Mapping Earthquakes Around the World: A Geospatial Analysis

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Problem and Motivation

- Earthquakes can have devastating effects on people and infrastructure, making tracking essential.
- Accurate location data is needed to identify seismic trends and prepare for disasters.
- Associating earthquakes with countries enables a comprehensive understanding of global seismic activity.
- Disaster responses could be improved by identifying regions prone to earthquakes through mapping.
- The ultimate goal is to reduce the impact of earthquakes and improve disaster preparedness worldwide.

Data source and background.

- The earthquake data was sourced from the US Geological Survey and includes information on time, location, magnitude, and place.
- The code uses the requests and pandas libraries to fetch, store, and manipulate the data.
- The custom.geojson file was generated from https://geojson-maps.ash.ms/ and contains geographic information for the world's countries.
- GeoJSON is a format for encoding geographic data structures that is based on the JSON format.

Download vector maps

Build your map

Click the map to select your countries or choose from the presets to the right.

Build Custom GeoJSON

Resolution

How detailed does your map need to be?

- (•) Low resolution (110 metre, smallest file)
- ( ) Medium resolution (50 metre)
- ( ) High resolution (10 metre, largest file)

Regions

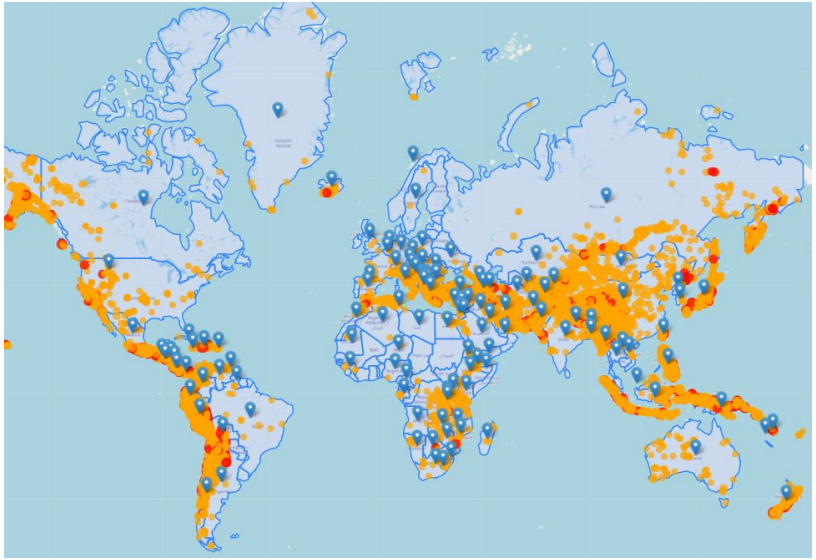
Choose from some preset regions

- [ ] North America
- [ ] South America
- [ ] Asia
- [ ] Africa
- [ ] Europe
- [ ] Oceania
- [ ] Other

Data Mapping

- Analysis of earthquake data from 2000 to 2022, with a minimum magnitude of 4.5.
- Collection of data from the USGS earthquake data API with Python requests library.
- Processing of data using Pandas DataFrame for easy manipulation and analysis.
- Visualization of earthquake data on an interactive map with markers that provide magnitude and location information.
- Geospatial analysis to link earthquakes to countries, enabling comprehensive seismic activity study.

Methodology



Each earthquake's location linked to the corresponding country using geospatial analysis.

Earthquake data grouped by country, and trends analyzed using yearly counts.

Country centroids obtained to place markers on the map, showing country-level earthquake data.

Earthquake data visualized on an interactive map with country-level trends displayed on marker popups.

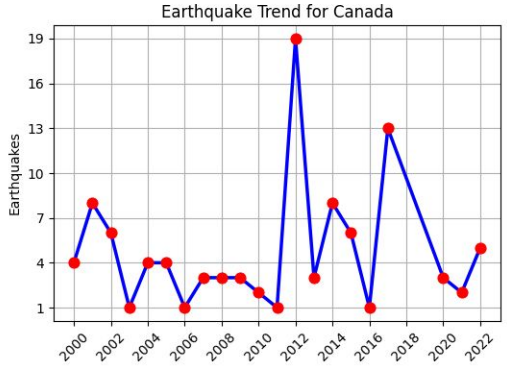
Tools

- The code uses Python programming language to fetch earthquake data from USGS website.
- Pandas library is used for data manipulation and analysis, while Matplotlib and Seaborn are used for data visualization.
- Requests library is used for making HTTP requests to USGS website to fetch data.
- Folium library is used for visualizing data on an interactive map.
- GeoPandas library is used to process geojson data for country centroid calculation

Novelty

- This provides a comprehensive analysis of global earthquake data over the last 22 years.
- The use of geospatial data analysis techniques allows for the identification of earthquake patterns and trends over time.
- The incorporation of earthquake magnitude and location data enhances the understanding of earthquake risk and impact.
- The use of interactive maps and data visualizations facilitates the exploration and interpretation of earthquake data.
- The inclusion of earthquake trend analysis by country allows for a deeper understanding of earthquake activity at a regional level.

Visualization



- Map markers with circle size proportional to magnitude provide clear and intuitive representation.
- Different color-coded magnitudes in the legend make it easy to interpret the data.
- Trend analysis plot for each country provides an insight into their earthquake activity over time.
- Customized legend with easy-to-understand color codes and circle sizes makes data interpretation simple.
- Popup trend analysis plot offers interactive and detailed insights about earthquake trends in each country.
- Combined visualization of the data on the map and the trend analysis helps to analyze the data in a more integrated way.

Future works

- Incorporate additional data sources, such as seismometer recordings, to enhance the accuracy and granularity of earthquake data.
- Develop a real-time monitoring and alert system for seismic activity in high-risk areas.
- Explore the use of machine learning algorithms for predicting earthquake occurrence and magnitude.

References

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Thank You