Project Design Report

Team Name: Tsunami
Team Members:

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Project Title: Visualization of Epic Earthquakes
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Overview of the project

The purpose of this project is to assist analyzing the trend of the earthquakes by visualizing them. There is a number of earthquakes happening every day around the world. The location and the magnitude of earthquake differ from earthquake to earthquake, and some of them cause major damages. To minimize the damage from the earthquake, it is important to analyze the trend of the earthquakes and predict the future earthquakes.

In this project, we are going to visualize the earthquake on the map. Since there are countless times of the earthquake, we are only going to visualize the earthquakes that are larger than certain magnitudes. Each earthquake is represented by a circle, and the center of the circle is the epicenter of the earthquake. Furthermore, the radius of each circle represents the magnitude of the earthquake. The final result is going to look like a time-lapse of the earthquake in the past few years.

Why is this project important and/or interesting?

As we mentioned in the overview, the earthquake could cause massive damages. Some of the damages are even deadly. Although it is currently impossible to predict when exactly the earthquake is going to happen, we can still learn a number of things from the earthquake in the past. For instance, it could mean a portent of the major earthquake if one of the places is experiencing a number of minor earthquakes continuously. By knowing the possibility of the major earthquake happening soon, we can better prepare for the earthquake.

This project is also interesting because we can visually see the hot spot of the earthquake. There are few mechanisms of the earthquake, but the most common cause of the earthquake is marine plate resisting inland plate. Thus, there are some places where often experiences many earthquakes and some places where almost never experiences the earthquake.

The Objective of the project

The following are the objective of this project:

- Visualize the earthquakes from past few years onto the map.
- Visualize the earthquake in chronological order.
- Find the hot spot of the earthquake.
- Find the trend of the earthquake before and after of the epic earthquake.

What we would like to learn by completing this project

We are excited to learn new techniques for the visualization. We have been both interested in visualization but never had a chance to learn them before taking this course. This is a great opportunity to self-learn some of the visualization techniques. Specifically, we would like to learn the following:

- How to process and analyze the large data.
- How to place a circle or other objects onto the map with respect to given information. In our case, we are drawing a circle with given earthquake information such as location and magnitude.
- How to draw multiple objects on one screen in chronological order.

What data we will use

We will be using the data from United States Geological Survey (USGS). USGS is a scientific agency of the United States government. USGS being the official federal government agency, the credibility of the data is very high. USGS has earthquake information available to the public at https://earthquake.usgs.gov/earthquakes/search/.

We can retrieve earthquake data with the custom filter such as data, time, magnitude, and geographic region. We can also retrieve the data in multiple formats which includes CSV, KML, QuakeML, and GeoJson.

Hardware and Software

Our project is a programming project.

- Programming Language: Python 3 with anaconda 3.4.0 or higher.
- Environment: OSX 10.13 or higher
- IDE: PyCharm
- Text Editor: Atom
- VCS: Git/Github

Project schedule

As of now, no implementation has done. We are in process of designing the project and exploring the external APIs that may be valuable to our project.

The following is our schedule for this project:

1. 03/18/2018 - 03/25/2018:
    a. Research techniques that may be useful for our project. Since this week is a spring week, not much progress is expected to be made.
2. 03/25/2018 - 03/31/2018:
    a. Set up the programming environment.
    b. Process and organize the data from USGS.
    c. Create a function which draws a circle based on the location and the magnitude of the earthquake.
3. 04/01/2018 - 04/07/2018:
    a. Start creating a GUI.
        i. Visualize earthquake on the map.
        ii. Visualize earthquake in chronological order.
        iii. (Optional) Allow users to filter earthquake to be visualized.
4. 04/8/2018 - 04/14/2018:
    a. Continue working on GUI.
5. 04/15/2018 - 04/19/2018:
    a. Polish up the GUI.
    b. Polish up the code.
    c. Write the project final report.

How to evaluate the project

The project is complete and successful if the project meets the following criteria:

1. Each circle represents an earthquake based on the location and the magnitude of the earthquake. The radius increases as the magnitude of the earthquake increases.
2. Each circle is placed onto the map based on the location of the earthquake.
3. Multiple earthquakes can be visualized on the map at the same time.
4. Earthquakes are visualized in chronological order. The final result will be like a time-lapse of earthquakes in the past few years.

Other information

The things to be determined is to decide which earthquake is going to be visualized. If we decide to visualize every single earthquake, the result of visualization may become noisy and difficult to see it. It's important to keep the balance between clean visualization and a good amount of information.

Another thing to be determined is to choose the range of dates which we want to retrieve the data of the earthquake. Although it is undecided yet, we are leaning towards visualizing a few months before and after of the major earthquake such as the one hit Japan in 2011.