R Tutorial: Visualizing + Analyzing SSNs

💻Overview

This tutorial will introduce participants to visualizing and analyzing SSNs using a sample spatial social network in R. It is expected to take 2 hours. This tutorial assumes the audience has a basic understanding of R syntax, network concepts, and GIS. The entire documentation for the package and tutorial can be found here: [Spatial Social Networks (SSN) Visualization and Metrics with R](#).

💻Preparation: Software Installation & Packages

1. Download R & R Studio: https://posit.co/download/rstudio-desktop/
   Youtube: [Download R and R Studio for Mac](#) || [Download R and R Studio for Windows](#)

2. Open R Studio

3. Install the development version of `SSNtools` (run scripts in R console):
   ```
   install.packages(devtools)
   devtools::install_github("friendlycities-gatech/SSNtools")
   library(SSNtools)
   ```
   You can test whether the installation is successful by calling `library(SSNtools)` in your R script.

4. Install required packages for data wrangling and visualization:
   While running functions in the `SSNtools` package does not require additional package dependencies, data wrangling and map visualization rely on external packages. Run the following R scripts in your R Studio console. If you are not familiar with these packages, you are encouraged to look them up beforehand.
   ```
   install.packages(tidyverse)
   install.packages(sf)
   install.packages(basemaps)
   install.packages(tmap)
   install.packages(stplanr)
   ```

```
install.packages(ggplot2)
install.packages(igraph)
install.packages(tigris)
```

🖥️Background Reading

Here are some recommended pre-read materials if you are not sure about the concepts below. Please explore the full tutorial at https://friendlycities-gatech.github.io/SSN_tutorial/.

Introduction to R
Tidyverse tidy data and pipes syntax
Geographic data in R (represented as sf object)
Making maps with R (using tmap package)
Network data format (node table and edge list)
Social Networks (UCGIS - GIS&T Body of Knowledge)

🖥️Tutorial Agenda

Here is the tutorial: Spatial Social Networks (SSN) Visualization and Metrics with R https://friendlycities-gatech.github.io/SSN_tutorial/ (Liang et al., 2023)

Before the workshop: Please install the software and packages listed above.

9:15 - 9:30: Overview of tutorial and SSN package, setting up R Studio

9:30 - 10:15: Visualizing a network through the tutorial

Installing `SSNtools` package;
Tutorial structure
A quick SSN visualization demo (Chapters 3-4)

10:15 - 10:30: Break time

10:30 - 11:15: Running SSN metrics and visualization (Firehose!)

SSN hotspots (Chapter 6.1.1)
K Fulfillment (Chapter 6.2.1)
Flattening Ratio: Global and Local (Chapter 6.3.1, 6.3.2)
Linked Activity Spaces (Chapter 6.4)

11:15 - 11:45: Create a map or a summary statistics table to analyze our sample data or your data! Lab help time; free-style Q & A.

12 Lunch time.

🖥️During the Tutorial

You are encouraged to follow the instructor to copy and run codes on your local R studio during the tutorial. You can also explore the tutorial web content at your own pace. You can find all the codes for the tutorial here:

https://github.com/friendlycities-gatech/SSN_tutorial/tree/main/ExampleCodes (click on a specific script -> Raw -> right click -> Save as -> delete the extension .txt, so file name should only be name.R -> Save)

Virtual Participants: If you are lost during the tutorial or need help, please message Sichen Jin if you are online. In person participants: Please raise your hand if you are offline and our onsite volunteers may come to help you. You can also reach out to the instructor for help during the break time (10:15-11:30 am) or during the lab hour (11:15-11:45 am).

🖥️Using your Own Data

Data for this tutorial is supplied as part of the R package. Here is an example dataset: MafiaNodes.csv; MafiaEdges.csv. However, you can use your own data if you'd like. You will need a nodelist and an edgelist. Each row of the nodelist should represent attributes of a node, including at least a node label (or ID) and the node's geographic information (coordinates or geometry). Each row of the edgelist should represent attributes of an edge, including at least a source and target column *that correspond to the node label (or ID)*. Please use the MafiaNodes and MafiaEdges examples above as guidelines for formatting your own data.

🖥️ References for Metrics

Liang, X., Baker, J., DellaPosta, D., & Andris, C. (2023). Is your neighbor your friend? Scan methods for spatial social network hotspot detection. *Transactions in GIS*. https://doi.org/10.1111/tgis.13050

Andris, C., DellaPosta, D., Freelin, B. N., Zhu, X., Hinger, B., & Chen, H. (2021). To racketeer among neighbors: spatial features of criminal collaboration in the American Mafia. *International Journal of Geographical Information Science*, 35(12), 2463-2488.

Sarkar, D., Andris, C., Chapman, C. A., & Sengupta, R. (2019). Metrics for characterizing network structure and node importance in Spatial Social Networks. *International Journal of Geographical Information Science*, 33(5), 1017-1039.

Wang, Y., Kang, C., Bettencourt, L. M., Liu, Y., & Andris, C. (2015). Linked activity spaces: Embedding social networks in urban space. *Computational Approaches for Urban Environments*, Ed. Marco Helbich et al. 313-336.