



IS415 Geospatial Analytics and Applications

User guide for: **GeoNinjas**

*Discover the hidden insights of Spatial Point Patterns Analysis & Network Constrained
Spatial Point Patterns Analysis*

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How to use GeoNinjas: your quick start guide

Welcome to GeoNinjas – *Discover the hidden insights of Spatial Point Patterns Analysis & Network Constrained Spatial Point Patterns Analysis*

Our application will assist users with two kinds of Spatial Point Patterns Analysis: *Spatial Point Patterns Analysis and Network Constrained Spatial Point Patterns Analysis*.

Application Link



GEONINJAS

<https://valtyl.shinyapps.io/IS415-GAA-Shiny/>

Navigation Tab Bar

GEONINJAS

HOME

VISUALISATION

TMAP


SPPA

NETSPPA

The Navigation Bar will be located at the top, displaying our ShinyApp's features such as Visualisation, Tmap, SPPA, NetSPPA. To distinguish your active tab, the words on the active tab will be **bolded**. Additionally, the Home Page Tab will be selected as the default tab.

1. Home Tab

ECONOMICS
HOME
ABOUT US
CONTACT US



GEONINJAS

PAPER DESCRIPTION

Location point pattern analysis reflects the distribution of the points, whether the distribution is random or clustered. This form of analysis can be very useful in the evaluation of events such as crime, traffic accidents, diseases, etc. Thus, we would like to give other analysts and investigate whether there are any dependency relationships between different point distributions to make a comparison or contrast.

A common kind of spatial point patterns analysis is called nearest neighbour spatial point patterns analysis which allows us to measure if the distribution of the spatial point events occur alonging a network. For our Shiny application, we will use ARKINS as an example.

To spatial point patterns analysis, we would like to find if the ARKINS locations in Singapore are randomly distributed throughout the country and if not, where are the locations with higher concentrations of ARKINS. Also, at those locations of higher concentration, do the ARKINS locations co-seed with other point events the train stations, hotels, etc?

The nearest neighbour spatial point patterns analysis, we would like to discover whether the distribution of the ARKINS locations are affected by the rail routes in Singapore. Through these analyses, we can investigate whether the distribution of ARKINS locations in Singapore are affected by road events in the road network.

PAPER MOTIVATION

Geographical datasets are often used by users to help. However, many do not know what tool to use or how they to make use of those data since they are so different from the geospatial data processing, viz., shapefile and more.

The aim of our project is to create a Shiny web application that will help users with the geographical analysis of ARKINS. In particular spatial point patterns analysis. As such, we does not need to be technically trained to conduct the analyses.

ABOUT OUR APPLICATION

Our applications is focused on ARKINS in Singapore and will assist users with two methods of Point Pattern Analysis:

- Spatial Point Patterns Analysis (SPPA)
- Network Geostatistical Point Patterns Analysis (NGPPA)


We SPPE users will be able to view the kernel density maps of ARKINS in different areas. Here are the areas chosen and the reasons why:

1. Marina Bay Sands Area (20 ARKINS)
1. Downtown Core - Old main ARKINS (22 ARKINS)
1. District - Old main ARKINS (20 ARKINS)
1. Airport - New main ARKINS (20 ARKINS)
1. Jurong - High density of private estates (2 ARKINS)
1. Northshore - Higher density of shared and private estates (2 ARKINS)
1. East - High density of private estates (2 ARKINS)

As well, we will be focusing on the street network in Singapore. We chose Raffles as Raffles has a significant number of ARKINS and each type of point events (Public Attractions, Bus Stops, Hotels, Shopping Malls, F&B and Universities) are greater than 5, which will allow them to draw better statistical conclusions than the other areas with less than five points. For example, Raffles only has 1 attraction and University Town will only have 2 bus stops making statistical conclusions using Network Geostatistical Point Pattern Analysis.

To learn more about how to use our application, click on our user guide!

CREDITS



SMU

SINGAPORE MANAGEMENT
UNIVERSITY

This project is done for GEO5 Computational Analysis & Applications, a module in Singapore Management University, with the guidance of Professor Kian Teo Hoang.

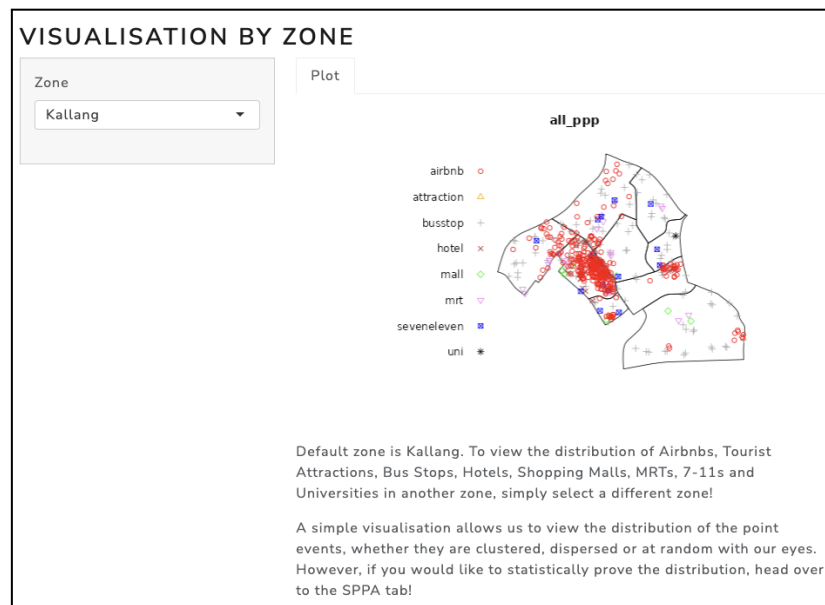
Team info:

- Tan Jui Lin, Student
- Seng Guan Lim, Student
- Derek Koh, Student

With the Home Page Tab being the default tab, you will be immediately greeted by this page once you have loaded our application. On this page, you will be able to find our project description, which explains the nitty gritty details of our project, along with our project motivation, which explains our main reasons and motivations for selecting these features for our project.

Additionally, a brief description about our application is provided for you to better understand our application and how it can help you with your respective needs.

2. Visualisation Tab



Visualisation Main Panel

The visualisation tab is the second page in our application. In this tab, you can visualise Airbnbs surrounded by variables such as MRT station, Bus stops, 7-11, Tourist attractions, Malls, Hotels, and Universities.

Additionally, we have divided it into different zones, with Kallang as default as Kallang has the most Airbnbs present.

2.1. Visualisation Tab – Drop Down Box

VISUALISATION BY ZONE

Zone

Kallang

Kallang

Downtown Core

Outram

Rochor

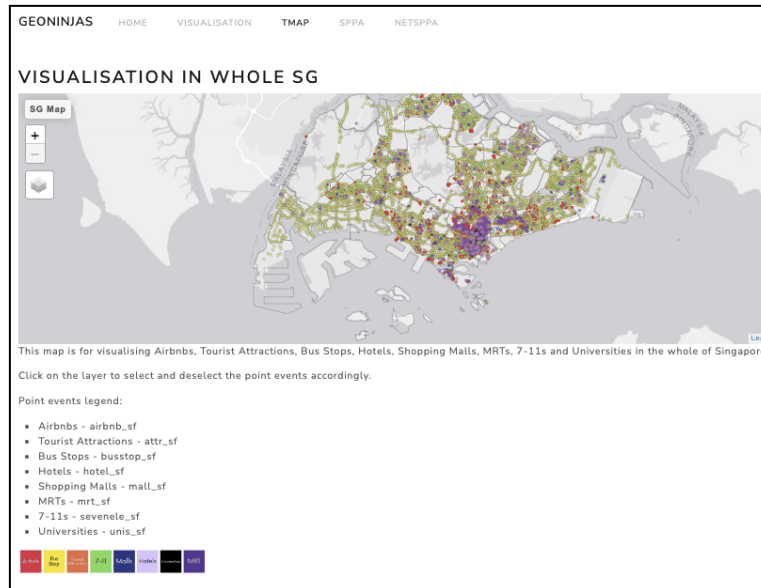
Jurong West

Sembawang

Pasir Ris

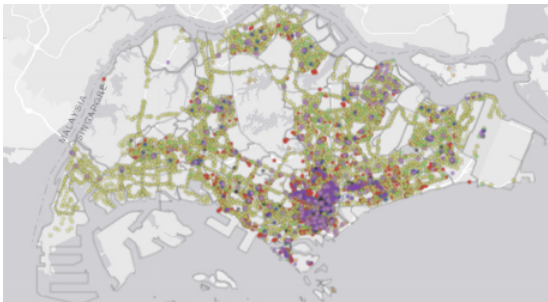
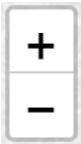
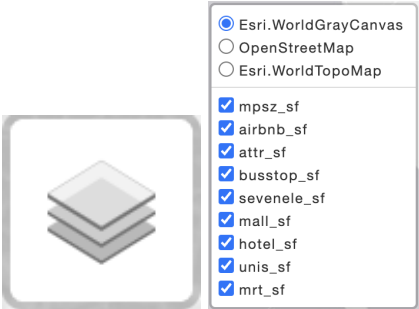

The drop down box will be available on the left side of the page. From there, you can select your desired zone to visualise.

3. Tmap Tab

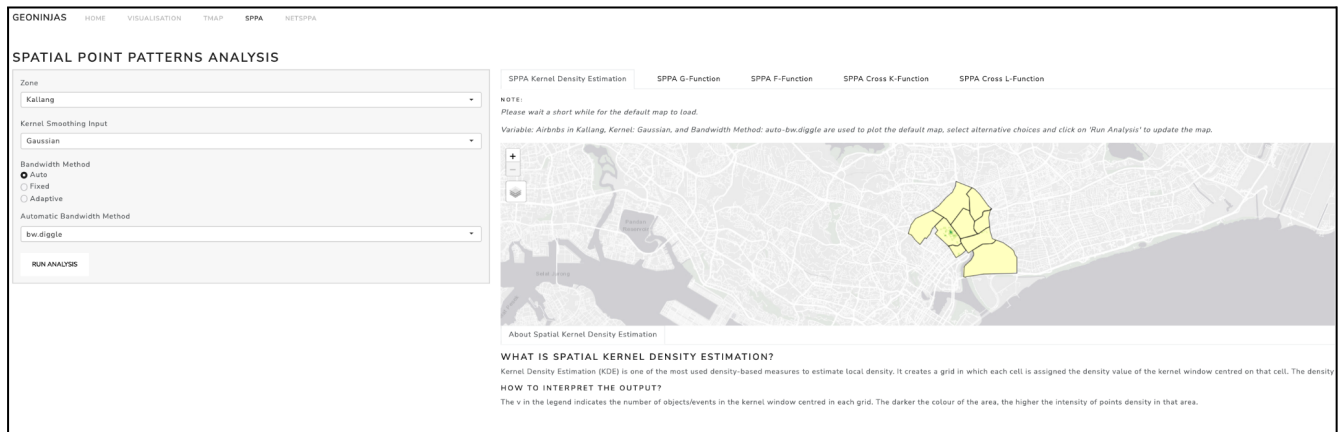


Tmap Main Panel

The Tmap tab is the third page in our application. In this tab, you can visualise Airbnbs surrounded by variables such as MRT station, Bus stops, 7-11, Tourist attractions, Malls, Hotels, and Universities in the whole of Singapore.

Feature	Functionality
	This map is for visualising Airbnbs, Tourist Attractions, Bus Stops, Hotels, Shopping Malls, MRTs, 7-11s and Universities in the whole of Singapore.
	You can utilise the '+' and '-' buttons on the left, which will help you zoom in and out respectively. Based on personal preference, you also can choose to use your mouse to zoom manually.
 <ul style="list-style-type: none"> <input checked="" type="radio"/> Esri.WorldGrayCanvas <input type="radio"/> OpenStreetMap <input type="radio"/> Esri.WorldTopoMap <input checked="" type="checkbox"/> mpsz_sf <input checked="" type="checkbox"/> airbnb_sf <input checked="" type="checkbox"/> attr_sf <input checked="" type="checkbox"/> busstop_sf <input checked="" type="checkbox"/> sevenele_sf <input checked="" type="checkbox"/> mall_sf <input checked="" type="checkbox"/> hotel_sf <input checked="" type="checkbox"/> unis_sf <input checked="" type="checkbox"/> mrt_sf 	<p>This icon will enable you to swap between three different layers as shown on the image on the right to visualise the map differently.</p> <p>Additionally, you can choose unselect the checkbox between airbnb_sf, attr_sf, busstop_sf, sevenele_sf, mall_sf, hotel_sf, unis_sf, and mrt_sf to isolate the spatial point data for better visualisation. Unselecting mpsz_sf will remove the borders.</p>
	There is a legend to indicate the different colours for the different variables.

4. SPPA Tab



The SPPA is the fourth tab that you can access in our application. SPPA is short form for Spatial Point Patterns Analysis.

There five sub tabs are mainly:

- 1) SPPA Kernel Density Estimation
- 2) SPPA G-Function
- 3) SPPA F-Function
- 4) SPPA Cross K-Function
- 5) SPPA Cross L-Function

The layout of the sub tabs are similar, with a main visualisation panel on the right and a side panel for selection of inputs on the left

4.1. SPPA Tab - Kernel Density Estimation

SPPA Kernel Density Estimation

SPPA G-Function

SPPA F-Function

SPPA Cross K-Function

SPPA Cross L-Function

Zone

Kallang

Kernel Smoothing Input

Gaussian

Bandwidth Method

☒ Fixed
 ☐ Adaptive

Automatic Bandwidth Method

bw.diggle

RUN ANALYSIS

NOTE:

Please wait a short while for the default map to load.

Variable: Airbnbs in Kallang, Kernel: Gaussian, and Bandwidth Method: auto-bw.diggle are used to plot the default map, select alternative choices and click on 'Run Analysis' to update the map.

About Spatial Kernel Density Estimation

WHAT IS SPATIAL KERNEL DENSITY ESTIMATION?
 Kernel Density Estimation (KDE) is one of the most used density-based measures to estimate local density. It creates a grid in which each cell is assigned the density value of the kernel window centred on that cell. The density value is estimated by counting the number of object/events in that kernel window.

HOW TO INTERPRET THE OUTPUT?
 The v in the legend indicates the number of objects/events in the kernel window centred in each grid. The darker the colour of the area, the higher the intensity of points density in that area.

SPPA KDE Main Panel

Feature	Functionality
	The darker the colour of the area, the higher the intensity of points density in that area. The v in the legend indicates the number of objects or events in the kernel window centered within each grid.
	You can utilise the '+' and '-' buttons on the left, which will help you zoom in and out respectively. Based on personal preference, you also can choose to use your mouse to zoom manually.
	<p>This icon will enable you to swap between three different layers as shown on the image on the right to visualise the map differently.</p> <p>Additionally, deselecting 'zone()' will remove the outline of the zone, and 'kde_raster' will remove the raster.</p>
<div>About Spatial Kernel Density Estimation</div> <div>WHAT IS SPATIAL KERNEL DENSITY ESTIMATION?</div> <div>Kernel Density Estimation (KDE) is one of the mostly used density-based measures to estimate local density. It creates a grid which each cell is assigned the density value of the kernel window centered on that cell. The density value is estimated by counting the number of object/events in that kernel window.</div> <div>HOW TO INTERPRET THE OUTPUT?</div> <div>The v in the legend indicate the number of object/events in kernel window centered in each grid. Essentially, the darker the color of the area, the higher the intensity of points density in that area.</div>	At the bottom of the page, we will briefly explain Spatial Kernel Density Estimation and its interpretation.

Zone

Kallang

Kernel Smoothing Input

Gaussian

Bandwidth Method

☒ Auto
☐ Fixed
☐ Adaptive

Automatic Bandwidth Method

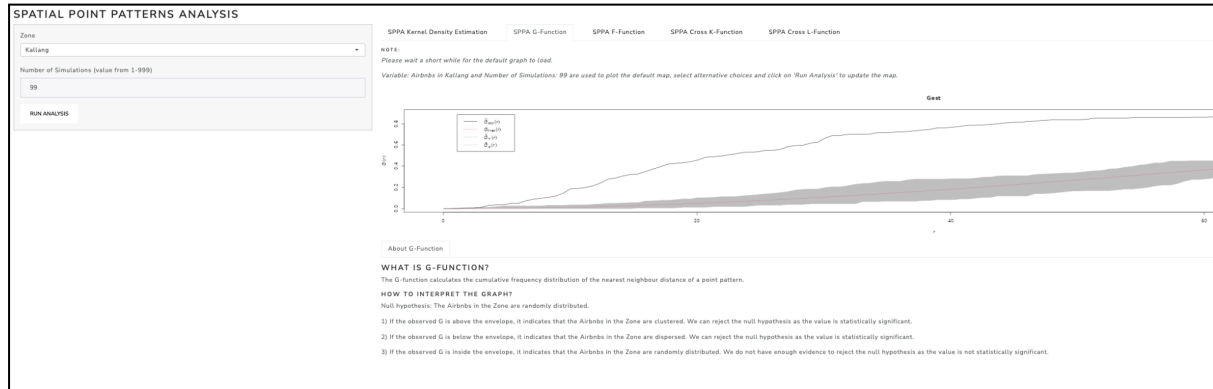
bw.diggle

RUN ANALYSIS

SPPA KDE Side Panel

Feature	Functionality
<div> <div>Zone</div> <div> <div>Kallang</div> <div> <div>Kallang</div> <div>Downtown Core</div> <div>Outram</div> <div>Rochor</div> <div>Jurong West</div> <div>Sembawang</div> <div>Pasir Ris</div> </div> </div> </div>	<p>Similar to the visualisation tab, you can select the desired zone to compute KDE for SPPA. Kallang will be selected as usual, as it has the highest concentration of Airbnbs.</p>
<div> <div>Kernel Smoothing Input</div> <div> <div>Gaussian</div> <div> <div>Gaussian</div> <div>Epanechnikov</div> <div>Quartic</div> <div>Disc</div> </div> </div> </div>	<p>For the kernel smoothing method, apart from Gaussian, you can select Epanechnikov, Quartic, and Disc.</p> <p>Check out this link for a detailed explanation of the main differences between these different methods.</p>
<div> <div>Bandwidth Method</div> <div> <input checked="" type="radio"/> Auto <input type="radio"/> Fixed <input type="radio"/> Adaptive </div> </div>	<p>For the bandwidth option, Auto will be selected as default. Fixed and Adaptive can be selected.</p>
<div> <div>Automatic Bandwidth Method</div> <div> <div>bw.diggle</div> <div> <div>bw.diggle</div> <div>bw.CvL</div> <div>bw.scott</div> <div>bw.ppl</div> </div> </div> </div>	<p>Automatic bandwidth:</p> <p>bw.diggle will be selected as the default. We can choose bw.CvL, bw.scott, and bw.ppl as well.</p> <p>Similarly, we can refer to this link for more detailed information about the different bandwidth method</p>
<div> <div>Fixed Bandwidth Method (in km)</div> <div> <div>0</div> <div>1</div> <div>5</div> </div> </div>	<p>Fixed bandwidth:</p> <p>There will be a slider input which will allow you to input a numeric value in km. Note that 1km will be set as the default but you will be able to pick a number between 0 and 5.</p>
<div> <div>Adaptive</div> </div>	<p>Adaptive bandwidth:</p> <p>This bandwidth method will be automatically calculated for the KDE map.</p>
<div> <div>RUN ANALYSIS</div> </div>	<p>After selecting all of the desired inputs, remember to click the Run Analysis button to update the KDE map with the new changes.</p>

4.2. SPPA - G-Function



SPPA G-Function Main Panel

Feature	Functionality
	G-Function graph to visualise (Monte Carlo simulation test) the spatial distribution of point features where clustering, dispersion, or randomness is shown over a range.
<p>About G-Function</p> <p>WHAT IS G-FUNCTION? The G-function calculates the cumulative frequency distribution of the nearest neighbour distance of a point pattern.</p> <p>HOW TO INTERPRET THE GRAPH? Null hypothesis: The Airbnbs in the Zone are randomly distributed.</p> <ol style="list-style-type: none"> 1) If the observed G is above the envelope, it indicates that the Airbnbs in the Zone are clustered. We can reject the null hypothesis as the value is statistically significant. 2) If the observed G is below the envelope, it indicates that the Airbnbs in the Zone are dispersed. We can reject the null hypothesis as the value is statistically significant. 3) If the observed G is inside the envelope, it indicates that the Airbnbs in the Zone are randomly distributed. We do not have enough evidence to reject the null hypothesis as the value is not statistically significant. 	You can read up more about G-Function at the bottom of the page, with the interpretation method.

Zone

Kallang

Number of Simulations (value from 1-999)

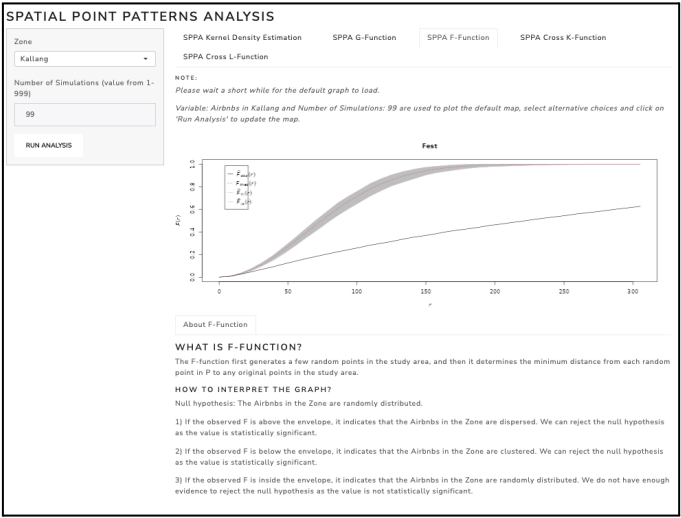
99

RUN ANALYSIS

SPPA G-Function Side Panel

Feature	Functionality
<div> <div>Zone</div> <div> <div>Kallang</div> <div> <div>Kallang</div> <div>Downtown Core</div> <div>Outram</div> <div>Rochor</div> <div>Jurong West</div> <div>Sembawang</div> <div>Pasir Ris</div> </div> </div> </div>	The drop down box features all of the zones to compute the G-Function
<div> Number of Simulations (value from 1-999) </div> <div>99</div>	The default simulations will be set at 99. You will be able to set a value from 1 to 999. Find out more about the simulations here .
<div>RUN ANALYSIS</div>	Do not forget to click the Run Analysis button after selecting desired inputs.

4.3. SPPA - F-Function



Zone

Kallang

Number of Simulations (value from 1-999)

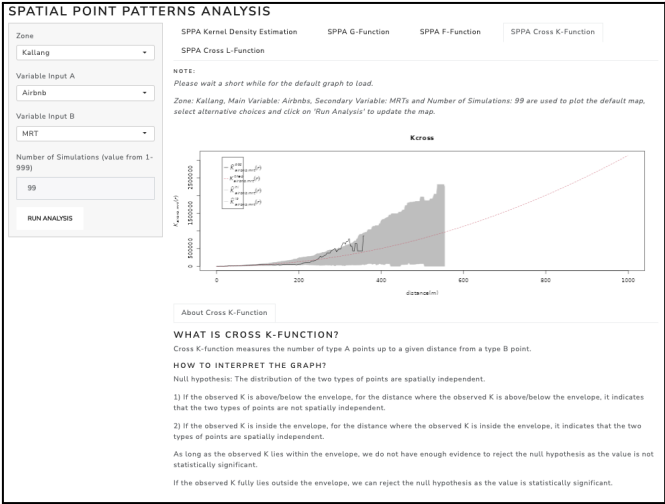
99

RUN ANALYSIS

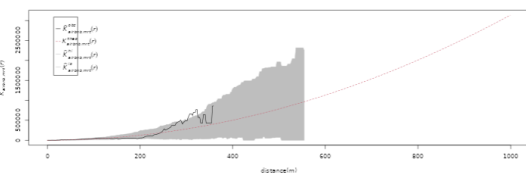
SPPA F-Function Side Panel

Feature	Functionality
<div> <div>Zone</div> <div> <div>Kallang</div> <div> <div>Kallang</div> <div>Downtown Core</div> <div>Outram</div> <div>Rochor</div> <div>Jurong West</div> <div>Sembawang</div> <div>Pasir Ris</div> </div> </div> </div>	Similar to G-Function, the drop box features zones to compute the F-Function.
<div> <div>Number of Simulations (value from 1-999)</div> <div>99</div> </div>	The default simulations will also be set at 99. You will be able to set a value from 1 to 999.
<div>RUN ANALYSIS</div>	Always remember to click the Run Analysis button after inputting desired changes.

4.4. SPPA – Cross K-Function



SPPA Cross K-Function Main Panel

Feature	Functionality
<div><div>Kcross</div><div></div></div>	<div>Cross K-Function graph to visualise (Monte Carlo simulation test) the spatial independence between two types of points.</div> <div>With the Cross K-Function, we will be able to see the relationship between 2 variables (main and secondary), unlike earlier functions.</div>
<div><div>About Cross K-Function</div><div><div>WHAT IS CROSS K-FUNCTION?</div><div>Cross K-function measures the number of type A points up to a given distance from a type B point.</div><div>HOW TO INTERPRET THE GRAPH?</div><div>Null hypothesis: The distribution of the two types of points are spatially independent.</div><div>1) If the observed K is above/below the envelope, for the distance where the observed K is above/below the envelope, it indicates that the two types of points are not spatially independent.</div><div>2) If the observed K is inside the envelope, for the distance where the observed K is inside the envelope, it indicates that the two types of points are spatially independent.</div><div>As long as the observed K lies within the envelope, we do not have enough evidence to reject the null hypothesis as the value is not statistically significant.</div><div>If the observed K fully lies outside the envelope, we can reject the null hypothesis as the value is statistically significant.</div></div></div>	<div>Similarly, there will be information about Cross K-Function and the interpretation method at the bottom of the page.</div>

Zone

Kallang

Variable Input A

Airbnb

Variable Input B

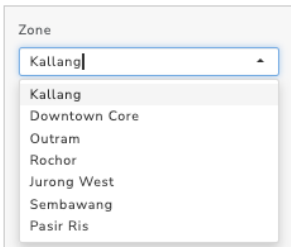
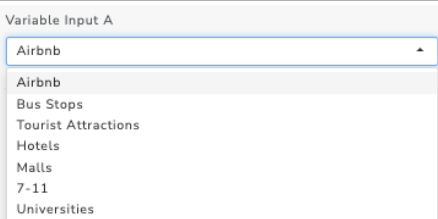
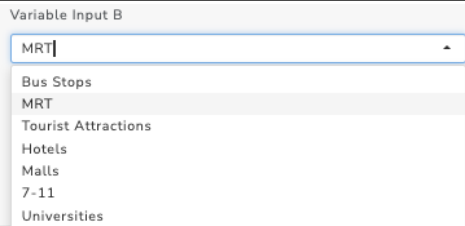


MRT

Number of Simulations (value from 1-999)

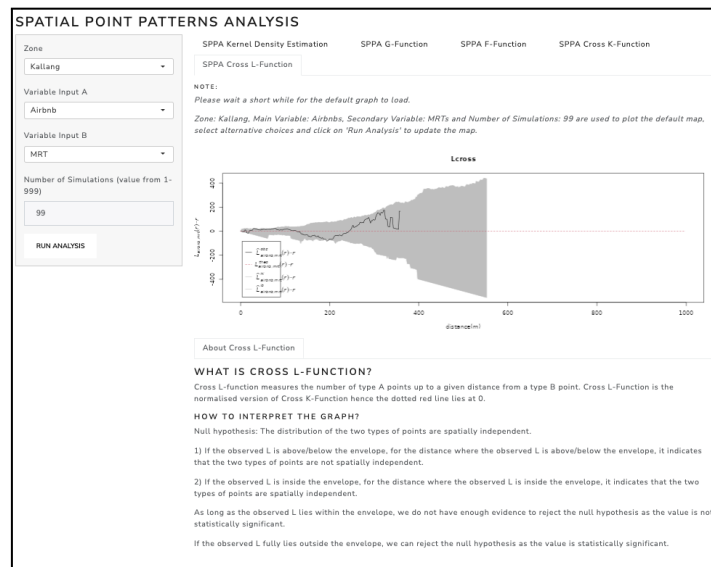
99

RUN ANALYSIS

SPPA Cross K-Function Side Panel

Feature	Functionality
	The first drop down list named Zone will allow you to select the zones.
	The second drop down list will allow you to select the Variable A (1 st variable) , which ranges from Airbnb, Bus Stops, MRT, 7-11, Hotels, Malls, Tourist Attractions, and Universities.
	The third drop down list will allow you to select the Variable B (2 nd variable) , which ranges from Airbnb, Bus Stops, MRT, 7-11, Hotels, Malls, Tourist Attractions, and Universities.
	The default simulations will also be set at 99. You will be able to set a value from 1 to 999.
	Always remember to click the Run Analysis button after inputting desired changes.

4.5. SPPA – Cross L-Function



SPPA Cross L-Function Main Panel

Feature	Functionality
	<p>Cross L-Function graph to visualise (Monte Carlo simulation test) the spatial independence between two types of points.</p> <p>With the Cross L-Function, we will be able to see the relationship between 2 variables (main and secondary), unlike G and F functions.</p>
<p><input type="button" value="About Cross L-Function"/></p> <p>WHAT IS CROSS L-FUNCTION? Cross L-function measures the number of type A points up to a given distance from a type B point. Cross L-Function is the normalised version of Cross K-Function hence the dotted red line lies at 0.</p> <p>HOW TO INTERPRET THE GRAPH? Null hypothesis: The distribution of the two types of points are spatially independent.</p> <ol style="list-style-type: none"> 1) If the observed L is above/below the envelope, for the distance where the observed L is above/below the envelope, it indicates that the two types of points are not spatially independent. 2) If the observed L is inside the envelope, for the distance where the observed L is inside the envelope, it indicates that the two types of points are spatially independent. <p>As long as the observed L lies within the envelope, we do not have enough evidence to reject the null hypothesis as the value is not statistically significant.</p> <p>If the observed L fully lies outside the envelope, we can reject the null hypothesis as the value is statistically significant.</p>	<p>Similarly, there will be information about Cross L-Function and the interpretation method at the bottom of the page.</p>

Zone

Kallang

Variable Input A

Airbnb

Variable Input B

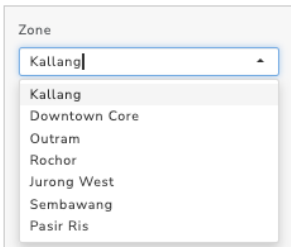
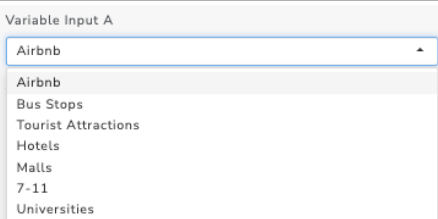
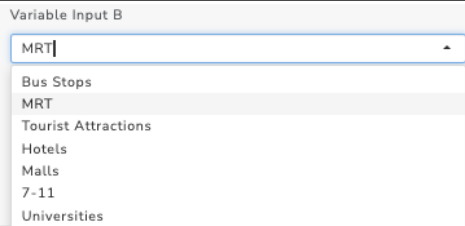


MRT

Number of Simulations (value from 1-999)

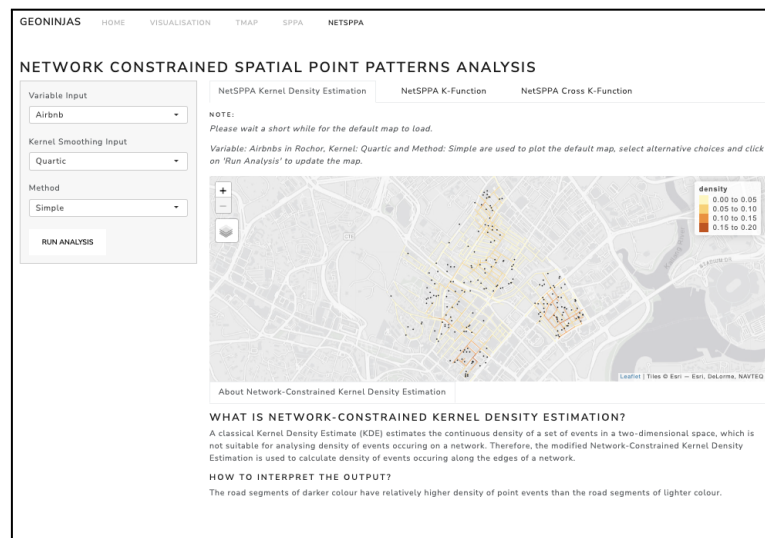
99

RUN ANALYSIS

SPPA Cross L-Function Side Panel

Feature	Functionality
	The first drop down list named Zone will allow you to select the zones.
	The second drop down list will allow you to select the Variable A (1 st variable) , which ranges from Airbnb, Bus Stops, MRT, 7-11, Hotels, Malls, Tourist Attractions, and Universities.
	The third drop down list will allow you to select the Variable B (2 nd variable) , which ranges from Airbnb, Bus Stops, MRT, 7-11, Hotels, Malls, Tourist Attractions, and Universities.
	The default simulations will also be set at 99. You will be able to set a value from 1 to 999.
	Always remember to click the Run Analysis button after inputting desired changes.

5. NetSPPA



The NetSPPA is the fifth tab that you can access in our application. NetSPPA is short form for Network-Constrained Spatial Point Patterns Analysis.

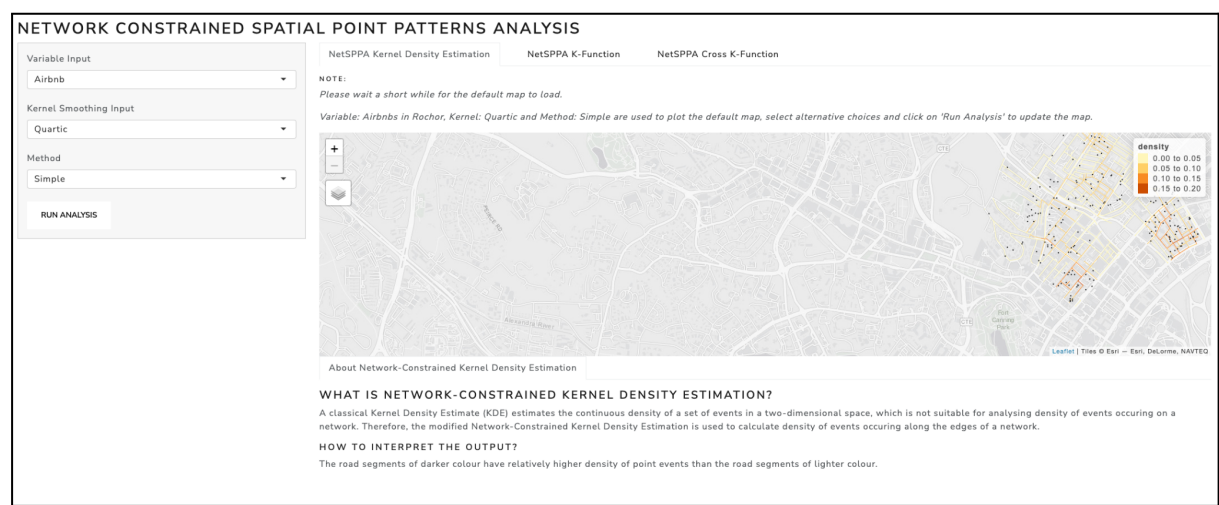
The NetSPPA tab focuses on the street network in Rochor.

There three sub tabs are mainly:

- 1) NetSPPA Kernel Density Estimation
- 2) NetSPPA K-Function
- 3) NetSPPA Cross K-Function

The layout of the sub tabs are similar, with a main visualisation panel on the right and a side panel for selection of inputs on the left

5.1. NetSPPA – Kernel Density Estimation



Variable Input

Airbnb

Kernel Smoothing Input

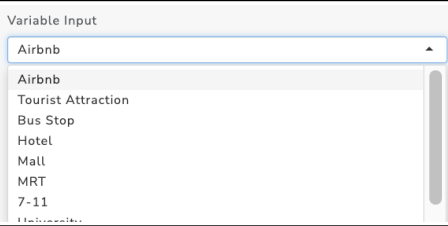
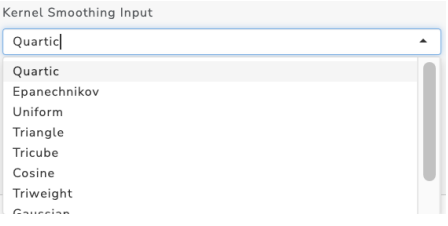
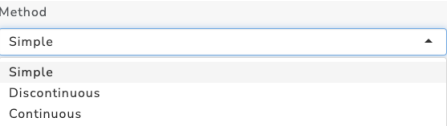

Quartic

Method

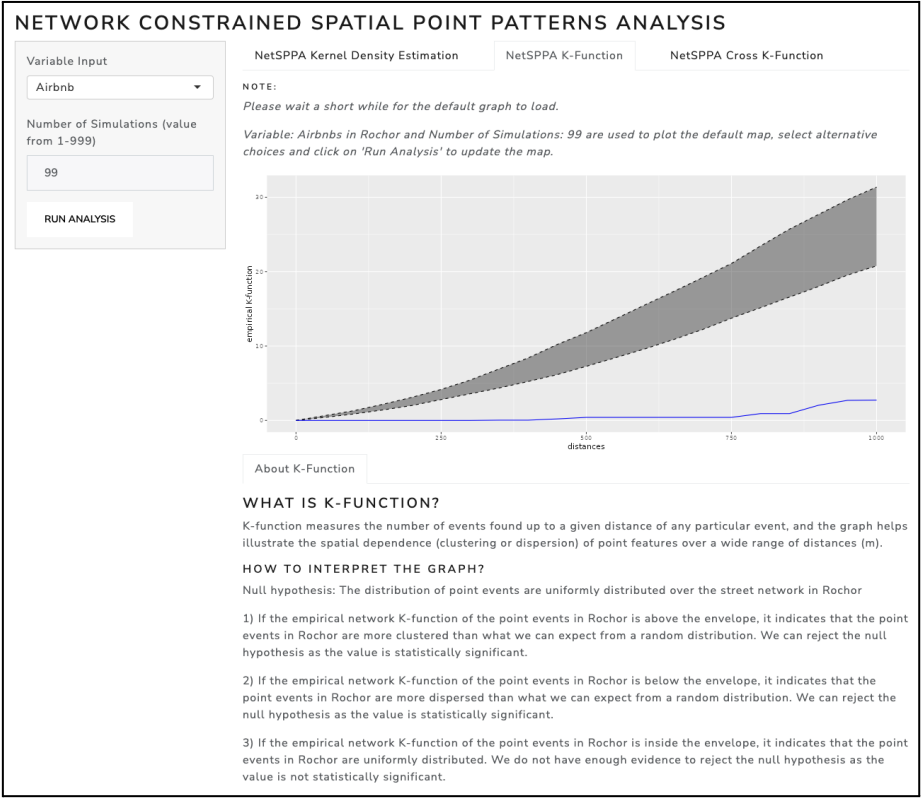
Simple

RUN ANALYSIS

NetSPPA KDE side Panel

Feature	Functionality
	<p>The first drop down list named variable input will allow you to select the desired variables for visualisation. Default variable will be Airbnb.</p>
	<p>With Quartic selected as default for kernel computation method, this drop down list will help u pick from Triangle, Tricube, Cosine, Triweight, Gaussian, Scaled Gaussian, Epanechnikov and Uniform.</p> <p>You can get a more in-depth explanation of the various kernels here.</p>
	<p>With Simple selected as the default, you will be able to change the setting to Discontinuous and Continuous using the drop down list.</p>
	<p>Always remember to click the Run Analysis button after inputting desired changes.</p>

5.2. NetSPPA – K-Function



NetSPPA K-Function Main Panel

Feature	Functionality
	K-Function graph to visualise (Monte Carlo simulation test) the spatial distribution of point features where clustering, dispersion, or randomness is shown over a range.
<div><div>About K-Function</div><div>WHAT IS K-FUNCTION?</div><div>K-function measures the number of events found up to a given distance of any particular event, and the graph helps illustrate the spatial dependence (clustering or dispersion) of point features over a wide range of distances (m).</div><div>HOW TO INTERPRET THE GRAPH?</div><div>Null hypothesis: The distribution of point events are uniformly distributed over the street network in Rochor</div><div>1) If the empirical network K-function of the point events in Rochor is above the envelope, it indicates that the point events in Rochor are more clustered than what we can expect from a random distribution. We can reject the null hypothesis as the value is statistically significant.</div><div>2) If the empirical network K-function of the point events in Rochor is below the envelope, it indicates that the point events in Rochor are more dispersed than what we can expect from a random distribution. We can reject the null hypothesis as the value is statistically significant.</div><div>3) If the empirical network K-function of the point events in Rochor is inside the envelope, it indicates that the point events in Rochor are uniformly distributed. We do not have enough evidence to reject the null hypothesis as the value is not statistically significant.</div></div>	Similarly, there will be information about K-Function and the interpretation method at the bottom of the page.

Variable Input

Airbnb

Number of Simulations (value from 1-999)

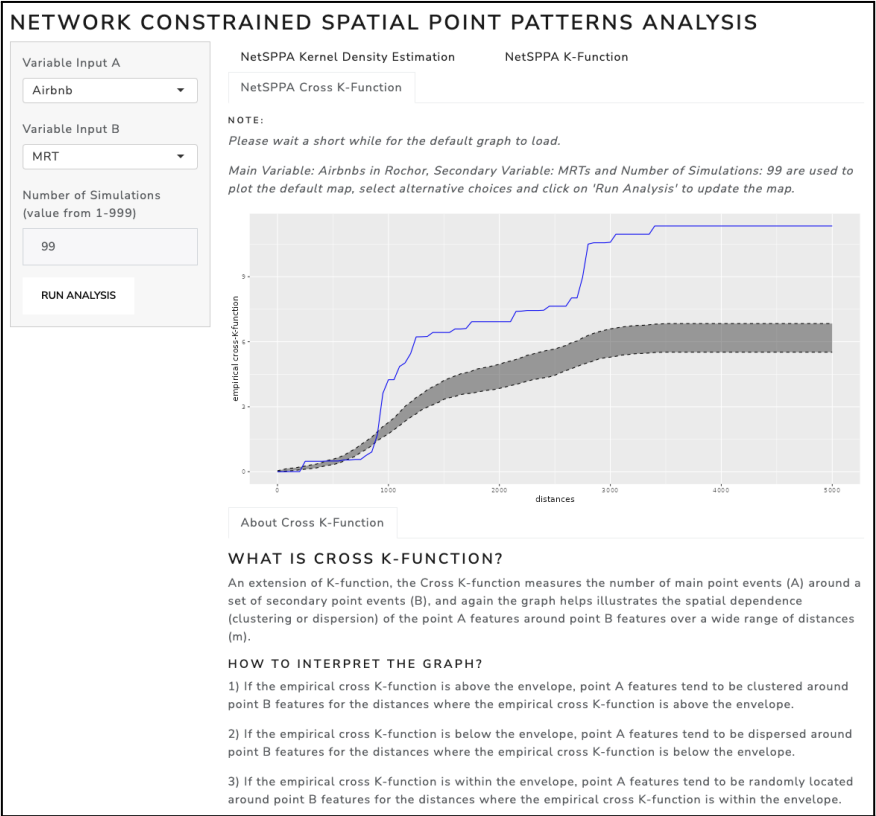
99

RUN ANALYSIS

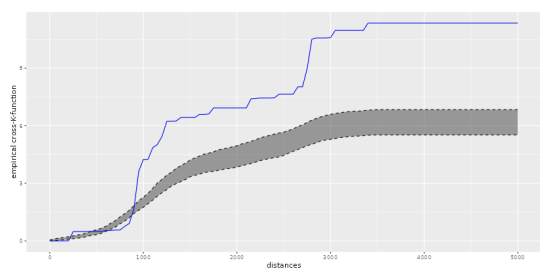
NetSPPA K-Function side Panel

Feature	Functionality
<div><div>Variable Input</div><div><div>Airbnb</div><div><div>Airbnb</div><div>Tourist Attraction</div><div>Bus Stop</div><div>Hotel</div><div>Mall</div><div>MRT</div><div>7-11</div><div>University</div></div></div></div>	<p>The first drop down list named variable input will allow you to select the desired variables for visualisation. Default variable will be Airbnb.</p>
<div><div>Number of Simulations (value from 1-999)</div><div><div>99</div></div></div>	<p>The default simulations will also be set at 99. You will be able to set a value from 1 to 999.</p>
<div><div>RUN ANALYSIS</div></div>	<p>Always remember to click the Run Analysis button after inputting desired changes.</p>

5.3. NetSPPA – Cross K-Function



NetSPPA Cross K-Function Main Panel

Feature	Functionality
	<p>Cross K-Function graph to visualise (Monte Carlo simulation test) the spatial distribution between two types of point features.</p> <p>With the Cross K-Function, we will be able to see the relationship between 2 variables (main and secondary), unlike earlier functions.</p>
<div>About Cross K-Function</div> <div>WHAT IS CROSS K-FUNCTION? An extension of K-function, the Cross K-function measures the number of main point events (A) around a set of secondary point events (B), and again the graph helps illustrates the spatial dependence (clustering or dispersion) of the point A features around point B features over a wide range of distances (m). HOW TO INTERPRET THE GRAPH? 1) If the empirical cross K-function is above the envelope, point A features tend to be clustered around point B features for the distances where the empirical cross K-function is above the envelope. 2) If the empirical cross K-function is below the envelope, point A features tend to be dispersed around point B features for the distances where the empirical cross K-function is below the envelope. 3) If the empirical cross K-function is within the envelope, point A features tend to be randomly located around point B features for the distances where the empirical cross K-function is within the envelope.</div>	<p>Similarly, there will be information about Cross K-Function and the interpretation method at the bottom of the page.</p>

Variable Input A

Airbnb

Variable Input B

MRT

Number of Simulations
(value from 1-999)

99

RUN ANALYSIS

NetSPPA Cross K-Function side Panel

Feature	Functionality
<div> <div>Variable Input A</div> <div> <div>Airbnb</div> <div>Airbnb</div> <div>Bus Stops</div> <div>Tourist Attractions</div> <div>Hotels</div> <div>Malls</div> <div>7-11</div> <div>Universities</div> </div> </div>	<p>The second drop down list will allow you to select the Variable A (1st variable) , which ranges from Airbnb, Bus Stops, MRT, 7-11, Hotels, Malls, Tourist Attractions, and Universities.</p>
<div> <div>Variable Input B</div> <div> <div>MRT</div> <div>Bus Stops</div> <div>MRT</div> <div>Tourist Attractions</div> <div>Hotels</div> <div>Malls</div> <div>7-11</div> <div>Universities</div> </div> </div>	<p>The third drop down list will allow you to select the Variable B (2nd variable) , which ranges from Airbnb, Bus Stops, MRT, 7-11, Hotels, Malls, Tourist Attractions, and Universities.</p>
<div> <div>Number of Simulations (value from 1-999)</div> <div>99</div> </div>	<p>The default simulations will also be set at 99. You will be able to set a value from 1 to 999.</p>
<div> <div>RUN ANALYSIS</div> </div>	<p>Always remember to click the Run Analysis button after inputting desired changes.</p>