Visualising global AI state actors

Data Visualization Project Milestone 2
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GROUP MEMBERS

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I. DESIGN OVERVIEW

In the previous milestone, we proposed a project which helps visualize the ranking per country regarding the development of AI related technologies, using a multitude of different indicators. We decided that we would build our project around a world map and enhance the user experience through interactions and by superimposing additional graphs and data around the map. As such, we directly implemented a basic skeleton of the web page, as shown in Figure 1. We center our project around the interactive chloropleth map, which can display the main index as well as the indicators. Users can click on countries to visualize more detailed information as well as a graph showing its position in the global ranking and the distribution of index scores in the dataset. We plan on adding a pop-up toolbar on the left side of the screen giving the user the possibility to explore different indicators or perform filtering operations.

II. IMPLEMENTATION STEPS

For our website, we aim to efficiently show the different factors which impact a country's capabilities in the AI sector. With that objective in mind, we have come the following implementation steps :

1) **Backend server & frameworks**
   To setup a working environment with deployment capabilities, we chose to use FastAPI (ref.) as a web server. Further, Tailwind CSS (ref.) is used for the responsive design of web components.

2) **World map**
   The world map is the basis of our website, on top of which we will be able to display the various visualizations. In terms of design, we aim for a very simple world map with few and light colors, a slight difference between the earth and the water and clear demarcation of borders. We also want to show that we don't have data for all countries by using a different color for the missing countries in our dataset. No names will appear on our map, as they would only clutter the user's view, rather we use an information "bubble" to show the name and specific information.

3) **Data display**
   We plan to use a different chloropleth palette for each feature of the dataset. We will need to make design choices for each one, making sure we take into account user accessibility (our choices must be colorblind-safe). We need to specify color functions mapping from the domain 0-100 to the palette range. We must also reserve a space to add a label for the color scale. Additionaly, we will provide a pop-up to cite our sources.

4) **Filter menu**
   After having developed a display for each factor, we need to create an interface that allows the user to select any of them to display. This menu is interactive and its display can be toggled (it will be possible to open it with a side button). The menu will be the list of all the factors with a selection button next to the name of each factor. Only one can be selected. We also plan on changing the chloropleth color scale based on the currently displayed factor.
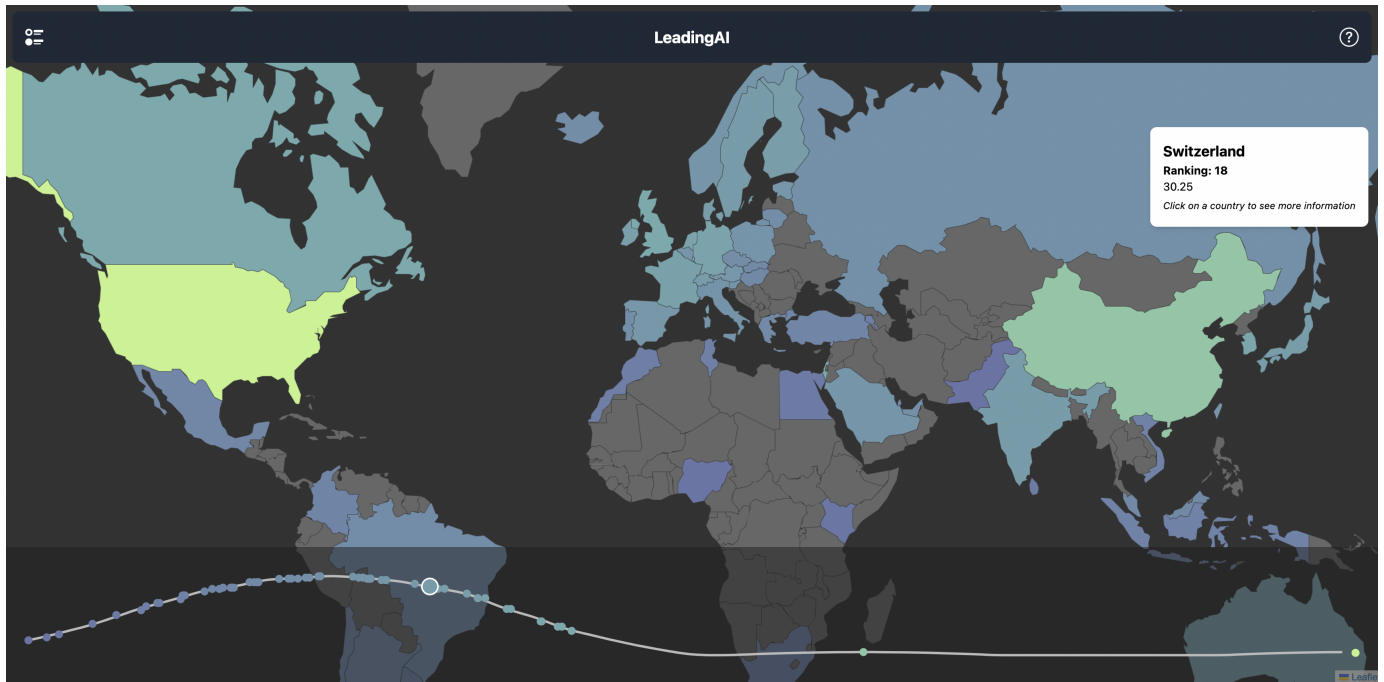
Fig. 1: Basic skeleton of the web page visualizing the dataset

5) **Additional statistics** In addition to the main map display, we want to show some graphs that give an overview of the data. These graphs will be displayed at the bottom of our web page. Their purpose is to provide a key visualization regarding the distribution of indices and factors. As seen in Figure 1, the distribution of the index shows that many countries are on distributed on the lower side of the index and how the sector is led by few state actors very far from the mean of the distribution. To build this statistic, we perform Kernel Density Estimation on the features and use a curve basis from D3.js on which we project the data points. This graph could also be worked on to show more key statistics.

III. ADDITIONAL IDEAS

- **Home Page**
  Adding a home page containing an overall storytelling and key takeaways, perhaps in the form of graphs. This can be merged with the following point to make the site more ergonomic (fewer click required).

- **Fully interactive experience**
  If no factors are selected, we want to show the distribution of all factors on the bottom visualization, which would give an overview of the data. In addition, we want our map to be interactive. Hovering the cursor over a country would highlight the country's position in each distribution map for each factor.

- **Comparison of factors**
  Add the ability to display different factors at the same time, for example to compare them. It could be a predefined set of factors (like all factors describing the "innovation" criteria) or the user could decide which factors to display/compare. To add this feature, we need to display the values differently per country. For example, by adding multiple colored dots for each selected factor.

IV. RESOURCES

To make our website we plan to use concepts from most of the COM-480 course. The main lecture used is the one about map visualization: we proceed as in the course, using leaflet.js and converting a shapefile to GeoJSON, we are able to build the desired chloropleth by superimposing content rendered from D3.js.

Most of the other graphs will be designed using courses on D3.js: we might need the lecture about graphs but also data and tabular data. It will help us decide which one suits the data best and what we want to convey. To go further and potentially link the map with the graphs, as well as interact with them, the lecture about interaction will serve us well. Finally, a key factor in effectively sharing information (and engaging our readers) is storytelling and the corresponding lecture.