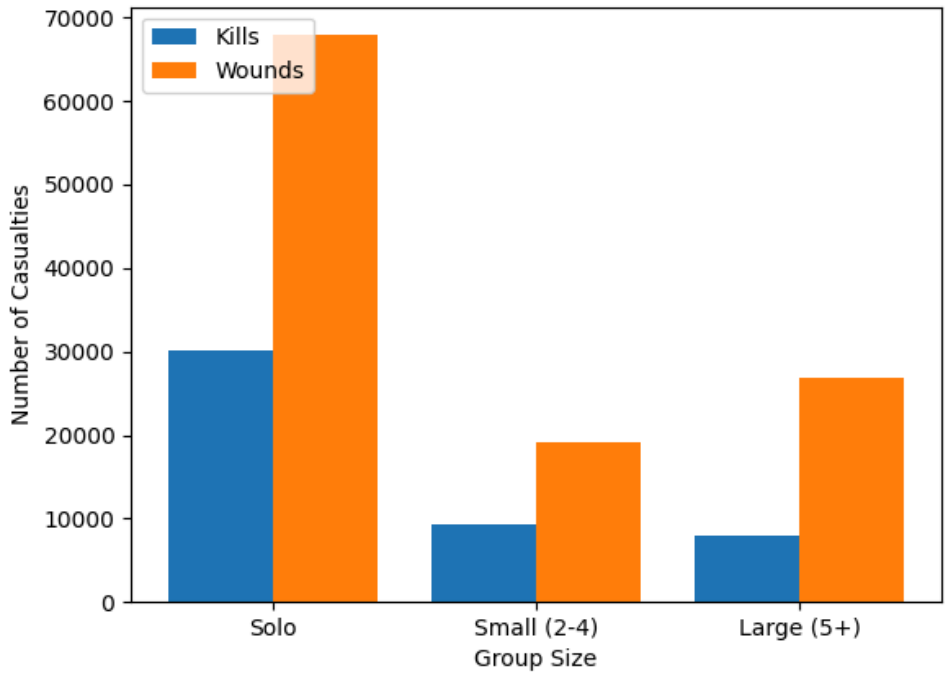
Distribution of Suicide Terrorist Attacks and Group Sizes



Dataset processed with Pandas; visualization of group sizes performed using Matplotlib for bar chart creation, with clear categorization of solo attackers, small groups, and larger groups, including a provision for unknown group sizes.

The second bar graph ("*Distribution of Casualty Impact and Group Sizes*"), on the next page, shows that, since solo attackers are more common, they are seemingly more impactful, particularly while observing the provided visualization. To avoid any red-herrings, I decided that such data should be presented differently. I decided to add marker details for each event point on the interactive map, specifically to show the sum and average of fatalities, injuries, and perpetrators. That way, group size cannot be generalized within the entire dataset and is provided more relativity while being analyzed. Groups of attackers, regardless of number, typically present a similar number of casualties. I hypothesize that larger groups may have greater access to resources, thus are well strategized and deal more injuries than small groups.

Distribution of Casualty Impact and Group Sizes



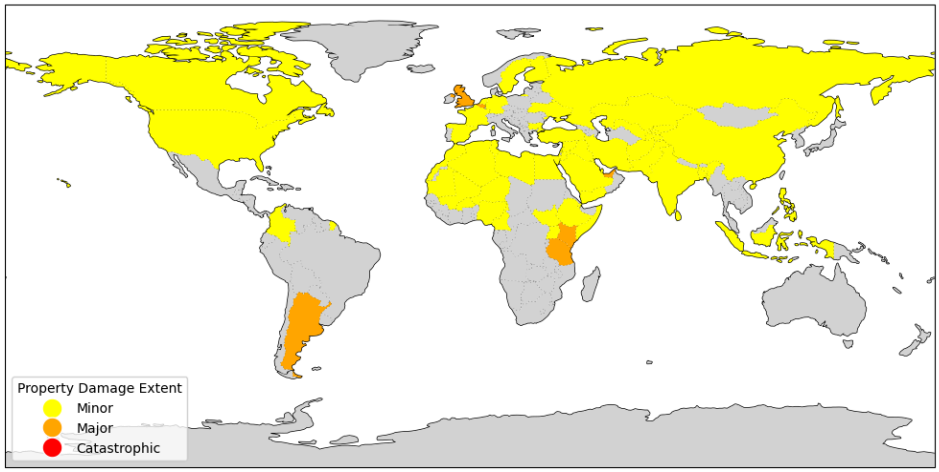
The data was grouped and aggregated using Pandas; the bar chart visualization, depicting casualties in terms of kills and wounds by group size, was created using Matplotlib, highlighting differences in impact between solo actors and groups.

The interactive map is bolstered by a dashboard with varying analytical capabilities, which provides a multi-dimensional view of terrorism that transcends mere geographical plotting. The integration of graphs forms the crux of the analytics page, featuring charts detailing aspects of the extent of property damage ('propextent_txt'), types of targets ('targsubtype'), attack methodologies ('attacktype'), and organization names ('gname'), which serve as pivotal tools for decoding the complex narrative of terrorism, including common motivations, strategies, targets, and resources. In the future, I would like to create an ability for users to switch out charts to visualize information in various forms, such as pie graphs, word maps, stacked bar charts, scatter plots, line graphs, or correlation matrices. These visual aids will be meticulously designed to not only present quantitative data but also to facilitate a qualitative assessment of terrorism's evolving landscape. These graphs are still yet to be properly connected to the dataset, as my efforts were faced with many technical hurdles and my overambitious work-ethic.

To reflect on these results, during my exploratory analysis I created a map which illustrates the extent of property damage ('propextent_txt') in different countries due to terrorist attacks. It categorizes the extent of damage by minor, major, and catastrophic, highlighting the financial impact of terrorism. These damages are rated by their reported cost of damages. Damages worth over a billion United States Dollars (USD) are categorized as catastrophic, while damages under a million USD are categorized as minor. The following stacked bar chart compares the extent of property damage across the categorized attacker groups. It highlights the severity of damage in relation to the number of perpetrators. As previously observed, solo attackers seem to cause the

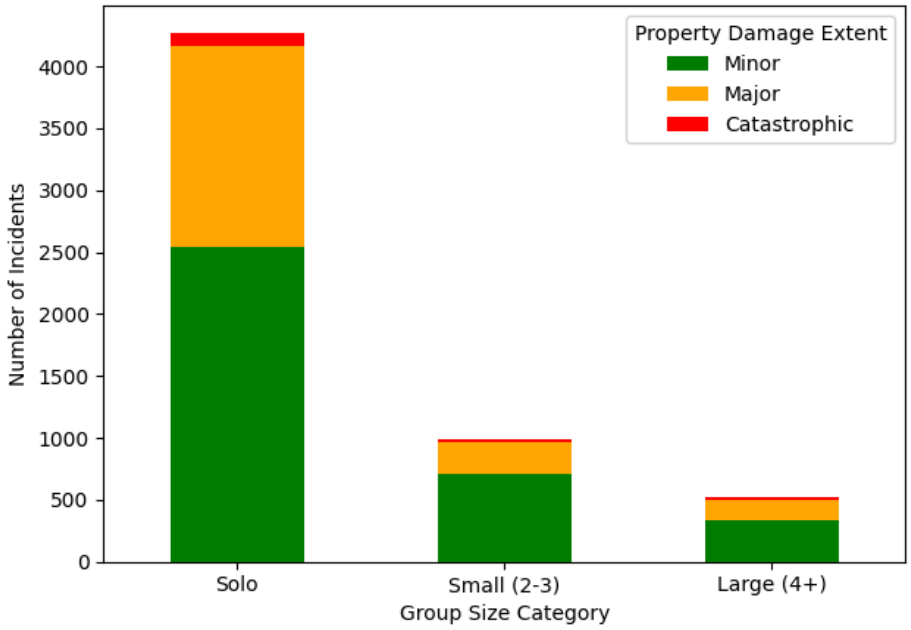
majority of incidents. This data might indicate that while large groups can carry out damaging attacks, individual actors are also capable of causing significant harm.

Spatial Distribution of Average Property Damage after Suicide Terrorist Attacks



The extent of property damage ('propextent_txt') by terrorism was classified and mapped using Pandas and Matplotlib, with Cartopy providing geographical mapping capabilities. Colors represent varying degrees of damage, from minor to catastrophic.

Distribution of Property Damage Severity and Group Sizes



Using Pandas for data processing and Matplotlib for visualization, this chart indicates property damage ('propextent_txt') severity against the size of terrorist groups ('nperps') , with color coding for the scale of damage.

To conclude, distinguishing the operational and ideological traits of active terrorist groups, especially regarding the strategic implementation of suicide tactics versus the actions of less

coordinated individual attackers, is feasible by analyzing various data visualizations that capture the complexities of terrorist activities. By examining group sizes through bar charts, which segregate solo attackers from small and larger groups, one can infer the strategic impact and prevalent ideologies, as solitary attackers often hold significant destructive potential, possibly due to stealth and surprise or radical self-motivation.

These visual representations, alongside stacked bar charts reflecting casualty impact, suggest that larger groups might employ suicide tactics as part of well-resourced operations, potentially to inflict mass casualties or significant property damage. Such analytical insights are augmented by an interactive dashboard which allows users to explore the specifics of attacks, including fatalities, injuries, and the number of perpetrators, offering a richer, contextual understanding of terrorism's fabric. When assessing the data on property damage and its correlation with group size, one might conclude that individual actors, while less organized, can enact considerable harm, analogous to the damage wrought by larger groups. The interactive maps and accompanying pie charts that illustrate property damage, target types, and the spread of terrorist organizations can elucidate the operational characteristics and ideological underpinnings of these groups, painting a picture of the varied and evolving nature of terrorist strategies.

3. *What distinct operational patterns emerge when comparing suicide attacks orchestrated by large terrorist organizations with those committed by small extremist groups and individual actors?*

Operational patterns in suicide attacks show a shift from early uses of this tactic as a strategic military substitute to its current role as a tool of insurgency and ideological warfare. The evolution of suicide terrorism has seen groups like Hezbollah in the 1980s use suicide bombings as both a theological expression and a practical military strategy, especially when other tactical successes diminished. This is the first strings of suicide attacks that can be observed in the GTD and they are located in Lebanon. The very first recorded suicide attack was committed on December 12th, in 1981. For the next nine years, until November 25th, 1991, a long string of suicidal attacks emerged in Lebanon; peaking in 1985 with a recorded 16 attacks. This string of suicide terrorist attacks in Lebanon reveals a consistent pattern of violence and conflict within the country, especially concentrated in key areas such as Beirut, Tyre, and Sidon.

The prevalence of bombings and explosions as the primary mode of attack indicates a strategic choice for these operations, pointing towards an ongoing confrontation with a focus on high-impact methods. Targets of these attacks are predominantly governmental, military, or diplomatic, including embassies, military headquarters, and checkpoints. This targeting pattern underscores the intent to strike at symbols of authority, governance, and foreign presence,signaling the objectives of the groups involved. The recurring use of suicide tactics, particularly vehicle-borne explosives, demonstrates a calculated approach to terrorism that seeks to maximize both damage and symbolic impact. High casualty figures in several incidents reflect the severity of these attacks, with significant implications for both the local population and broader security dynamics. Additionally, the data shows extensive property damage, often

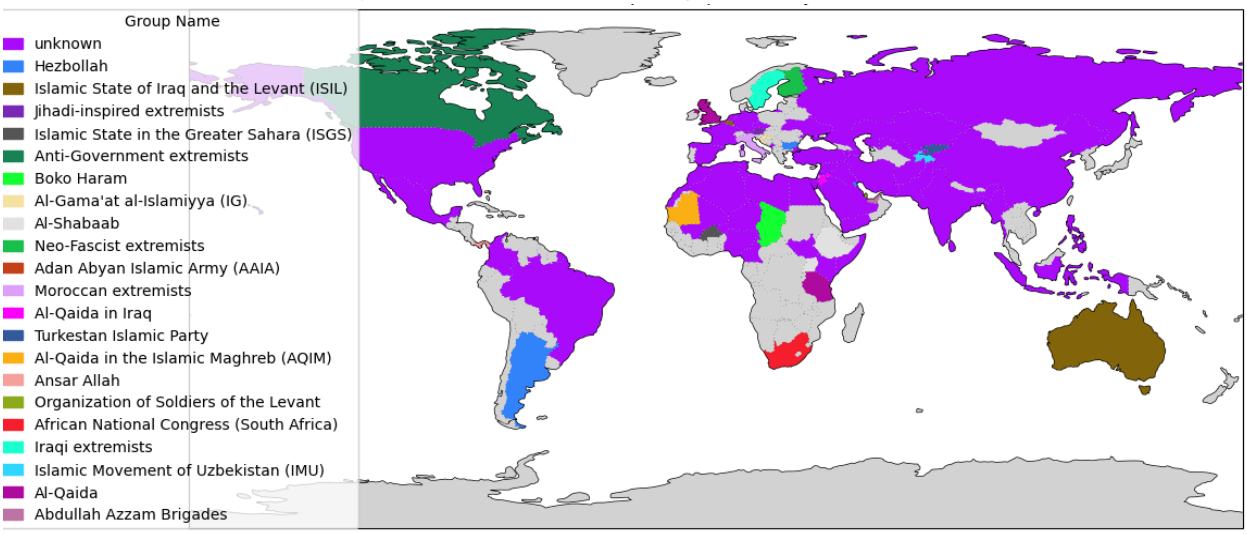
resulting in the complete destruction of the targets, which speaks to the intensity of the attacks. Repeated mentions of groups such as Hezbollah and the Syrian Social Nationalist Party indicate the prominence of their roles in the conflicts. Challenges in attributing responsibility for these incidents are also apparent, with multiple groups claiming responsibility and authorities expressing doubts over such claims. This uncertainty in attribution hints at the complex interplay of motivations and allegiances in Lebanon's conflict scenario. During this time, Lebanon was experiencing a civil war that had begun in the mid-1970s and lasted until 1990 [16]. This war was multifaceted, involving sectarian divisions, political strife, and foreign interventions, which contributed to the country's instability. The Lebanese Civil War was characterized by the fragmentation of society along religious and political lines, with various factions vying for power, including Christian and Muslim militias, the Lebanese Armed Forces, and Palestinian groups. The war was also marked by the intervention of regional powers, such as Syria and Israel, each supporting different militias or forces within Lebanon. The presence of Palestinian militants and the Palestine Liberation Organization (PLO) in Lebanon led to Israeli military interventions, including invasions in 1978 and 1982 aimed at rooting out the PLO. Further research reflects that various groups such as Hezbollah, the Lebanese National Resistance Front, Khalid ibn Walid, the Syrian Social Nationalist Party, the Arab Socialist Baath Party, and the PLO were involved with these attacks which often targeted military and governmental entities, including embassies, military checkpoints, and army posts. Notably, the United States and French forces, part of the Multinational Force in Lebanon, were also targeted during this period, in the 1983 Beirut barracks bombings.

This trend of suicide attacks, re-emerging in the 1980s with Hezbollah, spread to other groups like the Tamil Tigers, who adopted it for military-style operations, targeting hard locations and personnel rather than civilians. In recent years, groups such as ISIS and al-Qaeda have continued to orchestrate attacks with varying success. ISIS, despite losing territory and leaders, maintains its global network, using media to inspire lone attackers, demonstrating an operational shift toward leveraging individual actors capable of executing their strategies. This indicates a pattern where centralized large terrorist organizations enable individual actors to carry out attacks in the West and regions of strategic interest, aligning with the groups' long-term objectives but adapted to their current capabilities and counterterrorism pressures. Al-Qaeda, while having faced significant losses including the death of its leader, still influences a broad network of affiliates with a more decentralized leadership structure. They are implicated in attacks that are bold and increasingly threaten capital cities, showcasing an operational shift to more audacious and regionally-focused attacks. This suggests that while the operational profiles may differ in scale and method between larger groups and individual actors, the ideological underpinnings remain consistent, with both employing suicide tactics as a means to project power and influence.

The following map and word cloud displays the most common terrorist organizations by country. This visualization informs us about the geographical spread and prominence of different terrorist groups across the world. This process concentrates on the names of the organizations involved. Without surprise, the most common terrorist groups indicate the aforementioned organizations,

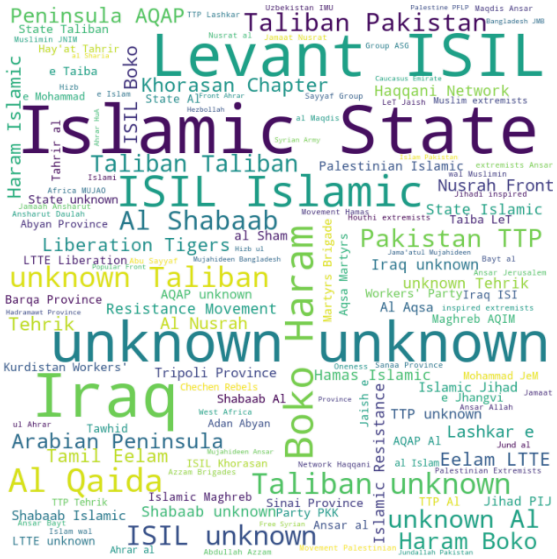
Al-Qaeda and Hezbollah, as global organizations which likely have military-grade resources. Most notably, organizations which are unknown indicate that no terrorist organizations claimed a large majority of attacks, or that these attacks were organized by individual actors. The severity of attacks and their subsequent weapons may be scrutinized to determine the effectiveness of individual actors in certain locations.

Spatial Distribution of Predominant Terrorist Organizations in Suicide Terrorist Attacks



Utilizing Plotly and Matplotlib for mapping, this visualization assigns the Alphabet color scale to the most frequent terrorist groups ('gname', 'gname2', 'gname3') by country, illustrating their global dispersion and regional dominance.

Word Cloud of Predominant Terrorist Organizations



This visualization was created using the WordCloud Python library, which processes text data to display the prominence of terrorist group names ('gname', 'gname2', 'gname3'). The script employs natural language processing techniques, normalizing entries like "unknown."

It's important to evaluate whether the data elements can be related or linked to each other to answer research questions effectively. This involves identifying common identifiers such as date, location, and individual/group name, which enable cross-referencing or linking of data points within the dataset. The timeframe over which these attacks occur indicates a prolonged period of unrest, with terrorist activities persisting over several years. Leveraging this information, we will be able to see a clear shift in the operational patterns of suicide attacks carried out by large terrorist organizations versus those by smaller groups or individual actors. The earliest recorded suicide attacks, employed by groups like Hezbollah, were organized to be a mix of theological statement and tactical military operation. The concentration of such attacks in conflict zones like Lebanon during its civil war is indicative of their strategic use against military and governmental targets. In contrast, modern-day groups such as ISIS have utilized media to inspire individual actors, indicating a strategic pivot to remotely empower lone attackers in line with the group's broader objectives but responsive to their diminished capabilities and increased counterterrorism efforts. Al-Qaeda's evolution also reflects this trend, as it has moved towards enabling regional affiliates to conduct more ambitious attacks, often in capital cities, suggesting a shift towards audacity and regional focus.

To conclude, these operational shifts are encapsulated in the provided visualizations, which plot the frequency and spread of attacks by various organizations and highlight their tactical evolutions. For example, the spatial distribution maps and word clouds concentrate on the names of terrorist organizations, reflecting their geographical and operational prominence. These can serve to emphasize the prevalence of certain groups and the operational shifts within individualized tactics, supported by data on the nature of attacks, targets, and the scale of operations. Moreover, the analysis of group sizes and casualty rates provides insight into the effectiveness of different attack strategies, where larger groups potentially access greater resources to cause more significant damage, while smaller groups or individuals still manage to execute impactful operations. Thus, while methods and scales may vary, the underlying ideological motivations remain consistent, which can be leverages to understand why suicide attacks may be a potent method of warfare in a certain region.

4. *Is it possible to categorize suicide attacks based on their characteristics and identify patterns that are specific to the geographical locations where they occur?*

Patterns specific to geographical locations in suicide attacks can indeed be categorized and analyzed. Historical data suggests that operational patterns of terrorist groups are influenced by various factors, including ideological beliefs, strategic goals, available resources, and local socio-political contexts. For instance, in regions with ongoing conflicts or where state control is weak, such as parts of the Middle East, South Asia, and Africa, large terrorist organizations might have the capacity to execute complex suicide operations, often aiming for maximum casualties and widespread damage to signal their strength or oppose governmental forces.

In contrast, in more stable regions with effective law enforcement, isolated individuals or small extremist groups may find it challenging to carry out large-scale suicide attacks. Instead, they might opt for lower-scale, but still lethal, tactics, focusing on softer targets to bypass security measures. The operational patterns in these contexts are often characterized by the use of less sophisticated weaponry and may also include lone-wolf type attacks inspired by larger group ideologies but executed independently. Just last week, a 40-year old homeless man was shot down by police after killing 6 people and injuring a dozen more. All he took with him was a knife for his stabbing spree in a mall in New South Wales, Australia, targeting civilian women and their children because "he wanted a girlfriend and he's got no social skills and he was frustrated out of his brain," according to his father in a statement to the Associated Press [19]. This tragedy won't be recorded in the Global Terrorim Database as a terrorist incident, but it shows how much damage a single actor can do without a predictable plan or motive.

To conclude, geographical categorization and pattern identification of suicide attacks reveal a complex tapestry where large organizations might direct more organized, resource-intensive operations in conflict zones, while smaller entities and individual actors adapt to local circumstances, often in more stable regions, to carry out their attacks. By visualizing the Global Terrorism Database's rich dataset, the project aims to illuminate the patterns, motivations, and impacts of suicide terrorism in a way that is both insightful and accessible. The interactive map successfully embodies this intention, offering a gateway into the vast dataset through geographical exploration. The dashboard, though currently underdeveloped, represents the ambition to not only present data but to analyze and interpret it within the same interface. The goal is to enable users to draw correlations, explore trends, and gain insights without needing to navigate away from the tool or engage in complex data processing independently.

Conclusion:

This comprehensive visualization project hopes to elucidate the intricate dynamics of suicide terrorism through a meticulous analysis of the Global Terrorism Database from 1970 to 2020. The analysis of visualizations in relation to the research questions and the overarching hypothesis demonstrates a methodical approach to understanding the evolution and characteristics of suicide terrorism within the data available from the Global Terrorism Database (GTD).

I answered the first research question by elucidating the concentrated areas of suicide attacks, showing significant hotspots and their evolution over time. The change in prevalence within each category, such as the notable increase in Iraq, Afghanistan, Pakistan, and Nigeria, illustrates a shift towards these regions becoming focal points for such attacks. The data has shown that while some countries exhibit a high frequency of suicide attacks, others have none, indicating varying operational contexts.

Then, I answered the second research question by providing a granular view of the operational size of groups involved in suicide attacks, the number of casualties, and the extent of property

damage. These visualizations suggest that larger terrorist organizations tend to conduct more resource-intensive suicide attacks, possibly due to greater logistical capabilities and strategic goals, compared to smaller groups or individual actors who might carry out attacks with a different scale and impact. By examining the trends of suicide tactics, one can infer the groups' strategic adaptation in response to counterterrorism measures and ideological motivations.

The third research question was answered by underscoring the evolution of suicide attacks from large, organized operations by entities such as Hezbollah and the Tamil Tigers, to the more recent decentralized approach of groups like ISIS and Al-Qaeda. Large organizations have historically carried out complex suicide operations, while smaller groups or individual actors, often inspired by these organizations, have resorted to simpler, yet still impactful tactics. The provided maps and word clouds illustrate the global dispersion of these groups and the operational shifts to individualized tactics, supporting the hypothesis that suicide attacks may be a potent method of warfare in certain regions.

Finally, the fourth research question simply reveals my initial inspiration for the project's visual tool, which categorize suicide attacks based on various operational characteristics and may someday link these patterns to specific geographical locations. Large terrorist organizations tend to execute complex operations in conflict zones, whereas in more stable regions, individual actors or smaller groups adapt their strategies. This supports the hypothesis that suicide attacks are indeed categorizable and that these categories reveal distinct patterns influenced by geography.

In essence, the comprehensive data preparation, normalization, and visualization efforts have effectively addressed the research questions and supported the hypothesis. The visualizations have not only presented applicable data but provided an interpretative analysis that reflects the changes in suicide terrorism over time and across different geographies. The work done thus far lays a strong foundation for further development and research, highlighting the importance of robust and dynamic visual analytics in understanding complex global phenomena like terrorism.

By harnessing advanced analytics and predictive modeling, this investigation has laid bare the operational and ideological underpinnings that characterize the most active terrorist groups, offering an in-depth look into the evolution of suicide tactics and the operational patterns across various terrorist organizations. The findings reveal a notable shift in the operational profiles of terrorist attacks over time, affirming the initial hypothesis that larger, more organized groups tend to exhibit a higher degree of strategic planning and complexity in their use of suicide tactics. This study has not only categorized suicide attacks to highlight geographical influences on their execution but has also provided a nuanced understanding of how different scales of terrorist organizations adapt and evolve their strategies.

The proposed interactive page exemplifies the integration of front-end technologies with back-end processing to deliver a comprehensive analytical tool. The code and resources meticulously selected and developed for this application underscore a commitment to providing

an intuitive, informative, and interactive experience for users seeking to understand the global landscape of terrorism. From the analysis of this vast dataset, such a report has the power to offer valuable insights for policymakers, security experts, and scholars. The impact of such events underscores the importance of continuous and rigorous data analysis in the fight against terrorism, highlighting the evolving nature of terrorist tactics and the necessity of adaptive countermeasures. By understanding the patterns, motivations, and strategies of terrorist organizations, the international community can better anticipate and mitigate the impact of these heinous acts, ultimately contributing to a safer, more secure world.

In conclusion, the analytics page for the Global Terrorism Database project, with its interactive map and envisioned dashboard, is a testament to the potential of data visualization in making complex datasets understandable and engaging. While the project has achieved notable successes, it also faces significant challenges that offer valuable learning opportunities and directions for future development. The journey of this project underscores the iterative nature of developing analytical tools, where feedback, reflection, and continuous improvement are key to achieving the ultimate goal of making data meaningful and accessible to all.

Glossary:

1. **Analytics Page:** A web page or platform that uses data visualization tools like interactive maps and dashboards to present and analyze data, often used in this context to examine the global patterns of terrorism.
2. **Criminogenic:** Factors or situations likely to result in criminal behavior.
3. **Counter-terrorism:** Activities and strategies aimed at preventing, thwarting, and responding to terrorist attacks.
4. **Dashboard:** An information management tool that visually tracks, analyzes, and displays key performance indicators (KPI), metrics, and key data points to monitor the health, performance, or efficiency of a given subject.
5. **Data Preparation:** The process of cleaning and organizing raw data to make it suitable for analysis.
6. **Descriptive Analytics:** The process of analyzing historical data to understand past behaviors and assess how they might influence future outcomes.
7. **Geographical Localization:** The study of the physical location of terrorist attacks to identify patterns and trends based on geographic regions.
8. **Global Terrorism Database (GTD):** A comprehensive database that records detailed information about terrorist incidents worldwide.
9. **Group dynamics:** The interactions and processes within a terrorist organization that influence its members' behavior and decisions.
10. **Ideological Ethos:** The set of beliefs and values that characterizes a particular ideology, motivates groups, and influences their choice of targets, tactics, and strategies.
11. **Interactive Map:** A digital map designed to allow users to interact with the information presented, such as zooming in/out or clicking on markers to reveal more details.
12. **Life-course Perspective:** A research approach that examines an individual's life history through social, psychological, and biological contexts.
13. **Machine Learning:** A method of data analysis that automates analytical model building, enabling computers to learn from and make predictions or decisions based on data.
14. **Marker Details:** Information displayed on the interactive map when a user selects a specific marker, often including data about terrorist events such as the number of fatalities, injuries, and the date range of events.
15. **Martyrdom:** The act of sacrificing one's life for a cause, often glorified by terrorist groups as a noble act.
16. **Multidisciplinary Approach:** Combining or involving several academic disciplines or professional specializations in an approach to a topic or problem.
17. **National Intelligence Council:** A U.S. government agency responsible for providing long-term strategic analysis to senior United States policymakers.
18. **Natural Language Processing (NLP):** A field of artificial intelligence that focuses on the interaction between computers and humans through natural language, used here to filter and refine media articles for relevant information.

19. **Normalization:** A data preparation process that involves adjusting and standardizing data to ensure consistency and accuracy across a dataset.
20. **Operational profiles:** Characteristics and methods associated with terrorist attacks, including tactics, targets, and execution.
21. **Organized Crime:** Criminal activities that are planned and controlled by powerful groups and carried out on a large scale.
22. **Predictive Modeling:** A statistical technique used to predict future outcomes based on historical data.
23. **Psychological Warfare:** The use of propaganda, threats, and other psychological tactics to influence the opinions, emotions, attitudes, and behavior of opposition groups.
24. **Socio-Demographic:** Combination of social and demographic factors such as age, gender, income, and education, used in population analysis.
25. **Socio-Political:** Refers to how societal and political dynamics influence each other and impact various aspects of life, including governance, individual behavior, and collective actions.
26. **START:** The National Consortium for the Study of Terrorism and Responses to Terrorism, a research and education center at the University of Maryland that manages the GTD.
27. **Suicide attack:** A violent attack in which the attacker expects to die in the process.
28. **Suicide Tactics:** Methods of terrorism that involve the perpetrator intending to kill themselves during the commission of the attack.
29. **Terrorism:** The unlawful use of violence and intimidation, especially against civilians, in the pursuit of political aims.
30. **Terrorist Incident:** An act deemed to be terrorism based on criteria such as intent to coerce, intimidate, or convey a message to a larger audience than the immediate victims.
31. **Victimization:** The process of being harmed or adversely affected by a criminal act or other wrongdoing.

Appendices:

[A] Dataset Description:

The dataset includes well-defined variables such as eventid, iyear, imonth, iday, country, region, and attacktype1_txt, among others. Each column has a clear definition, found within the Codebook, indicating what aspect of the terrorist event it describes. Given the extensive list of columns retained for analysis from the Global Terrorism Database (GTD), I'll describe each column based on the GTD codebook information:

GTD ID and Date

- eventid: Unique identifier for the event, combining the date and a sequential case number.
- iyear: The year in which the incident occurred.
- imonth: The month in which the incident occurred.
- iday: The day on which the incident occurred.
- extended: Indicates if the event lasted more than 24 hours (1 = Yes, 0 = No).

Incident Information

- country & country_txt: The country where the incident occurred, with both numeric and textual representations.
- longitude & latitude: The general coordinates of where each event has occurred.
- region & region_txt: Geographic region of the incident.
- provstate: Province or state of the incident.
- city: City where the incident took place.
- vicinity: Indicates if the incident occurred in the vicinity of the location mentioned (1 = Yes, 0 = No).

Criteria for Inclusion

- crit1, crit2, crit3: Criteria based on the nature of the terrorist act, including political, economic, religious, or social goals; intention to coerce, intimidate, or publicize; and actions outside international humanitarian law.
- doubtterr: Indicates doubt about whether the incident qualifies as terrorism (1 = Yes, indicates doubt; 0 = No, no doubt).

Attack Information

- multiple: Indicates if this incident is part of a coordinated series of attacks.
- suicide: Identifies if the incident was a suicide attack (1 = Yes, 0 = No).
- attacktype1 & attacktype1_txt: Primary type of attack; numeric and textual.
- attacktype2 & attacktype2_txt, attacktype3 & attacktype3_txt: Secondary and tertiary types of attack, if applicable.

Target Information

- targtype1 & targtype1_txt, targsubtype1 & targsubtype1_txt: Primary target type and subtype.
- corp1: Corporation or entity targeted.
- target1: Specific target description.
- natlty1 & natlty1_txt: Nationality of the target.

Perpetrator Information

- gname, gsubname: Name and subgroup of the perpetrator organization.
- gname2, gsubname2, gname3, gsubname3: Names and subgroups of secondary and tertiary perpetrator organizations, if any.
- motive: Presumed motive behind the attack.

Perpetrator Uncertainty and Participation

- guncertain1: Reflects uncertainty about the attribution of the attack to the reported perpetrators (1 = Yes, there is uncertainty; 0 = No, there is no uncertainty).
- individual: Indicates if the attack was carried out by an individual not affiliated with a known group (1 = Yes, an individual; 0 = No, not an individual).
- nperps: The estimated number of total perpetrators involved in the incident.
- nperpcap: The number of perpetrators who were captured or killed during the incident or its aftermath.

Claims of Responsibility

- claimmode, claimmode_txt: Coding and textual description for the method of claim if the perpetrators issued a claim of responsibility.
- claimmode2, claimmode2_txt, claimmode3, claimmode3_txt: Coding and textual descriptions for secondary and tertiary claims if multiple claims were made.

Weapon Information

- weaptype1, weaptype1_txt: The general category of weapon used in the incident.
- weapsubtype1, weapsubtype1_txt: A more specific subtype of the weapon used.
- weaptype2, weaptype2_txt, weapsubtype2, weapsubtype2_txt: Additional weapon types and subtypes used in the incident, if applicable.
- weaptype3, weaptype3_txt, weapsubtype3, weapsubtype3_txt: Third set of weapon type and subtype used, if applicable.
- weaptype4, weaptype4_txt, weapsubtype4, weapsubtype4_txt: Fourth set of weapon type and subtype used, if applicable.
- weapdetail: Detailed narrative description of the weapons used.

Casualties and Consequences

- nkill: Total number of fatalities.

- nwound: Total number of injured individuals.
- property: Indicates if there was property damage (1 = Yes, 0 = No).
- propextent & propextent_txt: Extent of property damage.
- propcomment: Comments on property damage.

Hostage and Kidnap Information

- ishostkid: Indicates if a kidnapping or hostage situation occurred (1 = Yes, 0 = No).
- nhostkid: Number of hostages or kidnapped individuals.

Ransom Information

- ransom: Indicates if a ransom was demanded (1 = Yes, 0 = No).
- ransomnote: Notes about the ransom.

Additional Notes and Sources

- addnotes: Additional relevant information about the incident.
- scite1, scite2, scite3: Source headlines and citations for the incident data.

International Logistical Information

- INT_LOG, INT_IDEO, INT_MISC, INT_ANY: Variables indicating the international aspects of the incident.

Recommended Reading:

[1] "Global Terrorism Database 1970 - 2020" [data file]. START (National Consortium for the Study of Terrorism and Responses to Terrorism). https://www.start.umd.edu/gtd

[2] "Global Terrorism Database Codebook: Methodology, inclusion criteria, and variables." (2021 August). University of Maryland. START (National Consortium for the Study of Terrorism and Responses to Terrorism). https://www.start.umd.edu/gtd/downloads/Codebook.pdf

[3] Miller, Erin and Brian Wingenroth. "Global Terrorism Database: Real-time Data Collection Pilot Evaluation." (2023). University of Maryland, START. https://www.start.umd.edu/publication/global-terrorism-database-real-time-data-collection-pilot-evaluation

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