

# Assignment 2: Creating Interactive Visualizations

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## 1 Introduction

### 1.1 Dataset Overview

ArtVis consists of exhibition data involving various artists, spanning multiple years and locations. The data provides insight into the global distribution of art exhibitions and artist collaborations over time. Preprocessing was carried out to clean and standardize the dataset; see *Implementation* for more details.

### 1.2 Target Users and Tasks

The visualization targets amateur enthusiasts of art and history (e.g., high school students, occasional history learners, novice artists). The main tasks include:

- Exploring how exhibitions are distributed across locations over time.
- Investigating the connections between artists who exhibited together.
- Filtering exhibitions by year and nationality to focus on specific groups of artists.

## 2 Visualization

The final visualization solution consists of two main components:

- The first consists of an interactive map that allows users to explore exhibition locations over time. Bubbles represent the number of exhibitions at each location. Users can adjust the slider to select a year range, dynamically updating the map and the list of results.
- The second consists of a network graph that displays relationships between artists who exhibited together. Users can filter the network by exhibition year and nationality using dropdown menus.

## 2.1 Interactive Map

The first tab features an interactive map, built using the Leaflet library. The map uses bubbles to represent the number of exhibitions at each location. Users can adjust the year range via a slider and explore how this affects exhibition distribution.

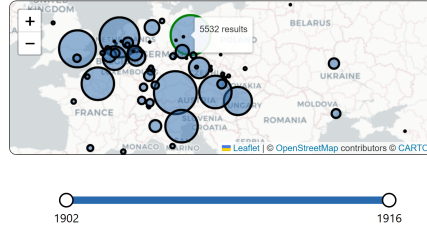


Fig. 1: Map visualization with a selection marked with green

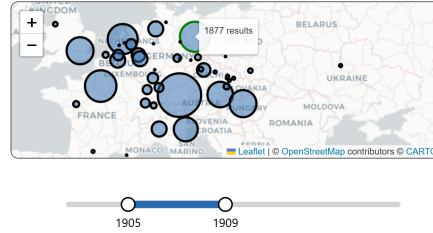


Fig. 2: Map with changed range of time using double range slider

- **Map Bubbles:** The size of each bubble on the map is proportional to the number of exhibitions at a specific location during the selected time range. These sizes are relative to one another rather than absolute, enabling users to easily compare exhibition densities across different locations. Hovering over a bubble reveals the precise number of exhibitions at that location within the chosen time period.<sup>1</sup>
- **Slider Interaction:** The slider allows users to define a custom time range by adjusting the start and end years. This dynamic filtering updates the map in real time, with bubble sizes recalculated to reflect the exhibition counts for the selected range. This feature not only enables analysis of fixed time periods but also helps identify trends over time. For example, a city with a historically high number of exhibitions may initially display the largest bubble, but as the timeframe shifts, the bubble might shrink relative to other cities that have gained prominence in later years.<sup>2</sup>
- **Click Interaction:** Clicking on a bubble provides detailed information about the exhibitions associated with that location during the selected timeframe, with a maximum of 150 records displayed at once. The selected bubble is highlighted in green to visually distinguish it from others, making it easier to track changes in its size or associated data across different time periods.
- **List:** The list gives the user feedback on the chosen location and the number of results. For performance reasons, only maximal 150 results are shown at a time. To make it easier to navigate and search, the results are sorted by last name, first name, and exhibition year. <sup>3</sup>

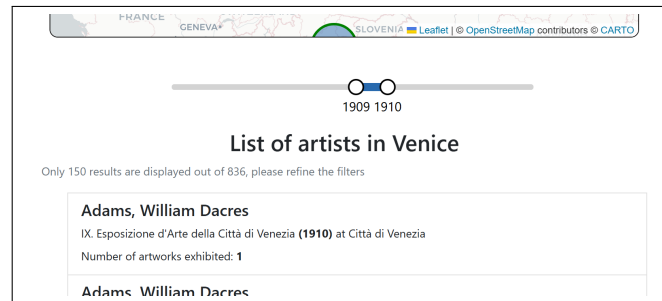


Fig. 3: Textual feedback about the results and the chosen location.

## 2.2 Network Visualization

The second tab presents a network visualization that illustrates relationships among artists based on their participation in shared exhibitions. In this network:

- **Nodes:** Represent individual artists, allowing users to identify and explore specific individuals within the network.
- **Edges:** Indicate connections between artists who have exhibited together, highlighting collaborative or thematic linkages.

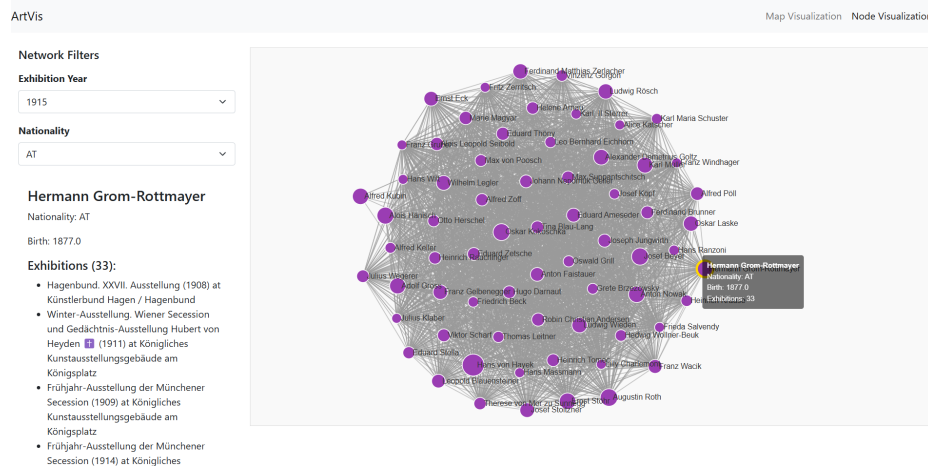


Fig. 4: Network visualization of artist relationships.

Users can refine the displayed artists and their connections using filters for exhibition year and nationality, making it easier to focus on specific time periods or cultural backgrounds. The intuitive interface also supports zooming and panning, enabling seamless navigation through the network and allowing users to delve deeper into areas of interest.

These interactive features provide a dynamic and engaging way to explore the interconnectedness of artists, facilitating the discovery of patterns and relationships that might otherwise remain hidden.

### Key Features

- **Performance Optimizations:** Utilized debounced event listeners and efficient data processing to ensure smooth interactions with large datasets.
- **Accessibility Enhancements:** Incorporated ARIA labels, keyboard navigation, and high-contrast styles to make the visualization accessible to all users.
- **User Experience:** Implemented intuitive features like drag-and-drop, zooming, and a responsive design to provide an engaging experience.

These features collectively create a user-friendly tool for exploring the interconnectedness of artists through their exhibition histories.

### Visualization Techniques:

- **Hovering:** Displays additional details such as exhibition counts and artist information when hovering over bubbles or nodes.
- **Clicking:** Reveals more in-depth information like exhibition lists and artist histories upon clicking a bubble or node.
- **Dragging:** Allows users to reposition nodes to explore different sections of the network.

A dynamic slider facilitates temporal analysis, allowing users to track the evolution of exhibitions over time. The two-sided slider in the map enables filtering exhibitions by year, while dropdown menus provide more specific queries, such as filtering by nationality or exhibition year.

## 3 Implementation

Dataset preprocessing was done using Python, with the following steps:

- **Missing Values:** Handled using pandas, standardizing missing or nonsensical values (e.g., numeric artist names) to NULL.
- **Standardization:** Date columns were standardized to a uniform year format.
- **Transliteration:** Text in Cyrillic or Chinese (e.g., location and exhibition names in Russian) was transliterated to Latin characters using the `transliterate` and `pypinyin` libraries.

The visualizations were implemented using D3.js and Leaflet:

- **D3.js:** Used for rendering both the map and network visualizations and handling dynamic interactivity.
- **Leaflet:** Used for creating the interactive map, displaying exhibition locations with bubbles.

## 4 Conclusion

The combination of the map-based visualization and the network graph allows users to uncover insights into exhibition locations and artist relationships. The interactive features—sliders, hover/click events, and dropdown filters—provide flexibility for deeper exploration. This solution supports amateur art history enthusiasts by offering an intuitive, engaging way to analyze the multidimensional ArtVis exhibition data.