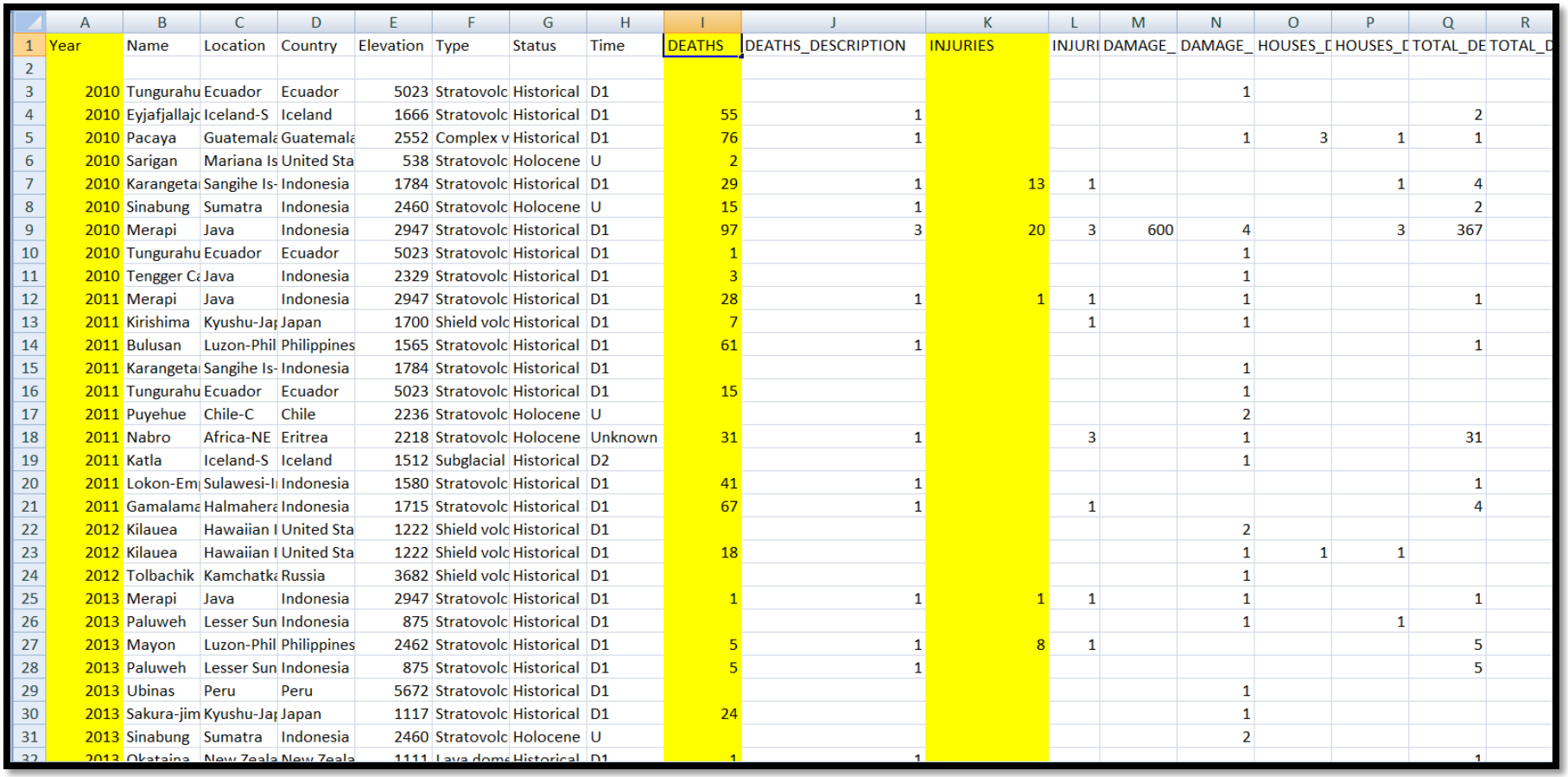
Data Visualization Laboratory Work – 1

Ravinthiran Partheepan

Programming Language

- Task 1 and 2 – R Script and Shiny Package
- Task 3,4 and 6/7 – Plotly Package and Python

Info about the Dataset



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Year	Name	Location	Country	Elevation	Type	Status	Time	DEATHS	DEATHS_DESCRIPTION	INJURIES	INJURI	DAMAGE_	DAMAGE_	HOUSES_D	HOUSES_D	TOTAL_DE	TOTAL_D
2																		
3	2010	Tungurahu	Ecuador	Ecuador	5023	Stratovolc	Historical	D1						1				
4	2010	Eyjafjallajc	Iceland-S	Iceland	1666	Stratovolc	Historical	D1	55	1							2	
5	2010	Pacaya	Guatemala	Guatemala	2552	Complex v	Historical	D1	76	1				1	3	1	1	
6	2010	Sarigan	Mariana Is	United Sta	538	Stratovolc	Holocene	U	2									
7	2010	Karangeta	Sangihe Is-	Indonesia	1784	Stratovolc	Historical	D1	29	1	13	1				1	4	
8	2010	Sinabung	Sumatra	Indonesia	2460	Stratovolc	Holocene	U	15	1							2	
9	2010	Merapi	Java	Indonesia	2947	Stratovolc	Historical	D1	97	3	20	3	600	4		3	367	
10	2010	Tungurahu	Ecuador	Ecuador	5023	Stratovolc	Historical	D1	1					1				
11	2010	Tengger Ca	Java	Indonesia	2329	Stratovolc	Historical	D1	3					1				
12	2011	Merapi	Java	Indonesia	2947	Stratovolc	Historical	D1	28	1	1	1		1			1	
13	2011	Kirishima	Kyushu-Jap	Japan	1700	Shield volc	Historical	D1	7			1		1				
14	2011	Bulusan	Luzon-Phil	Philippines	1565	Stratovolc	Historical	D1	61	1							1	
15	2011	Karangeta	Sangihe Is-	Indonesia	1784	Stratovolc	Historical	D1						1				
16	2011	Tungurahu	Ecuador	Ecuador	5023	Stratovolc	Historical	D1	15					1				
17	2011	Puyehue	Chile-C	Chile	2236	Stratovolc	Holocene	U						2				
18	2011	Nabro	Africa-NE	Eritrea	2218	Stratovolc	Holocene	Unknown	31	1		3		1			31	
19	2011	Katla	Iceland-S	Iceland	1512	Subglacial	Historical	D2						1				
20	2011	Lokon-Em	Sulawesi-I	Indonesia	1580	Stratovolc	Historical	D1	41	1							1	
21	2011	Gamalama	Halmahera	Indonesia	1715	Stratovolc	Historical	D1	67	1		1					4	
22	2012	Kilauea	Hawaiian I	United Sta	1222	Shield volc	Historical	D1						2				
23	2012	Kilauea	Hawaiian I	United Sta	1222	Shield volc	Historical	D1	18					1	1	1		
24	2012	Tolbachik	Kamchatka	Russia	3682	Shield volc	Historical	D1						1				
25	2013	Merapi	Java	Indonesia	2947	Stratovolc	Historical	D1	1	1	1	1		1			1	
26	2013	Paluweh	Lesser Sun	Indonesia	875	Stratovolc	Historical	D1						1		1		
27	2013	Mayon	Luzon-Phil	Philippines	2462	Stratovolc	Historical	D1	5	1	8	1					5	
28	2013	Paluweh	Lesser Sun	Indonesia	875	Stratovolc	Historical	D1	5	1							5	
29	2013	Ubinas	Peru	Peru	5672	Stratovolc	Historical	D1						1				
30	2013	Sakura-jim	Kyushu-Jap	Japan	1117	Stratovolc	Historical	D1	24					1				
31	2013	Sinabung	Sumatra	Indonesia	2460	Stratovolc	Holocene	U						2				
32	2013	Okataina	New Zeala	New Zeala	1111	Lava dom	Historical	D1	1	1							1	

Attribute and it's Type

- This dataset is based on quantitative type.
- Quantitative attribute – Year,

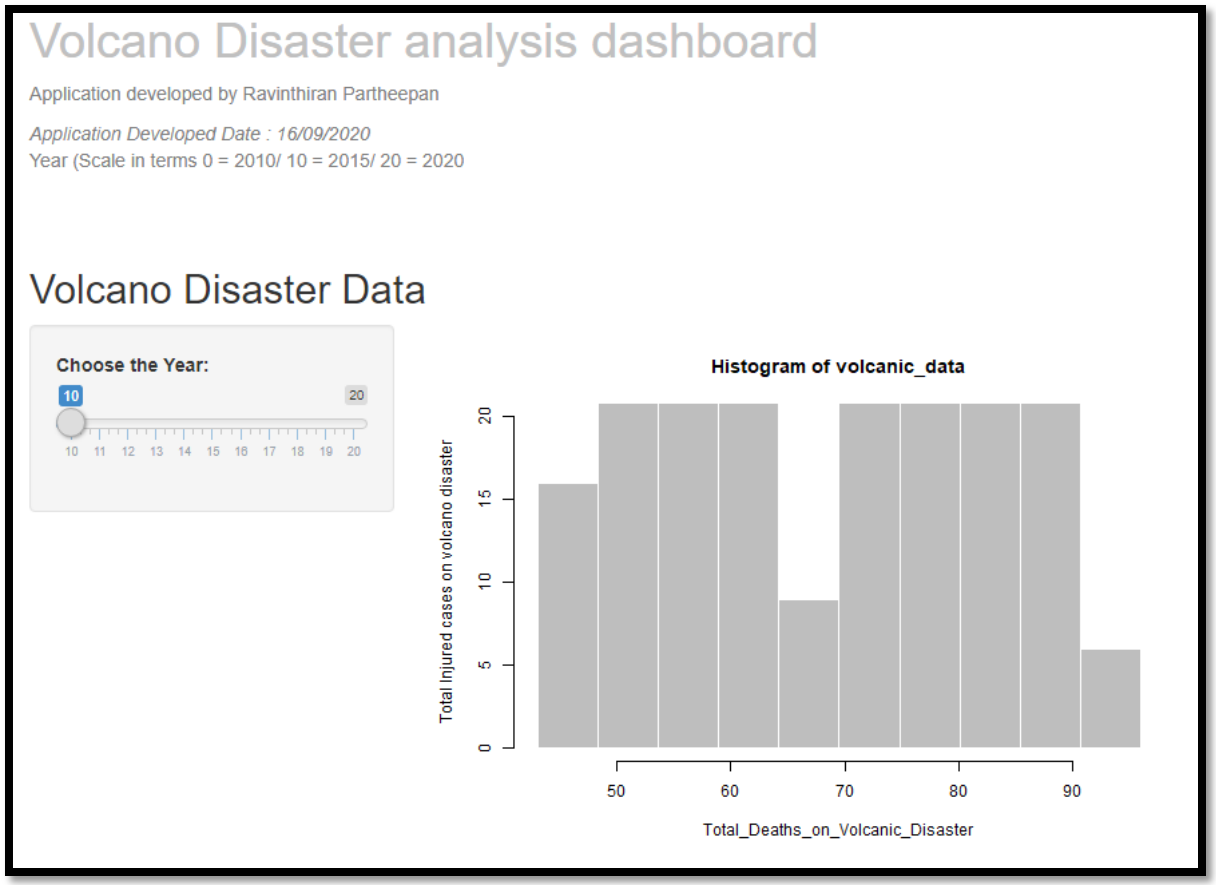
  Total_death_on_Volcano_Disaster and

  Total_Injured_cases_on_Volcano_Disaster
- Attribute Type – Ratio type

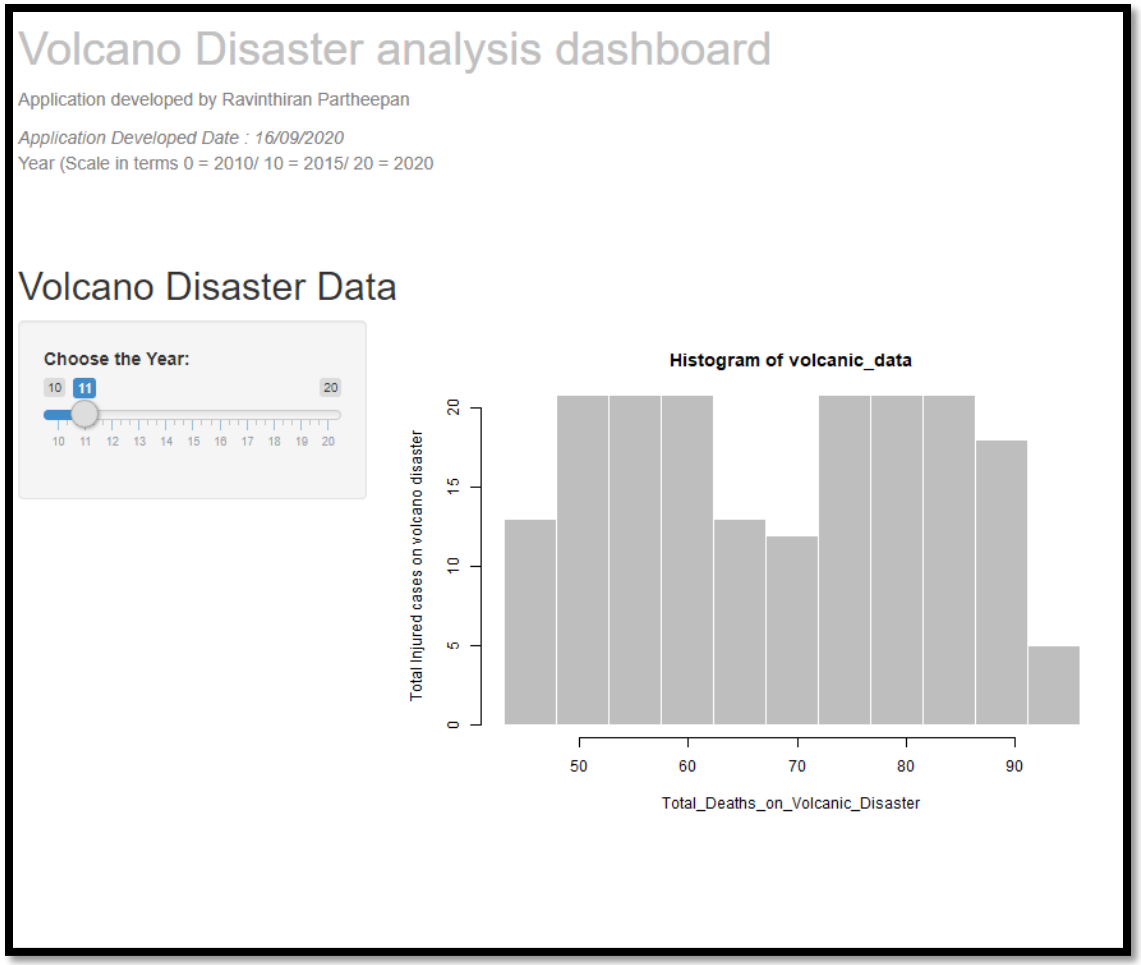
Why it is a Ratio type ?

- It’s a numeric data.
- Ordered Values – selected attribute “Year”
- Can compute the variations from a non zero point value.
- Eg, 2010-2011-2012,.....2019

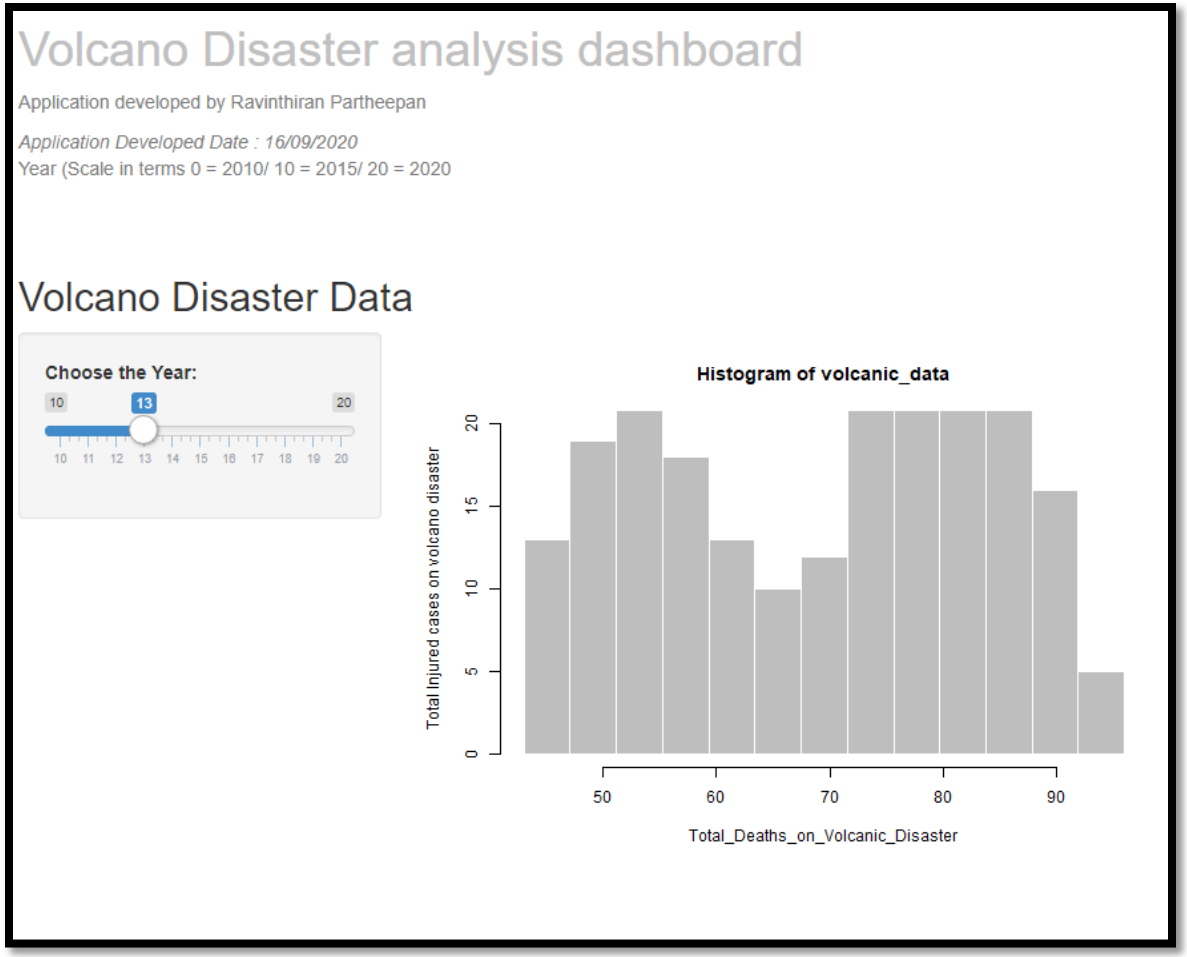
2010 Volcano Disaster Analysis Visualization with histogram Plot



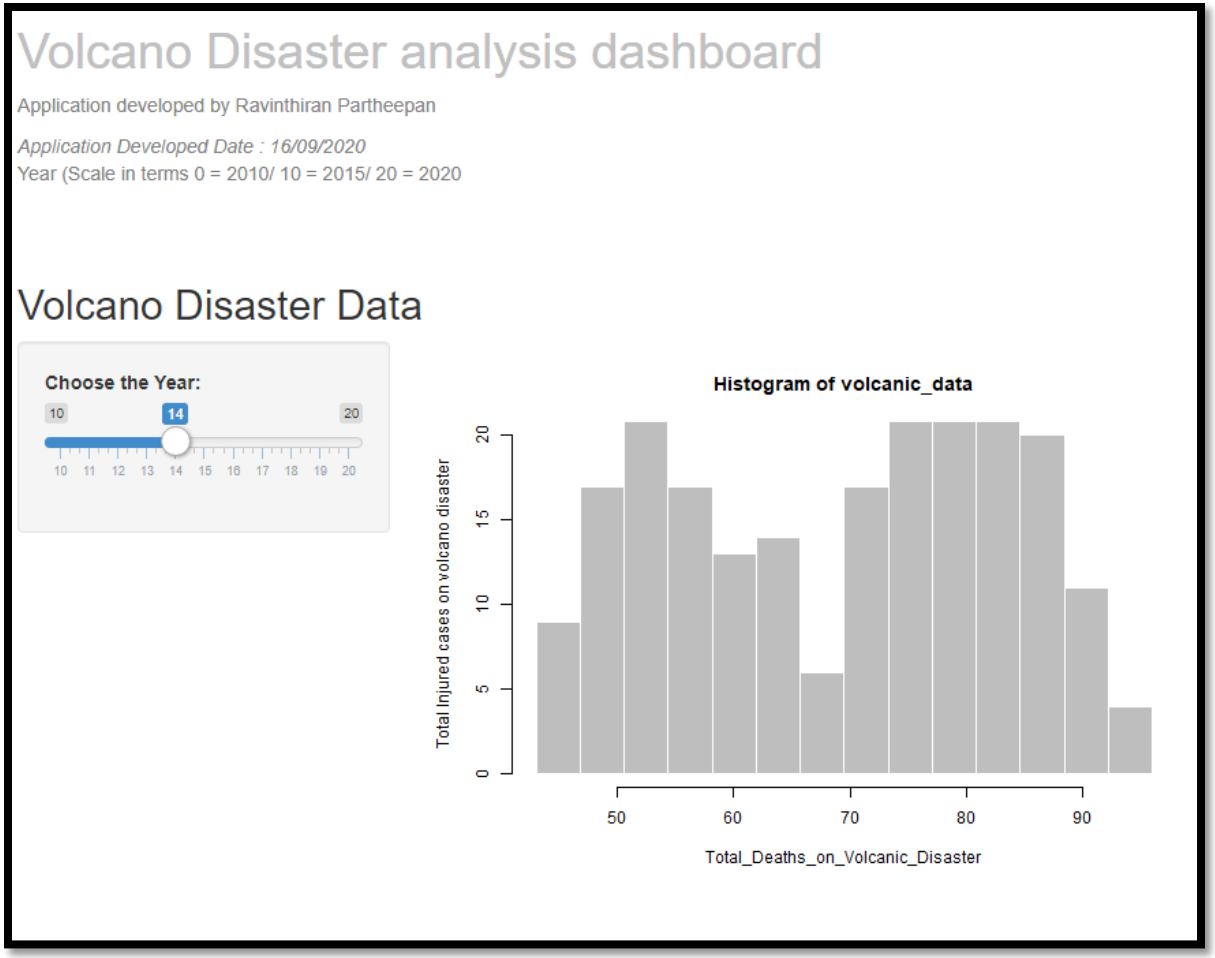
2011 Volcano Disaster Analysis Visualization with histogram Plot



2013 Volcano Disaster Analysis Visualization with histogram Plot



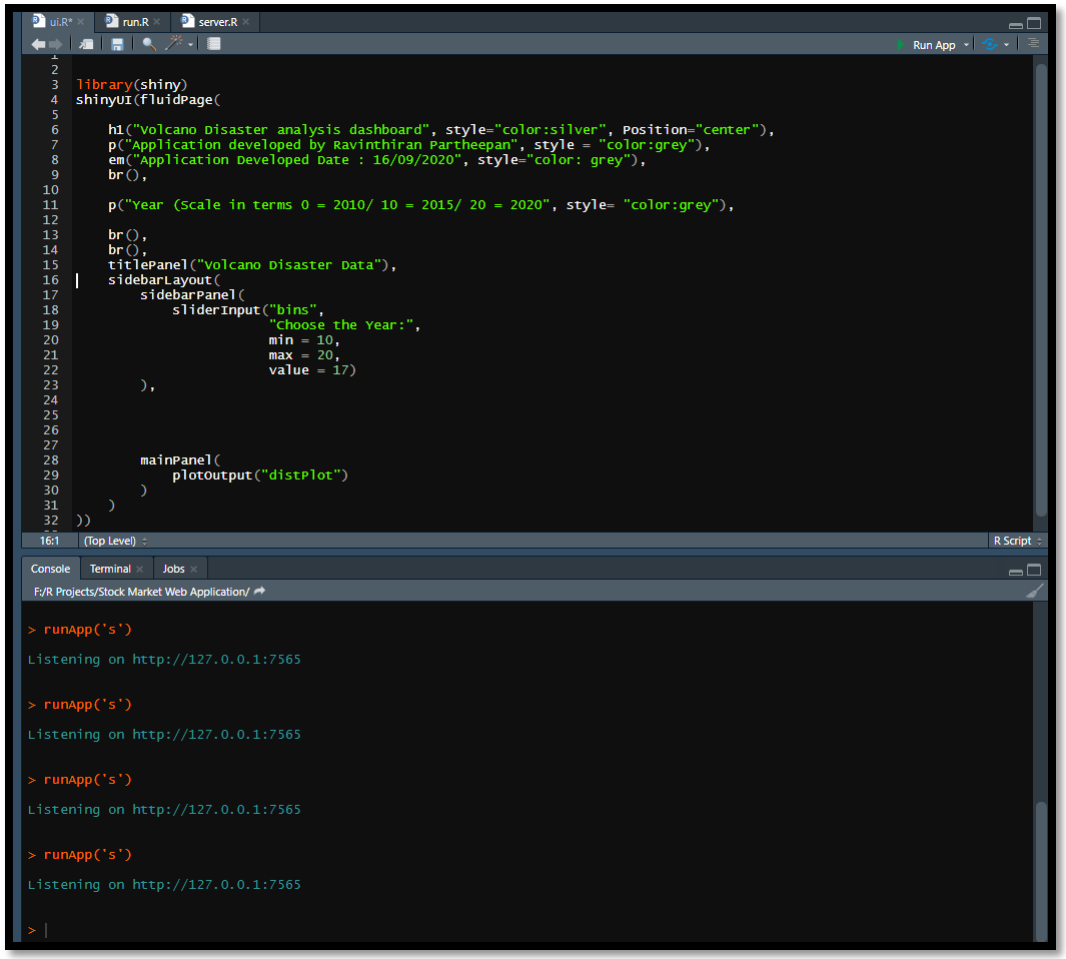
2014 Volcano Disaster Analysis Visualization with histogram Plot



Interactive Data Visulaization

- Programming language Used – R
- Package Used – Shiny

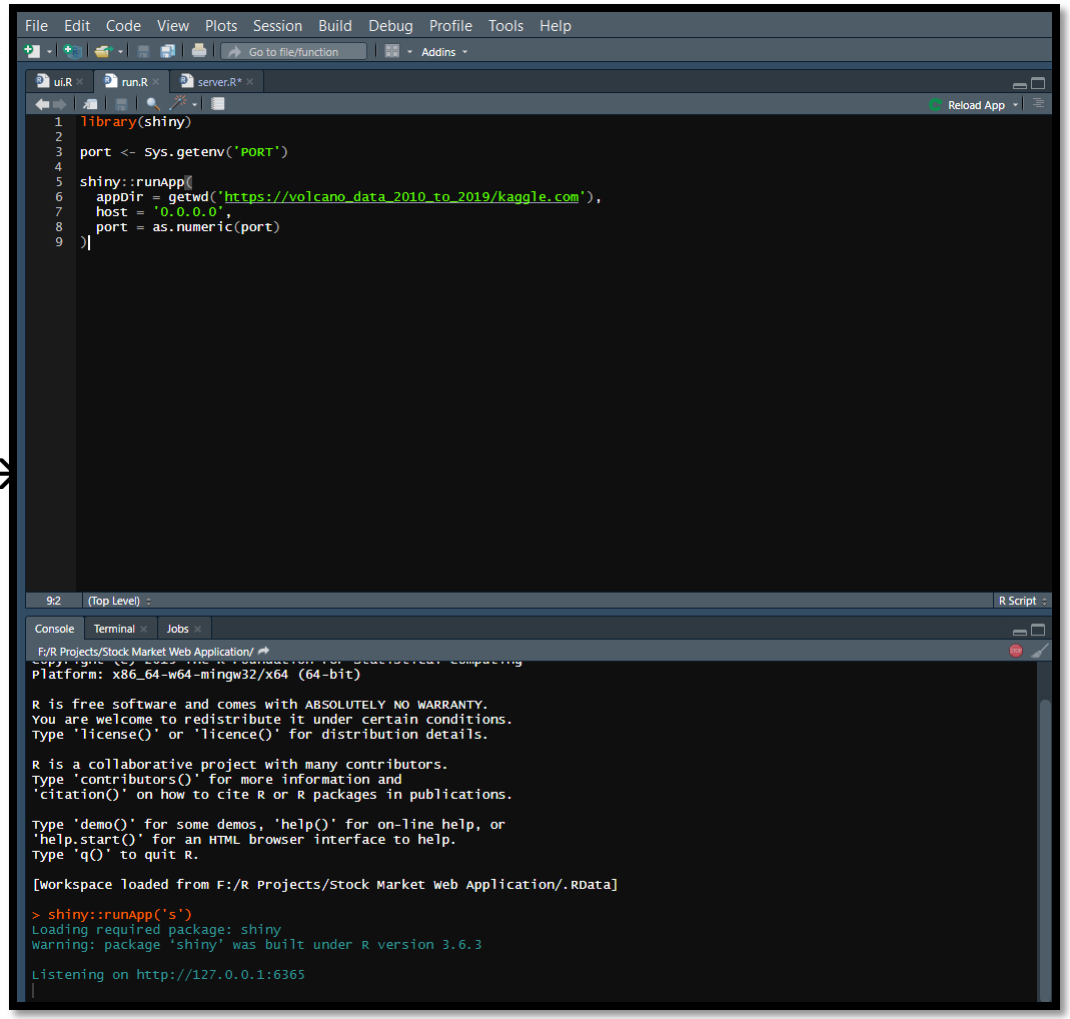
- UI.R (Front End) ------→



Interactive Data Visulaization

- Programming language Used-R
- Package Used – Shiny

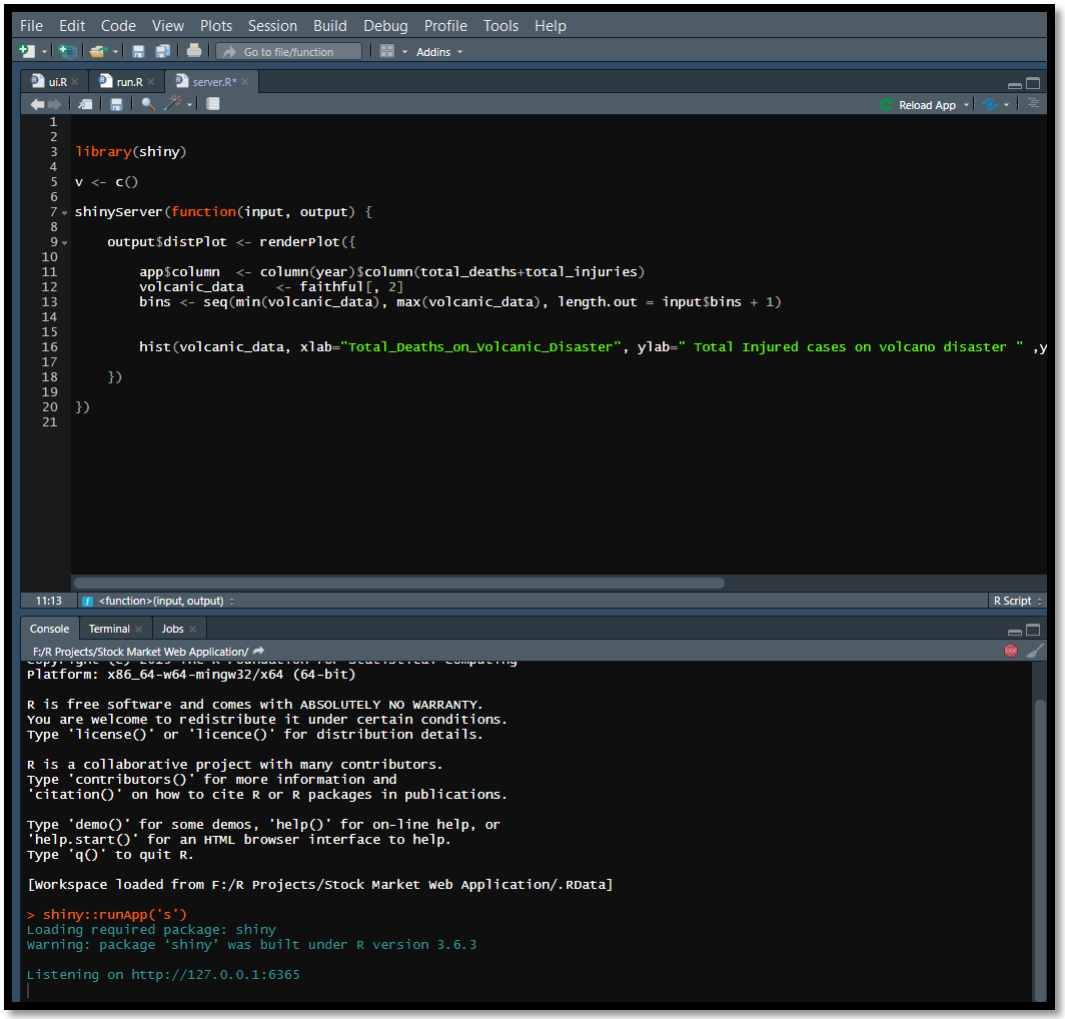
- Port Connectivity ----- ----->



Interactive Data Visulaization

- R Script
- Package Used – Shiny

- Port Connectivity ---→



Heroku (PaaS)

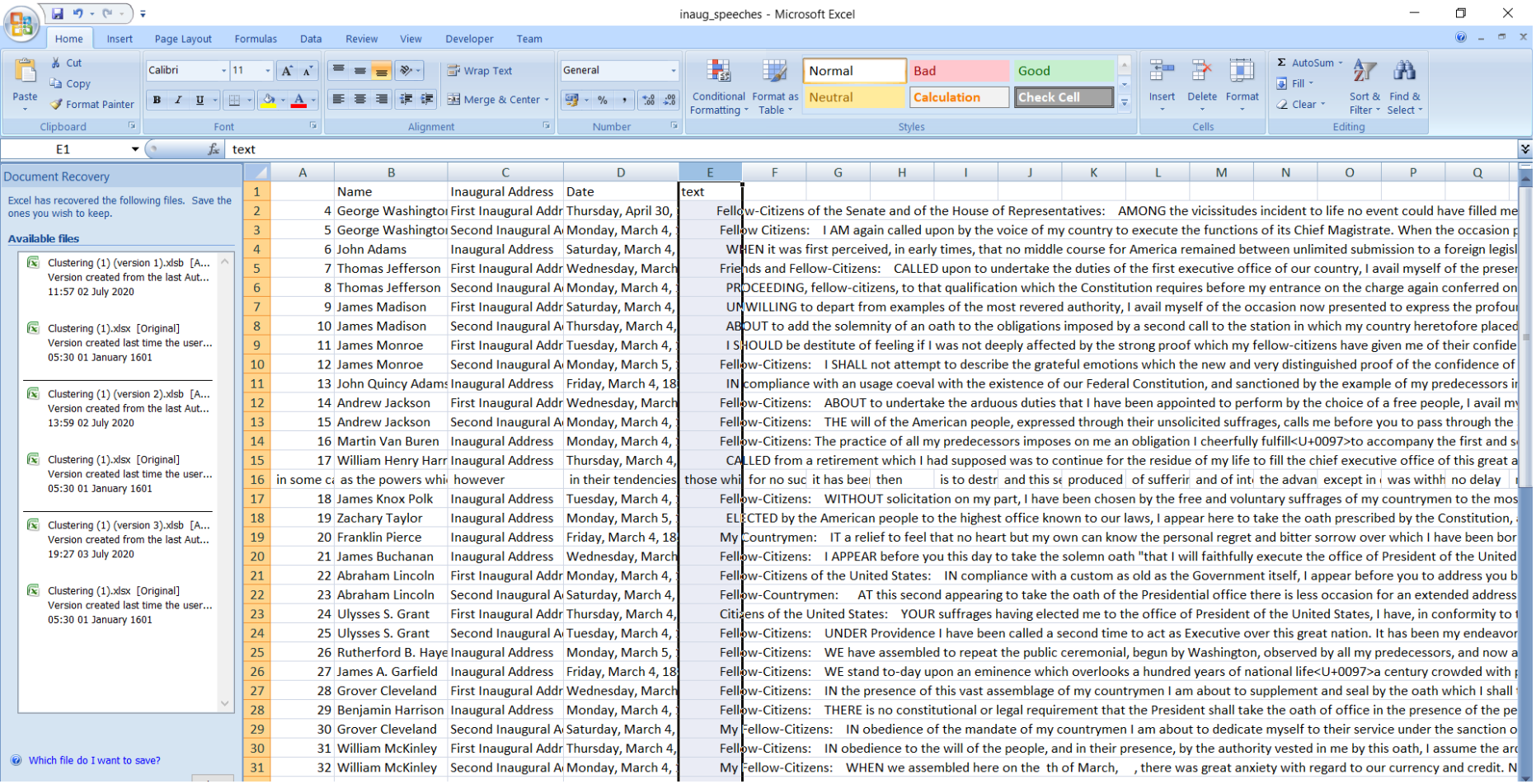
- Link to the web application :-

- https://volcano-disaster-analysis-rp.herokuapp.com/

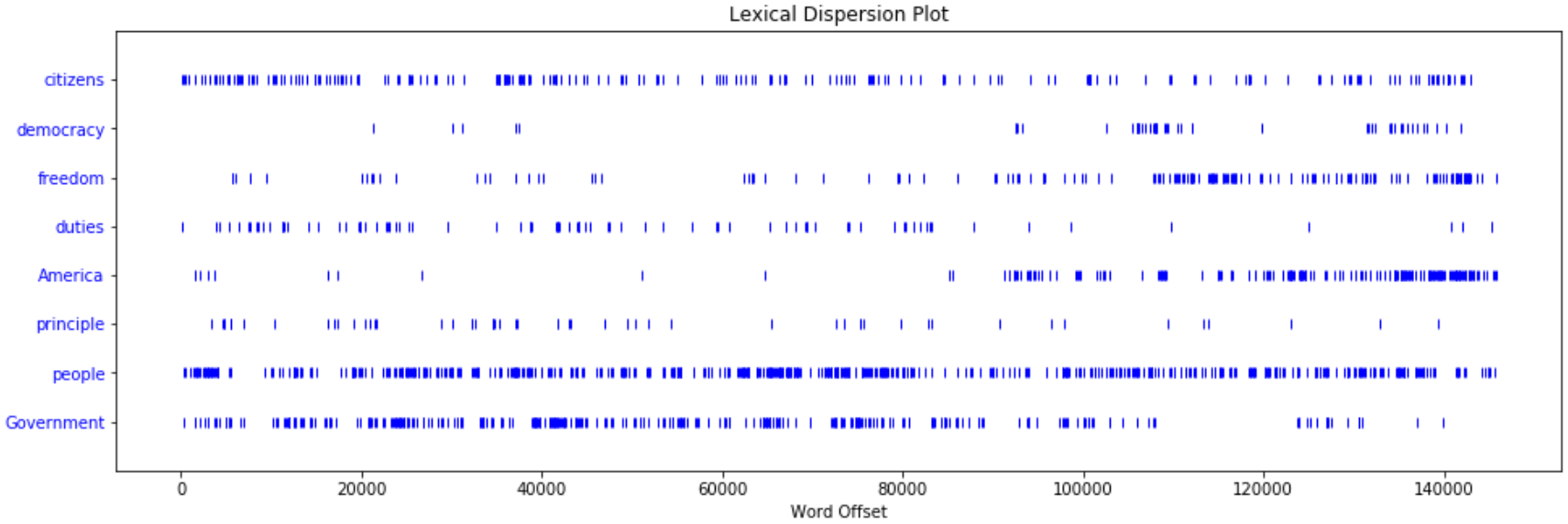
Task No. 8

Text Visualization

About Dataset - Presidential Inaugural Addresses

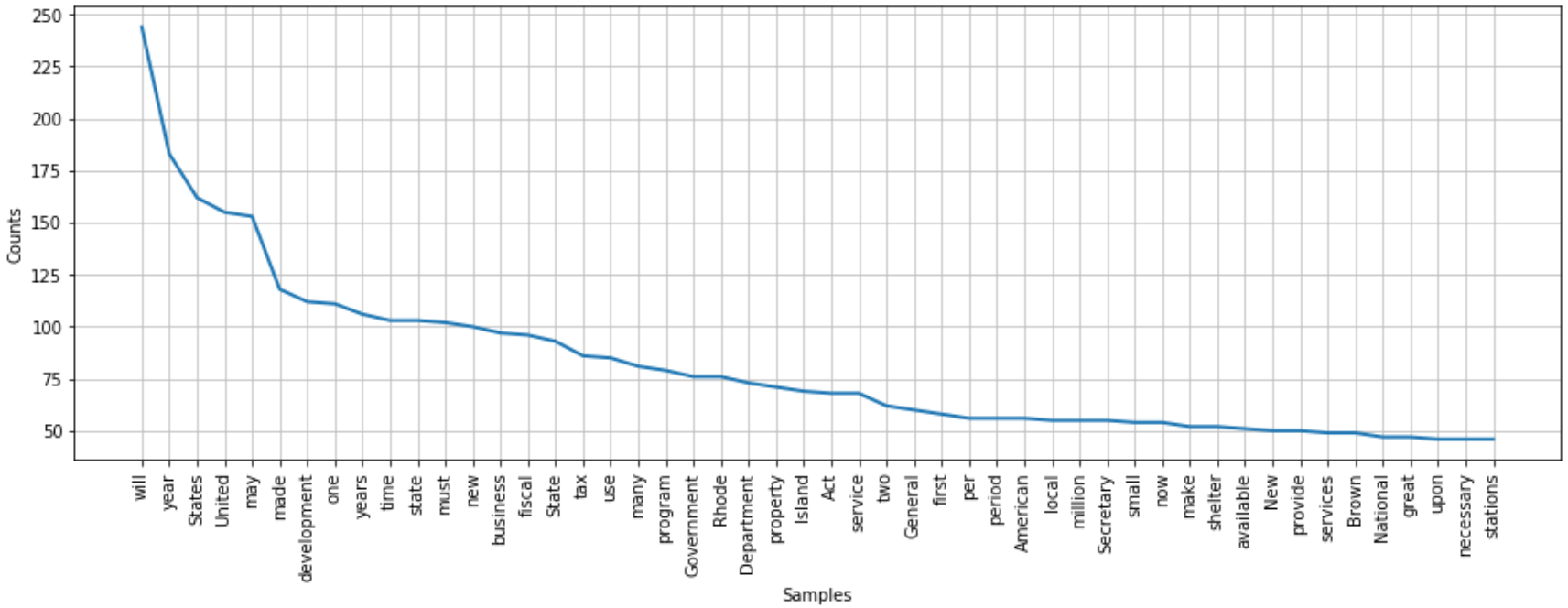


Lexical Dispersion



Lexical diversity lets us what is the percentage of the unique words in the text corpus

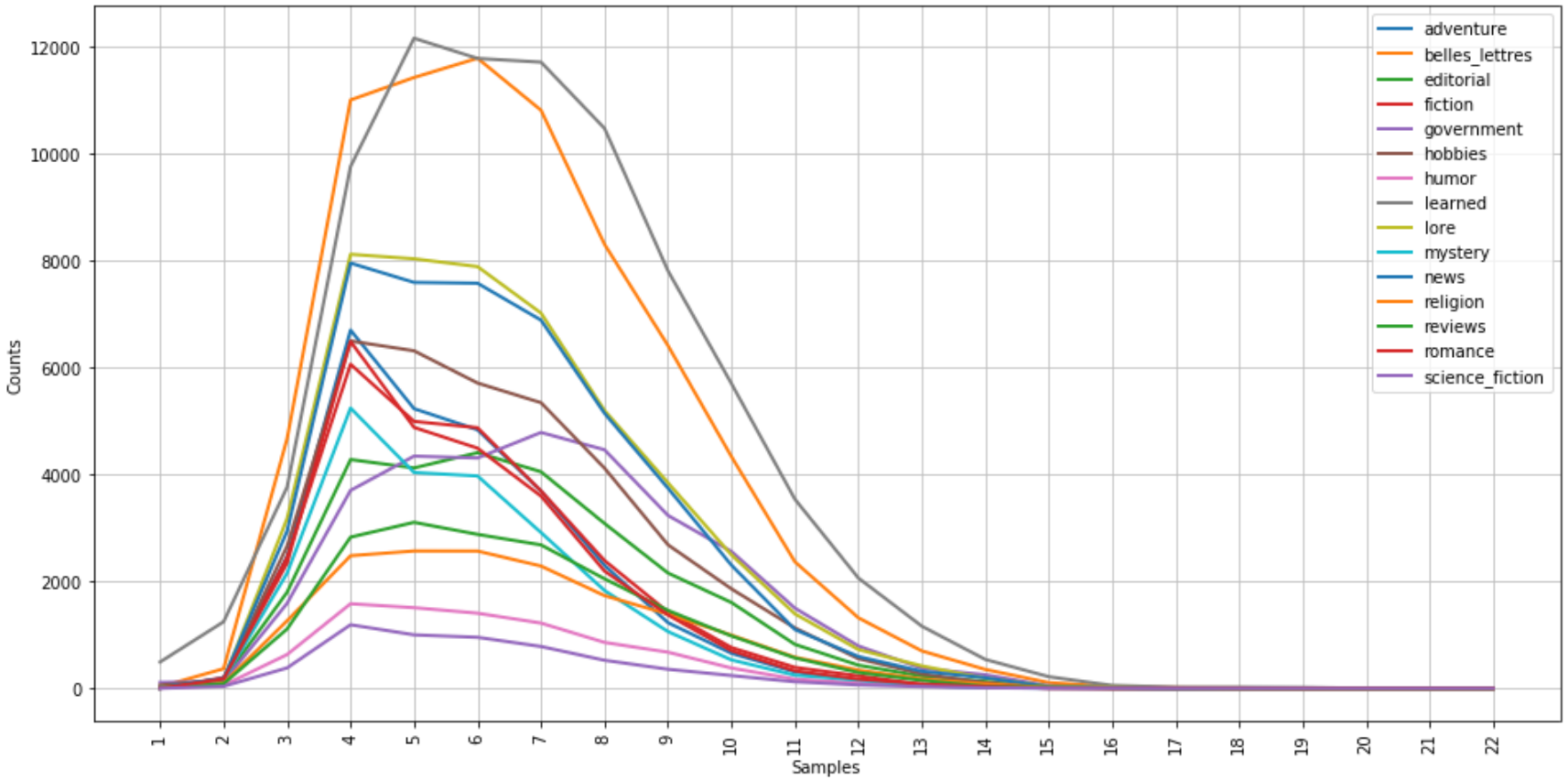
Word Counts


Counts
250
225
200
175
150
125
100
75
50
will
year
States
United
may
made
development
one
years
time
state
must
new
business
fiscal
State
tax
use
many
program
Government
Rhode
Department
property
Island
Act
service
two
General
first
per
period
American
local
million
Secretary
small
now
make
shelter
available
New
provide
services
Brown
National
great
upon
necessary
stations
Samples

Word Cloud

WordClouds help in detecting the words that occur frequently.

Word Length Distribution



This plot helps to visualize the composition of different word length in the text corpus.

Program Code – Python and NLTK

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from wordcloud import WordCloud,STOPWORDS
```

In [4]:
```
import nltk
nltk.download('inaugural')
```

```
[nltk_data] Downloading package inaugural to
[nltk_data]     C:\Users\RAVINTHIRAN\AppData\Roaming\nltk_data...
[nltk_data]   Unzipping corpora\inaugural.zip.
```

Out[4]: True

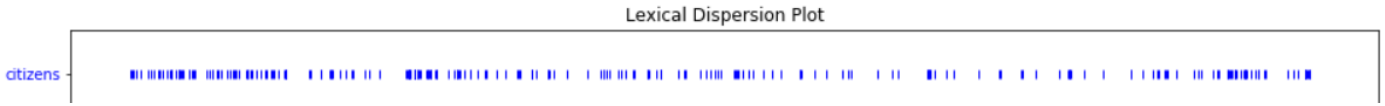
In [5]:
```
from nltk.corpus import inaugural
data = pd.read_csv('F:/Applied Informatics/Semester III/Data Visualization/Homeworks/Task8/archive.csv')
text = inaugural.raw()
wordcloud = WordCloud(max_font_size=60).generate(text)
plt.figure(figsize=(16,12))

plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")
plt.show()
```

Program Code

In [14]:
```
nltk.download('gutenberg')
nltk.download('treebank')
from  nltk.book import text4 as inaugural_speeches
plt.figure(figsize=(16,5))
topics = ['citizens', 'democracy', 'freedom', 'duties', 'America','principle','people', 'Government']
inaugural_speeches.dispersion_plot(topics)
```

```
[nltk_data] Downloading package gutenberg to
[nltk_data]     C:\Users\RAVINTHIRAN\AppData\Roaming\nltk_data...
[nltk_data]   Package gutenberg is already up-to-date!
[nltk_data] Downloading package treebank to
[nltk_data]     C:\Users\RAVINTHIRAN\AppData\Roaming\nltk_data...
[nltk_data]   Unzipping corpora\treebank.zip.
```

```
*** Introductory Examples for the NLTK Book ***
Loading text1, ..., text9 and sent1, ..., sent9
Type the name of the text or sentence to view it.
Type: 'texts()' or 'sents()' to list the materials.
text1: Moby Dick by Herman Melville 1851
text2: Sense and Sensibility by Jane Austen 1811
text3: The Book of Genesis
text4: Inaugural Address Corpus
text5: Chat Corpus
text6: Monty Python and the Holy Grail
text7: Wall Street Journal
text8: Personals Corpus
text9: The Man Who Was Thursday by G . K . Chesterton 1908
```



Program Code

In [16]:
```
nltk.download('brown')
from nltk.corpus import brown
stop_words = set(STOPWORDS)
topics = ['government', 'news', 'religion','adventure','hobbies']
for topic in topics:
    # filter out stopwords and punctuation mark and only create array of words
    words = [word for word in brown.words(categories=topic)
            if word.lower() not in stop_words and word.isalpha() ]
    freqdist = nltk.FreqDist(words)
    # print 5 most frequent words
    print(topic,'more :', ' , '.join([ word.lower() for word, count in freqdist.most_common(5)]))
    # print 5 least frequent words
    print(topic,'less :', ' , '.join([ word.lower() for word, count in freqdist.most_common()[-5:]]))
```

```
[nltk_data] Downloading package brown to
[nltk_data]     C:\Users\RAVINTHIRAN\AppData\Roaming\nltk_data...
[nltk_data]   Unzipping corpora\brown.zip.
```

```
government more : will , year , states , united , may
government less : load , cadre , perception , lengthened , shadow
news more : said , will , one , last , two
news less : pupils , render , vitally , richer , fuller
religion more : god , world , one , may , new
religion less : medium , sat , ivory , velvet , sadness
adventure more : said , back , man , one , time
adventure less : snick , fisted , overhand , plunge , insanely
hobbies more : will , one , may , time , two
hobbies less : explore , hinterlands , bride , winner , sweepstakes
```

In [17]:
```
corpus_genre = 'government'
words = [word for word in brown.words(categories=corpus_genre) if word.lower() not in stop_words and word.isalpha() ]
freqdist = nltk.FreqDist(words)
```

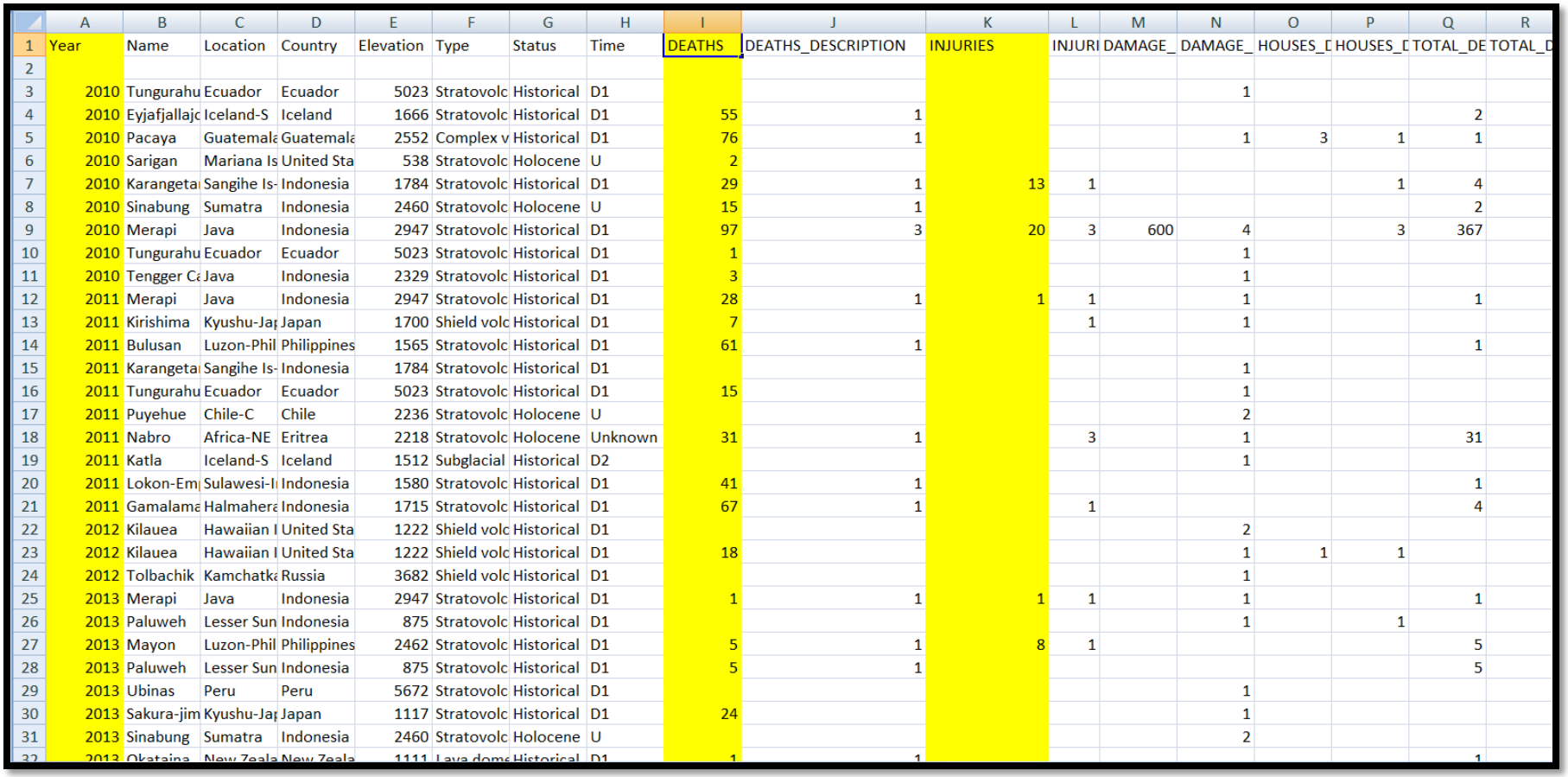
Task No.2

- A box plot is used for summarizing a set of data measured on an interval scale.
- It is often used in explanatory data analysis.
- This type of graph is used to show the shape of the distribution, its central value, and its variability.

Programming Language

- Task 1 and 2 – R Script and Shiny Package
- Task 3,4 and 6/7 – Plotly Package and Python

Info about the Dataset



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2																		
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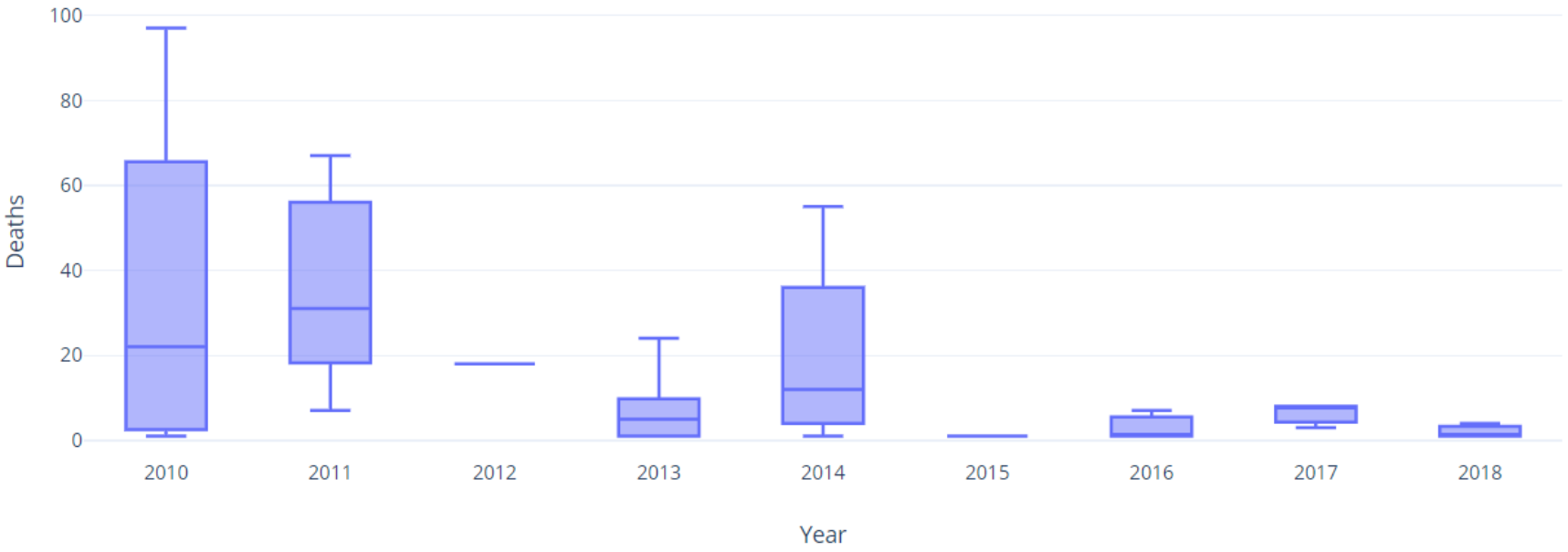
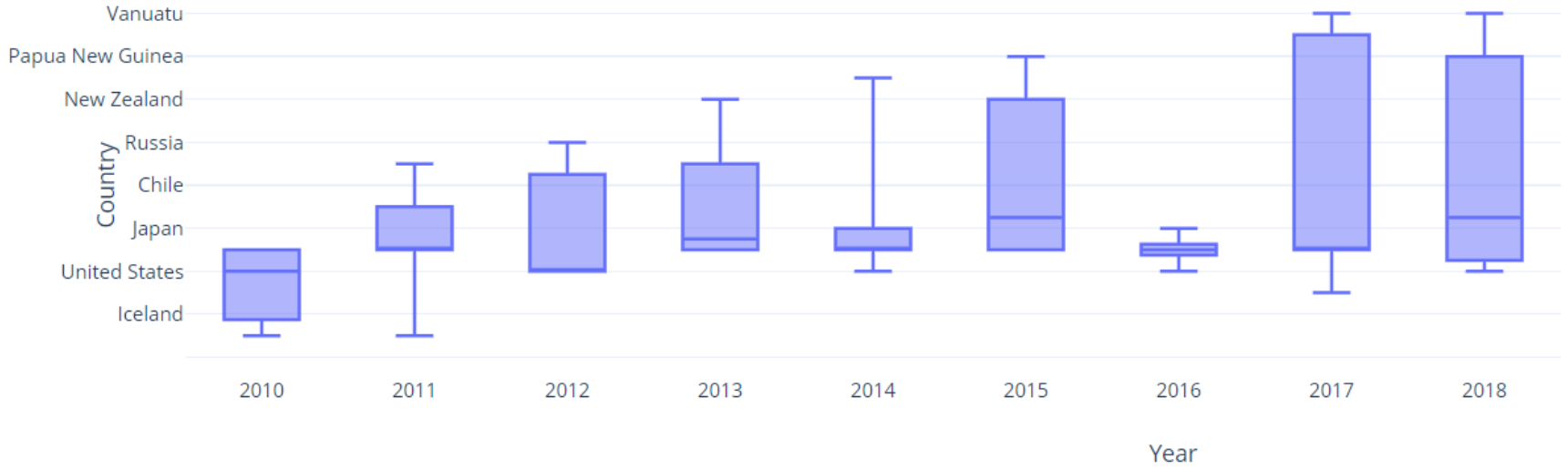
4	2010	Eyjafjallajc	Iceland-S	Iceland	1666	Stratovolc	Historical	D1	55	1							2	
5	2010	Pacaya	Guatemala	Guatemala	2552	Complex v	Historical	D1	76	1				1	3	1	1	
6	2010	Sarigan	Mariana Is	United Sta	538	Stratovolc	Holocene	U	2									
7	2010	Karangeta	Sangihe Is-	Indonesia	1784	Stratovolc	Historical	D1	29	1	13	1				1	4	
8	2010	Sinabung	Sumatra	Indonesia	2460	Stratovolc	Holocene	U	15	1							2	
9	2010	Merapi	Java	Indonesia	2947	Stratovolc	Historical	D1	97	3	20	3	600	4		3	367	
10	2010	Tungurahu	Ecuador	Ecuador	5023	Stratovolc	Historical	D1	1					1				
11	2010	Tengger Ca	Java	Indonesia	2329	Stratovolc	Historical	D1	3					1				
12	2011	Merapi	Java	Indonesia	2947	Stratovolc	Historical	D1	28	1	1	1		1			1	
13	2011	Kirishima	Kyushu-Jap	Japan	1700	Shield volc	Historical	D1	7			1		1				
14	2011	Bulusan	Luzon-Phil	Philippines	1565	Stratovolc	Historical	D1	61	1							1	
15	2011	Karangeta	Sangihe Is-	Indonesia	1784	Stratovolc	Historical	D1						1				
16	2011	Tungurahu	Ecuador	Ecuador	5023	Stratovolc	Historical	D1	15					1				
17	2011	Puyehue	Chile-C	Chile	2236	Stratovolc	Holocene	U						2				
18	2011	Nabro	Africa-NE	Eritrea	2218	Stratovolc	Holocene	Unknown	31	1		3		1			31	
19	2011	Katla	Iceland-S	Iceland	1512	Subglacial	Historical	D2						1				
20	2011	Lokon-Em	Sulawesi-I	Indonesia	1580	Stratovolc	Historical	D1	41	1							1	
21	2011	Gamalama	Halmahera	Indonesia	1715	Stratovolc	Historical	D1	67	1		1					4	
22	2012	Kilauea	Hawaiian I	United Sta	1222	Shield volc	Historical	D1						2				
23	2012	Kilauea	Hawaiian I	United Sta	1222	Shield volc	Historical	D1	18					1	1	1		
24	2012	Tolbachik	Kamchatka	Russia	3682	Shield volc	Historical	D1						1				
25	2013	Merapi	Java	Indonesia	2947	Stratovolc	Historical	D1	1	1	1	1		1			1	
26	2013	Paluweh	Lesser Sun	Indonesia	875	Stratovolc	Historical	D1						1		1		
27	2013	Mayon	Luzon-Phil	Philippines	2462	Stratovolc	Historical	D1	5	1	8	1					5	
28	2013	Paluweh	Lesser Sun	Indonesia	875	Stratovolc	Historical	D1	5	1							5	
29	2013	Ubinas	Peru	Peru	5672	Stratovolc	Historical	D1						1				
30	2013	Sakura-jim	Kyushu-Jap	Japan	1117	Stratovolc	Historical	D1	24					1				
31	2013	Sinabung	Sumatra	Indonesia	2460	Stratovolc	Holocene	U						2				
32	2013	Okataina	New Zeala	New Zeala	1111	Lava dom	Historical	D1	1	1							1	

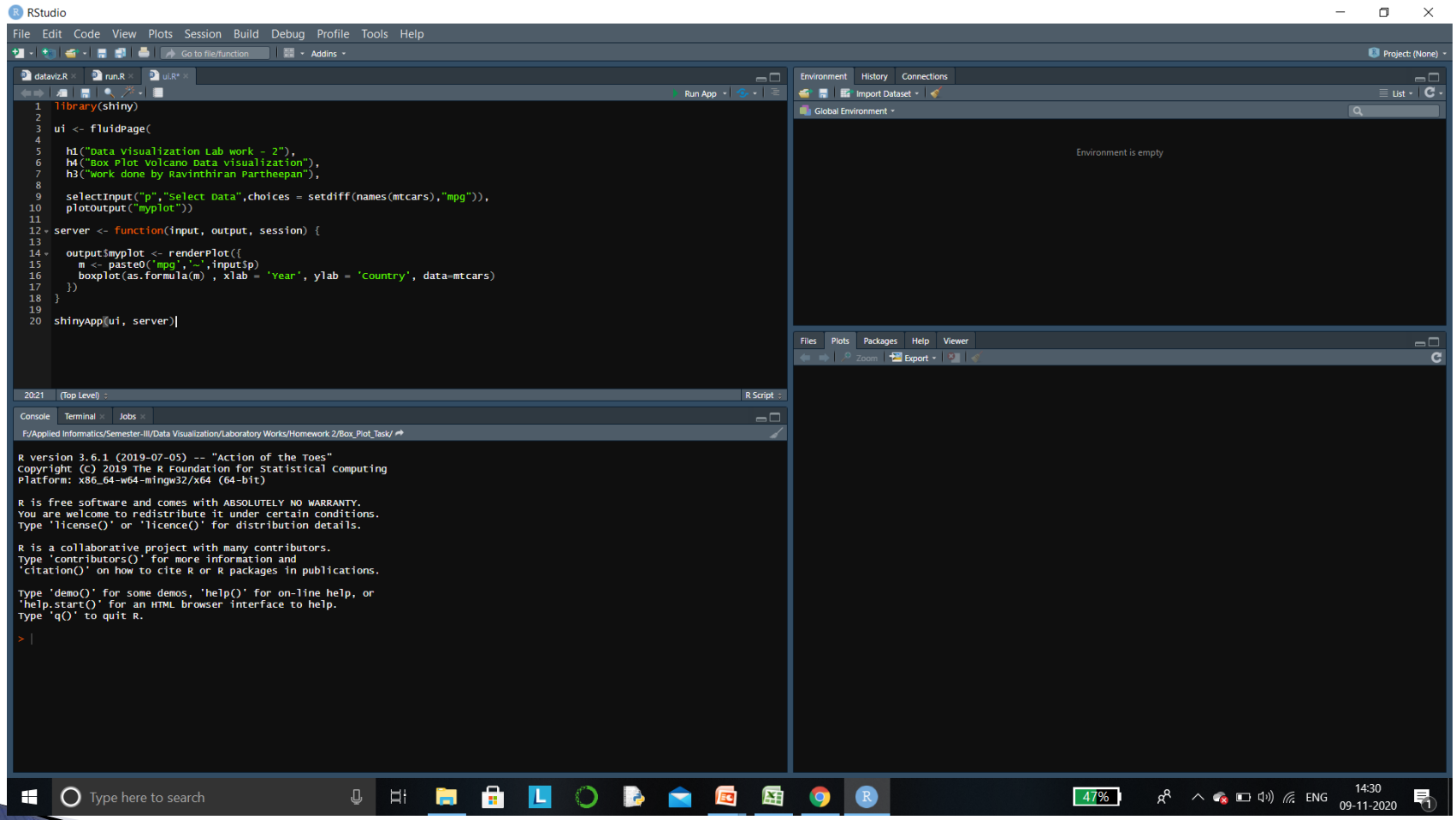
Box Plot – Volcano Year and Death



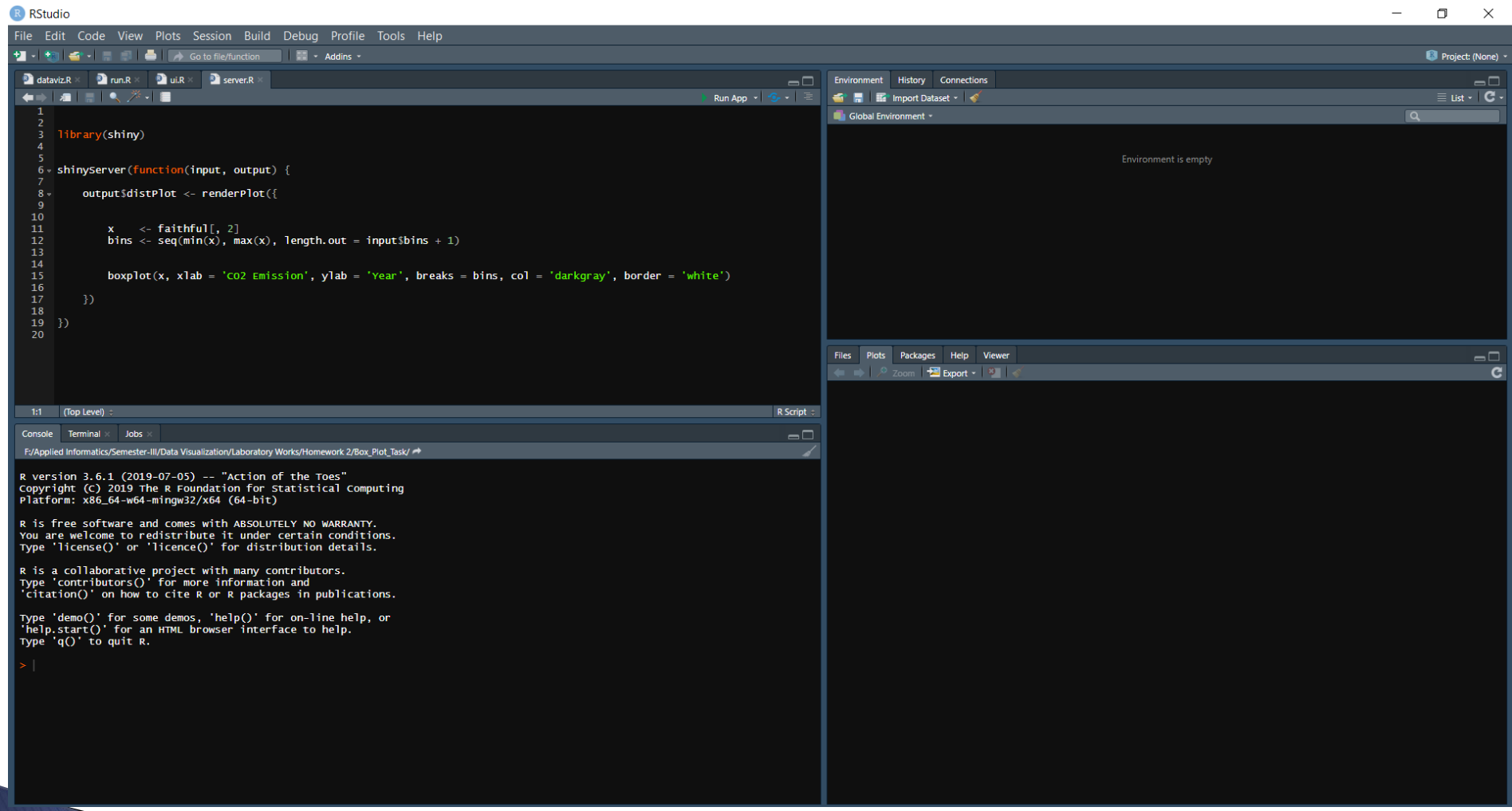
Box Plot – Volcano Country and Year



Program Code – R and Shiny



Program Code – R and Shiny



Task – 3 Distance Metrices

- **Euclidean** - Direction gives the direction from each cell to the closest source.
- **Manhattan -** Manhattan distance, also known as city block distance and used calculate the distance between two data points in a grid-like path.
- **Simple Matching Co-efficient –** It gives equal information and diversity about data.
- **Jaccard -** used to calculate the intersection of n × n clusters and divided by the union of two sets.
- **Cosine –** It is a metric used to measure the angle between two vectors and determines which vectors are in same direction.

Time Series Plot

- Time series graphs can be used to visualize trends in counts or numerical values over time.
- Because date and time information is continuous categorical data (expressed as a range of values),
- points are plotted along the x-axis and connected by a continuous line.

Ploty – Geomap program code

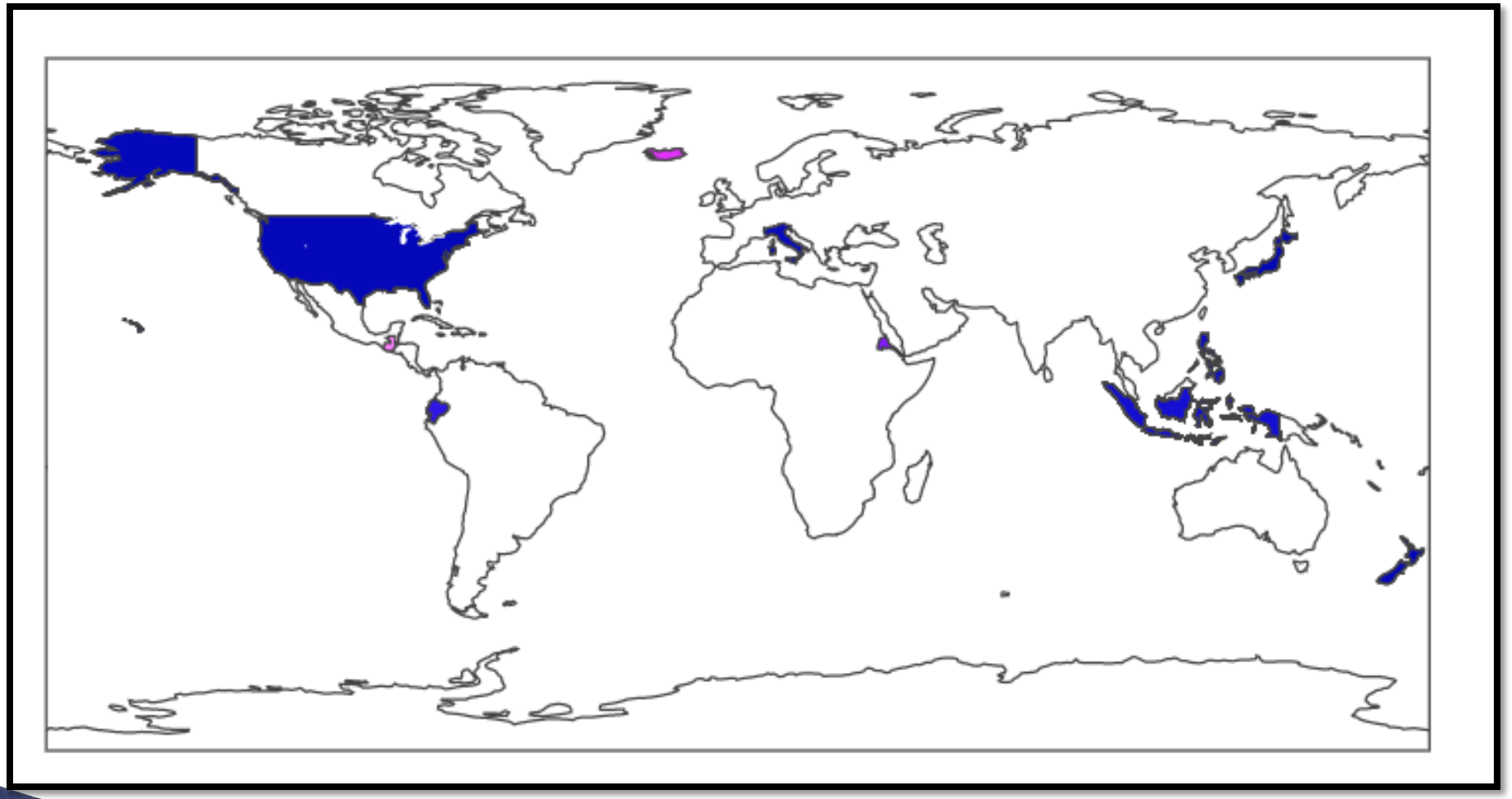
task3.py - F:/Applied Informatics/Semester-III/Data Visualization/Laboratory Works/Homework 3/task3.py (3.7.2)

File Edit Format Run Options Window Help

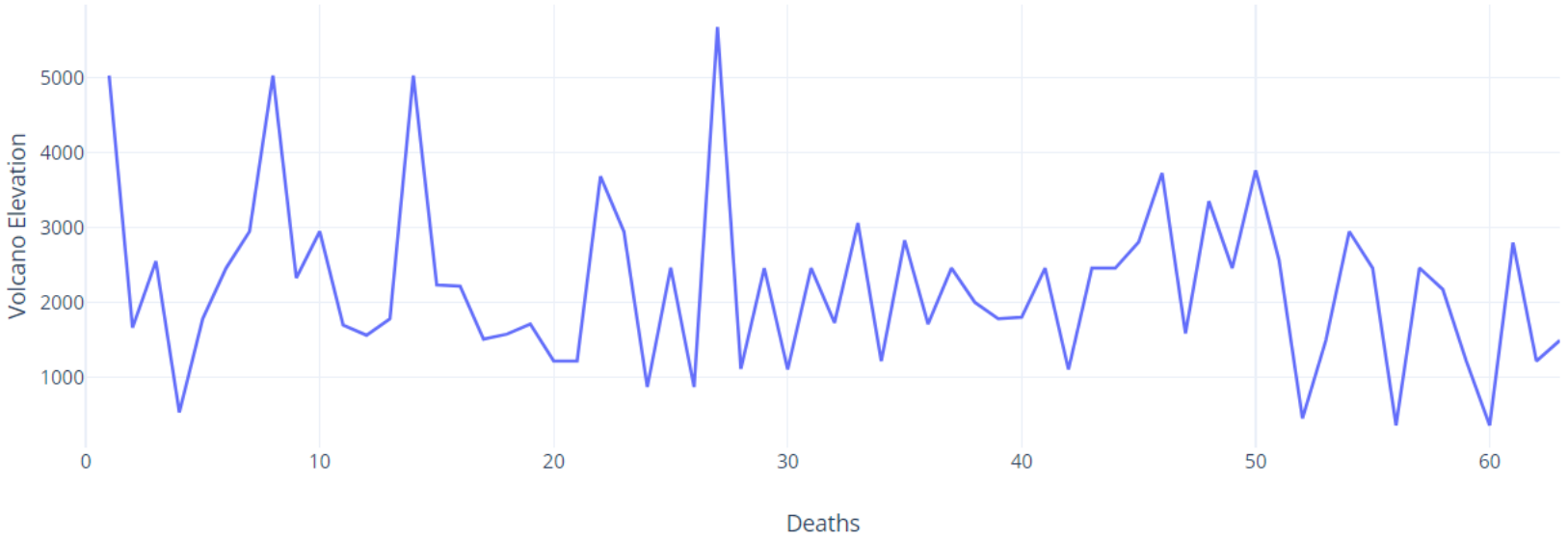
```
from urllib.request import urlopen
import json
with urlopen('https://raw.githubusercontent.com/plotly/datasets/master/geojson-counties-fips.json') as response: counties = json.load(response)
import pandas as pd
df = pd.read_csv('F:/Applied Informatics/Semester-III/Data Visualization/Laboratory Works/Homeowrk_1/volcano_data_2010.csv', dtype={"fips": str})
df.reset_index(inplace=True)

df['year'] = [d.year for d in df.elevation]
df['elevation'] = [d.strftime('%b') for d in df.elevation]
years = df['year'].unique()

np.random.seed(100)
mycolors = np.random.choice(list(mpl.colors.XKCD_COLORS.keys()), len(years), replace=False)


plt.figure(figsize=(16,12), dpi= 80)
for i, y in enumerate(years):
    if i > 0:
        plt.plot('month', 'value', data=df.loc[df.year==y, :], color=mycolors[i], label=y)
        plt.text(df.loc[df.year==y, :].shape[0]-.9, df.loc[df.year==y, 'value'][-1:].values[0], y, fontsize=12, color=mycolors[i])

# Decoration
plt.gca().set(xlim=(-0.3, 11), ylim=(2, 30), ylabel='$Elevation', xlabel='$Year$')
plt.yticks(fontsize=12, alpha=.7)
plt.title("Seasonal Plot of Volcanic eruption elevation Time Series", fontsize=20)
plt.show()
import plotly.express as px
fig = px.choropleth(df, geojson=counties, locations='fips', color='elevation', color_continuous_scale="Viridis", range_color=(0, 12), scope='world', labels={'elevation':'Elevtion'} )
fig.update_layout(margin={"r":0,"t":0,"l":0,"b":0})
fig.show()
```

Ln: 31 Col: 0

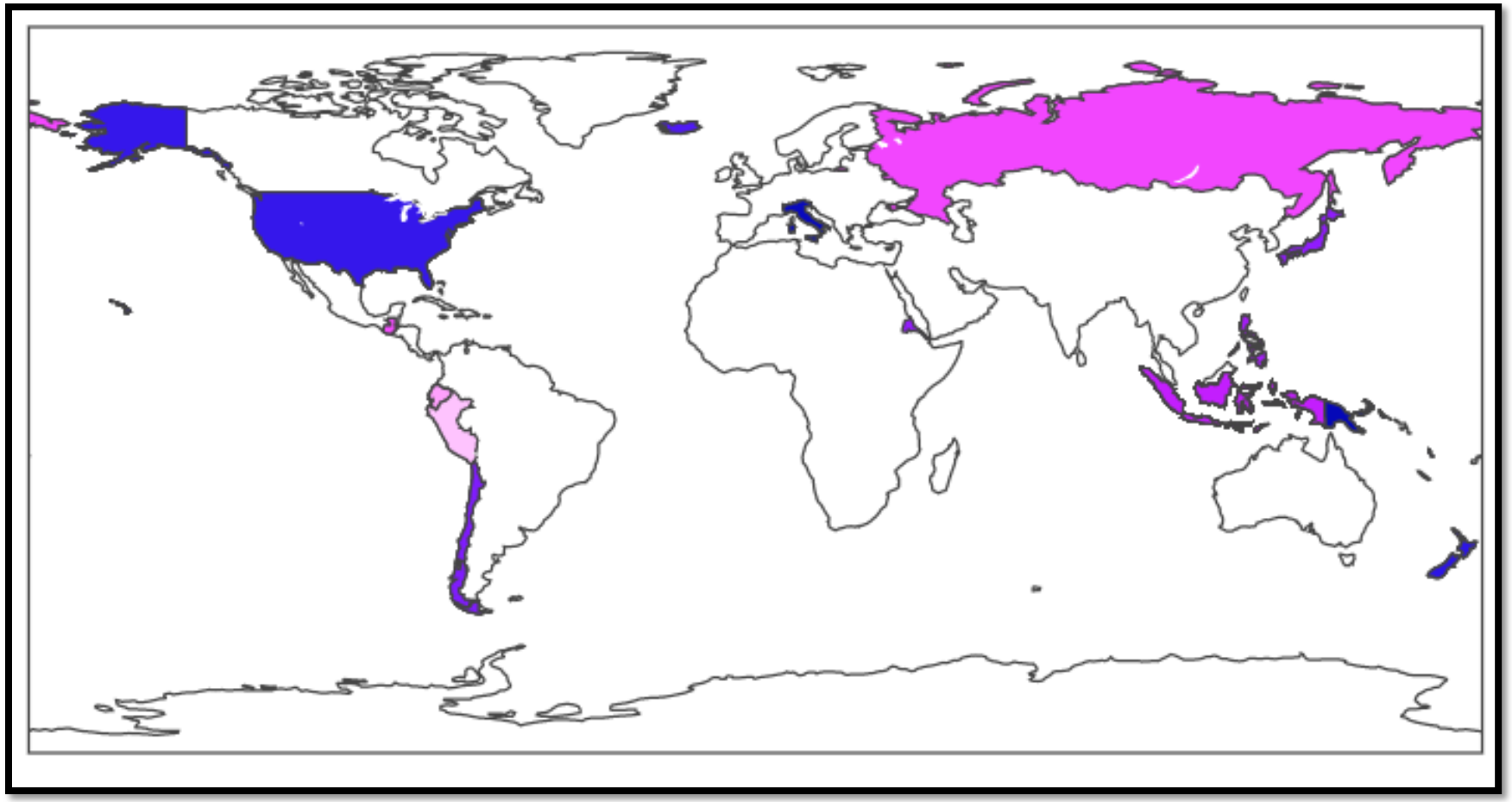
Volcano eruption – Countries



Time series – Volcano Elevation and Deaths



Countries and Elevation



Task No.4 – Multi-dimensional data visualization

- It represents one dimension as point and 2D, 3D as a object or graph.
- It is used for descriptive data analysis.
- The dimensions is a cluster of related objects also known as attributes.
- Multidimensional data is used to provide information about fact (Numerical) data in or more perspective.

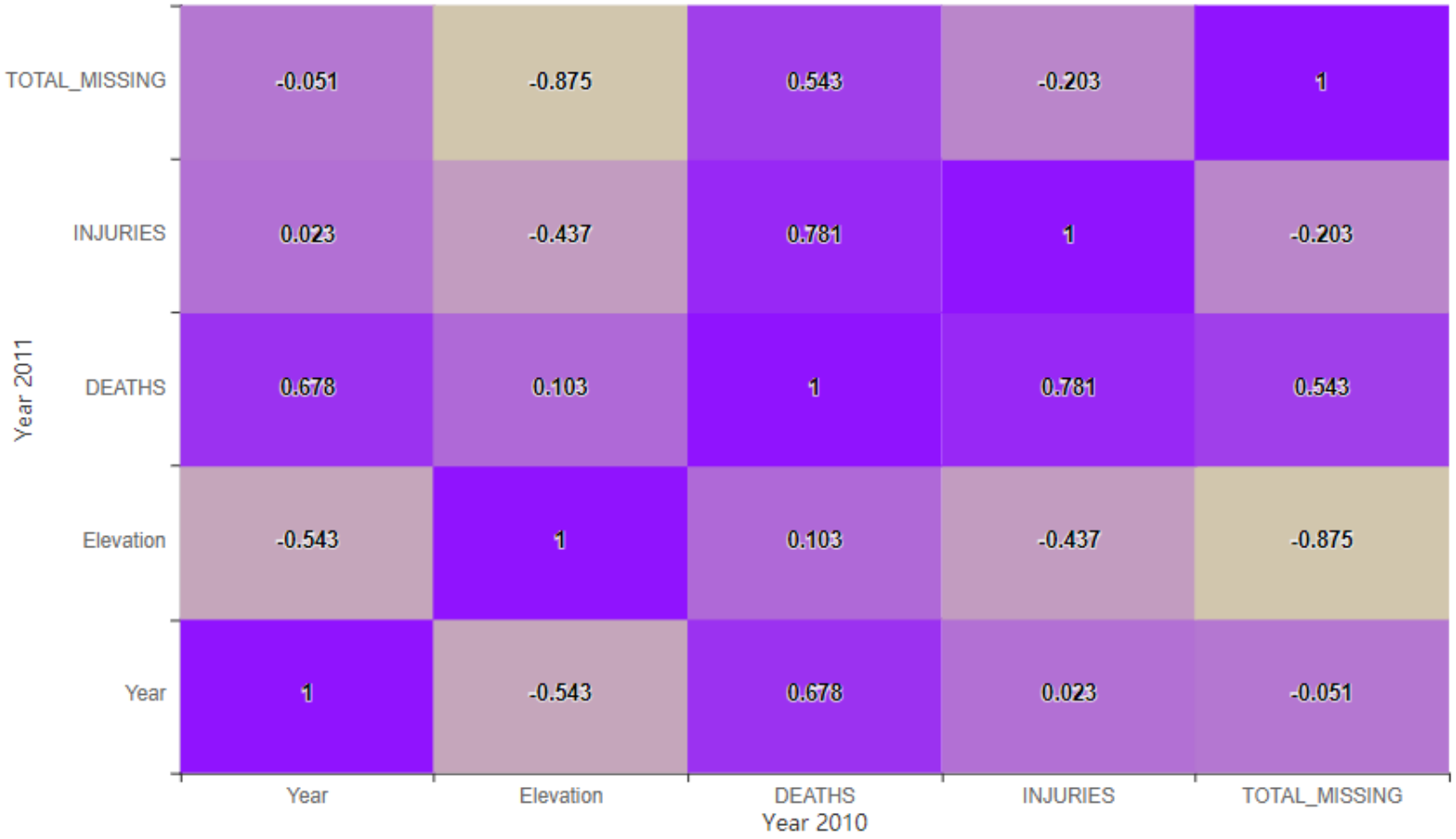
Common Methods to Visualize

- The **facet** approach partitions a **plot** into a matrix of panels.
- Each panel shows a different subset of the data.
- Colors – To show different groups / classes.
- Shapes – To show variations.
- Sizes – To show the analytic measurements.

Correlation Analysis

- Pearson Correlation coefficient also known as bivariate correlation
- It is a statistic that measures linear correlation between two variables *X* and *Y*.
- It has a value between +1 and −1.
- A value of +1 is total positive linear correlation, 0 is no linear correlation, and −1 is total negative linear correlation
- **Pearson Correlation (x,y) = cov(x,y) / std(x) * std(y)**
- Cov(x,y) = Sum[(x – mean(x)) (Y – mean(y))]
- **Correlation = [xy] – [x] * [y] / Sqrt([x^2] – [x]^2) * Sqrt([y^2] – [y]^2)**

Year 2010 and 2011 Correlation Analysis



Program Code

- Import pandas as pd , numpy as np
- Import seaborn as sns
- Import math
- Import matplotlib.pyplot as plt
- Import scipy.stats.pearsonr

- Volcano_filepath = “E:/Applied informatics/semester-III/Data Visulaization/Homework4/volcano_data_2010.csv"
- Volcano_data = pd.read_csv(volcano_filepath, index_col="Month")

- Vc = Volcano_data
- X = Volcano_filepath
  plt.sns.barplot(x=volcano_data.index, y=Volcano_data['NK'])
- Cov_volcano = cor(Vc, Volcano_data)

- Data_Volcano = **scipy.stats.pearsonr(x, y)**
- plt.figure(figsize=(14,7))
- plt.title(“Volcano Correlation analysis 2010 and 2011")
- sns.heatmap(data=Volcano_data, annot=True)

Task – 6/7

Principal Component Analysis

- **Principal component analysis** (**PCA**) is a technique used to emphasize variation and bring out strong patterns in a dataset.
- It's often used to make **data** easy to explore and **visualize**.
- Projects higher dimensional data into lower dimensional data
- It combines both the dimesion correlated features into new features.
- Provides valuable insights beyond descriptive statistics and helps to discover underlying patterns

PCA – Metrices for Data Exploration

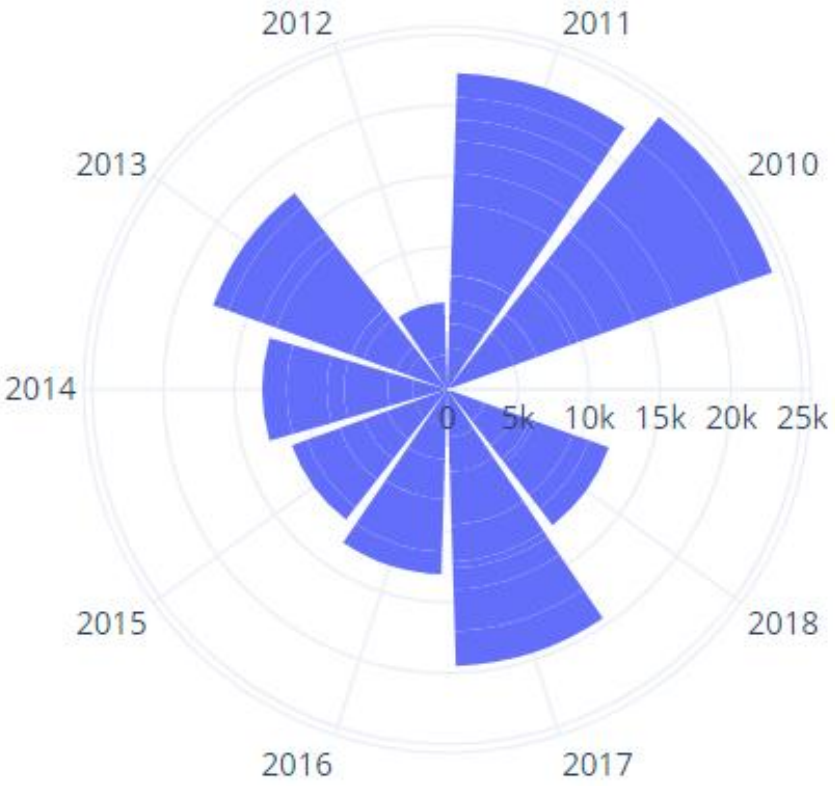
- Explained Variance - measures how much a model can reflect the variance of the whole data. Principle components try to capture as much of the variance as possible and this measure shows to what extent they can do that.

- Factor loading - indicates how much a variable correlates with a component. Each component is made of a linear combination of variables, where some might have more weight than others. Factor loadings indicate this as correlation coefficients, ranging from -1 to 1, and make components interpretable.

Program Code – Plotly

```
import numpy as np
import matplotlib.pyplot as plt
data = F://Applied Informatics/Semester-III/volcano_data_2010.csv
 Compute pie slices N = 20
theta = np.linspace(0.0, 2 * np.pi, N, endpoint=False)
radii = 10 * np.random.rand(N)
width = np.pi / 4 * np.random.rand(N)
colors = plt.cm.viridis(radii / 10.)
ax = plt.subplot(111, projection='polar')
ax.bar(theta, radii, width=width, bottom=0.0, color=colors, alpha=0.5)
plt.show()
```

Elevation and Year – Polar Bar



Longest axes – 2010
Smalles Axes – 2012

Country and Elevation

Deaths and Country

Thank You for Listening

Any Queries???