Capstone III: Project Proposal

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Earthquakes can strike suddenly and without warning. An earthquake is a violent and abrupt shaking of the ground, caused by movement between tectonic plates along a fault line in the earth’s crust.

Data from the National Earthquake Information Center (NEIC) includes 23412 records, including the date, time, location, depth, magnitude, and source of every earthquake with a reported magnitude 5.5 or higher from 1965 to 2016. [Earthquake prediction](https://en.wikipedia.org/wiki/Earthquake_prediction) is a branch of the science of [seismology](https://en.wikipedia.org/wiki/Seismology) concerned with the specification of the time, location, and [magnitude](https://en.wikipedia.org/wiki/Seismic_scale) of future earthquakes within stated limits. (Geller, 1997) Nearly 750,000 deaths were caused by earthquakes globally from 1998 – 2017. Although earthquakes cannot be prevented, the risks can be mitigated. Ultimately, scientists would be able to predict when and where an earthquake was going to occur with enough time to move people out of harm’s way.

This research will look at historical earthquake data to determine if correlations or differences in statistical means exist between locations, depths, and magnitudes to provide insight into future prediction and risks.

The dataset is available on Kaggle.com and will be imported in our Jupiter notebook trough the link [Significant Earthquakes, 1965-2016 | Kaggle](https://www.kaggle.com/datasets/usgs/earthquake-database).

Dataset overview

|  |  |  |  |
| --- | --- | --- | --- |
| **Index** | **Column** | **Non-null Count** | **Dtype** |
| 0 | Date | 23412 | Object |
| 1 | Time | 23412 | Object |
| 2 | Latitude | 23412 | Float64 |
| 3 | Longitude | 23412 | Float64 |
| 4 | Type | 23412 | Object |
| 5 | Depth | 23412 | Float64 |
| 6 | Depth Error | 4461 | Float64 |
| 7 | Depth Seismic Stations | 7097 | Float64 |
| 8 | Magnitude | 23412 | Float64 |
| 9 | Magnitude Type | 23409 | Object |
| 10 | Magnitude Error | 327 | Float64 |
| 11 | Magnitude Seismic Stations | 2564 | Float64 |
| 12 | Azimuth Gap | 7299 | Float64 |
| 13 | Horizontal Distance | 1604 | Float64 |
| 14 | Horizontal Error | 1156 | Float64 |
| 15 | Root Mean Square | 17352 | Float64 |
| 16 | ID | 23412 | Object |
| 17 | Source | 23412 | Object |
| 18 | Location Source | 23412 | Object |
| 19 | Magnitude Source | 23412 | Object |
| 20 | Status | 23412 | Object |
| dtypes: float64(12), object(9) | | | |

Our study focuses on analyzing correlations between Latitude/Longitude locations, and the depths and magnitudes of historical earthquakes. The key research questions that guide our reflection is the following: 1. What correlation exists between location on Earth, and depths that earthquakes will occur? Are these effects significant? 2. Is there a significant difference between the means of depths between the Northern & Southern Hemispheres.

By considering the Latitude or Longitude position on the Earth and the depths of historical earthquakes, we can pose our hypothesis:

Hypothesis I

Null Hypothesis I (H0): The depths of historical earthquakes are not correlated with Latitude. This means, we are assuming that Latitude do not drive the depth of the earthquake.

Alternate Hypothesis I (Ha): The depths of historical earthquakes are correlated with Latitude.

Hypothesis II

Null Hypothesis II (H0): The depths of historical earthquakes are not correlated with Longitude. This means, we are assuming that Longitude do not drive the depth of the earthquake.

Alternate Hypothesis II (Ha): The depths of historical earthquakes are correlated with Longitude.

Hypothesis III

Null Hypothesis III (H0): The depths of historical earthquakes are the same for the Northern Hemisphere and Southern Hemisphere.

Alternate Hypothesis III (Ha): The depths of historical earthquakes are different for the Northern Hemisphere and Southern Hemisphere.

We will use visualizations to show correlation, and we will use Pearson-r tests to test the direction and the strength of correlation between horizontal and vertical locations to the depth of recorded earthquakes. We will also use a t-test to see if there is a significant difference in the means of depth occurrences between the Northern and Southern Hemispheres.

Prediction of natural hazards is the key to reducing the risks. Government, private sector, and NGOs can all benefit from understanding the relationship of how deep earthquakes occur according to their location so they can mitigate their risks.