

# Project Plan: Earthquake Prediction Model

## Problem Definition

The problem at hand is to develop an earthquake prediction model using a kaggle dataset. The primary objective is to explore and understand the key features of earthquake data, visualize the data on a world map for a global overview, split the data for training and testing, and ultimately construct a neural network model that can predict earthquake magnitudes based on the provided features.

## Design Thinking

## Data Source

The first step in solving this problem is selecting a suitable kaggle dataset that contains earthquake data. This dataset should include essential features such as date, time, latitude, longitude, depth, and magnitude. The choice of the dataset is crucial as it forms the foundation of our model.

The screenshot shows the Kaggle website interface. The browser's address bar displays 'kaggle.com/datasets/usgs/earthquake-database'. The left sidebar contains navigation links: Home, Competitions, Datasets (selected), Models, Code, Discussions, Learn, and More. Below these are 'Your Work' and 'viewed' sections. The main content area features the dataset title 'Significant Earthquakes, 1965-2016' with a subtitle 'Date, time, and location of all earthquakes with magnitude of 5.5 or higher'. It includes a 'Data Card' tab, a 'Code (1010)' button, and a 'Discussion (4)' link. A world map thumbnail is visible. The 'About Dataset' section contains 'Context' and 'Content' information. The 'Usability' section shows a score of 8.53. The 'License' is 'CC0: Public Domain'. The 'Expected update frequency' is 'Not specified'. The 'Tags' are 'Earth Science' and 'Geology'. At the bottom, there is a 'Start a new kernel' button. The footer includes a cookie notice, a search bar, and system information like '29°C Mostly cloudy' and '12:14 PM 10/11/2023'.

database - Microsoft Excel																													
MS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
532	#####	15:55:10	-21.558	170.596	Earthquake	150				6.9 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
533	#####	20:55:57	61.58	-150.126	Earthquake	55				5.6 MW							ISCSEM84	ISCSEM84	ISCSEM	ISCSEM	Automatic								
534	#####	0:12:17	-16.654	-177.279	Earthquake	15				6.1 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
535	#####	6:25:55	-40.354	-26.485	Earthquake	20				6.8 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
536	#####	0:06:38	-11.791	121.601	Earthquake	20				6.9 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
537	#####	4:22:17	-31.241	-177.747	Earthquake	25				5.8 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
538	#####	9:13:28	29.734	142.669	Earthquake	15				5.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
539	#####	12:55:32	-56.111	-27.62	Earthquake	100				5.7 MW							ISCSEM84	ISCSEM84	ISCSEM	ISCSEM	Automatic								
540	#####	21:42:00	-10.665	-76.228	Earthquake	40				8.1 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
541	#####	8:01:34	-1.571	-15.611	Earthquake	15				7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
542	#####	18:28:55	-18.319	167.58	Earthquake	35				5.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
543	#####	14:21:03	22.332	145.978	Earthquake	10				6.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
544	#####	2:39:29	38.796	21.242	Earthquake	25				5.9 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
545	#####	16:24:33	19.102	-67.878	Earthquake	26.5				6 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
546	#####	12:45:14	-15.37	-175.109	Earthquake	15				6.4 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
547	#####	3:02:34	-31.973	-60.301	Earthquake	113				6.1 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
548	#####	15:31:05	52.141	-169.158	Earthquake	29.2				5.6 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
549	#####	11:50:33	-23.822	-67.864	Earthquake	135				5.6 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
550	#####	12:49:44	41.746	144.389	Earthquake	32.5				6.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
551	#####	18:45:03	-15.681	167.298	Earthquake	35				6.3 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
552	#####	2:51:54	17.042	-61.885	Earthquake	79.4				5.6 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
553	#####	6:29:54	48.019	146.857	Earthquake	460				5.9 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
554	#####	7:01:12	-57.064	-25.518	Earthquake	35				5.8 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
555	#####	2:19:13	-14.851	167.051	Earthquake	35				5.9 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
556	#####	2:18:19	-25.563	-70.497	Earthquake	51.8				5.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
557	#####	7:32:53	6.6	-82.746	Earthquake	16.7				5.6 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
558	#####	4:56:59	-13.954	167.040	Earthquake	125				6.8 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
559	#####	9:31:38	3.251	128.174	Earthquake	75				5.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
560	#####	17:17:43	44.475	151.655	Earthquake	15				5.9 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
561	#####	13:06:35	14.351	-91.963	Earthquake	70				5.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
562	#####	18:08:15	-3.424	145.703	Earthquake	25				6.3 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
563	#####	21:07:53	-4.928	144.05	Earthquake	65				6.3 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
564	#####	2:08:05	21.487	94.322	Earthquake	94.3				5.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
565	#####	20:52:18	29.535	80.823	Earthquake	20				5.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
566	#####	12:26:55	-26.121	-61.152	Earthquake	378				6.3 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
567	#####	15:30:01	37.30217	-116.408	Nuclear E	1.2	31.61	16	5.62	ML	0.245	10	261	1.476	99	0.86	C1329913	C1	C1	Reviewed									
568	#####	8:51:59	-15.98	169.834	Earthquake	230				6.3 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
569	#####	15:50:21	-7.039	148.256	Earthquake	30				6.6 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
570	#####	1:22:18	37.126	141.202	Earthquake	55.3				6.3 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
571	#####	8:18:07	-25.494	-70.55	Earthquake	25				7.7 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								
572	#####	22:16:21	-37.838	-111.763	Earthquake	10				5.6 MW							ISCSEM84	ISCSEM	ISCSEM	ISCSEM	Automatic								

## Feature Exploration

Once the dataset is acquired, it's essential to dive into feature exploration. This phase involves:

### 1. Data Inspection:

Carefully examining the dataset to understand its structure, data types, and any missing values.

### 2. Statistical Analysis:

Calculating summary statistics, including mean, median, standard deviation, and quartiles for each feature. This will help us identify outliers and understand the data's distribution.

### 3. Correlation Analysis:

Investigating the correlations between features, especially between earthquake magnitude and other variables. Identifying highly correlated features can be beneficial for model development.

## Visualization

Visualization plays a crucial role in gaining insights from the data. In this phase:

### 1. World Map Visualization:

Creating a world map visualization to display the geographical distribution of earthquakes. This can help identify earthquake-prone regions and patterns.

### 2. Time Series Plots:

Visualizing the earthquake data over time to detect any temporal trends or seasonality.

## **Data Splitting**

To evaluate our model effectively, we need to split the dataset into two subsets:

### **1. Training Set:**

This set will be used to train our neural network model. It should contain a significant portion of the data, ensuring that the model learns from a diverse range of examples.

### **2. Test Set:**

The test set is crucial for evaluating the model's performance. It should be separate from the training data and used to assess how well the model generalizes to unseen earthquake data.

## **Model Development**

In this phase, we focus on building the earthquake prediction model using a neural network. Key steps include:

### **1. Data Pre processing:**

Preparing the data for model input, which may involve normalization, scaling, or encoding categorical variables.

### **2. Neural Network Architecture:**

Designing the architecture of the neural network. This includes defining the number of layers, neurons, activation functions, and loss functions.

### **3. Model Training:**

Training the neural network on the training set using appropriate optimization techniques, such as stochastic gradient descent (SGD) or Adam.

## **Training and Evaluation**

The final phase involves training the model and evaluating its performance:

### **1. Model Training:**

Fit the neural network to the training data and monitor its convergence. Adjust hyper parameters as needed to optimize performance.

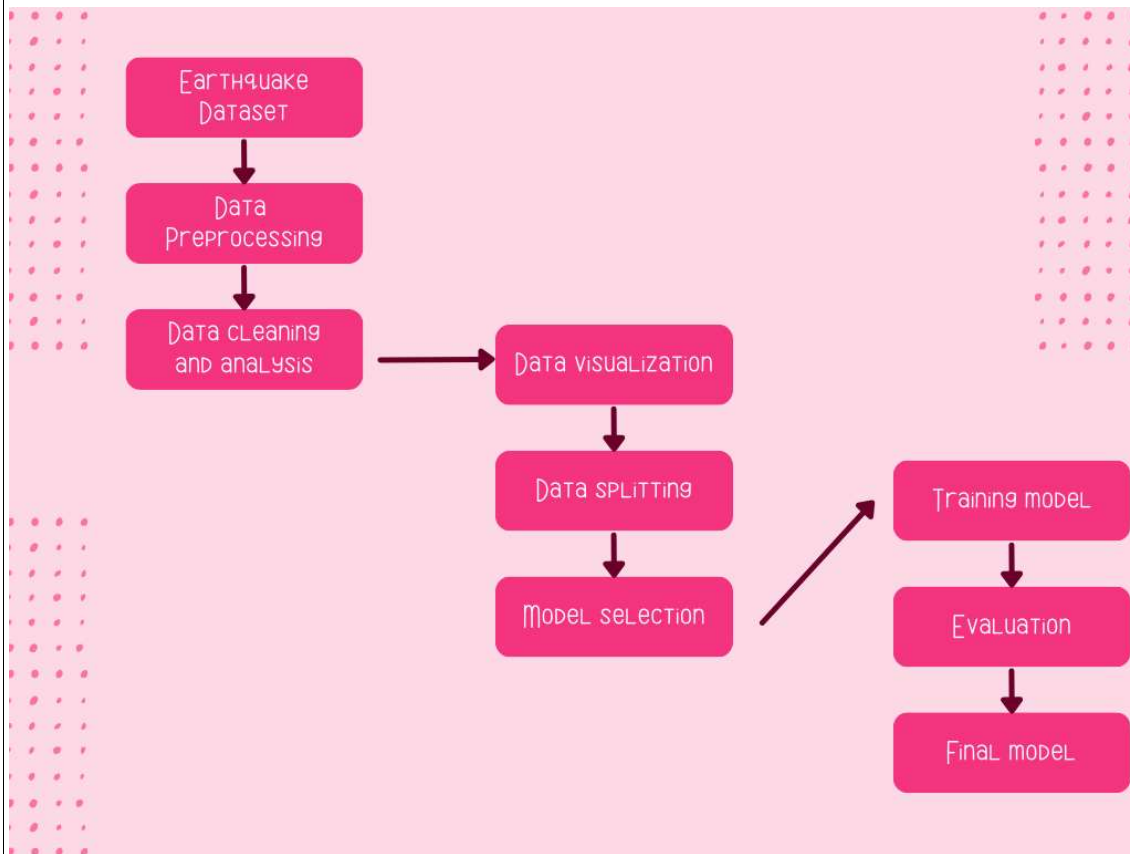
### **2. Model Evaluation:**

Assess the model's performance on the test set using appropriate evaluation metrics, such as mean squared error (MSE) or root mean squared error (RMSE).

### **3. Fine-Tuning:**

If the model's performance is not satisfactory, consider fine-tuning the architecture or exploring advanced techniques like hyper parameter tuning or different neural network architectures.

### Flow Chart:



### Conclusion:

In summary, the project aims to develop an earthquake prediction model by following a systematic approach, from data acquisition to model evaluation. The key is to combine data analysis, visualization, and machine learning techniques to create a robust model capable of predicting earthquake magnitudes. Regular monitoring and iterative improvements will be essential throughout the project's lifecycle to achieve the best possible results.