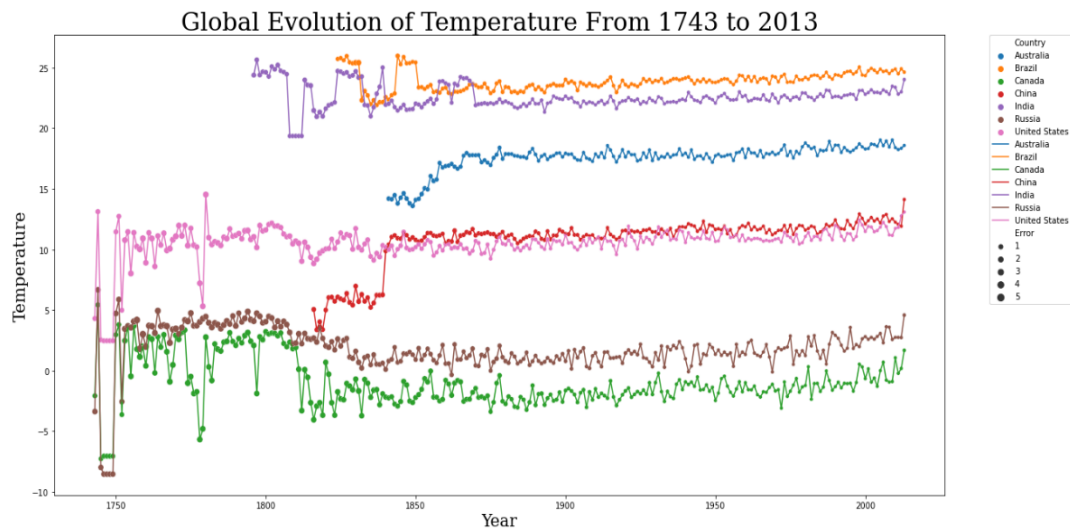


INFSCI 2415 Final Report

Global evolution of temperature, take the United States as an example

Figure 1: Combination of line plot and scatter plot of global temperature



Legend explained

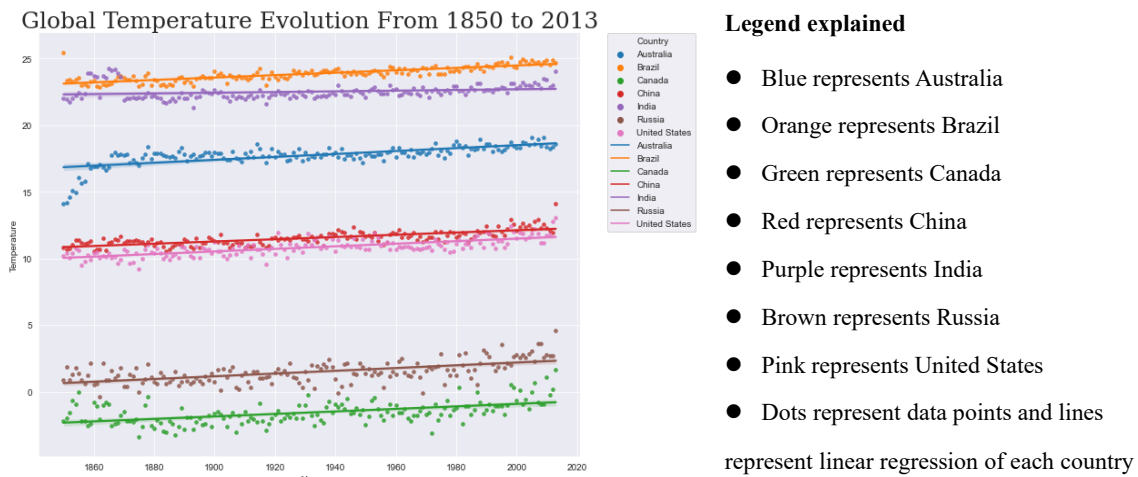
- Blue represents Australia
- Orange represents Brazil
- Green represents Canada
- Red represents China
- Purple represents India
- Brown represents Russia
- Pink represents United States
- Dots with different size and number represents the error. The magnitude of the error increases proportionally with the size of the dots or the numerical value.

Findings text introducing highlights of the produced figure in bulletin points

- This is a combined line plot and scatter plot that demonstrates the global temperature changes from 1743 to 2003.
- Temperatures in different countries varies due to the latitude differences.
- Before about 1850, temperatures in different countries were not stable and had large fluctuations.
- After about 1850, temperatures in different countries had small fluctuations and showed a very slow growth trend.

Data gathered from <https://www.kaggle.com/datasets/berkeleyearth/climate-change-earth-surface-temperature-data/data>
<https://github.com/ZZQ-dev/2415-final-project>

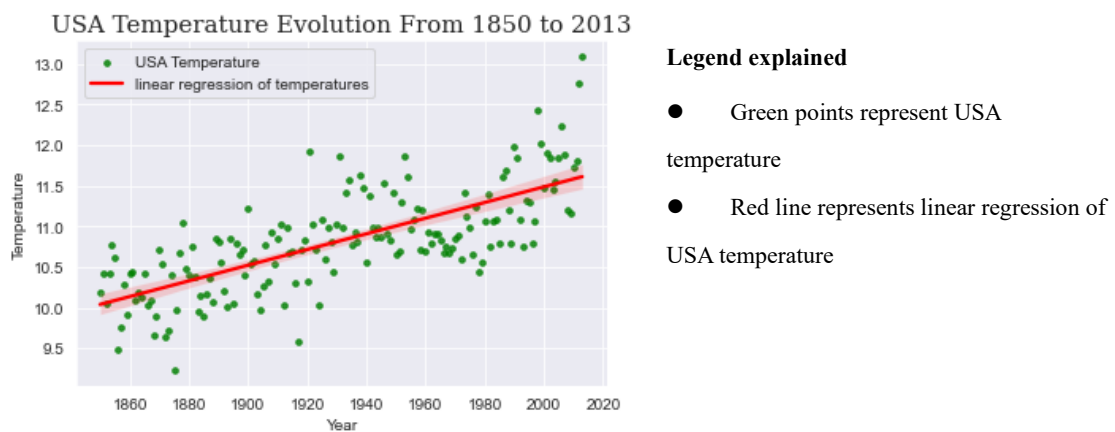
Figure 2: Scatter plot and linear regression of global temperature



Findings text introducing highlights of the produced figure in bulletin points

- This is a scatter plot with 7 linear models based on each country's temperature from 1850 to 2003.
- From 1850 to 2013, global temperatures show a slow and steady growth trend
- We can see small differences. For example, temperature growth in India is a bit slower than other countries.

Figure 3: Scatter plot and linear regression of USA temperature

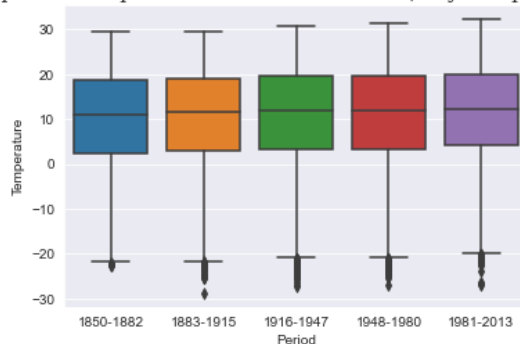


Findings text introducing highlights of the produced figure in bulletin points

- This is a scatter plot with the linear model based on USA's temperature from 1850 to 2003.
- Based on the confidence interval of the linear regression, we can see that the confidence level is very high.
- From 1850 to 2013, the average temperature of USA increased about 1.5 degree.

Figure 4: Boxplot of USA temperature

Boxplot of Temperature Evolution in USA (32 years per period)

**Legend explained**

- This boxplot does not need legend, and the color here means nothing, used for continent visualizing

Findings text introducing highlights of the produced figure in bulletin points

- This is a box plot based on USA's temperature from 1850 to 2003.
- Lower temperatures are rarer and gradually become outliers as time period increase
- The highest temperatures increase and become more dominant.

Data and method text describing the data and method used in this process

- I used Matplotlib, NumPy, Pandas, Seaborn to create all the visualizations in Jupiter Notebook.
- I used PyCharm to run Jupiter Notebook.
- I did data cleaning like filling NA before creating visualizations with Pandas and NumPy.
- `sns.scatterplot()` is used for scatter plots, `sns.lineplot()` is used for line plots, `sns.lmplot()` and `sns.regplot()` are used for linear regressions, `sns.boxplot()` is used for box plots.
- I used `get_legend_handles_labels()` to handle the legends error and used `plt.legend()`, `plt.title()`, `plt.xlabel()`, `plt.ylabel()` to get better visualizations.

Significance statement on why the presented figure is important

- Studying global temperature can help scientists understand how the climate is evolving over time.
- Temperature change has significant impacts on ecosystems. Studying those changes can help people protect the natural resources.
- Temperature changes also related to natural disasters like sea level rise. Studying them can help us make predictions and making plans for harmful impacts.
- Using regression models can help people predict temperature evolution, and using box plot can detect outliers and make the data distribution more robust and convincing.

GitHub link:

<https://github.com/ZZQ-dev/2415-final-project>

Data gathered from <https://www.kaggle.com/datasets/berkeleyearth/climate-change-earth-surface-temperature-data/data>
<https://github.com/ZZQ-dev/2415-final-project>