Global Terrorism Database

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MSDS 7330 File Organization and Database Management

Section 405, Group A

**Abstract:** The following is an analysis of the of the Global Terrorisim Database dataset, which enumerates terrorist attacks from 1970 – 2015 and can be located at <https://www.kaggle.com/START-UMD/gtd>. A crucial component of initiating a data analysis is to frame the data in a manner that relational attirbutes can be clearly noted and easily manipulated, which is why Structured Query Language (“SQL”) will be used for this study. The realtional structure of SQL will be essential in analyzing the multiple subtypes of information: geographic, forensic, demographic, political, etc. that are used to describe each terror attack. The dataset contains 137 attributes for 156,772 terrorist attacks, so the transactional speed of SQL is also advantageous. Diving into this dataset, we hope discern if there is geographic clustering of terror attacks and if the burst concentration of those terror attacks trend for an average length of time. If an origin of a burst is discernable, then we may be able to determine external causality from corresponding historical events and possibly a common causality by aggregating the data. We would also want to determine if there are cumulative insights on the types of terror attacks that were used over time and the methodologies in which they were carried out.

1. **Introduction**

In its most basic form, “terrorism” can be defined as using violence to coerce a party into action. With this definition, a great many events could be construed as terrorism. In order to analyze this dataset, it is critical to understand its specific definitions and bright lines for determining terror: "The threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation." Some historical background is needed to understand the full breadth of this data set. If to qualify as terrorism, any act that uses violence as means to an end by any non-government entity would mean that any failed coup in this history of humanity would be in this dataset. Noting that no data is included that exists before 1970, infers that this dataset is exclusively defined by what historians would call “modern terrorism”.

2. Exploring the Data

The file size of the data when downloaded is 29mb. Prior to loading the data, it was useful to explore the data set in its native format. We completed this by performing a text analysis on the 200 most common phrases located in the file. See Figure 1. 1970 
1971 
augus t 
police 
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automatic 
1975 
1974 
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1978 
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residence 
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central 
ex 
automatic 
s tation 
bomb 
car 
residence 
rocket 
branch 
school 
ex 
automatic 
s tation 
branch 
residence 
home 
ex 
automatic 
residence 
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firearm 
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s tation 
1999 
october 
november 
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violence 
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*Figure 1*

From this analysis we were able to make several conclusions based off of decade:

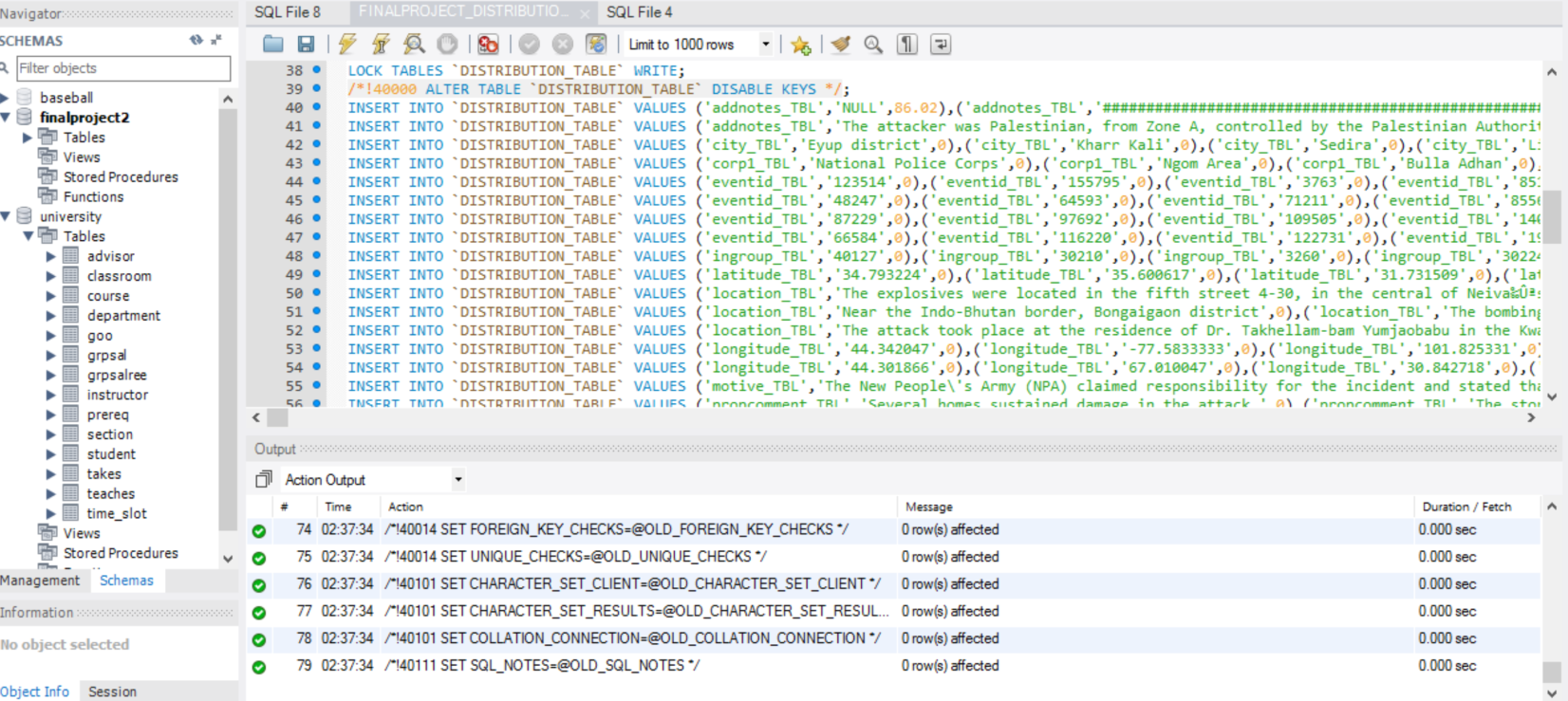
1. 1970s: Catholics vs. Protestants, US, Puerto Rico
2. 1980s: Abortion, Israel
3. 1990s: Turkey, Israel, India

The first conclusion confirms our assertion that the data set is based exclusively off of modern terrorism. It is commonly understood that the inception of modern terrorism originated with in Northern Ireland in the pursuite to disolve the Anglican Church of Ireland. As the dataset starts with a high volume of these attacks, it can only be concluded that the dataset revolves around the modern definition of terrorism.

2. Loading the Data into SQL

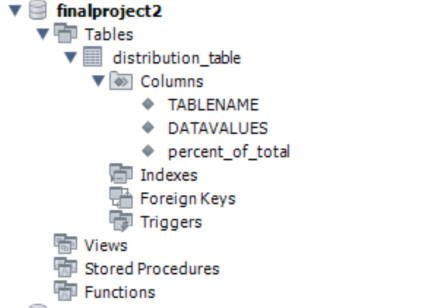
**2.1 Trial and Error**

The best way to determine what to do is to determine what not to do. Initially, we experienced complications in loading the data. We started off by loading the data via a SQL script as indicated in Figure 2.

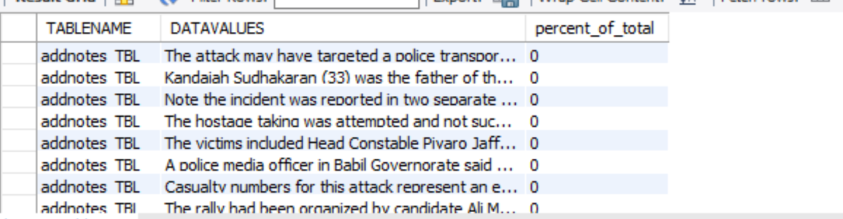


*Figure 2*

However, the data actual data from the Global Terrorism table (“GT) was not imported. The schema that resulted appeared as Figure 3, with no table available and queries would result as Figure 4, that had no useful data



*Figure 3*

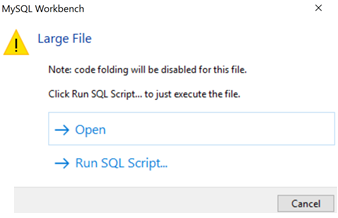


*Figure 4*

**Concerns:** We needed to make each column varchar(MAX) initially. Each column was surrounded by triple quotes, so we cleaned up the data.

**2.2 Successful Attempts**

To remedy this issue, we imported the data into a Microsoft SQL Server database. Afterwards, we wrote scripts to determine the max length of each column, and we altered the column width for each of the 127 columns accordingly. We then used sliding window functions to determine distribution of values for each of the 127 columns. We outputted the distribution of values per column into one table, DISTRIBUTION\_TABLE. Subsequently, we connected the SQL server to MYSQL to transfer the data using SSIS via an ODBC connection. After the data was in MYSQL, we performed a MYSQL dump of the data for the GT (I.e., the global terrorism table) and the DISTRIBUTION\_TABLE and uploaded it into box so that it could be loaded by the other teammates. The resulting file increase the previously 29mb data to a 201mb SQL file (See Figure 5, but it allowed the team to start with the same dataset.



*Figure 5*

Our succesful schema can be seen in Figure 6. A snippit of our GT table can be seen in Figure 7.

finalproject2 
Tables 
gt 
Columns 
Indexes 
Foreign Keys 
Triggers 
Views 
Stored Procedures 
Functions 

*Figure 6*

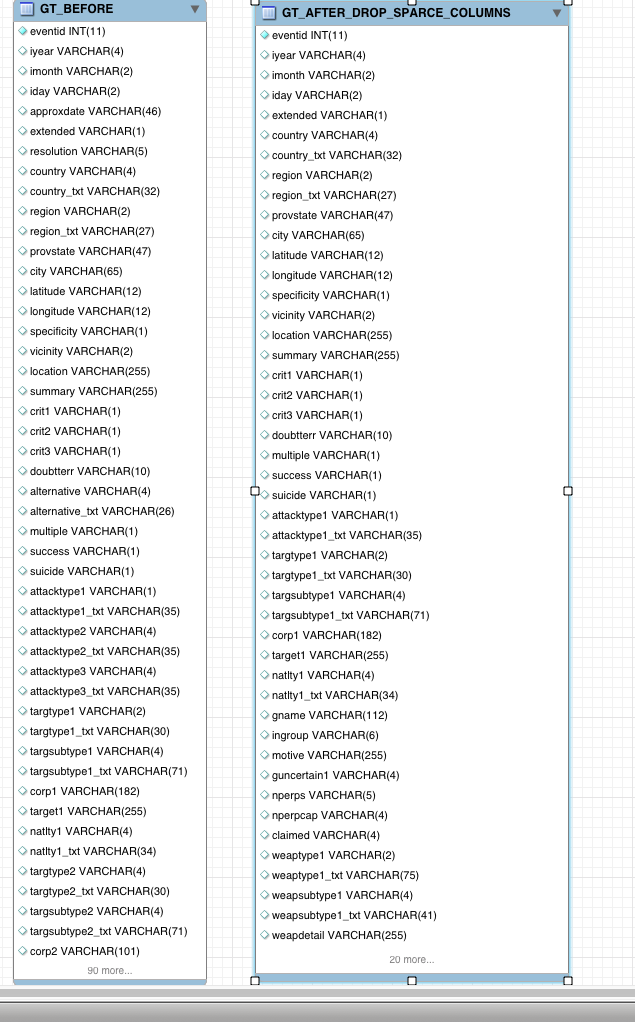
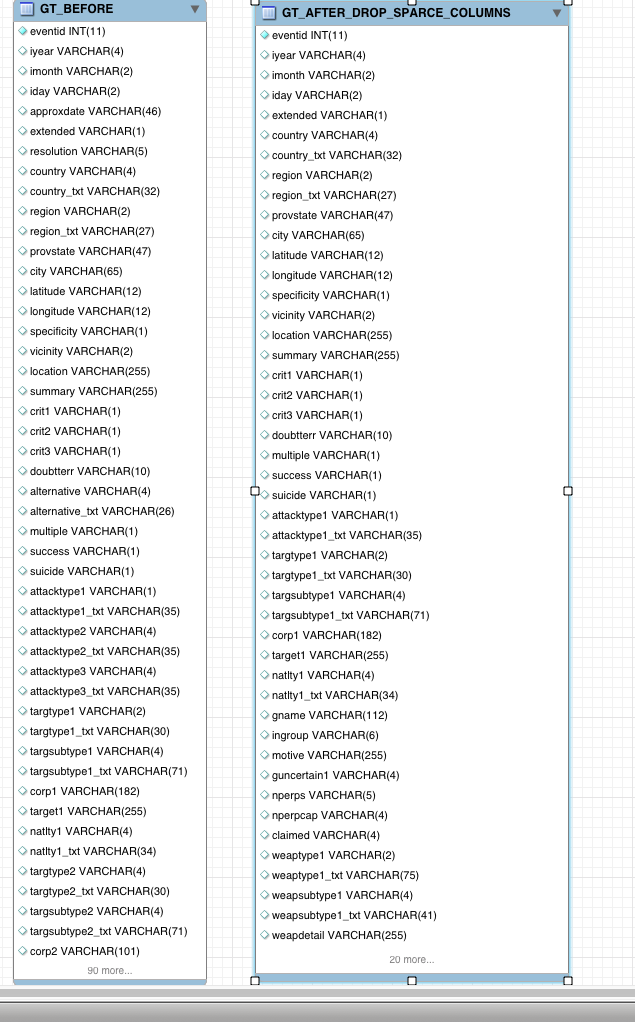
Result Grid 
eventid iyear 
1970 
1970 
1970 
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Central America & C 
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East Asia 
North America 
South America 
North America 

*Figure 7*

**Location of SQL Scripts:** All the scripts that were created to wrangle, and analyze the data can be found here. <https://smu.box.com/s/zhbm2idikopnuhxfvcxtmc880nud5pxa>. There were 22 scripts written to wrangle and profile the data. The SQL dump generated to scripts, which can be found in the “importdataintomysql” folder. The stored procedures and sql used is for both microsoft sql server and mysql

**3. Data Profiling**

Unfortunately, the method of uploading the entire dataset in one table hindered us by inundating us with data. We were bombarded with all 137 attributes, most of which were sparsely populated or NULL. We had to remove data in order to focus on key attributes that may be able to help us in determining correlation and causation. The criterion for sparseness was that 80% or more of the column was NULL or contained ‘.’. We then created alter tables for the sparse columns and dropped them. The final result left us with 66 attributes and almost a 52% reduction in inutile attributes. See Figure 8.

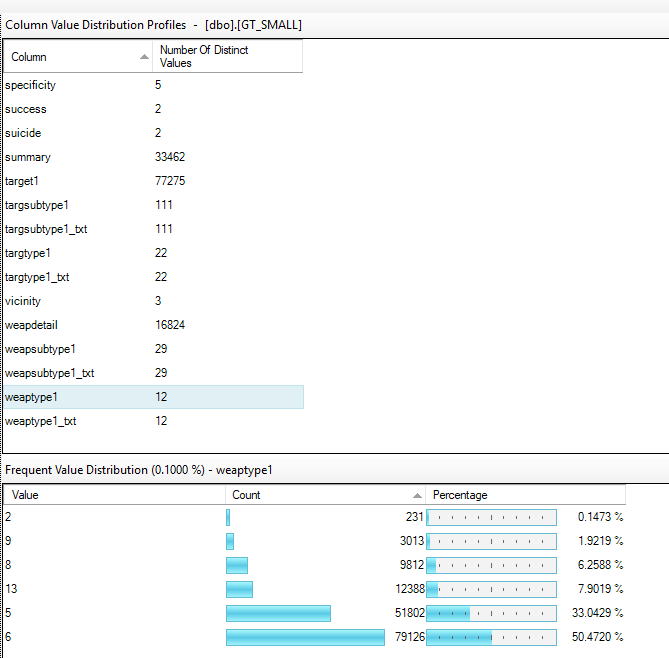


*Figure 8*

At this point, the table was ready for normalization.

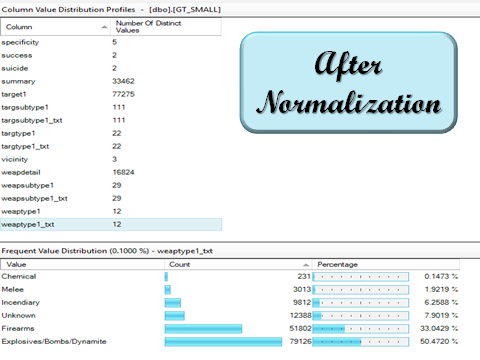
**4. Data Normalization**

The data was profiled using SQL Server Data Profiler (see Figure 9).

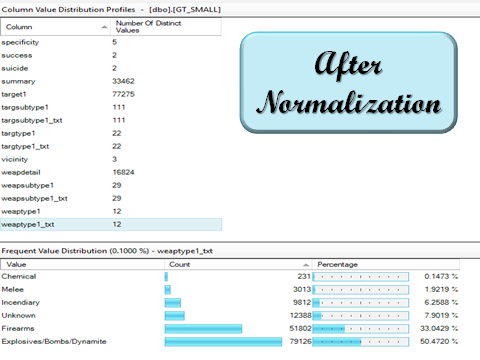


*Figure 9*

The profiler suggested that nine tables could be extracted from the large GT table. Individual tables were created using the columns from GT. These nine individual tables were validated by joining back to GT. The redundant columns were dropped form GT because they had been moved to the individual tables. Primary keys were created on the nine tables. From there, indices were created on the join columns in the GT table. Finally, a nine-way inner join was performed with the GT table to validate that everything has worked correctly. The profile after normalization is available on Figure 10 and 11.



*Figure 10*

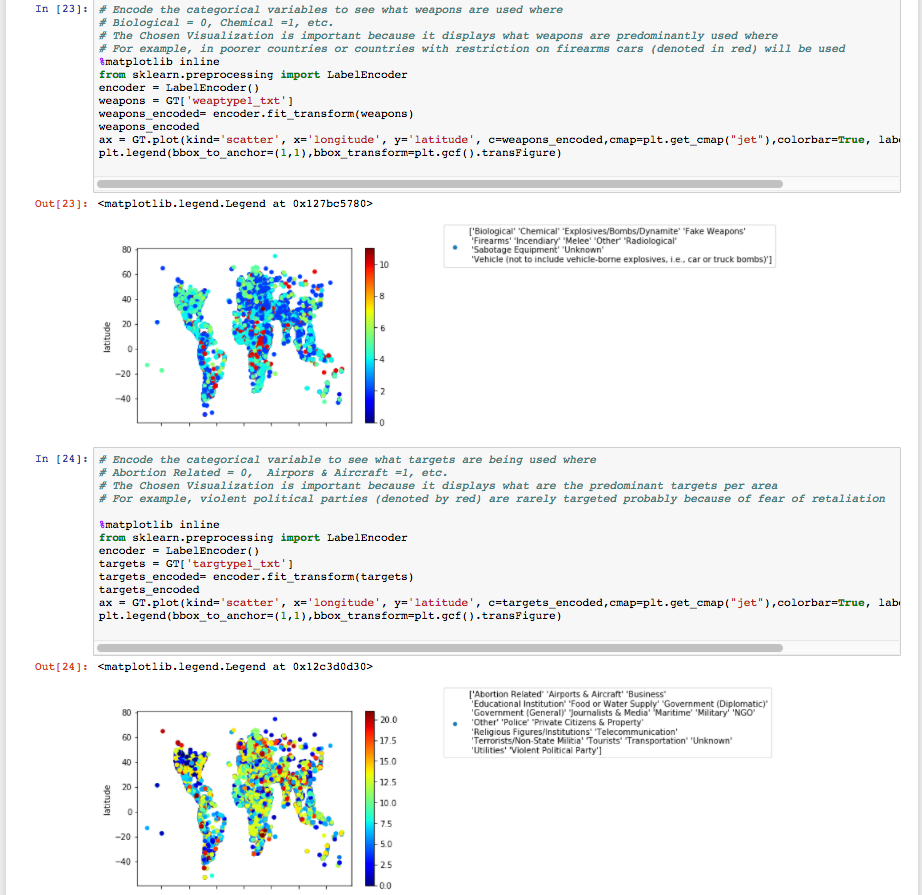


*Figure 11*

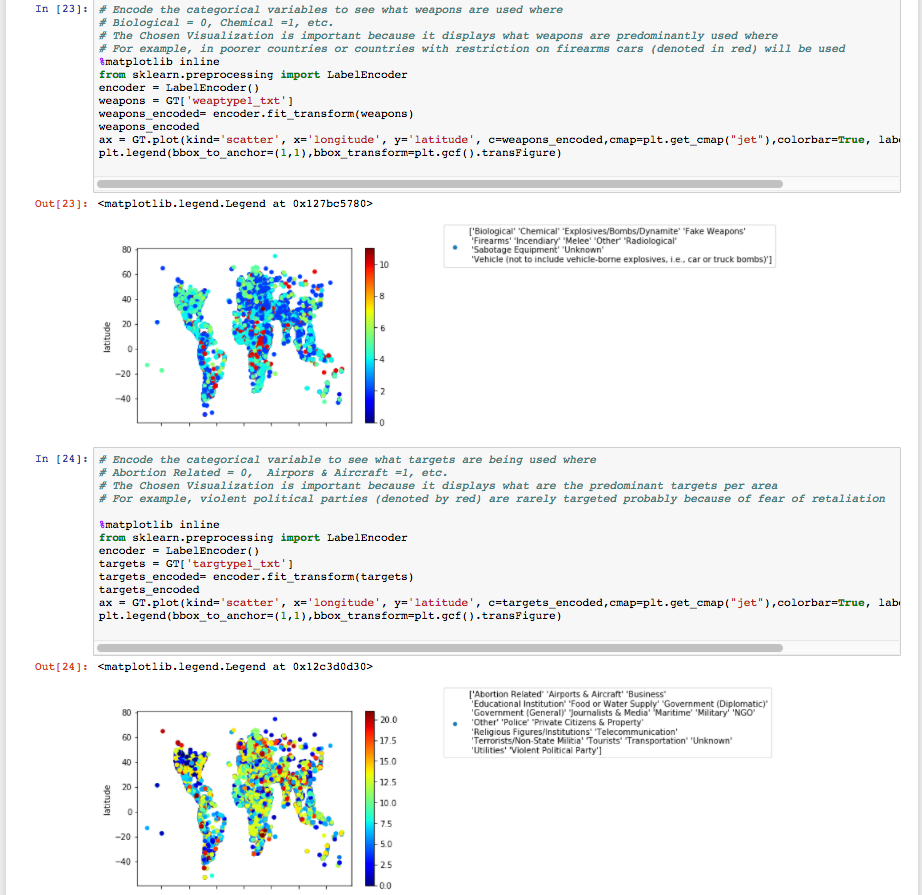
**5. Data Analysis**

**5.1 Python**

Unfortunately SQL is limited in its ability to perform visualizations. To append our analysis, we used python. See Figure 12 and 13.

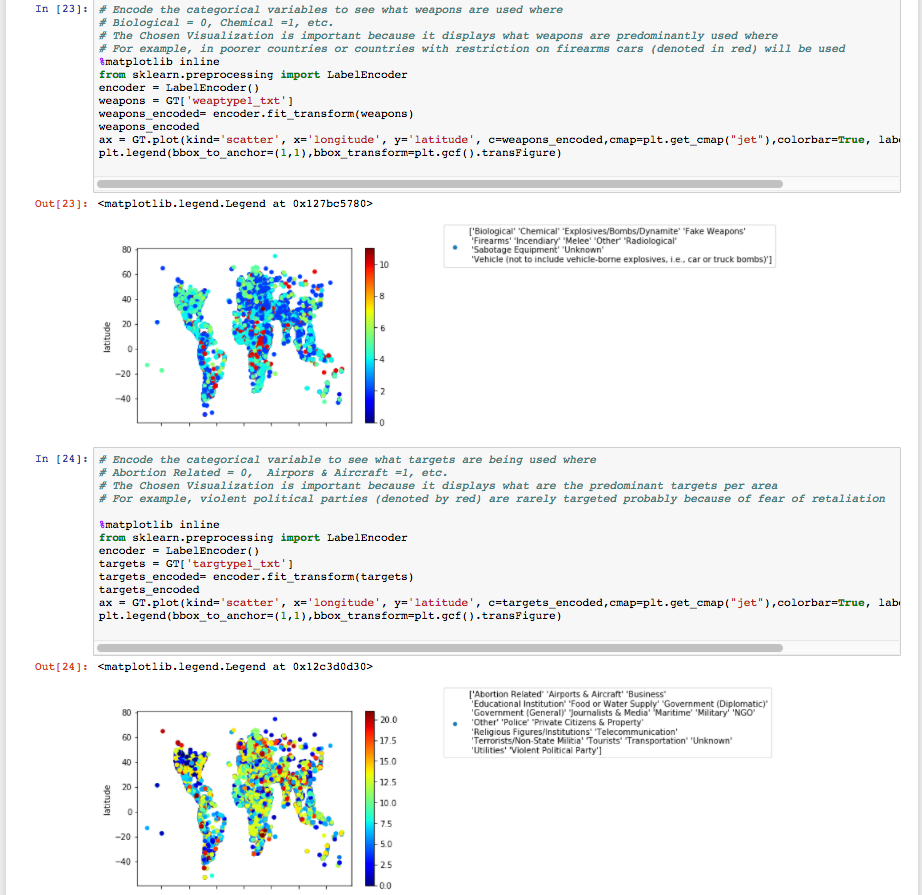


*Figure 12*

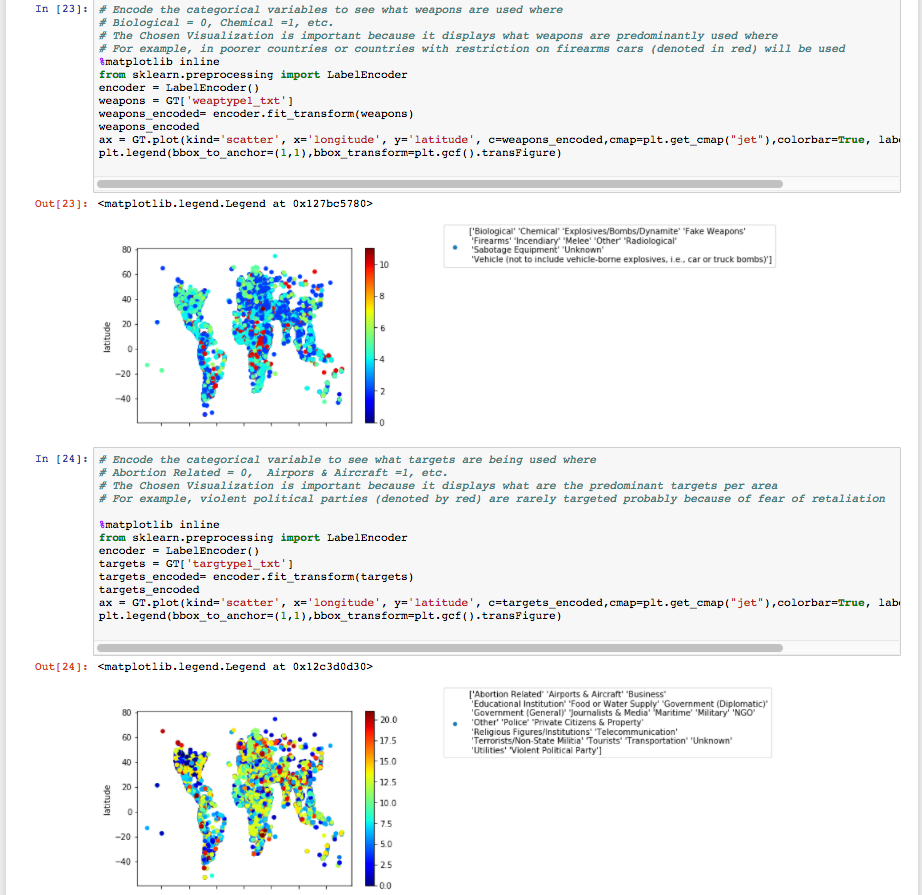


*Figure 13*

By completing this analysis we were able to determine from the resulting visualizations (See Figure 14 and 15) that the weapon of choice in indigent countries is the motor vehicle. The favorite target of terrorists are abortion related centers and airports.



*Figure 14*

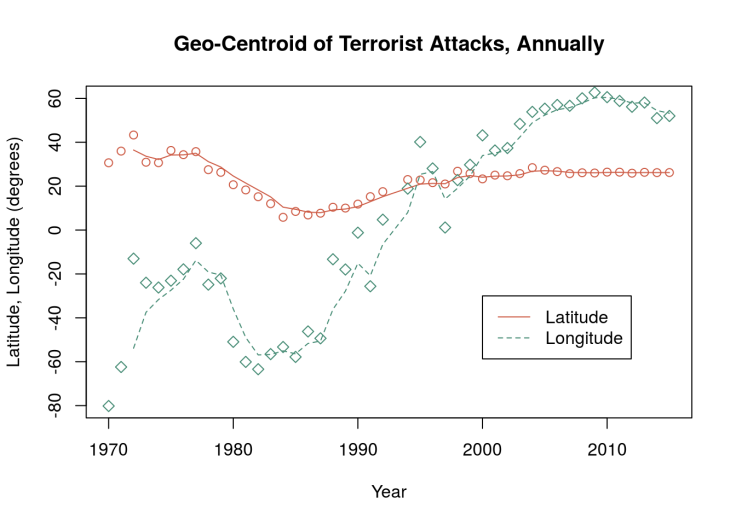


*Figure 15*

**5.2 R**

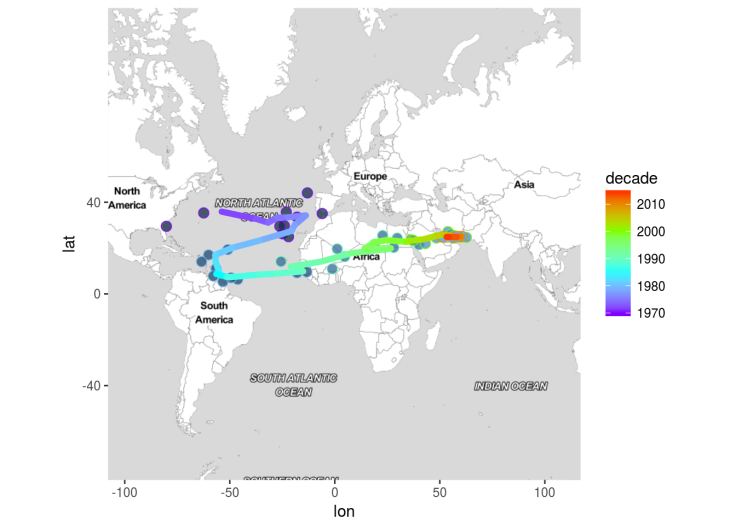
We elaborated on our analysis by performing visualization in R. To understand the geographic changing nature of terrorism over this period, we determine the geographic center of all the events that occurred in each year. That is to say, for all of the terror events that occurred in 1970, and for each subsequent year, the geo-centroid of the all of the latitude and longitude coordinates was determined.

The result of this is depicted in Figure 16. We can observe that in 1970 the “center” of terrorist activity occurred at latitude, longitude (30.649873, -80.178993), which corresponds to a location in the North Altantic Ocean, approximately 40 miles east of Jacksonville, Florida. This means that of the 651 reported terrorist events reported in 1970, the geographic center was just off of the east coast of the United States. Furthermore, we can observe that during the subsequent 10 years of reported terrorist activity that the center of activity consistently moved eastward towards the European coast, then reverted back towards the Americas in the mid 1980s, and then made a steady progression, year by year eastward to arrive in the Persian Gulf about 20 miles NE of Qatar, at latitude, longitude (26.204019, 51.978154).



*Figure 16*

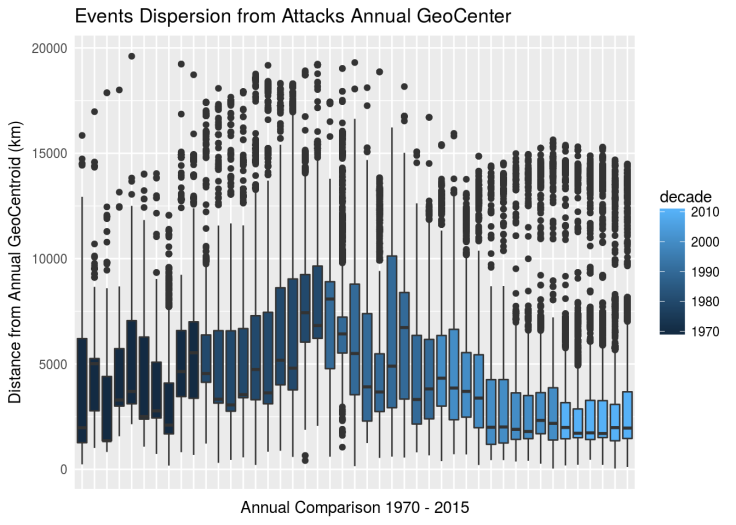
This can be more easily visualized on an earth map, as shown in Figure 16. Here, a dot is presented that represents the geo-centroid for each year’s reported terrorist activity, along with a connecting line to show the steady progression from west to east during this 45 year time period. This is likely a view of the history of terrorism either never known (for everyone under 50) or no longer remembered by most in the United States.



*Figure 16*

Another approach to visualize the trends is not just with the geographic center, but also by the dispersion from the center and the distributional characteristics. Figure 17 presents box plots for the annual distribution of terrorist events for the 45 year period. This visualization presents the distribution of the distance of each event from the geo-centroid of all events for that year. In other words, from the annual center, how closely (or disparately) spaced are all of the events for that year. We can make the following observations :

* 1970s - large majority of events occurred within a 5000 km distance from the geocentroid
* 1980s - the average distance increases slightlyto 5000 km from the centers (now located between western Europe or northern South America) and a clear bi-modal trend begins to emerge. There is a population of events that appear consistently at more than 15000 km from the annual center.
* 1990s - slight reduction in population distance from the annual mean, and also a return to a primarily uni-model distribution, as the overall centroid begins to march eastward across Africa
* 2000s - much stronger concentration of events to the annual center - now generally within 4000 km of the annual center and a reappearance of a bi-modal distribtion of events
* 2010s - least dispersion in the overall population difference from the annual centers. Seventy-five percent or more of the events in each year are contained within 2000 km of the annual center, but also, the development of three population distributions, one located at 7000 km from the centers and the other at 13000 km from the primary location. Thus, in the current era, there is a very strong concentration of terrorist events in the Mid-East, but also two other locations affected by 25% of the events.



*Figure 17*

**6. Conclusion**

Every day, there is more and more extractable data available in every possible subject, whether mundane or critical to personal security. What separates real, tenable, insight from noise is the value that is extracted when analyzing that data. With the Global Terrorism Database, the goal of analysis is intuitive. Modern terrorism is a blight on humanity, as it not only claims lives, but also the livelihood, mental wellbeing of its survivors. Our end goal was to delve into this topic to find any information that could be used to prevent these heinous acts from occurring.

With the use of SQL, we were able to delve into a seemingly overwhelming amount of data. As data grows exponentially, it can be staggering to manipulate the amount of data that is generated in just a few years, much less decades. SQL allowed us to import an exceedingly large amount of data , perform transactions, and normalize the data so we are able to grasp the full spectrum of a very broad vastly encompassing set. It is also rare that there is data that reaches as far as the 1970s; before notions of Big Data were a thought, no one would have thought to save specifics regarding the emerging trend of modern terrorism. In this case, we were fortunate to have the data cultivated for us, but in doing this, relationships were pre-established in a tabular format. SQL allowed us to work with the data in it’s native form so we could focus on further trimming down erroneous variables and obtaining a concentrated set that would enable us to analyze our data and discover trends.

As our dataset indicates that the reasons for causing terror can be numerous, so prevention based off of deterring motive would be difficult. We are however to capitalize on similarities that can point to certain aspects as being indicators or potentially risky attributes of Terror. With our Python analysis, we were able to determine the primary utensil of these antagonists: motor vehicles. We were also able to discover that two unrelated locations share a common likelihood in being the setting of a terrorist attacks: Abortion Centers and Airports.

It is not enough to just evaluate what has retroactively occurred in the past. Yes, it is true that history has a tendency to repeat itself, but as modern terrorism is a relatively recent, 40 year old, phenomenon; the escalating nature of violence could give birth new threats that we are not yet aware of. With our R analysis, we were able to see a solid trend line regarding geographic location for seemingly unrelated events. This level of insight unlocks predictive capabilities in determining ways to safeguards from future insurgent and insurrectionist attacks.

### References

[1] National Consortium for the Study of Terrorism and Responses to Terrorism (START), “The Global Terrorism Database, ” *University of Maryland,* <https://www.kaggle.com/START-UMD/gtd>.

[2] Devon McCann, “Northern Ireland: The Origin of Modern Terrorism,” *Gerogetown University,* [https://apps.cndls.georgetown.edu/projects/borders/exhibits/show/northern-ireland-modern-terror/societal-division- and-the-ira/ira](https://apps.cndls.georgetown.edu/projects/borders/exhibits/show/northern-ireland-modern-terror/societal-division-%20and-the-ira/ira).

[3] GTD Global Terrorism Database ,“Codebook: Inclusion Criteria and Variables,” *START,* <http://start.umd.edu/gtd/downloads/Codebook.pdf>

[4] Bryan Burrough, “The Bombings of America That We Forgot” Sep 20, 2016, <http://time.com/4501670/bombings-of-america-burrough/>

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