COM-480 Data Visualization
Project - Milestone 2

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1 Breakdown of the plots

The goal of this project is to assess the sustainability of a country's development. The visualizations should therefore show features representing sustainable development, linked with the level of CO2 emission. This can enable a better understanding of the data which could lead to strategies development on how one can decouple CO2 emissions from economic growth.

1.1 Introduction to Climate Change

In order to introduce the user of the website to the topic of sustainability, climate change should be addressed first. An average yearly temperature time series relative to the average temperature of the period between 1961 and 1990 will be implemented corresponding to the sketch in Figure1. The drop-down menu enables selection between global, northern- or southern hemisphere temperature. The range slider is executable by sliding the bubbles or by typing a number into the boxes.

The tools needed for this implementation is D3.js. The knowledge mostly stems from lecture 4, 5 and 11.

1.2 Spatial Representation Through Heat-Maps

The spatial representation of the data is done through a heat map in form of a world map. One shows the CO2 emission and one shows another sustainability feature (discussed in Milestone 1), which the user can choose. The user has control over the animation through time, they can stop and resume the animation and move it to specific years.

Hovering over a country will show some data about it. Clicking the country will open a more detailed view of data of the country correlated with its CO2 emissions.

These features are already partially implemented and hence accessible through the website, figure 2 is a screenshot of the current state. Lecture 8 (Maps) and D3.js were used to implement them.

1.3 Detailed Information

After the selection of country and time range a more in depth analysis will be shown by a plot between the chosen feature and the CO2 emission, the correlation coefficient and the coefficient of

determination. Also in this case D3.js will be used, paired with visualization concepts explained during several lectures (Colors, Mark, Channels, ...).

It is yet to define exactly how this data will be shown (different plots vs unified plot, scatter plots, ...), for the moment the idea is not to differ too much from the world temperature plot to avoid introducing a cognitive load for too high for the user. An example of a possible plot is shown in figure 3.

1.4 Statistical Comparison of Each Features with CO2 Emissions

The goal of this plot is to compare the evolution of the CO2 emissions through time with the other features. Hence, it will present the results of a statistical test (Spearman R) comparing each features with CO2 emissions (mean of result by country through time). Since this makes for a lot of aggregation, we want to offer the possibility to zoom in on some results. By clicking on a features bar plot, the results for all the countries separately will appear. We will use D3.js and the lectures related to it. A scheme of the desired interactive plot is shown in figure 4. Preliminary results obtained in Python are shown in figure 5.

1.5 Correlation Heat-maps of Features

The correlation between CO2 emission and a sustainability feature could be influenced by multi-collinearity. Therefore, a correlation heat-map will be shown. The start of data recording varies between features. Thus a dropdown menu will be created, from which the user can choose the time period he is interested in.

The calculations are done in Python and the figure will be implemented with d3.js. The knowledge mostly stem from lecture 4 and 11.

2 Implementation

The preprocessed data from Milestone 1 is further prepared according to the needed structure of each plot. The plots described in the chapter above are implemented by first visualizing the core image. Afterwards interactive options are added, such as the drop-down menu or slider. In the end, all figures will be merged together in the final website.

Finally, we have some extra ideas:

1. In addition to the scatterplot, the explained variance could be visualized like here
2. To enhance the correlation heatmap, a solar correlation map can be added with only one variable as the focus.
3. In addition to the correlation heatmap, a schemaball could be used to enhance the visual comprehension.
4. The global CO2 emissions can be shown as a stacked time series by country, to show the influence of each country.
5. In order to link climate change with CO2 emission, the CO2 emission time series could be added to the first figure.

3 Functional Project Prototype

The initial website is running with the basic skeleton of the visualization/widgets. It currently shows the content described in sections *Introduction to Climate Change* and *Spatial Representation through heat-map*, with the exception of the detailed view of countries and the selection of the index to compare against CO2 emissions in the heat-map.

The current state of the website can be accessed here.

4 Appendix

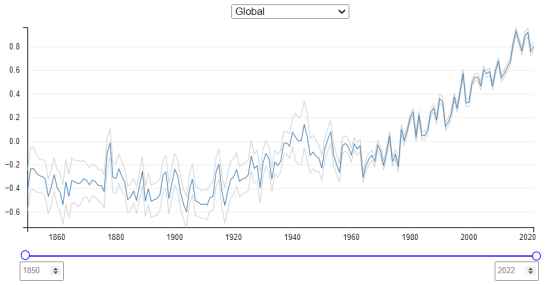

Figure 1: Interactive visualization of temperature change through the years.

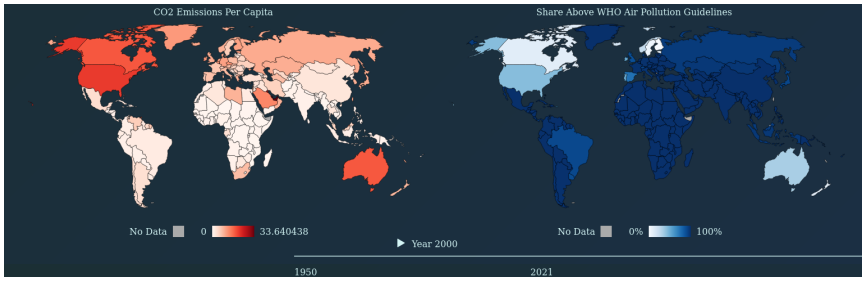

Figure 2: Animated heat-maps of two features through time.

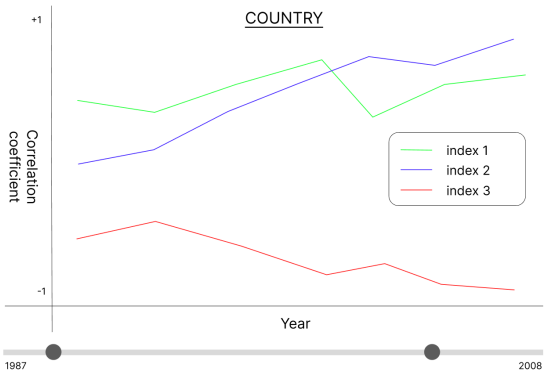

Figure 3: Detailed view of correlation coefficients of features for a country.

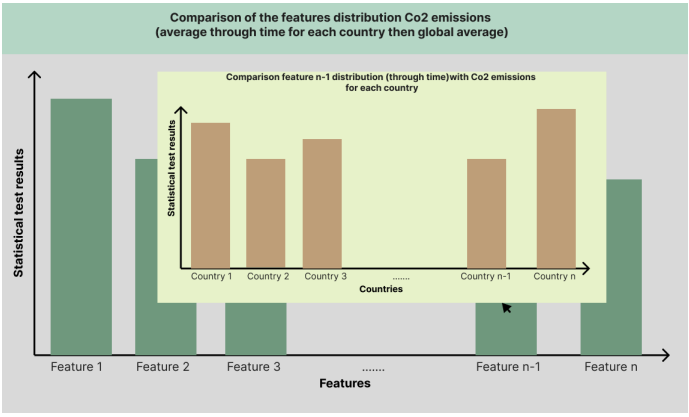

Figure 4: Comparison of results of statistical tests against CO2 emissions.

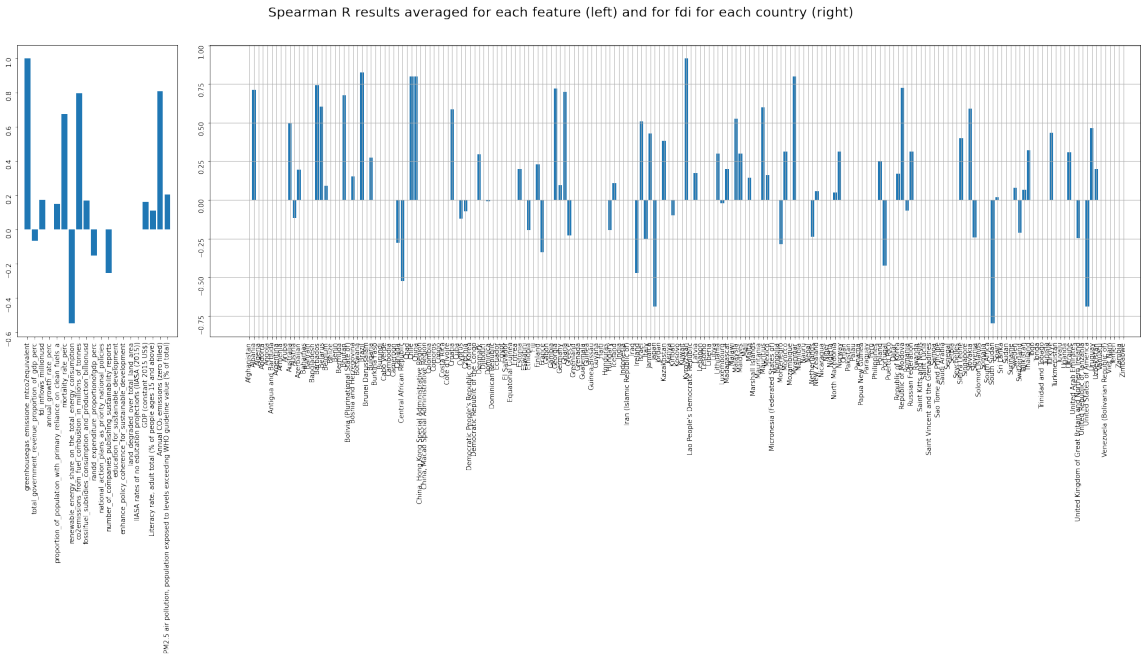

Figure 5: Preliminary results of statistical tests.

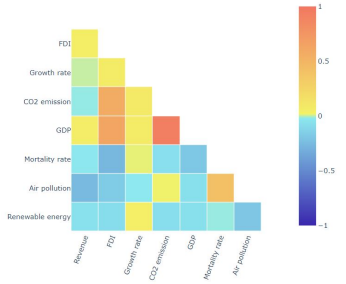

Figure 6: Correlation heat-map of features.