Data Visualization E-25

Dashboard Project

Group 1

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Contents

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1. Contribution

Abstract

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2. Background and Motivation

For our data visualization project, we chose to work with the *Global Earthquake* dataset[1] found on Kaggle. This dataset contains global earthquake event records from across the world. The data consist of things like time, geographic coordinates, depth, magnitude and other seismic-related attributes, making it well-suited for visual analysis and storytelling through data.

Our motivations for selecting this topic and dataset stem from a combination of personal and research interests.

2.1. Relevance to Real-world Problems

Earthquakes are one of the most impactful natural disasters. It destroys social infrastructure, communities and peoples way of life every time a substantial earthquake occurs, causing both human and economic losses.

Visualizing the geographical patterns can help communicate risk to the average person, and understanding the seismic activity can help prepare emergency responders and disaster prevention organizations to reduce losses and help with planning relief.

2.2. Suitability for Data Visualization Techniques

Earthquake data consists of spatial, temporal and multidimensional attributes, which makes it useful for a variety of data visualization techniques. This makes it possible to create a plethora of visual stories through things like map, clustering and time-based visualization to identify patterns.

Interest in how map visualization can be utilized has been the biggest motivation in choosing earthquakes as a topic. Seeing what kind of and how many attributes can be visualized in a map at one time, and how much this can tell about earthquake evolution and their trajectories over time.

2.3. Personal Interest

We live in an area with no significant seismic activity. So having never actually felt an earthquake, curiosity around how and where they happen has grown. Natural disasters like earthquakes have huge consequences on communities we have never been a part of, so understanding the severities of them is something we are interested in. Visualizing the data of earthquakes gives us a better understanding of the scale, and makes it easier to compare the geographical differences in regions that are more affected than others. This can also help us discover patterns and trends that are not immediately obvious through raw data, and help us understand the relationship between geological factors and seismic activity.

3. Project Objectives

Since our project has the goal of visualizing data about earthquakes, our objectives should revolve around their patterns, relationships and gaining an overall insight on earthquakes, which visualizations can reveal far better than raw table data.

Based on this reasoning we have developed a list of questions which we plan to answer with our visualization:

1. Where and when do earthquakes occur most frequently?
   - Does specific regions have more seismic activity than others?
   - How frequent are earthquakes (yearly, monthly, seasonal)?
   - Are clusters and hotspots identifiable?
2. How strong are the earthquakes?
   - What is the distribution of earthquake magnitudes?
   - Are high-magnitude earthquakes concentrated?
   - How often does high-magnitude (magnitude > 6) earthquakes occur?
3. What is the relationship between earthquake depth and magnitude?
   - Does depth relate to other attributes of earthquakes?
   - Are shallow earthquakes more common, and in which regions?
   - Is there a pattern to depth distribution over time?
4. How are earthquakes distributed geographically?
   - Do they relate to tectonic plate boundaries?
   - Are there patterns comparing continental vs. oceanic regions?
   - Is there specific bands of latitude/longitude where activity is higher?
5. How are earthquake patterns and trends developing over time?
   - Is earthquake frequency increasing, decreasing or stable over time?
   - Are there noticeable anomalies in specific years?
6. Can we easily identify extreme events?
   - Which earthquakes are outliers in magnitude or depth?
   - Are there extreme deviation in specific earthquake events?
7. What correlation of multiple variables are most common?
   - Does magnitude correlate with depth, location, time or any other attribute?
   - Are certain combination of attributes most common (e.g. shallow + high magnitude)?

With these questions we have set up sizeable goals we wish to accomplish with our visualizations and storytelling throughout or dashboard that we will create. These will be used to quality check and verify our project as a whole, but also the need of individual visualizations in our project. The ultimate goal is to have all these questions answered and how they are answered in our *Discussion* (Section 7) and *Conclusion* (Section 8).

4. Data

4.1. From Where

This project utilizes the “Global Earthquake Data” dataset from Kaggle [1], uploaded by user shreyasur965 on September 18, 2024. The dataset compiles 1,137 global earthquake records sourced from the Earthquake API via RapidAPI, providing granular attributes like magnitude, location, depth, and timestamps for reliable seismological analysis.

4.2. Description

The Recent earthquakes dataset contains records for 1137 distinct earthquake events, each described by 43 variables. Every record corresponds to a unique event, capturing a wide range of details that collectively offer a perspective on the earthquake’s context. Among the most important attributes are a unique identifier for each event, the exact date and time of the earthquake, and the magnitude, which quantifies the energy released during the event and is most often measured on widely recognized scales such as the Richter magnitude scale. The dataset also specifies the depth at which each earthquake originated beneath the Earth’s surface, recorded in km, which is an essential parameter for assessing the surface impact and potential for damage.

Geographical information in the dataset is provided at multiple levels of specificity, enabling a detailed understanding of where each event occurred. Each record documents the continent, country, subnational region, city, locality, and postal code associated with the earthquake’s epicenter, along with a full address or descriptive location field. Latitude and longitude coordinates give precise geo-spatial positioning for each event, enabling accurate mapping and deeper analysis. The place, distance from the nearest populated area, and timezone further enrich the dataset’s locational context, while additional details about the event’s location are captured in dedicated fields. The Shake intensity measured in the dataset, such as the Modified Mercalli Intensity (MMI), provides valuable insight into how events are felt by people and the potential for structural damage in affected areas. The measurements are used to assess how strongly an earthquake is felt at the surface, reflecting reports from individuals as well as instrumental data. In addition to intensity, the dataset includes information on tsunami triggers, indicating whether an earthquake has the potential to generate a tsunami and thus pose additional risks to coastal regions. The classification of event types, distinguishing between natural earthquakes and other seismic occurrences such as explosions, further enriches the contextual understanding of each record.

4.3. Data Processing

- remove unnecessary columns/data
- Prepare data
  - Remove or fill out blank entries/fields
- categorizing:
  - Magitude (small, medium, large).
  - Season (fall, summer, autumn, winter)
  - Month (Jan, Feb, Mar, …)

5. Visualization of Dashboard

5.1. Design

5.2. Must-Have Features

ID	Feature
F1	Must have at least 3 types of graphs (i.e barchart, timeseries plot or boxplots)
F2	Must have at least one animated graph
F3	Must have an AI-generated graph with description on how (platform and prompt used)
F4	Must have at least 9 graphs
F5	Must have an option to download the report as a manual from the dashboard
F6	Must have a map that visualizes the location of earthquakes and their depth and magnitude
F7	

5.3. Optional Features

ID	Feature
OF1	
OF2	

6. Results from Story

7. Discussion

8. Conclusion

Bibliography

[1] S. Sur, “Global Earthquake Data.” 2024.