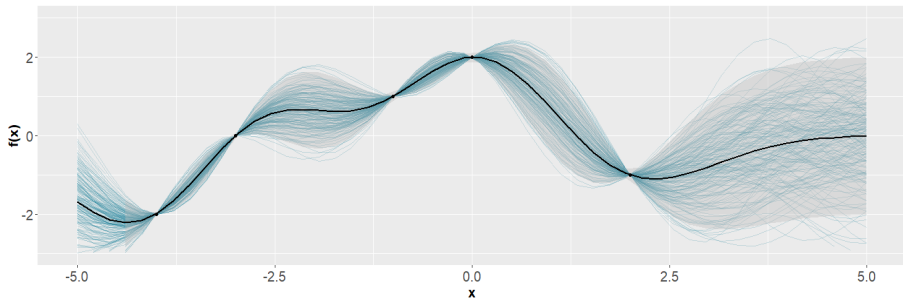# Geovisualization

Using the "Leaflet" package for spatial data visualization in R

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Outline

1. Introduction

The importance of spatial data visualization

Spatial data visualization plays a crucial role in understanding and interpreting data that is related to geographic locations. It allows us to visually explore and analyze complex spatial patterns, relationships, and trends. Important points to consider are:

Understand the data

Spatial data visualization provides a powerful means to understand complex information by representing it visually on a map. By mapping data onto geographical regions, we can easily identify patterns, clusters, and spatial relationships that might not be apparent in tabular or textual formats.

Know the context and location

By mapping data onto real-world locations, we can grasp the spatial context in which the data is situated. This context enables us to analyze data in relation to its surrounding environment, such as demographic information, infrastructure, land use, and natural resources.

Spatial analysis

Spatial analysis involves examining how different factors vary across geographic space. Visualization techniques help identify spatial patterns or clusters. For example, visualizing crime rates across a city can reveal high-crime areas or identify crime patterns.

Communication and storytelling

Maps are intuitive and widely understood, making them effective tools for conveying information to a diverse audience. By presenting data visually, we can communicate complex concepts, research findings, and geographic trends more effectively.

Decision making and planning

By visualizing data, stakeholders can gain a deeper understanding of spatial relationships, potential impacts, and trade-offs. For example, urban planners can use visualizations to analyze land use patterns, assess infrastructure needs, or evaluate the impact of new development projects.

Collaboration and engagement

Maps provide a common visual language that encourages interdisciplinary collaboration, allowing experts from various fields to analyze and interpret data together.

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Interactive spatial visualizations also encourage user engagement, enabling individuals to explore and interact with the data themselves.

In R we can use the "Leaflet" package to make interactive plots!

Leaflet is an open-source JavaScript library for interactive maps, and the Leaflet package in R is a wrapper that provides a seamless integration of Leaflet's functionalities within the R programming environment.

2. The "Leaflet" package

The "Leaflet" package allows you to create dynamic and interactive maps directly in R, making it a popular choice for spatial data visualization and analysis.

2.1. Key features

- Ease of use.
- Interactivity.
- Customization.
- Integration with R Ecosystem.
- Extensibility.

2.2. Use cases

Geographic data exploration

It is commonly used in fields like environmental science, urban planning, transportation, and epidemiology to analyze and understand geographic phenomena.

Data communication and storytelling

It allows you to create interactive maps that convey complex information in a visually appealing and engaging manner. Maps created with Leaflet can be embedded in reports, presentations, and websites to effectively communicate insights.

Spatial analysis and decision making

It enables users to perform spatial queries, identify patterns, and make data-driven decisions based on the insights gained from the maps.

3. Starting with the "Leaflet" package

First you have to install the packages doing in the R console:

- `install.packages("leaflet")`

Once installed, you can use this package at the R console, within R Markdown documents, and within Shiny applications.

You create a "Leaflet" map with these basic steps:

- Create a map widget by calling `leaflet()`.
- Add layers (i.e., features) to the map by using layer functions (e.g. `addTiles`, `addMarkers`, `addPolygons`) to modify the map widget.
- Repeat step 2 as desired.
- Print the map widget to display it.

```r
library(leaflet)

m <- leaflet() %>%
  addTiles() %>%  # Add default OpenStreetMap map tiles
  addMarkers(lng=174.768, lat=-36.852, popup="The birthplace of R")
m  # Print the map
```
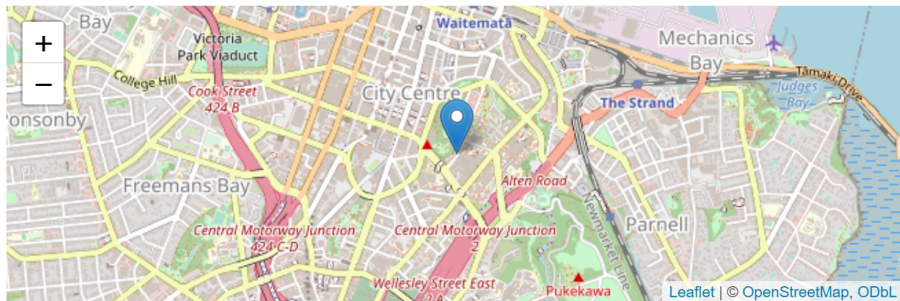

Figure: Example of how to create a map with the "Leaflet" package (Source: `https://rstudio.github.io/leaflet/`).

3. Conclusion

- Leaflet enables users to create dynamic and interactive maps that enhance understanding, facilitate communication, and support data-driven decision-making.
- Leaflet empowers users to explore and analyze spatial patterns, clusters, and trends in a visual and intuitive manner.
- We can create visual maps that captivate the audience, facilitating effective communication of insights and supporting data-driven storytelling.

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