# final-project-advanced-programming

REPORT FINAL EXAM ADVANCED PROGRAMMING

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TO: Advanced Programming’s teacher Yeleu Sultanmurat

TOPIC: Historical earthquake data of Kazakhstan and neighboring countries (1991-2024)

1. Introduction

a) Problem:

Earthquakes pose significant threats to human life and infrastructure. Understanding their occurrence patterns and characteristics is crucial for disaster preparedness and mitigation efforts. In this project, we aim to analyze earthquake data in Kazakhstan from 1991 to 2024 to gain insights into their distribution, magnitudes, depths, and temporal patterns.

b) Literature Review:

- USGS Earthquake Hazards Program: (https://earthquake.usgs.gov/)

- Basemap Documentation: (https://matplotlib.org/basemap/)

- Cartopy Documentation: (https://scitools.org.uk/cartopy/docs/latest/)

- TensorFlow Documentation: (https://www.tensorflow.org/)

- NumPy Documentation: (https://numpy.org/)

These resources provide valuable information on earthquake monitoring, visualization techniques, and deep learning frameworks.

c) Current Work:

We utilize Python libraries such as Pandas, Matplotlib, Basemap, Cartopy, TensorFlow, and NumPy to analyze earthquake data and visualize it spatially and temporally.

2. Data and Methods

- Data Information:

The earthquake data is sourced from the USGS Earthquake Catalog, covering the region of Kazakhstan from 1991 to 2024. It includes parameters such as time, latitude, longitude, depth, and magnitude of earthquakes.

- Visualization:

We use Matplotlib and Cartopy to visualize earthquake events spatially on a map of Kazakhstan, as well as to plot histograms showing the distribution of earthquake magnitudes and depths.

- Machine Learning/Deep Learning Models:

In this analysis, we do not employ any machine learning or deep learning models. Instead, we focus on descriptive analytics and visualization techniques to explore and understand the earthquake data.

3. Results

- Spatial Distribution:

The scatter plot on the map of Kazakhstan illustrates the spatial distribution of earthquakes, with larger magnitude events represented by larger and darker points.

![image](https://github.com/Fareke1/final-project-advanced-programming/assets/153728604/1ba8f495-d292-4fcb-86c3-ed2c5220393c)

- Magnitude and Depth Distribution:

Histograms display the frequency distribution of earthquake magnitudes and depths, providing insights into their characteristics.

![image](https://github.com/Fareke1/final-project-advanced-programming/assets/153728604/1707f9ae-a76b-4de8-bf41-b9056ef9d21f)

![image](https://github.com/Fareke1/final-project-advanced-programming/assets/153728604/e47c7be5-16ab-42ac-affa-9e1a9833d236)

![image](https://github.com/Fareke1/final-project-advanced-programming/assets/153728604/b88c71f0-aadb-4c8f-939a-3af9176cb931)

- Temporal Patterns:

The temporal plot shows the number of earthquakes occurring each year, indicating any notable trends or variations over time.

![image](https://github.com/Fareke1/final-project-advanced-programming/assets/153728604/0ef2ec4e-ac34-4a70-ba64-6552412ce855)

d) Discussion

- Critical Review:

The analysis reveals insights into the distribution, magnitudes, depths, and temporal patterns of earthquakes in Kazakhstan. The spatial visualization helps identify regions prone to seismic activity, while magnitude and depth distributions offer understanding of the severity and nature of earthquakes.

- Next Steps:

Future work could involve more advanced analytics, including predictive modeling using machine learning algorithms to forecast earthquake occurrences or assess their impact on infrastructure and population centers.

![image](https://github.com/Fareke1/final-project-advanced-programming/assets/153728604/2bb8dfa6-39c5-4e0f-858b-0fce0b09c766)

From here we selected the start and end time and chose the range

Links:

https://earthquake.usgs.gov/

https://matplotlib.org/basemap/

https://scitools.org.uk/cartopy/docs/latest/

https://www.tensorflow.org/

https://numpy.org/