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.*

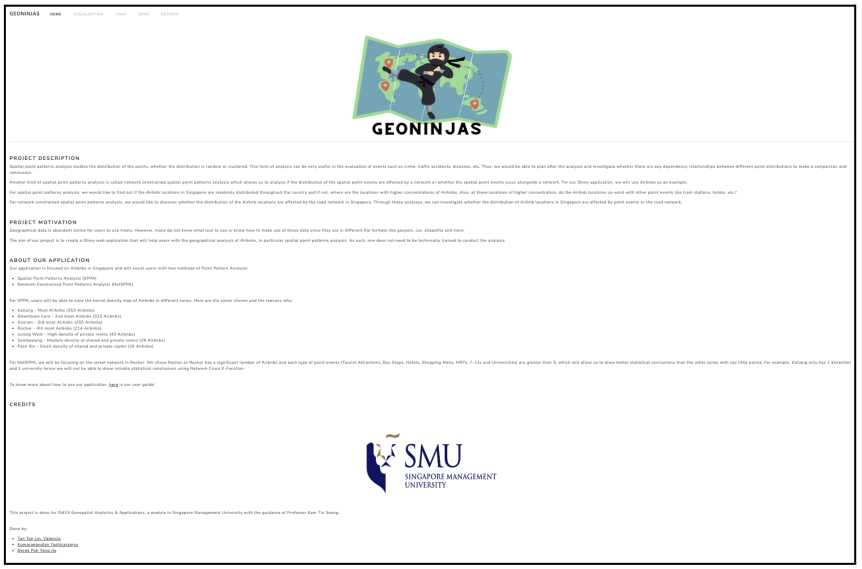
Application Link

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

Navigation Tab Bar

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.

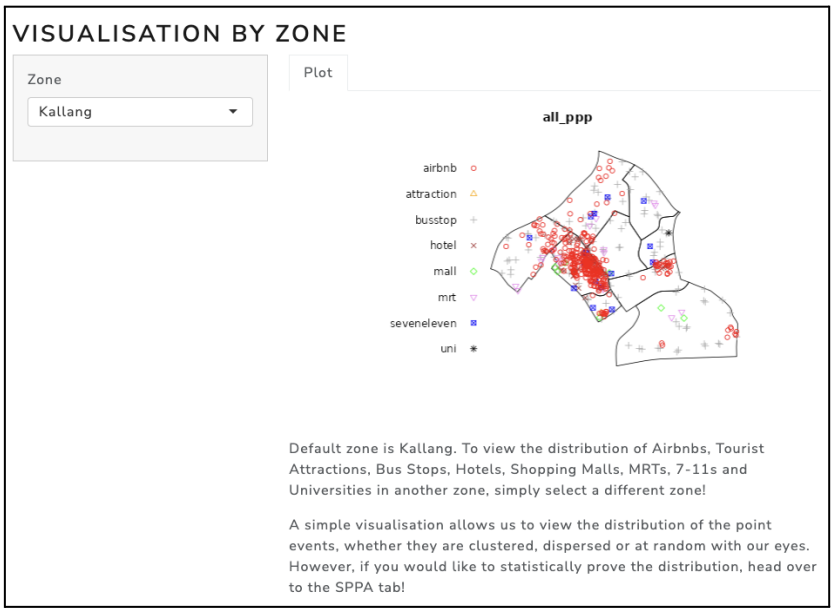
1. Home Tab



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

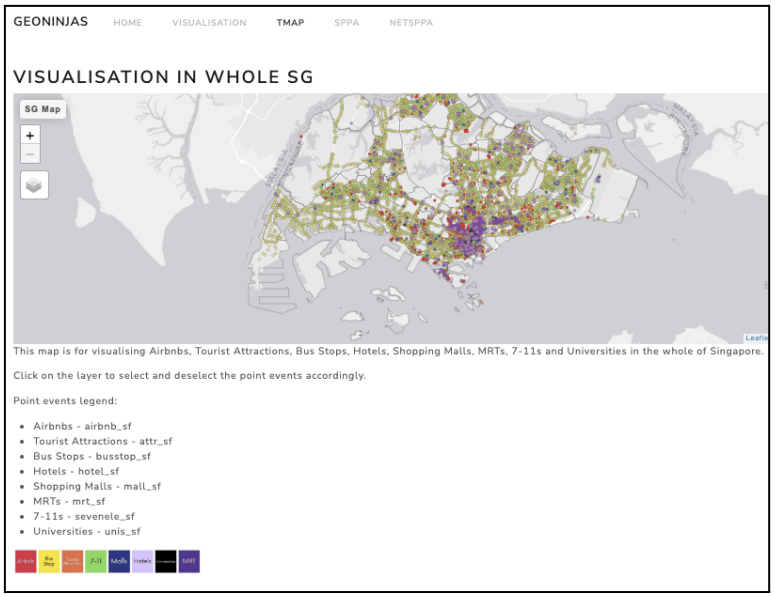
The visualisation tab is the second page in our application. In this tab, you can visualise Airbnbs surrounded by variables such as MRT station, Bus stops, 7-11, Tourist attractions, Malls, Hotels, and Universities.

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

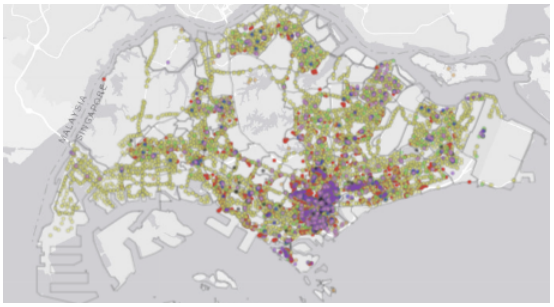
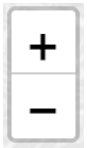
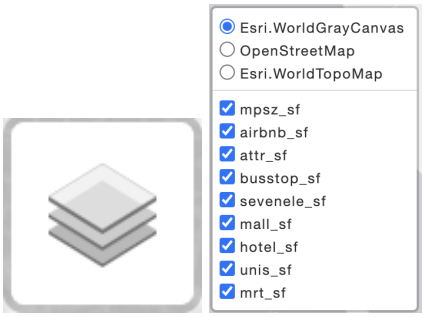
The drop down box will be available on the left side of the page. From there, you can select your desired zone to visualise.

3. Tmap Tab

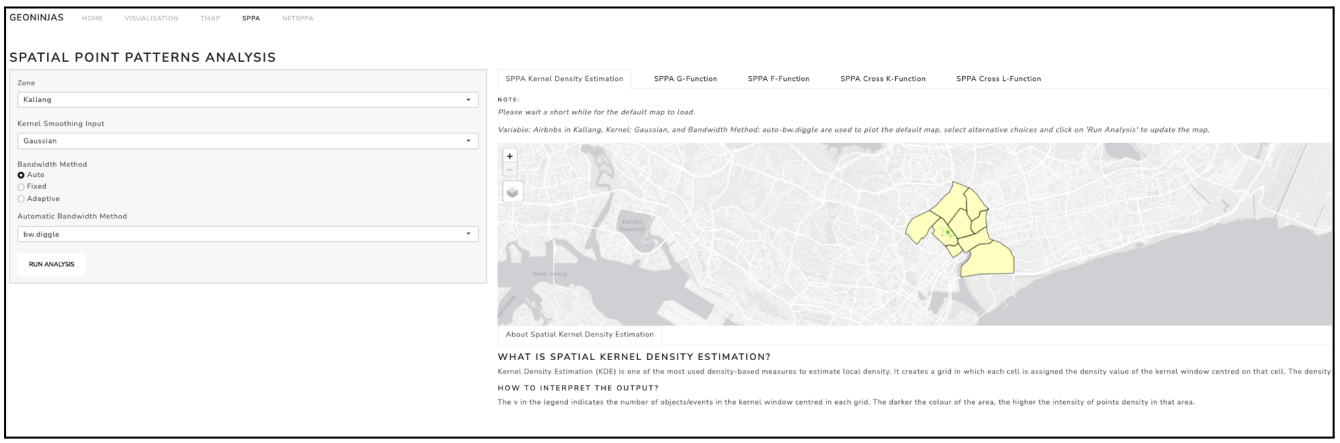


Tmap Main Panel

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.
	This icon will enable you to swap between three different layers as shown on the image on the right to visualise the map differently. 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.
	There is a legend to indicate the different colours for the different variables.

4. SPPA Tab



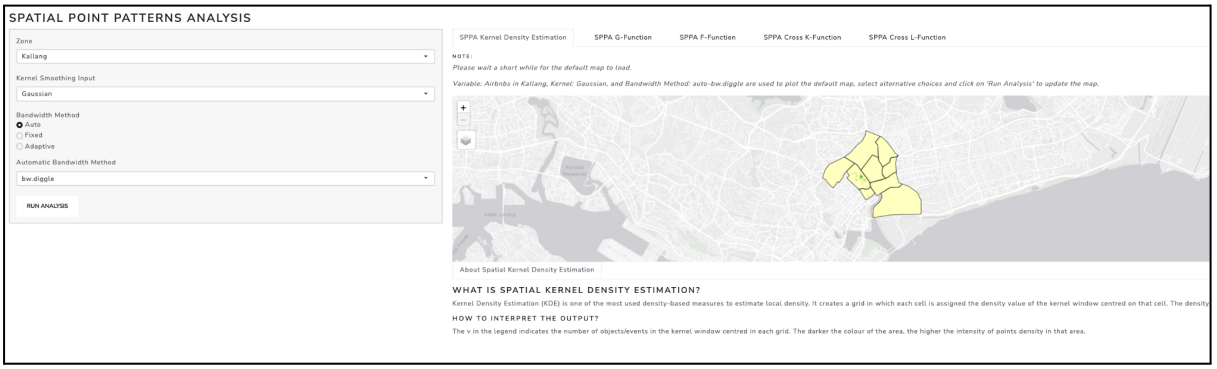
The SPPA is the fourth tab that you can access in our application. SPPA is short form for Spatial Point Patterns Analysis.

There five sub tabs are mainly:

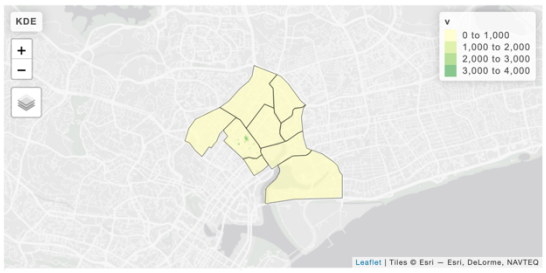
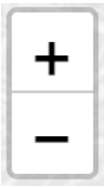
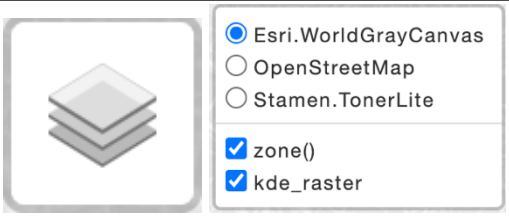
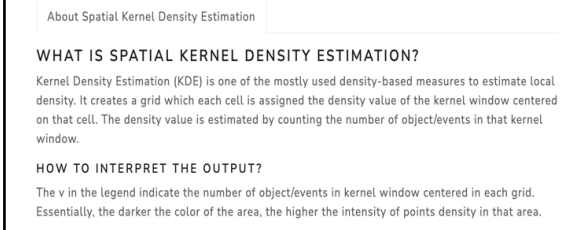
1) SPPA Kernel Density Estimation
2) SPPA G-Function
3) SPPA F-Function
4) SPPA Cross K-Function
5) SPPA Cross L-Function

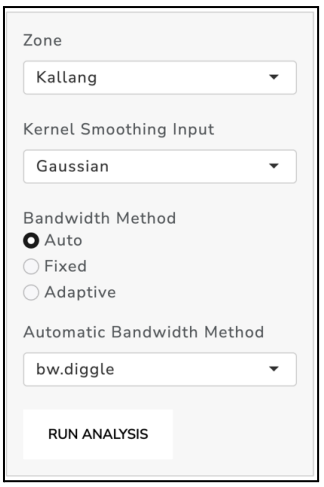
The layout of the sub tabs are similar, with a main visualisation panel on the right and a side panel for selection of inputs on the left

4.1. SPPA Tab - Kernel Density Estimation

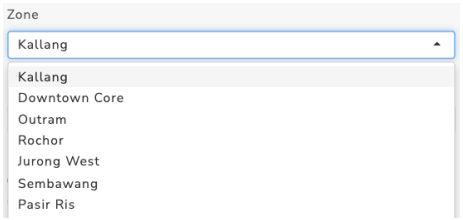
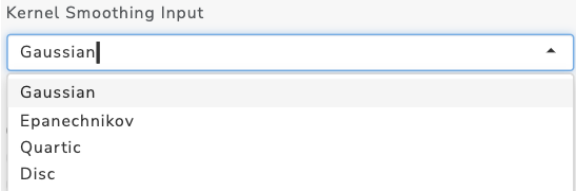
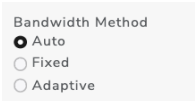
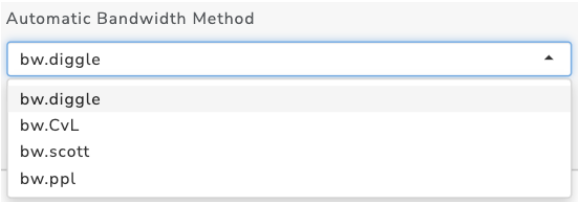
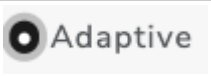


SPPA KDE Main Panel

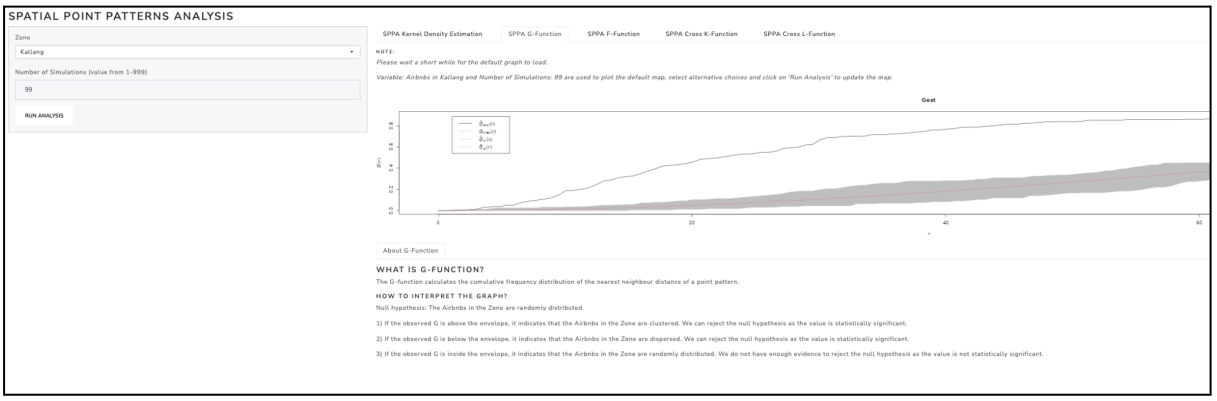
Feature	Functionality
	The darker the colour of the area, the higher the intensity of points density in that area. The v in the legend indicates the number of objects or events in the kernel window centered within each grid.
	You can utilise the '+' and '–' buttons on the left, which will help you zoom in and out respectively. Based on personal preference, you also can choose to use your mouse to zoom manually.
	This icon will enable you to swap between three different layers as shown on the image on the right to visualise the map differently. Additionally, deselecting 'zone()' will remove the outline of the zone, and 'kde_raster' will remove the raster.
	At the bottom of the page, we will briefly explain Spatial Kernel Density Estimation and its interpretation.



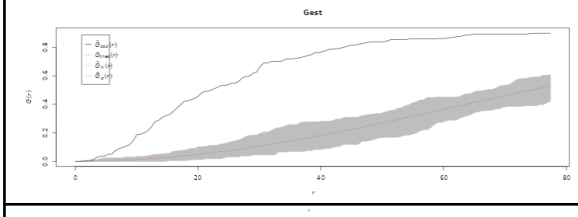
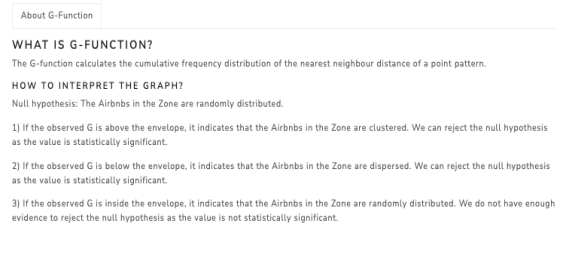
SPPA KDE Side Panel

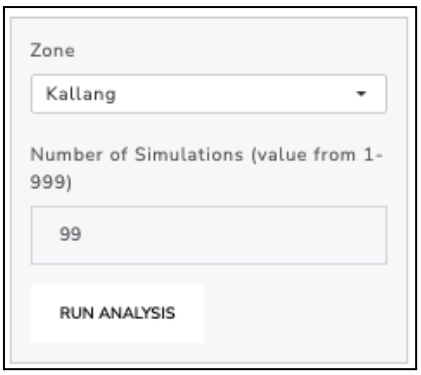
Feature	Functionality
	Similar to the visualisation tab, you can select the desired zone to compute KDE for SPPA. Kallang will be selected as usual, as it has the highest concentration of Airbnbs.
	For the kernel smoothing method, apart from Gaussian, you can select Epanechnikov, Quartic, and Disc. Check out this link for a detailed explanation of the main differences between these different methods.
	For the bandwidth option, Auto will be selected as default. Fixed and Adaptive can be selected.
	Automatic bandwidth: bw.diggle will be selected as the default. We can choose bw.CvL, bw.scott, and bw.ppl as well. Similarly, we can refer to this link for more detailed information about the different bandwidth method
	Fixed bandwidth: 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.
	Adaptive bandwidth: This bandwidth method will be automatically calculated for the KDE map.
	After selecting all of the desired inputs, remember to click the Run Analysis button to update the KDE map with the new changes.

4.2. SPPA - G-Function

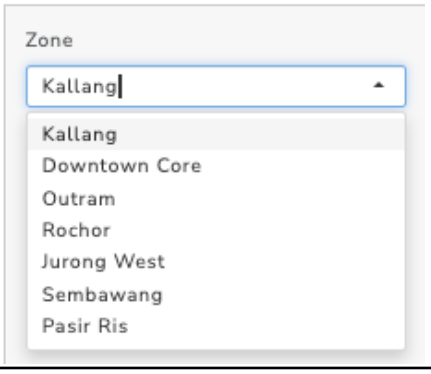
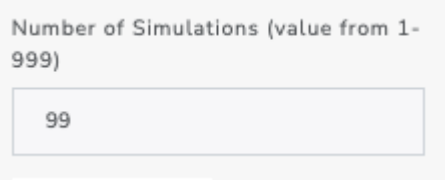


SPPA G-Function Main Panel

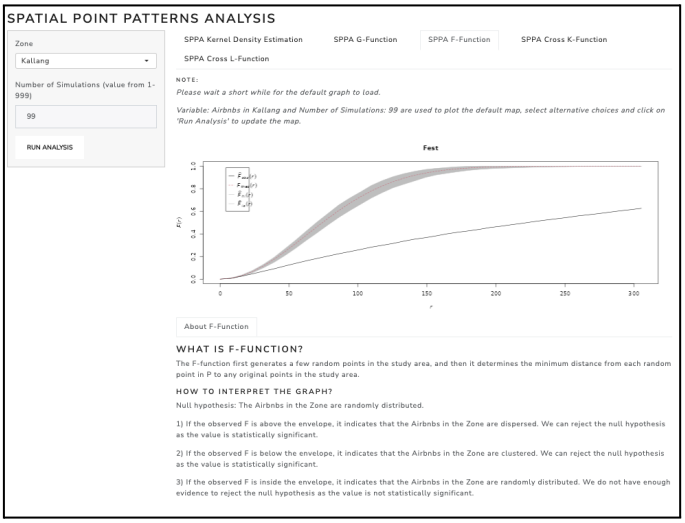
Feature	Functionality
	G-Function graph to visualise (Monte Carlo simulation test) the spatial distribution of point features where clustering, dispersion, or randomness is shown over a range.
	You can read up more about G-Function at the bottom of the page, with the interpretation method.



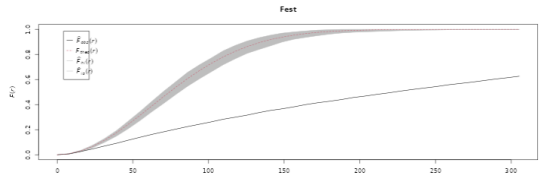
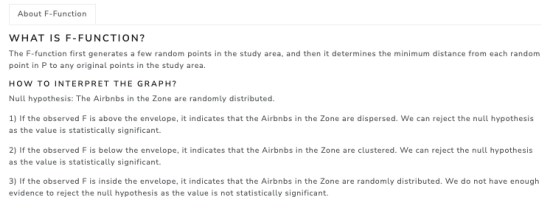
SPPA G-Function Side Panel

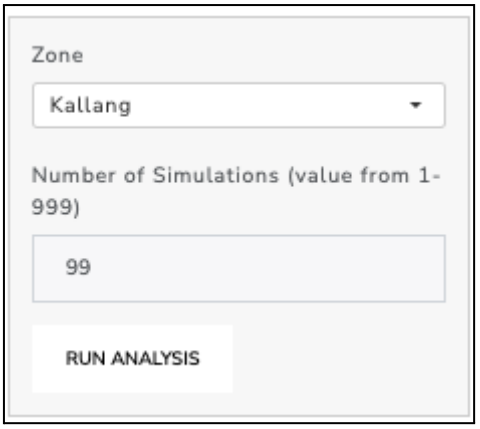
Feature	Functionality
	The drop down box features all of the zones to compute the G-Function
	The default simulations will be set at 99. You will be able to set a value from 1 to 999. Find out more about the simulations here.
	Do not forget to click the Run Analysis button after selecting desired inputs.

4.3. SPPA - F-Function

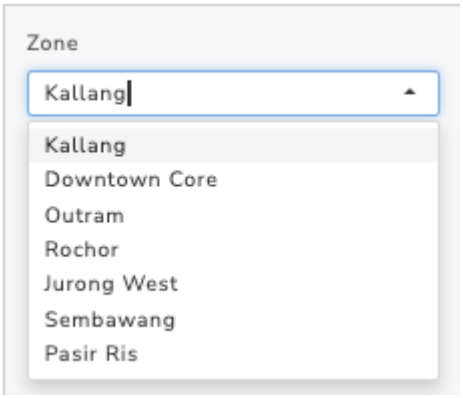
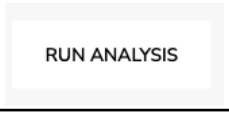


SPPA F-Function Main Panel

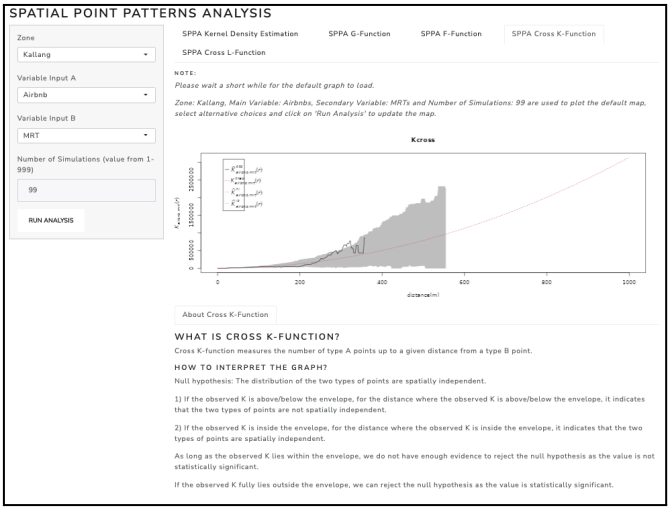
	F-Function graph to visualise (Monte Carlo simulation test) the spatial distribution of point features where clustering, dispersion, or randomness is shown over a range.
	Similarly, there will be information about F-Function and the interpretation method at the bottom of the page.



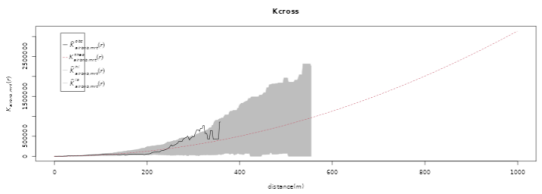
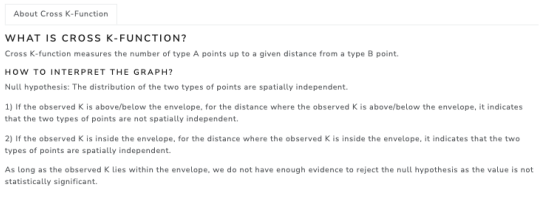
SPPA F-Function Side Panel

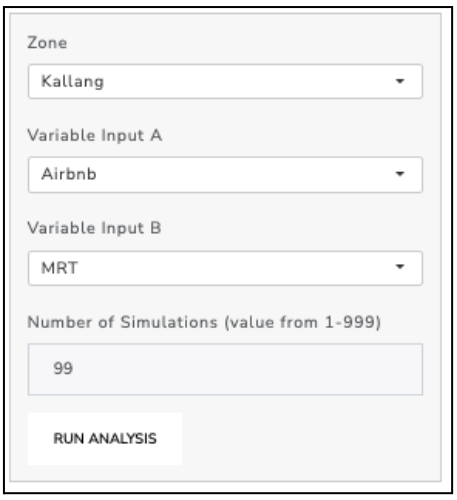
Feature	Functionality
	Similar to G-Function, the drop box features zones to compute the F-Function.
	The default simulations will also be set at 99. You will be able to set a value from 1 to 999.
	Always remember to click the Run Analysis button after inputting desired changes.

4.4. SPPA – Cross K-Function

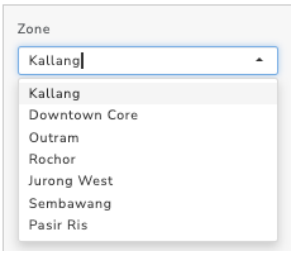
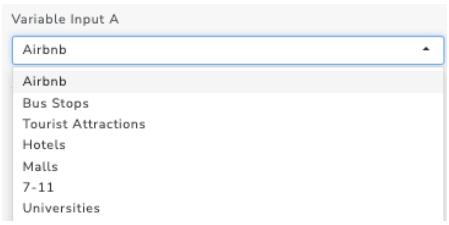
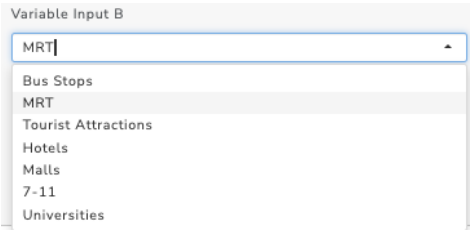
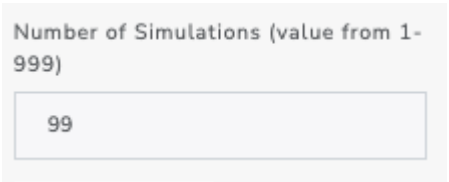


SPPA Cross K-Function Main Panel

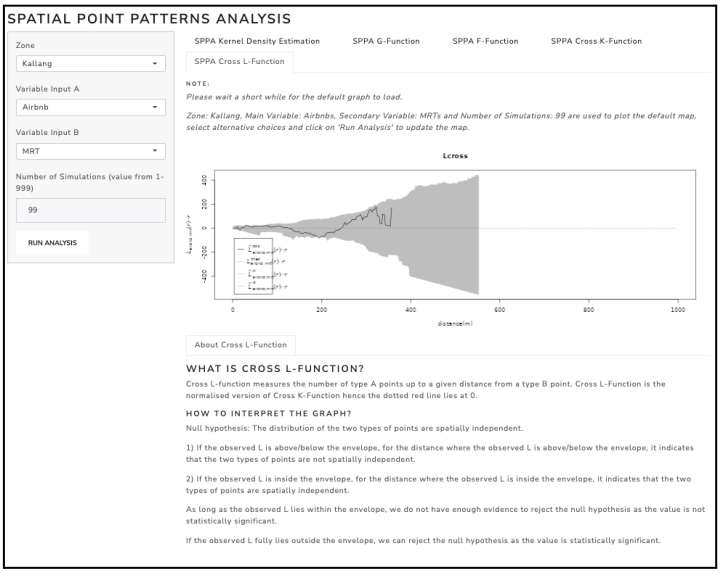
Feature	Functionality
	Cross K-Function graph to visualise (Monte Carlo simulation test) the spatial independence between two types of points. With the Cross K-Function, we will be able to see the relationship between **2 variables** (main and secondary), unlike earlier functions.
	Similarly, there will be information about Cross K-Function and the interpretation method at the bottom of the page.



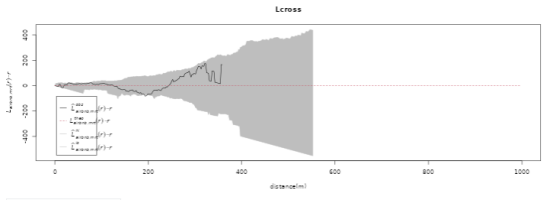
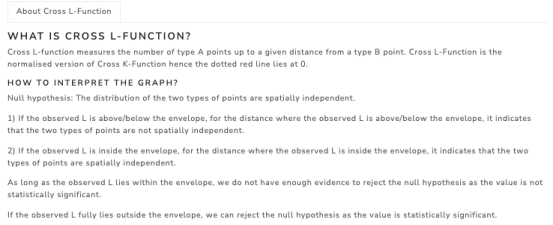
SPPA Cross K-Function Side Panel

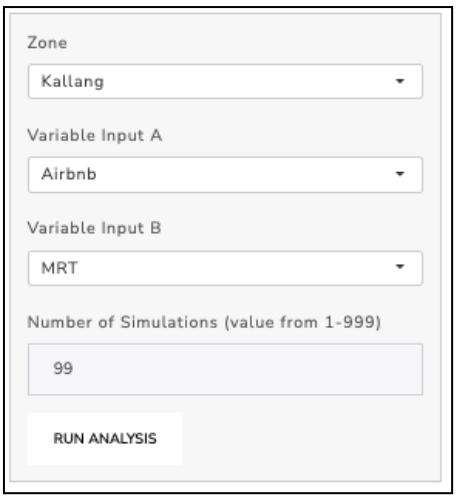
Feature	Functionality
	The first drop down list named Zone will allow you to select the zones.
	The second drop down list will allow you to select the **Variable A** (1st variable) , which ranges from Airbnb, Bus Stops, MRT, 7-11, Hotels, Malls, Tourist Attractions, and Universities.
	The third drop down list will allow you to select the **Variable B** (2nd 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

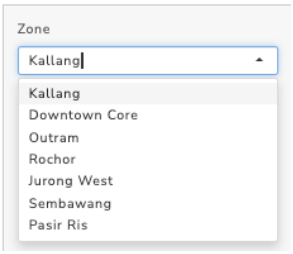
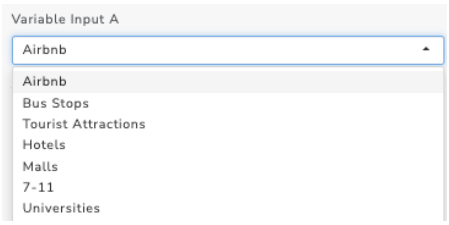
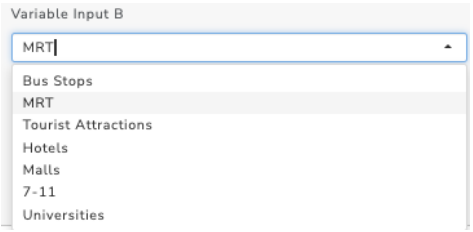
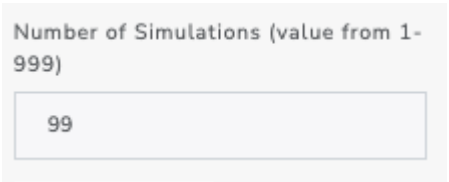


SPPA Cross L-Function Main Panel

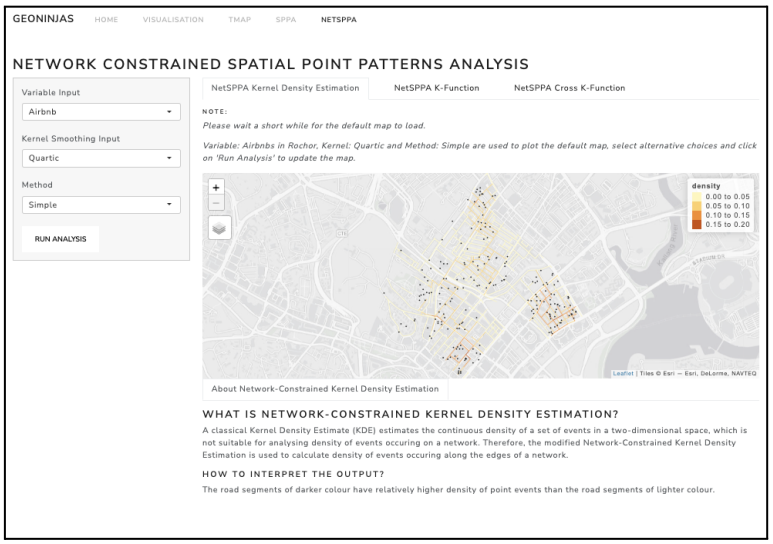
Feature	Functionality
	Cross L-Function graph to visualise (Monte Carlo simulation test) the spatial independence between two types of points. With the Cross L-Function, we will be able to see the relationship between **2 variables** (main and secondary), unlike G and F functions.
	Similarly, there will be information about Cross L-Function and the interpretation method at the bottom of the page.



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** (1st 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** (2nd 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.

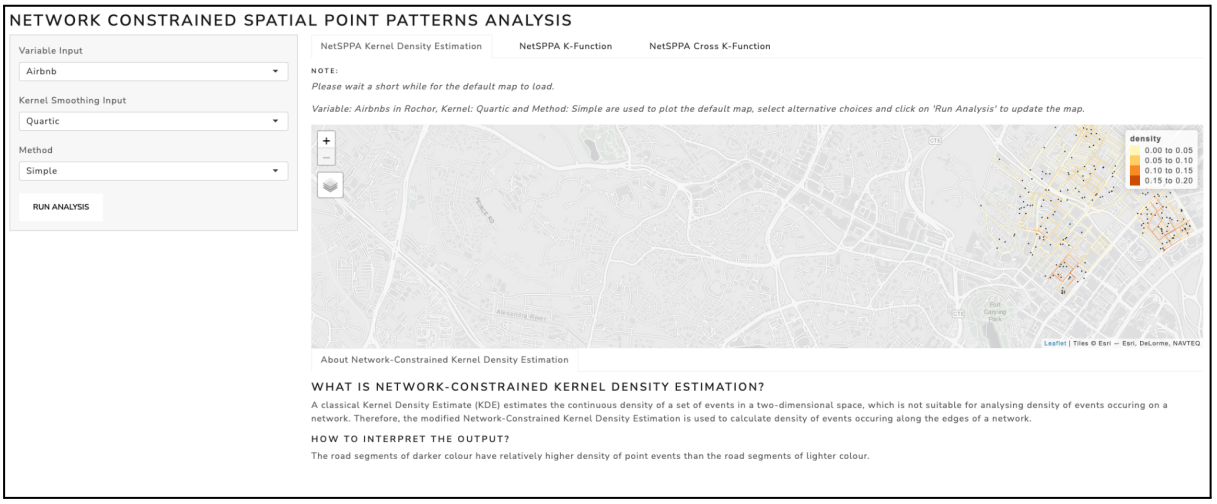
The NetSPPA tab focuses on the street network in Rochor.

There three sub tabs are mainly:

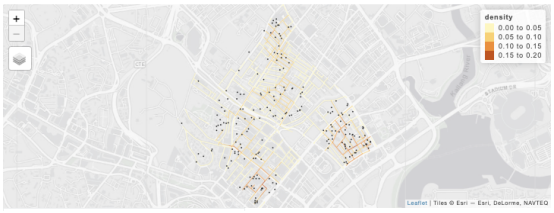
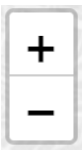
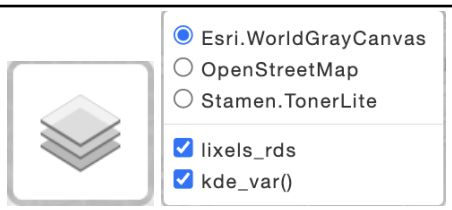
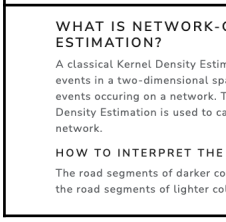
1) NetSPPA Kernel Density Estimation
2) NetSPPA K-Function
3) NetSPPA Cross K-Function

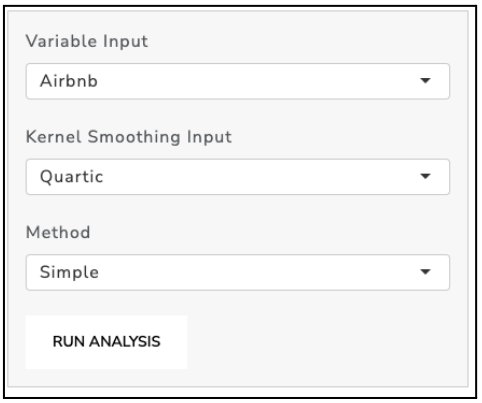
The layout of the sub tabs are similar, with a main visualisation panel on the right and a side panel for selection of inputs on the left

5.1. NetSPPA – Kernel Density Estimation

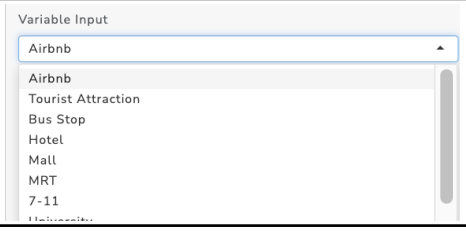
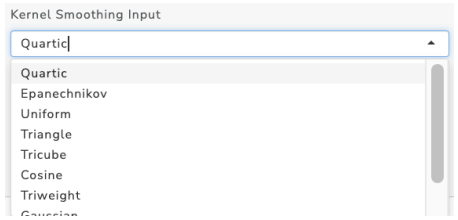
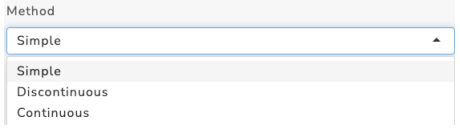


NetSPPA KDE Main Panel

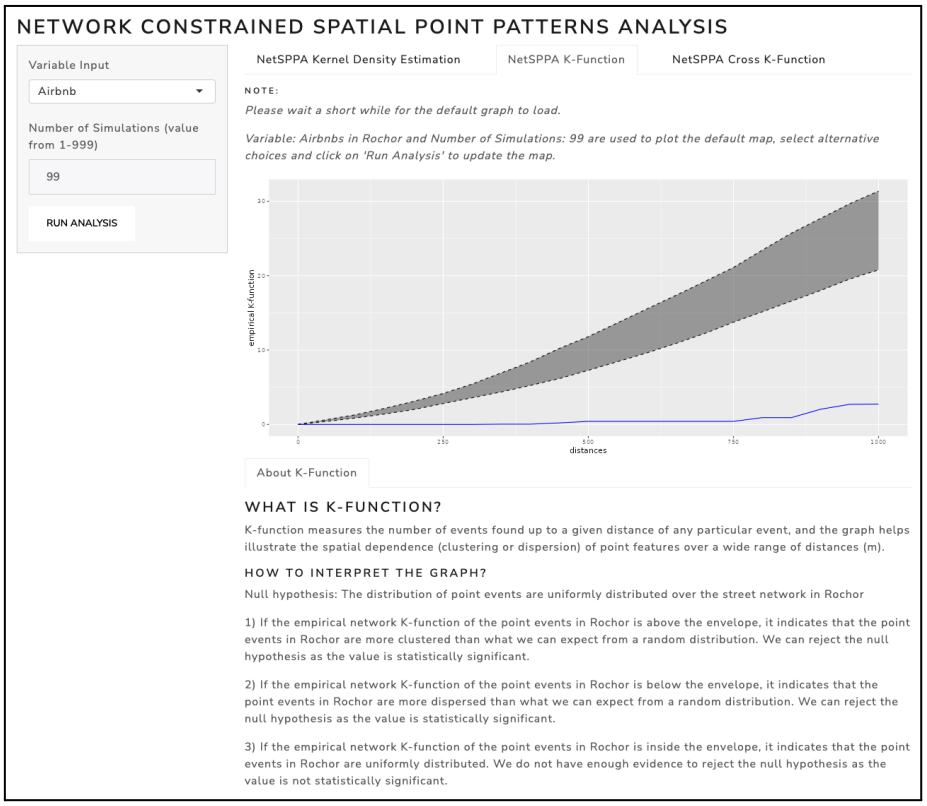
Feature	Functionality
	This is a visualisation of the Network Constrained Kernel Density Estimation. The darker the colour on the road, the higher the intensity of points density along the network.
	You can utilise the '+' and '–' buttons on the left, which will help you zoom in and out respectively. Based on personal preference, you also can choose to use your mouse to zoom manually.
	This icon will enable you to swap between three different layers as shown on the image on the right to visualise the map differently. Additionally, deselecting 'lixels.rds' will remove the network, and 'kde_var()' will remove the points on the map.
	At the bottom of the page, we will briefly explain the Network-Constrained Spatial Kernel Density Estimation along with its interpretation.



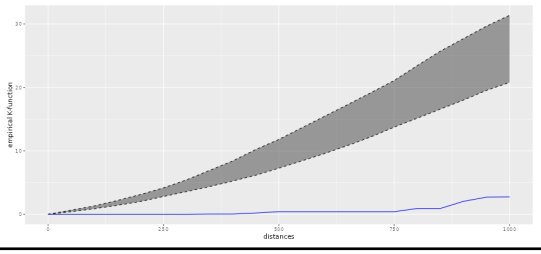
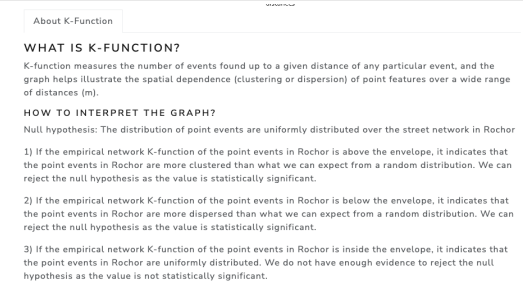
NetSPPA KDE side Panel

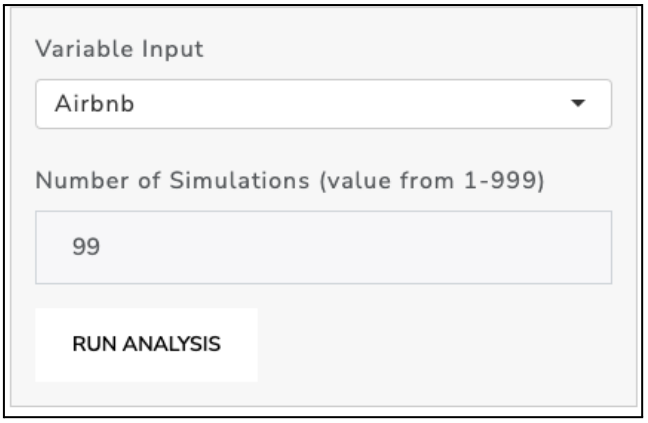
Feature	Functionality
	The first drop down list named variable input will allow you to select the desired variables for visualisation. Default variable will be Airbnb.
	With Quartic selected as default for kernel computation method, this drop down list will help u pick from Triangle, Tricube, Cosine,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

5.2. NetSPPA – K-Function

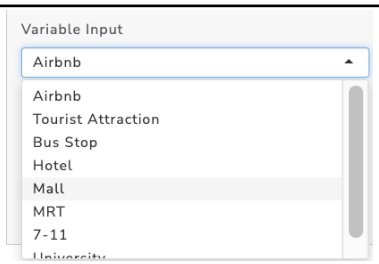


NetSPPA K-Function Main Panel

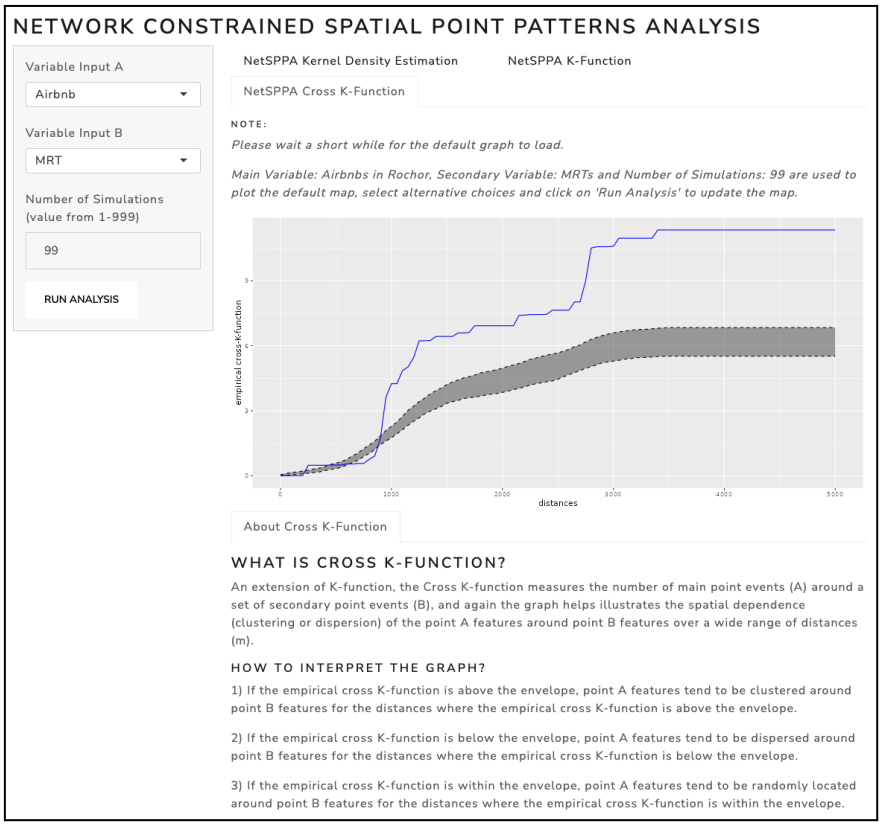
Feature	Functionality
	K-Function graph to visualise (Monte Carlo simulation test) the spatial distribution of point features where clustering, dispersion, or randomness is shown over a range.
	Similarly, there will be information about K-Function and the interpretation method at the bottom of the page.



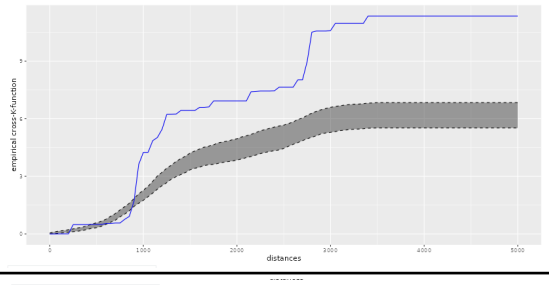
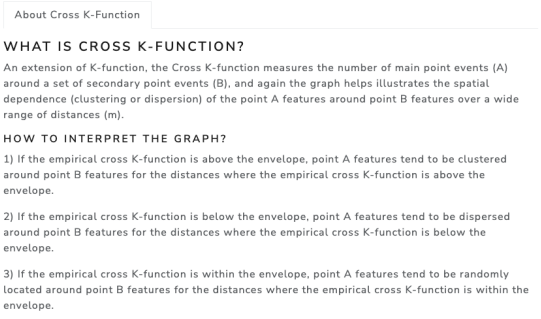
NetSPPA K-Function side Panel

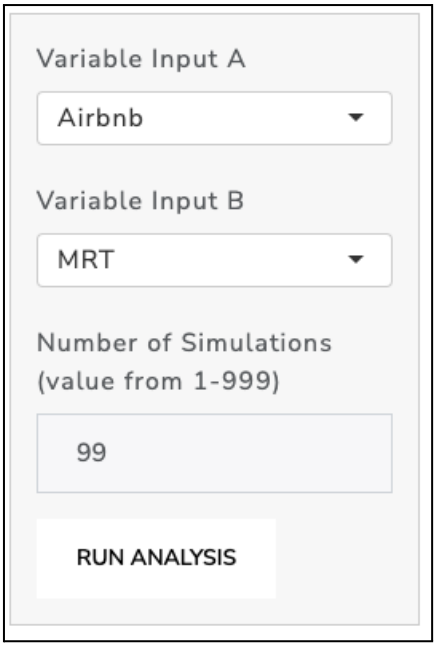
Feature	Functionality
	The first drop down list named variable input will allow you to select the desired variables for visualisation. Default variable will be Airbnb.
	The default simulations will also be set at 99. You will be able to set a value from 1 to 999.
	Always remember to click the Run Analysis button after inputting desired changes.

5.3. NetSPPA – Cross K-Function

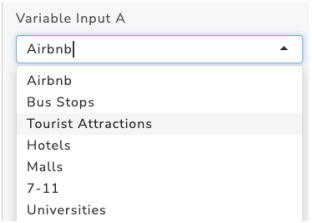
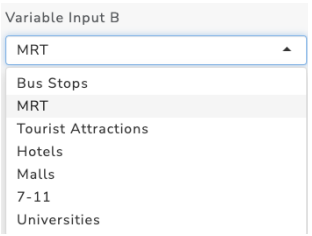


NetSPPA Cross K-Function Main Panel

Feature	Functionality
	Cross K-Function graph to visualise (Monte Carlo simulation test) the spatial distribution between two types of point features. With the Cross K-Function, we will be able to see the relationship between **2 variables** (main and secondary), unlike earlier functions.
	Similarly, there will be information about Cross K-Function and the interpretation method at the bottom of the page.



NetSPPA Cross K-Function side Panel

Feature	Functionality
	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.
	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.
	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.