



## IS415 Geospatial Analytics and Application



# spatial bros

### User Guide

*A Dynamic and Interactive R Shiny App for Point Patterns Analysis*

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## How to use Spatial Bros: Your Quick Start Guide

Welcome to Spatial Bros - A Dynamic and Interactive R Shiny App for Point Patterns Analysis (PPA).

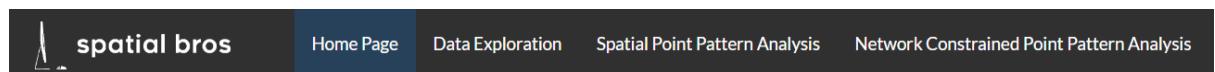
Our application will assist users with two kinds of Point Pattern Analysis: Spatial Point Patterns Analysis and Network-Constrained Point Patterns Analysis.

### Application Link



<https://renjieteo.shinyapps.io/SpatialBros/>

### Navigation Bar



The Navigation Bar is located at the top left of the screen, which will show the different functionalities the application can provide for you.

By default, you will be brought to the Home Page upon arriving on the website. Only when you click on a specific tab then it will highlight itself as the current active tab through a blue colour darkening.

# 1. Home Page

 spatial bros

Home Page Data Exploration Spatial Point Pattern Analysis Network Constrained Point Pattern Analysis

## Project Motivation

In today's technological advancing world, there are many useful and interesting spatial data sources that exist in the forms of Geospatial and Aspatial format. Geographical Geospatial data sets the foundation based on the geographical boundary locations and the Aspatial data are the records of observation that can be further prepared to be used to derive meaningful insights.

Despite all the data sources out on the interweb, there are not many people who are knowledgeable and trained to perform such analysis. Without the fundamental knowledge and training involved, any results based on the analysis performed could result in inaccuracies. Our group attempt is to mainly focus on performing analysis and develop a website based geographical spatial tool. R Shiny tool will be used with regards to developing the 1st/2nd Order & Network Constrained Point Pattern Analysis of Melbourne City, Australia.



This project is done for IS415 Geospatial Analytics & Application under the guidance of Professor Kam Tin Seong



## What is Point Pattern Analysis and Network Constrained Point Pattern Analysis?

Point Pattern Analysis methods helps provide insights about where things occur, how the distribution of incidents or the arrangement of data aligns with other features in the landscape, and what the patterns may reveal about potential connections and correlations.

Network constrained Spatial Point Patterns Analysis (NetSPAA) is a collection of spatial point patterns analysis methods special developed for analysing spatial point event occurs on or alongside network. The spatial point event can be locations of childcare centre for example. The network, on the other hand can be a road network or river network.

## About Spatial Bros

Spatial Bros is created to assist non technologically savvy users in performing geographical point pattern analysis. This application aims to assist users in 2 types of analysis, particularly in performing 1st/2nd Order & Network Constrained Spatial Point Pattern Analysis. For each of the analyses, the application will provide users with statistical functions, kernel density heat map estimation, various mappings and G&K function results. The application will cover an array of spatial points located in Melbourne City such as childcare centres, business establishments, famous landmarks including places of interest such as schools, theaters, health service, sports facilities, drinking fountains and public toilets. The spatial points will work in conjunction to cover areas of the city's road, pedestrian and tram network. From this application, users would be able to perform types of hypothesis testing that allow them to generate insights towards their conclusion on the distribution along the spatial points along the network.

The home page will be the first thing you will see when you access our application.

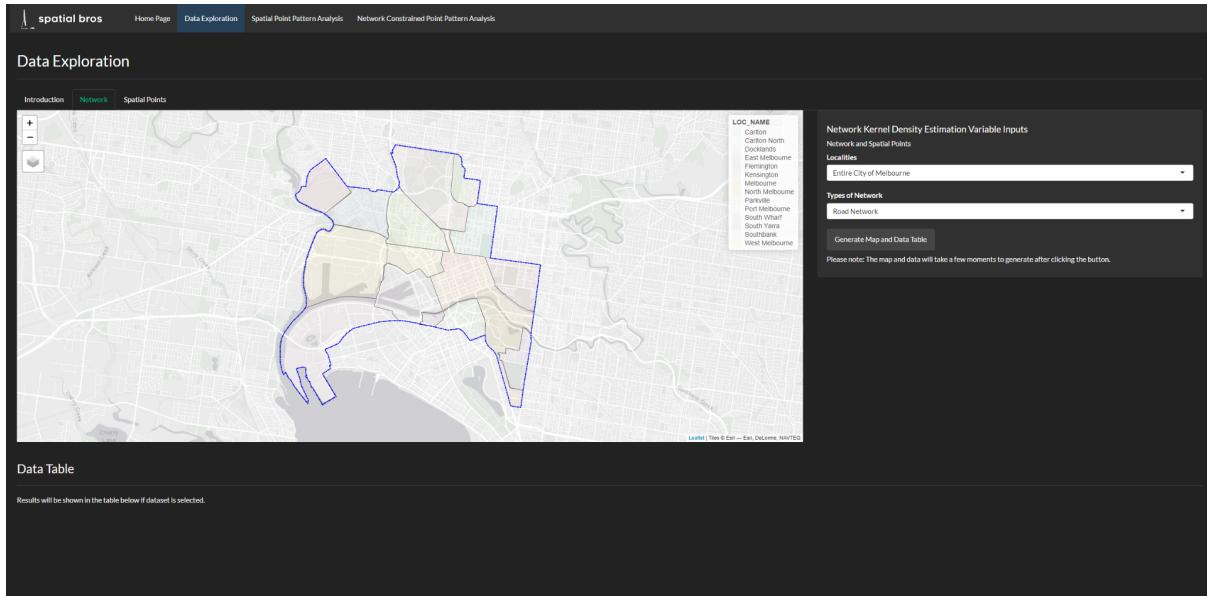
From the home page, you will see a quick overview of the project motivation. You will be able to see what our application does and gain a brief understanding and overview of what is point pattern and network constrained point pattern analysis.

On the right side of the home page, you are able to access our LinkedIn profiles of the creators of Spatial Bros to find out more about them.

**\*Note\***

**If you are unable to see our descriptions and images, please allow your browser to load for 2 - 3 minutes.**

## 2. Data Exploration



The Data Exploration is the second page that you will be able to access in our application.

From the Data Exploration, there are 3 sub tabs that is made available to you for usage:

- 1) Introduction
- 2) Network
- 3) Spatial Point

The layout of the Network and Spatial Point tab is similar in nature, with the main visualisation map being on the left and a side panel on the right for the selection of inputs.

## 2.1 Introduction

The screenshot shows a dark-themed application window titled "Welcome to Data Exploration". At the top, there is a navigation bar with three tabs: "Introduction" (which is highlighted in green), "Network", and "Spatial Points". Below the tabs, the main content area has a heading "Included datasets". Under "Included datasets", there are two sections: "Network" and "Spatial Points", each containing a bulleted list of dataset names.

**Network**

- Road Network - City of Melbourne
- Pedestrian Network - City of Melbourne
- Tram Network - City of Melbourne

**Spatial Points**

- Childcare Centres
- Business Establishments - Sub-categories by Industry Name
- Drinking Fountains
- Landmarks - Themes
- Public Toilets

**To start off:**

1. Select the Network / Spatial Points tab to explore network or spatial points
2. Select the localities
3. Select the location of interest and any specific themes or sub-categories if necessary
4. Click on 'Generate Map and Data Table' and you are ready to go!

### Data Exploration Introduction

This is the data exploration introduction tab where you will learn about what are the available datasets included in this application. In addition, we also provide you a brief overview of how you can navigate around the data exploration section.

## 2.2 Network

spatial bros Home Page Data Exploration Spatial Point Pattern Analysis Network Constrained Point Pattern Analysis

Data Exploration

Introduction Network Spatial Points

LOC\_NAME Carlton

Network Kernel Density Estimation Variable Inputs

Network and Spatial Points Localities Carlton

Types of Network Road Network

Generate Map and Data Table

Please note: The map and data will take a few moments to generate after clicking the button.

Data Table

Results will be shown in the table below if dataset is selected.

Show 25 entries Search:

seg_id	str_type	ctupdate	status_id	seg_descr	poly_area	gfid	street_id	seg_part	LGA_CODE21	LGA_NAME21	STE_CODE21	STE_NAME21	AUS_CODE21	AUS_NAME21	AREASQKM	LOCI_URI21	SHAPE_Leng	SHAPE_Area	LC_PLY_P
20542	Council	20210923	2	Drummond Street	6181.	1566	583	1	24600	Melbourne	2	Victoria	AUS	Australia	37.5452	<a href="https://linked.data.gov.au/dataset/neigp3/LGA2022/24600">https://linked.data.gov.au/dataset/neigp3/LGA2022/24600</a>	0.414591862894	0.00084126300132	IcpR467132

**Data Exploration Network Main Panel**

Feature	Functionality
<p>Map Visualization</p>	<p>This map is a visualisation of the Data Exploration Network being computed. The LOC_NAME in the legend represents the locality district 'Carlton' being analysed. From the visualisation, you are able to see the district outline and the network outlines.</p>
<p>Zoom Control</p>	<p>The map visualisation provides the option of zooming in and out. You can click on the '+' icon to zoom further into the map and '-' to zoom further out.</p>



Royal Park

Esri.WorldGrayCanvas  
 OpenStreetMap  
 Esri.WorldTopoMap

localities  
 boundary  
 network\_type

Base Map Control

When you hover your cursor over to this icon, this menu will appear where you are able to select your desired base map from Esri.WorldGrayCanvas to OpenStreetMap to Esri.WorldTopoMap.

You will also have the option of selecting and deselecting options such as 'localities', 'boundary' and 'network\_type' which are the Melbourne's city boundary outline and the network type outline.

### Network Kernel Density Estimation Variable Inputs

Network and Spatial Points

**Localities**

Carlton

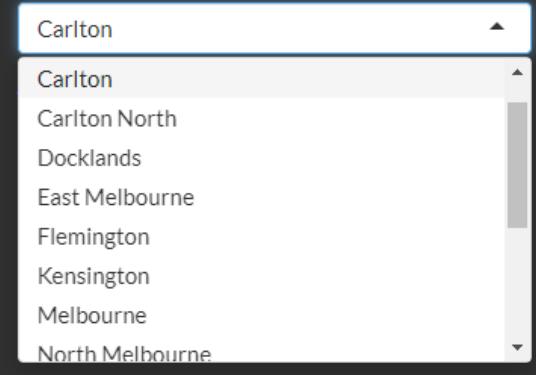
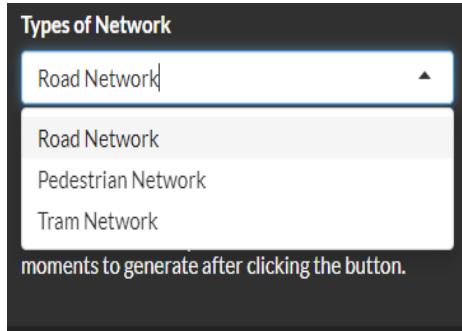
**Types of Network**

Road Network

**Generate Map and Data Table**

Please note: The map and data will take a few moments to generate after clicking the button.

Network Data Exploration Side Panel

Feature	Functionality
<p><b>Network Kernel Density Estimation Variable Inputs</b></p> <p>Network and Spatial Points</p> <p><b>Localities</b></p>  <p>Localities inputs for Data Exploration Network Kernel Density Estimation</p>	<p>From this drop down list, you can select the localities variable to generate the data.</p> <p>'Entire City of Melbourne' will be the default option.</p> <p>Other options are 'Carlton', 'Carlton North', 'Docklands', 'East Melbourne', 'Flemington', 'Kensington', 'Melbourne', 'North Melbourne', 'Parkville', 'Port Melbourne', 'South Wharf', 'South Yarra', 'SouthBank' and 'West Melbourne'.</p>
<p><b>Types of Network</b></p>  <p>Type of Network inputs for Data Exploration Network Kernel Density Estimation</p>	<p>From this drop down list, you can select the type of network variable to generate the data.</p> <p>'Road Network' will be the default option.</p> <p>Other options are 'Pedestrian Network' and 'Tram Network'.</p>
<p><b>Generate Map and Data Table</b></p> <p>Please note: The map and data will take a few moments to generate after clicking the button.</p> <p>Generate Map and Data Table Button</p>	<p>After selecting the above variable inputs, do remember to click on this 'Generate Map and Data Table' button to generate the data.</p>

Data Table

Results will be shown in the table below if dataset is selected.

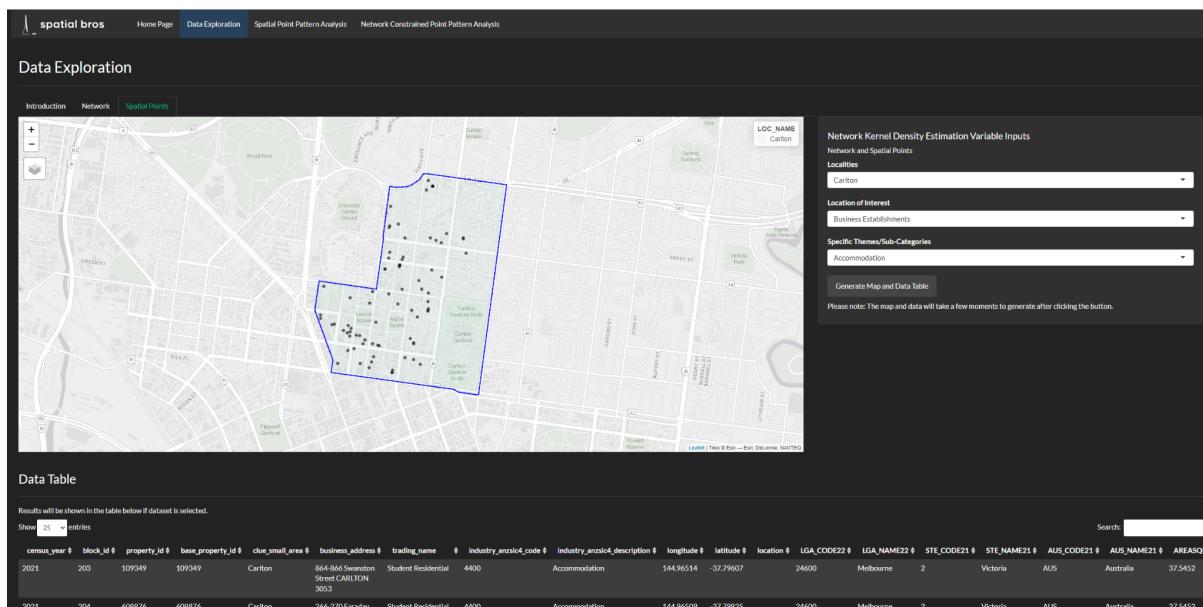
Show: 25 entries Search:

seg_id	str_type	dtupdate	status_id	seg_descr	poly_area	gisid	street_id	seg_part	LGA_CODE22	LGA_NAME22	STE_CODE21	STE_NAME21	AUS_CODE21	AUS_NAME21	AREASQKM	LOCI_URI21	SHAPE_Leng	SHAPE_Area	LC_PLY_PID
20542	Council Major	20210923	2	Drummond Street between Victoria Street and Queensberry Street	6181	1566	583	1	24600	Melbourne	2	Victoria	AUS	Australia	37.5452	<a href="https://linked.data.gov.au/dataset/aged3/LGA2022/24600">https://linked.data.gov.au/dataset/aged3/LGA2022/24600</a>	0.414391862894	0.00384126308132	kp7b467132
20644	Council Minor	20210923	3	Nichols Lane from Canning Street	67	1709	117833	1	24600	Melbourne	2	Victoria	AUS	Australia	37.5452	<a href="https://linked.data.gov.au/dataset/aged3/LGA2022/24600">https://linked.data.gov.au/dataset/aged3/LGA2022/24600</a>	0.414391862894	0.00384126308132	kp7b467132
21599	Arterial	20210923	1	Victoria Street between La Trobe Street and Rathdowne Street	4299	1844	1152	1	24600	Melbourne	2	Victoria	AUS	Australia	37.5452	<a href="https://linked.data.gov.au/dataset/aged3/LGA2022/24600">https://linked.data.gov.au/dataset/aged3/LGA2022/24600</a>	0.414391862894	0.00384126308132	kp7b467132
20725	Council Minor	20210923	3	C1147 from Ormond Place	109	1547	212	1	24600	Melbourne	2	Victoria	AUS	Australia	37.5452	<a href="https://linked.data.gov.au/dataset/aged3/LGA2022/24600">https://linked.data.gov.au/dataset/aged3/LGA2022/24600</a>	0.414391862894	0.00384126308132	kp7b467132
20543	Council Major	20210923	2	Intersection of Drummond Street and Queensberry Street	920	1565	0	1	24600	Melbourne	2	Victoria	AUS	Australia	37.5452	<a href="https://linked.data.gov.au/dataset/aged3/LGA2022/24600">https://linked.data.gov.au/dataset/aged3/LGA2022/24600</a>	0.414391862894	0.00384126308132	kp7b467132
22832	Council Minor	20210923	3	C11017 from University Street	37	1969	1509	2	24600	Melbourne	2	Victoria	AUS	Australia	37.5452	<a href="https://linked.data.gov.au/dataset/aged3/LGA2022/24600">https://linked.data.gov.au/dataset/aged3/LGA2022/24600</a>	0.414391862894	0.00384126308132	kp7b467132
20642	Council Minor	20210923	3	C11335 from Ph8004	83	1904	283	1	24600	Melbourne	2	Victoria	AUS	Australia	37.5452	<a href="https://linked.data.gov.au/dataset/aged3/LGA2022/24600">https://linked.data.gov.au/dataset/aged3/LGA2022/24600</a>	0.414391862894	0.00384126308132	kp7b467132
20753	Council Minor	20210923	3	Chumlee Place from 1	204	1987	117725	1	24600	Melbourne	2	Victoria	AUS	Australia	37.5452	<a href="https://linked.data.gov.au/dataset/aged3/LGA2022/24600">https://linked.data.gov.au/dataset/aged3/LGA2022/24600</a>	0.414391862894	0.00384126308132	kp7b467132

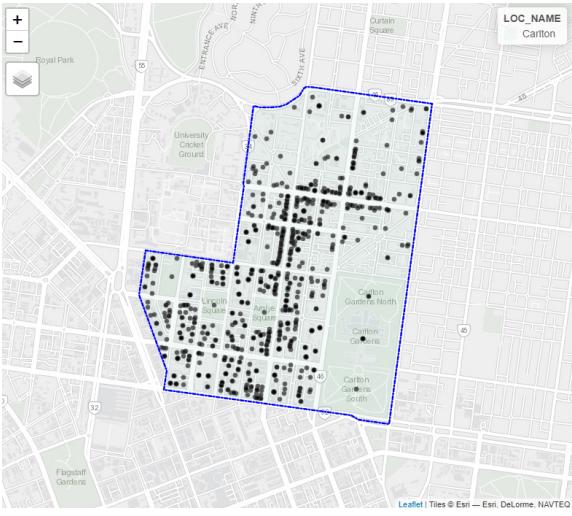
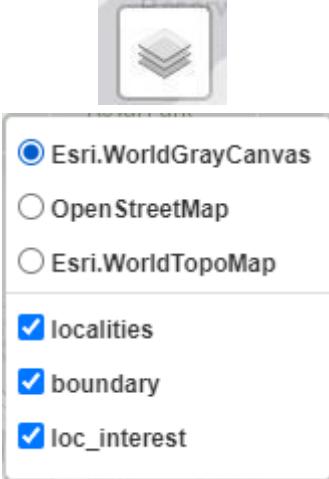
## Data Table Generated

This will be the data table that will be generated upon clicking the ‘Generate Map and Data Table’ button. Pages will be split with 25 entries as default. The table comprises of columns such as ‘seg\_id’, ‘str\_type’, ‘dtupdate’, ‘status\_id’, ‘seg\_descr’, ‘poly\_area’, ‘gisid’, ‘street\_id’, ‘seg\_part’, ‘LGA\_CODE22’, ‘LGA\_NAME22’, ‘STE\_CODE21’, ‘STE\_NAME21’, ‘AUS\_CODE21’, ‘AUS\_NAME21’, ‘AREASQKM’, ‘LOCI\_URI21’, ‘SHAPE\_Leng’, ‘SHAPE\_Area’, ‘LC\_PLY\_PID’, ‘LOC\_PID’, ‘DT\_CREATE’, ‘LOC\_NAME’, ‘LOC\_CLASS’, ‘STATE’ and lastly ‘geometry’.

## 2.3 Spatial Points



## Data Exploration Spatial Point Main Panel

Feature	Functionality
 <p data-bbox="367 848 605 880">Map Visualization</p>	<p>This map is a visualisation of the Data Exploration Spatial Points being computed. The LOC_NAME in the legend represents the locality district 'Carlton' being analysed. From the visualisation, you are able to see the district outline, the network outlines and the spatial points.</p>
 <p data-bbox="407 1082 573 1114">Zoom Control</p>	<p>The map visualisation provides the option of zooming in and out. You can click on the '+' icon to zoom further into the map and '-' to zoom further out.</p>
 <p data-bbox="367 1837 601 1868">Base Map Control</p>	<p>When you hover your cursor over to this icon, this menu will appear where you are able to select your desired base map from Esri.WorldGrayCanvas to OpenStreetMap to Esri.WorldTopoMap.</p> <p>You will also have the option of selecting and deselecting options such as 'localities', 'boundary' and 'loc_interest' which are the Melbourne's city boundary outline, the network type outline and lastly the point of interest.</p>

**Network Kernel Density Estimation  
Variable Inputs**

Network and Spatial Points

**Localities**

Carlton

**Location of Interest**

Business Establishments

**Specific Themes/Sub-Categories**

All

**Generate Map and Data Table**

Please note: The map and data will take a few moments to generate after clicking the button.

Spatial Points Data Exploration Side Panel

Feature	Functionality
<p>Network Kernel Density Estimation Variable Inputs</p> <p>Network and Spatial Points</p> <p><b>Localities</b></p> <p>Carlton</p> <p>Carlton</p> <p>Carlton North</p> <p>Docklands</p> <p>East Melbourne</p> <p>Flemington</p> <p>Kensington</p> <p>Melbourne</p> <p>North Melbourne</p>	<p>From this drop down list, you can select the localities variable to generate the data.</p> <p>'Entire City of Melbourne' will be the default option.</p> <p>Other options are 'Carlton', 'Carlton North', 'Docklands', 'East Melbourne', 'Flemington', 'Kesington', 'Melbourne', 'North Melbourne', 'Parkville', 'Port Melbourne', 'South Wharf', 'South Yarra', 'SouthBank' and 'West Melbourne'.</p>

Please note: The map and data will take a few moments to generate after clicking the button.

Location of Interest inputs for  
Spatial Points Data Exploration  
Network Kernel Density Estimation

From this drop down list, you can select the location of interest variable to generate the data.

'Childcare Centres' will be the default option.

Other options are 'Business Establishments', 'Drinking Fountain', 'Landmarks', and 'Public Toilets'.

Specific Themes/Sub-Categories inputs  
for Spatial Points Data Exploration  
Network Kernel Density Estimation

From this drop down list, you can select the Specific Themes/Sub-Categories variable to generate the data for Business Establishments.

'All' will be the default option

Other options are [1] "Clothing Retailing"  
[2] "Surveying and Mapping Services"  
[3] "Amusement Parks and Centres Operation"  
[4] "Footwear Retailing"  
[5] "Museum Operation"  
[6] "Optometry and Optical Dispensing"  
[7] "Sports and Physical Recreation Clubs and Sports Professionals"  
[8] "Sport and Camping Equipment Retailing"  
[9] "Takeaway Food Services"  
[10] "Cafes and Restaurants"  
[11] "Entertainment Media Retailing"  
[12] "Houseware Retailing"  
[13] "Sport and Physical Recreation Administrative Service"  
[14] "Vacant Space"  
[15] "Parking Services"  
[16] "Railway Rolling Stock Manufacturing and Repair Services"  
[17] "Computer System Design and Related Services"  
[18] "Primary Education"  
[19] "Port and Water Transport Terminal Operations"  
[20] "Convenience Store"  
[21] "Religious Services"  
[22] "Funeral, Crematorium and Cemetery"

Services"

[23] "Engineering Design and Engineering Consulting Services"

[24] "Building and Other Industrial Cleaning Services"

[25] "Management Advice and Other Consulting Services"

[26] "Specialist Medical Services"

[27] "Fuel Retailing"

[28] "Libraries and Archives"

[29] "Pathology and Diagnostic Imaging Services"

[30] "Accommodation"

[31] "Health and Fitness Centres and Gymnasia Operation"

[32] "Other Administrative Services n.e.c."

[33] "Communications Equipment Manufacturing"

[34] "Legal Services"

[35] "Employment Placement and Recruitment Services"

[36] "Arts Education"

[37] "Sewerage and Drainage Services"

[38] "State Government Administration"

[39] "Paper Product Wholesaling"

[40] "Automotive Body, Paint and Interior Repair"

[41] "Other Building Installation Services"

[42] "Other Electrical and Electronic Good Wholesaling"

[43] "General Practice Medical Services"

[44] "Other Interest Group Services n.e.c."

[45] "Other Health Care Services n.e.c."

[46] "Local Government Administration"

[47] "Telecommunication Goods Wholesaling"

[48] "Human Pharmaceutical and Medicinal Product Manufacturing"

[49] "Advertising Services"

[50] "Other Specialised Design Services"

[51] "Plumbing Good Wholesaling"

[52] "Supermarket and Grocery Stores"

[53] "Sports and Physical Recreation Venues, Grounds and Facilities Operation"

[54] "Aged Care Residential Services"

[55] "Nature Reserves and Conservation Parks Operation"

[56] "Other Personal Services n.e.c."

[57] "Other Residential Care Services"

[58] "Furniture Retailing"

[59] "Hairdressing and Beauty Services"

[60] "Other Store-Based Retailing n.e.c."

[61] "Accounting Services"

[62] "Other Telecommunications Services"

- [63] "Pubs, Taverns and Bars"
- [64] "Other Warehousing and Storage Services"
- [65] "Scientific Testing and Analysis Services"
- [66] "Higher Education"
- [67] "Cake and Pastry Manufacturing (Factory based)"
- [68] "Non-Residential Property Operators"
- [69] "Industrial and Agricultural Chemical Product Wholesaling"
- [70] "Child Care Services"
- [71] "Other Goods and Equipment Rental and Hiring n.e.c."
- [72] "Printing Support Services"
- [73] "Other Grocery Wholesaling"
- [74] "House Construction"
- [75] "Clothing Manufacturing"
- [76] "Veterinary Services"
- [77] "Other Heavy and Civil Engineering Construction"
- [78] "Architectural Services"
- [79] "Air and Space Transport"
- [80] "Scenic and Sightseeing Transport"
- [81] "Other Gambling Activities"
- [82] "Toy and Game Retailing"
- [83] "Other Social Assistance Services"
- [84] "Performing Arts Operation"
- [85] "Performing Arts Venue Operation"
- [86] "Real Estate Services"
- [87] "Bakery Product Manufacturing (Non-factory based)"
- [88] "Business and Professional Association Services"
- [89] "Laundry and Dry-Cleaning Services"
- [90] "Brothel Keeping and Prostitution Services"
- [91] "Other Auxiliary Finance and Investment Services"
- [92] "Antique and Used Goods Retailing"
- [93] "Technical and Vocational Education and Training"
- [94] "Credit Reporting and Debt Collection Services"
- [95] "Courier Pick-up and Delivery Services"
- [96] "Wired Telecommunications Network Operation"
- [97] "Newspaper and Book Retailing"
- [98] "Call Centre Operation"
- [99] "Central Government Administration"
- [100] "Financial Asset Investing"
- [101] "Other Manufacturing n.e.c."
- [102] "Data Processing and Web Hosting"

- Services"
- [103] "Banking"
- [104] "Scientific Research Services"
- [105] "Book Publishing"
- [106] "Medical and Surgical Equipment Manufacturing"
- [107] "Labour Association Services"
- [108] "Dental Services"
- [109] "Liquor Retailing"
- [110] "Foreign Government Representation"
- [111] "Financial Asset Broking Services"
- [112] "Adult, Community and Other Education n.e.c."
- [113] "Internet Publishing and Broadcasting"
- [114] "Superannuation Funds"
- [115] "Other Mining Support Services"
- [116] "Non-Residential Building Construction"
- [117] "Non-Store Retailing"
- [118] "Travel Agency and Tour Arrangement Services"
- [119] "Other Personal Accessory Retailing"
- [120] "Other Allied Health Services"
- [121] "Electrical, Electronic and Gas Appliance Retailing"
- [122] "Watch and Jewellery Retailing"
- [123] "Jewellery and Silverware Manufacturing"
- [124] "Creative Artists, Musicians, Writers and Performers"
- [125] "Music and Other Sound Recording Activities"
- [126] "Womens Clothing Retailing"
- [127] "Other Electrical and Electronic Goods Retailing"
- [128] "Flower Retailing"
- [129] "Health Insurance"
- [130] "Clubs (Hospitality)"
- [131] "Pharmaceutical, Cosmetic and Toiletry Goods Retailing"
- [132] "Market Research and Statistical Services"
- [133] "Other Transport Support Services n.e.c."
- [134] "Airport Operations and Other Air Transport Support Services"
- [135] "Other Repair and Maintenance n.e.c."
- [136] "Sports and Physical Recreation Instruction"
- [137] "Other Residential Building Construction"
- [138] "Rail Freight Transport"
- [139] "Other Electricity Generation"

- [140] "Office Administrative Services"
- [141] "Electricity Distribution"
- [142] "Land Development and Subdivision"
- [143] "Other Depository Financial Intermediation"
- [144] "On Selling Electricity and Electricity Market Operation"
- [145] "General Insurance"
- [146] "Auxiliary Insurance Services"
- [147] "Non-Depository Financing"
- [148] "Other Water Transport Support Services"
- [149] "Water Freight Transport"
- [150] "Computer and Computer Peripheral Retailing"
- [151] "Internet Service Providers and Web Search Portals"
- [152] "Amusement and Other Recreational Activities n.e.c."
- [153] "Mineral Exploration"
- [154] "Educational Support Services"
- [155] "Other Specialised Food Retailing"
- [156] "Other Telecommunications Network Operation"
- [157] "Gold Ore Mining"
- [158] "Hardware and Building Supplies Retailing"
- [159] "Dairy Produce Wholesaling"
- [160] "Gas Supply"
- [161] "Investigation and Security Services"
- [162] "Jewellery and Watch Wholesaling"
- [163] "Metal and Mineral Wholesaling"
- [164] "Wine and Other Alcoholic Beverage Manufacturing"
- [165] "Womens Footwear Retailing"
- [166] "Other Professional, Scientific and Technical Services n.e.c."
- [167] "Other Food Product Manufacturing n.e.c."
- [168] "Motion Picture Exhibition"
- [169] "Mens Clothing Retailing"
- [170] "Clothing and Footwear Repair"
- [171] "Chiropractic and Osteopathic Services"
- [172] "Printing"
- [173] "Petroleum Exploration"
- [174] "Physiotherapy Services"
- [175] "Computer and Electronic Office Equipment Manufacturing"
- [176] "Electricity Transmission"
- [177] "Other Construction Services n.e.c."
- [178] "Postal Services"
- [179] "Life Insurance"
- [180] "Silver-Lead-Zinc Ore Mining"

- [181] "Professional Photographic Services"
- [182] "Other Agriculture and Fishing Support Services"
- [183] "Alternative Health Services"
- [184] "Electronic (except Domestic Appliance) and Precision Equipment Repair and Maint"
- [185] "Other Professional and Scientific Equipment Manufacturing"
- [186] "Other Specialised Industrial Machinery and Equipment Wholesaling"
- [187] "Regulatory Services"
- [188] "Other Goods Wholesaling n.e.c."
- [189] "Commission-Based Wholesaling"
- [190] "Waste Remediation and Materials Recovery Services"
- [191] "Stationery Goods Retailing"
- [192] "Pharmaceutical and Toiletry Goods Wholesaling"
- [193] "Department Stores"
- [194] "Radio Broadcasting"
- [195] "Other Agricultural Product Wholesaling"
- [196] "Catering Services"
- [197] "Electronic Information Storage Services"
- [198] "Petroleum Product Wholesaling"
- [199] "Justice"
- [200] "Childrens Clothing Retailing"
- [201] "Mens Footwear Retailing"
- [202] "Police Services"
- [203] "Secondary Education"
- [204] "Motor Cycle Retailing"
- [205] "Urban Bus Transport (Including Tramway)"
- [206] "Post-production Services and Other Motion Picture and Video Activities"
- [207] "Other Public Order and Safety Services"
- [208] "Labour Supply Services"
- [209] "Clothing and Footwear Wholesaling"
- [210] "Passenger Car Rental and Hiring"
- [211] "Fire Protection and Other Emergency Services"
- [212] "Fruit and Vegetable Retailing"
- [213] "Fresh Meat, Fish and Poultry Retailing"
- [214] "Car Retailing"
- [215] "Pre-school Education"
- [216] "Professional and Scientific Goods Wholesaling"
- [217] "Automotive Electrical Services"
- [218] "Credit Union Operation"
- [219] "Toy and Sporting Goods"

Wholesaling"  
[220] "Other Automotive Repair and Maintenance"  
[221] "Footwear Manufacturing"  
[222] "Freight Forwarding Services"  
[223] "Road and Bridge Construction"  
[224] "Software Publishing"  
[225] "Other Electronic Equipment Manufacturing"  
[226] "Plumbing Services"  
[227] "Tyre Retailing"  
[228] "Other Converted Paper Product Manufacturing"  
[229] "Packaging Services"  
[230] "Residential Property Operators"  
[231] "Other Motor Vehicle Parts Manufacturing"  
[232] "Wooden Furniture and Upholstered Seat Manufacturing"  
[233] "Potato, Corn and Other Crisp Manufacturing"  
[234] "Lottery Operation"  
[235] "Fruit and Vegetable Wholesaling"  
[236] "Garden Supplies Retailing"  
[237] "Magazine and Other Periodical Publishing"  
[238] "Textile Finishing and Other Textile Product Manufacturing"  
[239] "Other Hardware Good Wholesaling"  
[240] "Motion Picture and Video Production"  
[241] "Furniture and Floor Covering Wholesaling"  
[242] "Road Freight Transport"  
[243] "Customs Agency Services"  
[244] "Site Preparation Services"  
[245] "Kitchen and Diningware Wholesaling"  
[246] "Fish and Seafood Wholesaling"  
[247] "Meat Processing"  
[248] "Other Specialised Machinery and Equipment Manufacturing"  
[249] "Tiling and Carpeting Services"  
[250] "Reproduction of Recorded Media"  
[251] "Other Horse and Dog Racing Activities"  
[252] "Hospitals (except Psychiatric Hospitals)"  
[253] "Basic Organic Chemical Manufacturing"  
[254] "Coal Mining"  
[255] "Rail Passenger Transport"  
[256] "Combined Primary and Secondary Education"  
[257] "Electric Lighting Equipment Manufacturing"

- [258] "Taxi and Other Road Transport"
- [259] "Milk and Cream Processing"
- [260] "Liquor and Tobacco Product Wholesaling"
- [261] "Pipeline Transport"
- [262] "Polymer Film and Sheet Packaging Material Manufacturing"
- [263] "Solid Waste Collection Services"
- [264] "Architectural Aluminium Product Manufacturing"
- [265] "Ready-Mixed Concrete Manufacturing"
- [266] "Electrical Services"
- [267] "Concreting Services"
- [268] "Cheese and Other Dairy Product Manufacturing"
- [269] "Lifting and Material Handling Equipment Manufacturing"
- [270] "Other Fabricated Metal Product Manufacturing n.e.c."
- [271] "Other Machinery and Equipment Wholesaling n.e.c."
- [272] "Cement and Lime Manufacturing"
- [273] "Heavy Machinery and Scaffolding Rental and Hiring"
- [274] "Marine Equipment Retailing"
- [275] "Defence"
- [276] "Other Machinery and Equipment Repair and Maintenance"
- [277] "Other Electrical Equipment Manufacturing"
- [278] "Computer and Computer Peripheral Wholesaling"
- [279] "Boatbuilding and Repair Services"
- [280] "Textile Product Wholesaling"
- [281] "Ambulance Services"
- [282] "Meat, Poultry and Smallgoods Wholesaling"
- [283] "Cut and Sewn Textile Product Manufacturing"
- [284] "Stevedoring Services"
- [285] "Free-to-Air Television Broadcasting"
- [286] "Pulp, Paper and Paperboard Manufacturing"
- [287] "Fertiliser Manufacturing"
- [288] "Gardening Services"
- [289] "Landscape Construction Services"
- [290] "Psychiatric Hospitals"
- [291] "Other Transport n.e.c."
- [292] "Air Conditioning and Heating Services"
- [293] "Motor Vehicle Dismantling and Used Part Wholesaling"
- [294] "Interurban and Rural Bus Transport"

- [295] "Manchester and Other Textile Goods Retailing"
- [296] "Grape Growing"
- [297] "Zoological and Botanical Gardens Operation"
- [298] "Cable and Other Subscription Broadcasting"
- [299] "Other Publishing (except Software, Music and Internet)"
- [300] "Forestry Support Services"
- [301] "Motor Vehicle New Part Wholesaling"
- [302] "Roofing Services"
- [303] "Painting and Decorating Services"
- [304] "Car Wholesaling"
- [305] "Beer Manufacturing"
- [306] "Glass and Glass Product Manufacturing"
- [307] "Copper Ore Mining"
- [308] "Wooden Structural Fitting and Component Manufacturing"
- [309] "Other Metal Ore Mining"
- [310] "Corporate Head Office Management Services"
- [311] "Metal Coating and Finishing"
- [312] "Iron Smelting and Steel Manufacturing"
- [313] "Newspaper Publishing"
- [314] "Document Preparation Services"
- [315] "Prepared Animal and Bird Feed Manufacturing"
- [316] "Logging"
- [317] "Fire and Security Alarm Installation Services"
- [318] "Plastering and Ceiling Services"
- [319] "Other Information Services"
- [320] "Correctional and Detention Services"
- [321] "Other Motor Vehicle and Transport Equipment Rental and Hiring"
- [322] "Motor Vehicle Parts Retailing"
- [323] "Cereal, Pasta and Baking Mix Manufacturing"
- [324] "Retail Commission-Based Buying and/or Selling"
- [325] "Other Sheet Metal Product Manufacturing"
- [326] "Other Ceramic Product Manufacturing"
- [327] "Photographic Film Processing"
- [328] "Horse and Dog Racing Administration and Track Operation"
- [329] "Photographic, Optical and Ophthalmic Equipment Manufacturing"
- [330] "Carpentry Services"
- [331] "Metal Furniture Manufacturing"

- [332] "Horse Farming"
- [333] "Casino Operation"
- [334] "Forestry"
- [335] "Floor Coverings Retailing"
- [336] "Cosmetic and Toiletry Preparation Manufacturing"
- [337] "Concrete Product Manufacturing"
- [338] "Fruit and Vegetable Processing"
- [339] "Basic Inorganic Chemical Manufacturing"
- [340] "Commercial Vehicle Wholesaling"
- [341] "Hire of Construction Machinery with Operator"
- [342] "Grain Storage Services"
- [343] "Grain Mill Product Manufacturing"
- [344] "Other Waste Collection Services"
- [345] "Oil and Gas Extraction"
- [346] "Toy, Sporting and Recreational Product Manufacturing"
- [347] "Structural Steel Erection Services"
- [348] "Music Publishing"
- [349] "Timber Wholesaling"
- [350] "Confectionery Manufacturing"
- [351] "Central Banking"
- [352] "Book and Magazine Wholesaling"
- [353] "Iron Ore Mining"
- [354] "Bauxite Mining"
- [355] "Domestic Government Representation"
- [356] "Other Structural Metal Product Manufacturing"
- [357] "Other Fishing"
- [358] "Motion Picture and Video Distribution"
- [359] "Bread Manufacturing (Factory based)"
- [360] "Seafood Processing"
- [361] "Cereal Grain Wholesaling"
- [362] "Plaster Product Manufacturing"
- [363] "Water Supply"
- [364] "Cured Meat and Smallgoods Manufacturing"
- [365] "Motor Vehicle Body and Trailer Manufacturing"
- [366] "Other Furniture Manufacturing"
- [367] "Aircraft Manufacturing and Repair Services"
- [368] "Rope, Cordage and Twine Manufacturing"
- [369] "Other Grain Growing"
- [370] "Cigarette and Tobacco Product Manufacturing"
- [371] "Other Non-Metallic Mineral Product Manufacturing"

	[372] "Farm Animals and Bloodstock Leasing"
<p>Specific Theme/Sub-categories</p>	<p>Please take note by selecting 'Business Establishments' or 'Landmarks', you have the option of selecting specific themes/sub-categories. Other locations of interest such as</p> <ol style="list-style-type: none"> <li>1. Childcare Centres</li> <li>2. Public Toilets</li> <li>3. Drinking Fountains</li> </ol> <p>do not have specific themes/sub-categories for you to select and will therefore be disabled. This does not mean you are unable to generate the map and data table results.</p>
<p>Generate Map and Data Table</p> <p>Please note: The map and data will take a few moments to generate after clicking the button.</p> <p>Generate Map and Data Table Button</p>	<p>After selecting the above variable inputs, do remember to click on this 'Generate Map and Data Table' button to generate the data.</p>

## Data Exploration Variable Inputs

Spatial Points

Localities

Docklands

Location of Interest

Landmarks

Specific Themes/Sub-Categories

Health Services

**Generate Map and Data Table**

Please note: The map and data will take a few moments to generate after clicking the button.

Health Services in Entire City of  Melbourne has no spatial points to be analysed. The analysis has been terminated.

### Data Exploration Data Inputs (Error)

Please do take note that some localities together with the location of interest and specific themes/sub-categories to be analysed do not have relevant data to be generated. Therefore an error message will be prompted to terminate the analysis

**Data Table**

Results will be shown in the table below if dataset is selected.

Show 25 entries

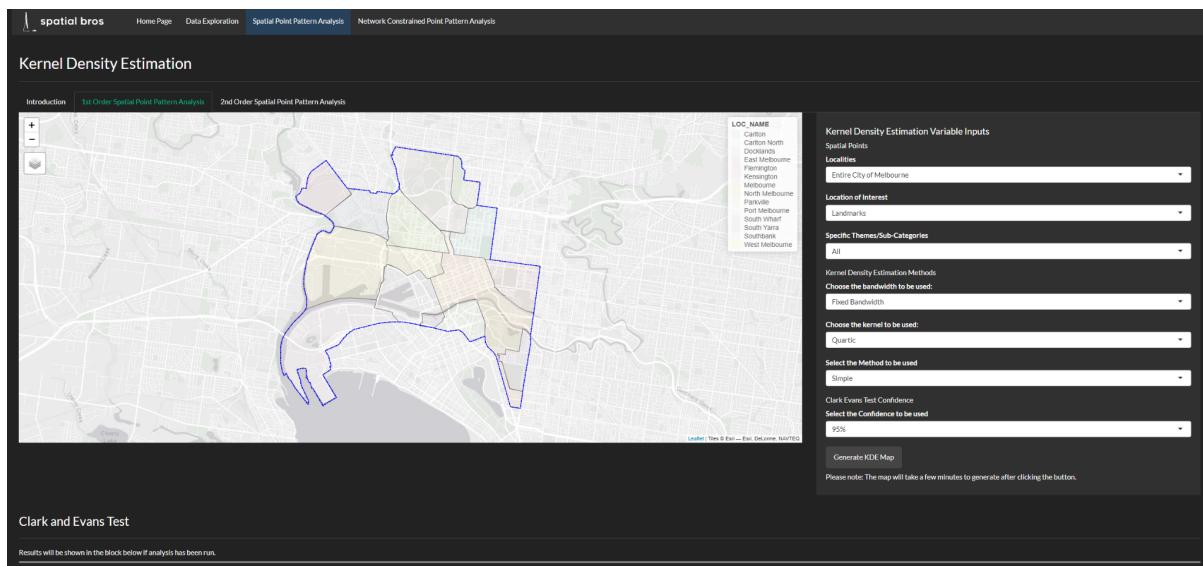
Search:

census_year	block_id	property_id	base_property_id	clue_small_area	business_address	trading_name	Industry_anzsic4_code	Industry_anzsic4_description	longitude	latitude	location	geometry	+
2028	1110	620308	595737	Docklands	Shop G03 4 Star Crescent DOCKLANDS VIC 3008	Sporting House	4251	Clothing Retailing	144.938	-37.81329	318494.3944551335812899.36544297		
2028	1110	620309	595737	Docklands	Shop F08 Level 117 Star Crescent DOCKLANDS VIC 3008	Gipmaps Pty Ltd	6922	Surveying and Mapping Services	144.938	-37.81329	318494.3944551335812899.36544297		
2028	1110	620309	595737	Docklands	Level 119-21 Star Crescent DOCKLANDS VIC 3008	Chimunks Playland And Cafe	9131	Amusement Parks and Centres Operation	144.938	-37.81329	318494.3944551335812899.36544297		
2028	1110	620309	595737	Docklands	Ground 5 Star Crescent DOCKLANDS VIC 3008	Star Ugg & Sheepskin	4252	Footwear Retailing	144.938	-37.81329	318494.3944551335812899.36544297		
2028	1110	620310	595737	Docklands	Shop G03 26 Wharf Street DOCKLANDS VIC 3008	Australian Cartoon Museum	8910	Museum Operation	144.938	-37.81329	318494.3944551335812899.36544297		
2028	1110	620311	595737	Docklands	Shop G01 122 Studio Lane DOCKLANDS VIC 3008	Sunglass Hut	8532	Optometry and Optical Dispensing	144.938	-37.81329	318494.3944551335812899.36544297		
2028	1110	620311	595737	Docklands	Shop G21 116 Studio Lane DOCKLANDS VIC 3008	The Melbourne Ice Limited	9112	Sports and Physical Recreation Clubs and Sports Professionals	144.938	-37.81329	318494.3944551335812899.36544297		
2028	1110	620311	595737	Docklands	Shop G07 30 Star Crescent DOCKLANDS VIC 3008	Fila Outlet	4241	Sport and Camping Equipment Retailing	144.938	-37.81329	318494.3944551335812899.36544297		

## Data Table Generated

This will be the data table that will be generated upon clicking the ‘Generate Map and Data Table’ button. Pages will be split with 25 entries as default. You are allowed to perform a search on the right side as well. The table comprises of columns such as ‘census\_year’, ‘block\_id’, ‘property\_id’, ‘base\_property\_id’, ‘clue\_small\_area’, ‘business\_address’, ‘trading\_name’, ‘industry\_anzsic4\_code’, ‘industry\_anzsic4\_description’, ‘longitude’, ‘latitude’, ‘location’ and ‘geometry’.

### 3. Spatial Point Pattern Analysis



The Spatial Point Pattern Analysis is the third page that you will be able to access in our application.

From the Spatial Point Pattern Analysis, there are 3 sub tabs that is made available to you for usage:

1. Introduction
2. 1st Order Spatial Point Pattern Analysis
3. 2nd Order Spatial Point Pattern Analysis

The layout of the 1st Order Spatial Point Pattern Analysis and 2nd Order Spatial Point Pattern Analysis tab is similar in nature, with the main visualisation map being on the left and a side panel on the right for the selection of inputs.

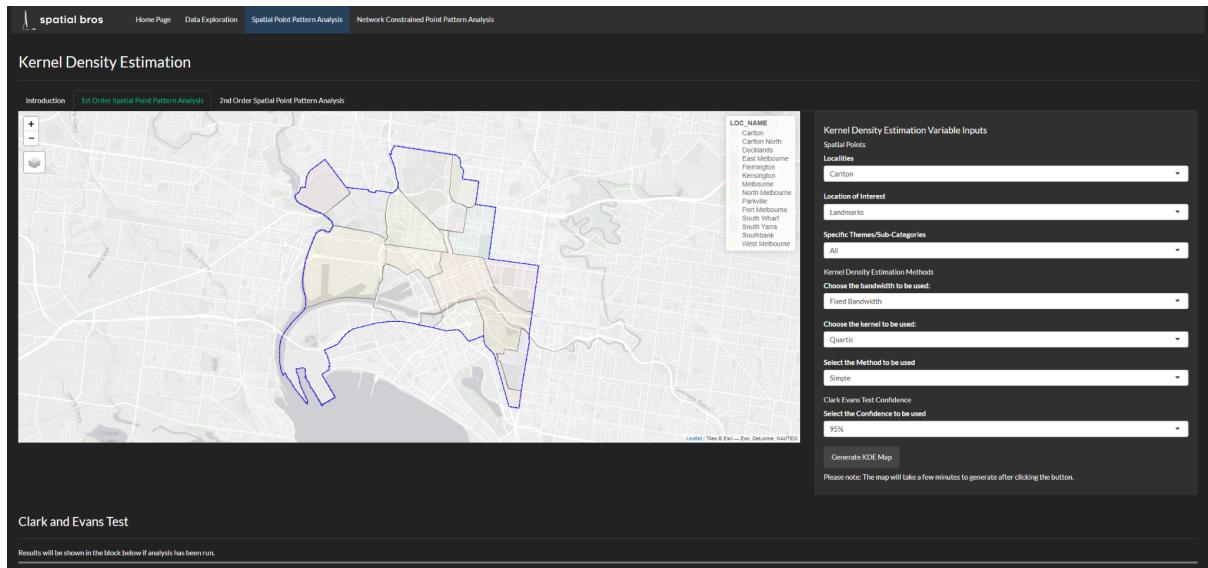
### 3.1 Introduction

The screenshot shows the spatial bros application interface. At the top, there is a navigation bar with links for Home Page, Data Exploration, Spatial Point Pattern Analysis (which is highlighted in blue), and Network Constrained Point Pattern Analysis. Below the navigation bar, the title "Kernel Density Estimation" is displayed. Underneath the title, there are three tabs: "Introduction" (selected), "1st Order Spatial Point Pattern Analysis", and "2nd Order Spatial Point Pattern Analysis". The main content area starts with a section titled "Welcome to the Spatial Point Pattern Analysis!". It includes a brief description of the service, mentioning spatial point pattern analysis methods for Melbourne, Australia, and listing two types of analysis: Kernel Density Estimation and G & K Function Analysis. It also lists five categories of points for selection: Childcare Centres, Business Establishments, Drinking Fountains, Landmarks, and Public Toilets. Following this, a section titled "Benefits of performing Spatial Point Pattern Analysis" lists two benefits: statistical benefits for identifying spatial patterns and better decision-making for urban planning. To the right of the main content, there is a white box titled "SPATIAL POINT PATTERN ANALYSIS" with "STEP BY STEP INSTRUCTION". It contains five numbered steps with corresponding icons: 1. SELECT TYPE OF ANALYSIS (magnifying glass icon), 2. SELECT POINT OF INTEREST (location pin icon), 3. SELECT OTHER PARAMETERS (line graph icon), 4. VIEW AND ANALYSE OUTPUT (line graph icon), and 5. VIEW AND ANALYSE OUTPUT (line graph icon). Each step is accompanied by a curved arrow pointing to the next step.

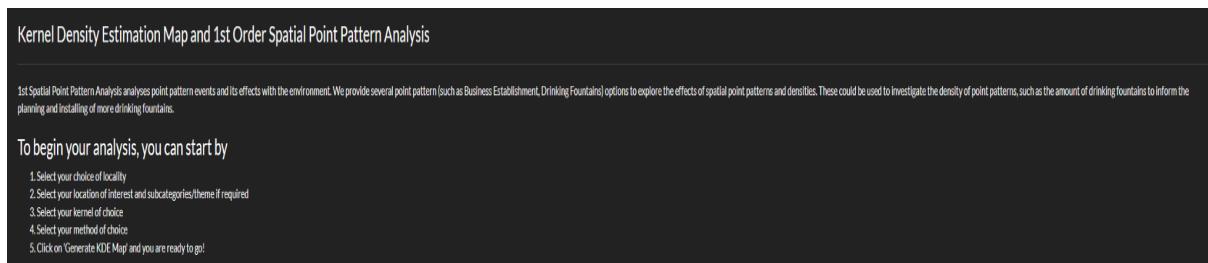
#### 1st/2nd Order Spatial Point Pattern Analysis Introduction

This is the spatial point pattern analysis introduction tab where you will learn about what is the available analysis included in this application. In addition, we also provide you a brief overview of the instructions and the benefits of performing spatial point pattern analysis.

## 3.2 1st Order Spatial Point Pattern Analysis

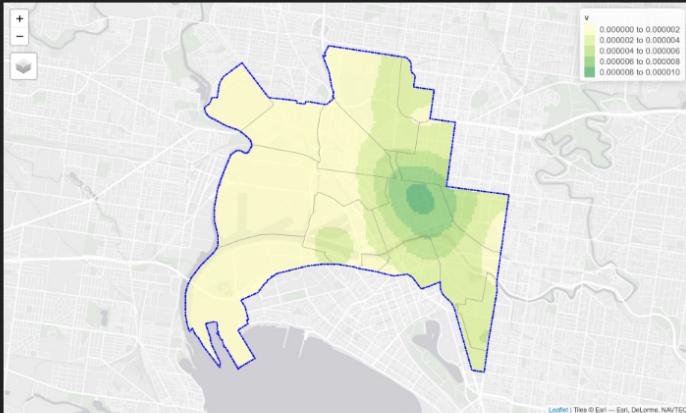


### 1st Order Spatial Point Pattern Analysis Main Panel



### Kernel Density Estimation explanation and 1st Order Spatial Point Pattern Analysis instructions

## Interpeting the Results



### Clark and Evans Test

Results will be shown in the block below if analysis has been run.

```
Clark-Evans test
No edge correction
Monte Carlo test based on 1999 simulations of CSR with fixed n

data: loc_interest.opp
R = 0.93842, p-value = 0.02
alternative hypothesis: two-sided
```

A legend will be shown at the top right side of the map. The colour shade intensity of the network will get darker if there is a higher relative density of spatial points specified (location of interest).

On contrary, if the colour shade intensity of the network is lighter, it represents a lower relative density alongside the network

The 'Clark and Evans Test' is a nearest neighbour test to analyse and statistically conclude point pattern events and its effects with the environment.

Hypothesis:

H0: The distribution of spatial points are randomly distributed

H1: The distribution of spatial points are not randomly distributed

If the p-value is less than the alpha of the confidence selected (ie. alpha will be 0.05 if confidence selected is 95%), we reject H0 (null hypothesis) that the spatial points are randomly distributed

If the p-value is more than the alpha of the confidence selected (ie. alpha will be 0.05 if confidence selected is 95%), we cannot reject H0 (null hypothesis) that the spatial points are randomly distributed

If H0 is rejected:

In the event if the R < 1, we can conclude that the spatial points resemble a clustered distribution

In the event if the R > 1, we can conclude that the spatial points resemble a dispersed distribution

## Interpretation of the results of 1st order spatial point analysis

An example map will be shown on how to interpret the above results when you decide to try your own analysis. In addition, it further explains and concludes the hypothesis results based on H0, H1.

## Key Function FAQ

### Confidence Level

How many simulations to run the statistical analysis. The number of simulations are mapped as follows:

95% - 39 | 99% - 199 | 99.9% - 1999

Given by the following formula:  $\alpha = 2 * \text{nrank} / (1 + \text{nsim})$  where nrank = 1

95% and 99% are typical confidence levels used

### Kernel Density Estimation Methods

#### Bandwidth Type

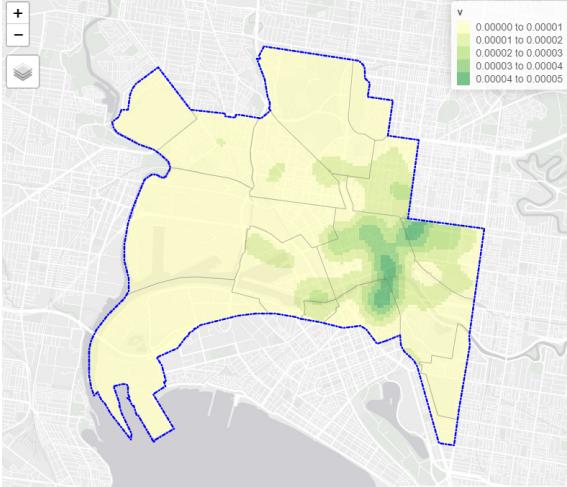
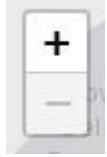
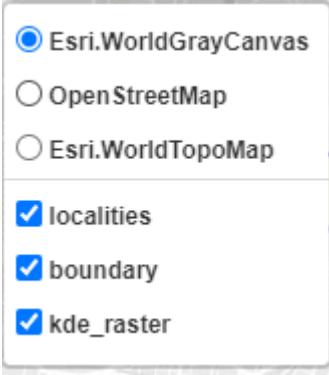
Fixed: Appropriate bandwidth will be selected by algorithm to generate Kernel Density Estimate

Adaptive: Appropriate bandwidth will be selected by algorithm to generate Kernel Density Estimate. Adaptive kernel is suitable to provide a smoother estimate when dealing with varying spatial point distributions. An example could be urban vs rural typologies where urban may have more spatial points over rural.

KERNEL	
TYPE	DESCRIPTION
QUARTIC	This kernel has a quartic shape and assigns more weight to points close to the centre than those further away. It has a slower decrease in weight towards the edges than triangular kernel.
EPANECHNIKOV	This kernel has a parabolic shape and assigns more weight to points close to the center than those further away. It has a faster decrease in weight towards the edges than tricube and triweight kernels.
GAUSSIAN	This kernel is a bell-shaped function that assigns weights to each data point in a neighborhood around a particular location, with the weights decreasing as the distance from the center location increases.
METHOD	
SIMPLE	This method uses a linear activation function, which simply multiplies the input by a weight and adds a bias term. This is the simplest activation function and is sometimes used in the output layer of a neural network.
CONTINUOUS	This method uses a continuous activation function such as the sigmoid function or the hyperbolic tangent function. These functions smoothly transform the input values into an output value between 0 and 1 (for sigmoid) or -1 and 1 (for hyperbolic tangent).
DISCONTINUOUS	These functions have a constant value for a range of input values and then abruptly switch to another constant value. Discontinuous activation functions are rarely used in neural networks due to their non-smoothness, which can cause optimization problems.

### FAQ and explanation for Kernel Type and Method Type

This section will explain to you some of the frequently asked questions and address your doubts regarding the statistical analysis. In addition, it explains the difference between each kernel type and method type.

Feature	Functionality
 <p data-bbox="367 837 605 871">Map Visualization</p>	<p>This map is a visualisation of the 1st Order Spatial Point Pattern Analysis being generated.</p> <p>The 'v' in the legend represents intensity of the location of interest being analysed. From the visualisation, you are able to see the district outline as well.</p>
 <p data-bbox="407 1080 573 1114">Zoom Control</p>	<p>The map visualisation provides the option of zooming in and out. You can click on the '+' icon to zoom further into the map and '-' to zoom further out.</p>
  <p data-bbox="375 1671 601 1704">Base Map Control</p>	<p>When you hover your cursor over to this icon, this menu will appear where you are able to select your desired base map from Esri.WorldGrayCanvas to OpenStreetMap to Esri.WorldTopoMap.</p> <p>You will also have the option of selecting and deselecting options such as 'localities', 'boundary' and 'kde_raster' which are the Melbourne's city boundary outline, the localities location of interest and lastly the intensity of the location of interest.</p>

**Kernel Density Estimation Variable Inputs**

Spatial Points

**Localities**

Entire City of Melbourne

**Location of Interest**

Landmarks

**Specific Themes/Sub-Categories**

All

Kernel Density Estimation Methods

**Choose the bandwidth to be used:**

Fixed Bandwidth

**Choose the kernel to be used:**

Quartic

**Select the Method to be used**

Simple

Clark Evans Test Confidence

**Select the Confidence to be used**

95%

**Generate KDE Map**

Please note: The map will take a few minutes to generate after clicking the button.

**1st Order Spatial Point Pattern Analysis Side Panel**

## Kernel Density Estimation Variable Inputs

Spatial Points

Localities

Docklands

Location of Interest

Landmarks

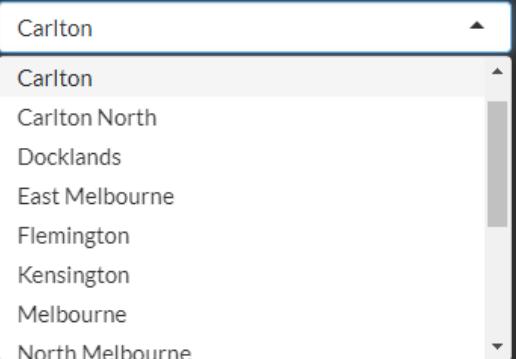
Specific Themes/Sub-Categories

Health Services

Health Services in Entire City of  Melbourne has no spatial points to be analysed. The analysis has been terminated.

### 1st Order Spatial Point Pattern Analysis Data Inputs (Error)

Please do take note that some localities together with the location of interest and specific themes/sub-categories to be analysed do not have relevant data to be generated. Therefore an error message will be prompted to terminate the analysis

Feature	Functionality
<p><b>Network Kernel Density Estimation Variable Inputs</b></p> <p>Network and Spatial Points</p> <p><b>Localities</b></p>  <p>Localities inputs for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation</p>	<p>From this drop down list, you can select the localities variable to generate the data.</p> <p>‘Entire City of Melbourne’ will be the default option.</p> <p>Other options are ‘Carlton’, ‘Carlton North’, ‘Docklands’, ‘East Melbourne’, ‘Flemington’, ‘Kesington’, ‘Melbourne’, ‘North Melbourne’, ‘Parkville’, ‘Port Melbourne’, ‘South Wharf’, ‘South Yarra’, ‘SouthBank’ and ‘West Melbourne’.</p>
 <p>Please note: The map and data will take a few moments to generate after clicking the button.</p> <p>Location of Interest inputs for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation</p>	<p>From this drop down list, you can select the location of interest variable to generate the data.</p> <p>‘Childcare Centres’ will be the default option.</p> <p>Other options are ‘Business Establishments’, ‘Drinking Fountain’, ‘Landmarks’, and ‘Public Toilets’.</p>

**Specific Themes/Sub-Categories**

Community Use

All  
Community Use  
Education Centre  
Health Services  
Industrial  
Leisure/Recreation  
Mixed Use  
Office

**Specific Themes/Sub-Categories inputs for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation**

**Location of Interest**

Childcare Centres

**Specific Themes/Sub-Categories**

All

**Generate Map and Data Table**

Please note: The map and data will take a few moments to generate after clicking the button.

**Specific Theme/Sub-categories**

**Kernel Density Estimation Methods**

**Choose the bandwidth to be used:**

Fixed Bandwidth

Fixed Bandwidth  
Adaptive Bandwidth

**Bandwidth method for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation**

From this drop down list, you can select the Specific Themes/Sub-Categories variable to generate the data.

'All' will be the default option.

Other options are 'Community Use', 'Education Centre', 'Health Services', 'Industrial', 'Leisure/Recreation', 'Mixed Use', 'Office', 'Place of Assembly', 'Place of Worship', 'Purpose Built', 'Residential Accommodation', 'Retail', 'Specialist Residential Accommodation', 'Transport', 'Vacant Land' and 'Warehouse/Store'

Please take note by selecting 'Business Establishments' or 'Landmarks', you have the option of selecting specific themes/sub-categories. Other locations of interest such as

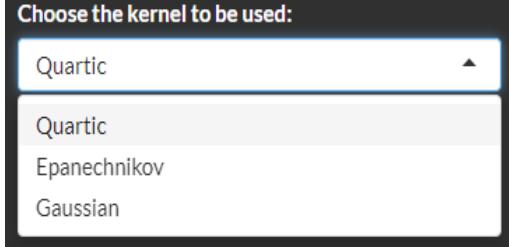
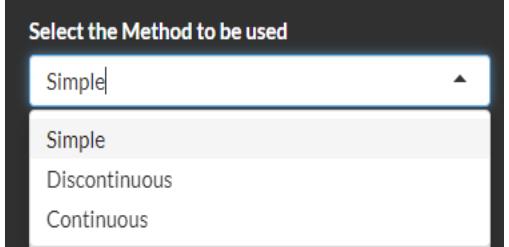
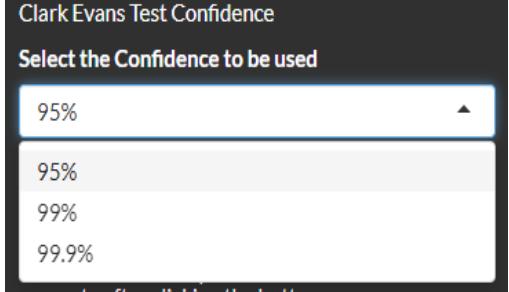
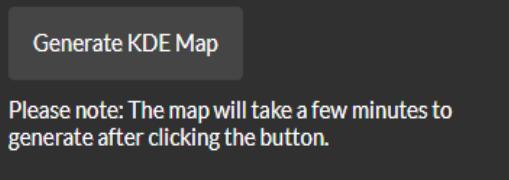
4. Childcare Centres
5. Public Toilets
6. Drinking Fountains

do not have specific themes/sub-categories for you to select and will therefore be disabled. This does not mean you are unable to generate the map and data table results.

From this drop down list, you can select the Bandwidth method variable to generate the data.

'Fixed Bandwidth' will be the default option.

The other option is 'Adaptive Bandwidth'.

 <p style="text-align: center;">Kernel method for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation</p>	<p>From this drop down list, you can select the Kernel method variable to generate the data.</p> <p>'Quartic' will be the default option.</p> <p>The other options are 'Epanechnikov' and 'Gaussian'</p>
 <p style="text-align: center;">Method to be used for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation</p>	<p>From this drop down list, you can select the method variable to generate the data.</p> <p>'Simple' will be the default option.</p> <p>The other options are 'Continuous' and 'Discontinuous'.</p>
 <p>generate after clicking the button.</p> <p style="text-align: center;">Clark Evans Test Confidence for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation</p>	<p>From this drop down list, you can select the Clark Evans Test Confidence variable interval to generate the data.</p> <p>'95%' will be the default option.</p> <p>The other options are '99%' and '99.9%'</p>
 <p style="text-align: center;">Generate KDE Map Button</p> <p>Please note: The map will take a few minutes to generate after clicking the button.</p>	<p>After selecting the above variable inputs, do remember to click on this 'Generate KDE Map' button to generate the data.</p>

## Clark and Evans Test

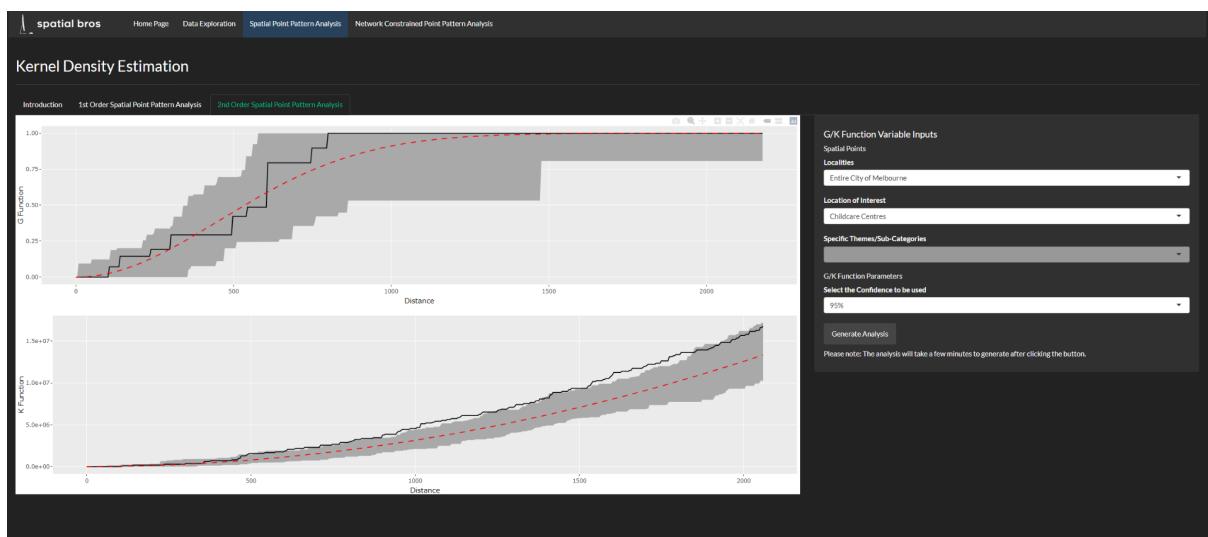
Results will be shown in the block below if analysis has been run.

Error: non-numeric argument to binary operator

## Clark and Evans Test Results

Upon clicking on the ‘Generate KDE Map’ button, the Clark and Evans Test result will be generated here.

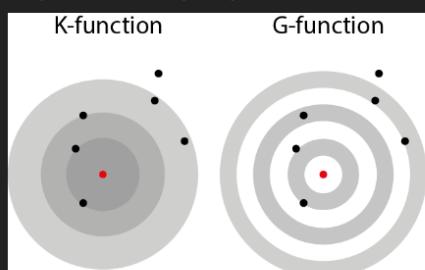
## 3.3 2nd Order Spatial Point Pattern Analysis



2nd Order Spatial Point Pattern Analysis Main Panel

### 2nd Order Spatial Point Pattern Analysis and Statistical Functions - G & K

2nd Spatial Point Pattern Analysis analyses effects of interaction between point pattern events.



The G / K-function is a method used in spatial Point Pattern Analysis (PPA) to inspect the spatial distribution of a set of points. It allows the user to assess if the set of points is more or less clustered than what we could expect from a given distribution.

Most of the time, the set of point is compared with a random distribution. The empirical K-function for a specified radius  $r$  is calculated with the following formula listed: [GFunction K Function](#)

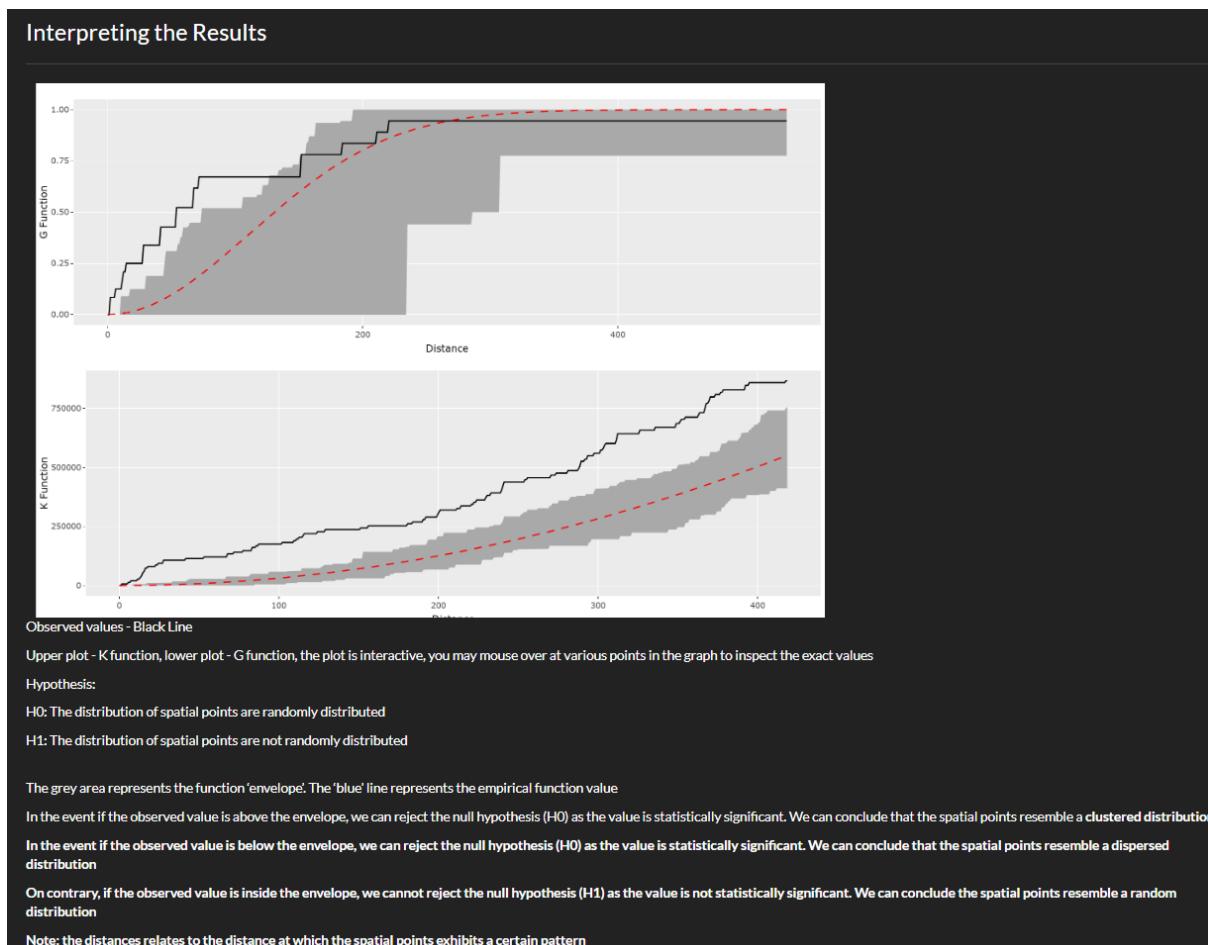
Basically, the K-function calculates for a radius  $r$  the proportion of cells with a value below  $r$  in the distance matrix between all the points  $D_{ij}$ . In other words, the K-function estimates the average number of neighbours of a typical random point

A modified version of the K-function is the G-function (Pair Correlation Function). The regular K-function is calculated for subsequent disks with increasing radii and thus is cumulative in nature. The G-function uses rings instead of disks and permits the analysis of the points concentrations at different geographical scales.

1. Select your location of interest
2. Select your start value in (metres). We will recommend you to start with 0 to begin.
3. Select your end value in (metres). We will recommend you to end with 500 metres to begin.
4. Select the confidence level to perform the statistical testing.
5. Click on 'Generate Analysis' and you are ready to go!

## 2nd Order Spatial Point Pattern Instructions and Explanations

An example on the concept of 2nd order spatial point pattern analysis will be shown. In addition, it provides you with instructions on how to perform your own analysis.



### Interpretation of the results of 2nd order spatial point analysis

An example of the results of the G & K function will be shown on how to interpret the above results when you decide to try your own analysis. In addition, it further explains and concludes the hypothesis results based on H0, H1.

## Key Function FAQ

### Start/End

**Distances for statistical analysis to be run and plotted**

### Confidence Level

**How many simulations to run the statistical analysis. The number of simulations are mapped as follows:**

**95% - 39 | 99% - 199 | 99.9% - 1999**

**Given by the following formula:  $\alpha = 2 * nrank / (1 + nsim)$  where  $nrank = 1$**

**95% and 99% are typical confidence levels used**

## Key Function FAQ

This section will explain to you some of the frequently asked questions and address your doubts regarding the 2nd order G & K function analysis.

### G/K Function Variable Inputs

Spatial Points

Localities

Entire City of Melbourne

Location of Interest

Business Establishments

Specific Themes/Sub-Categories

All

G/K Function Parameters

Select the Confidence to be used

95%

Generate Analysis

Please note: The analysis will take a few minutes to generate after clicking the button.

## 2nd Order Spatial Point Pattern Analysis Side Panel

## G/K Function Variable Inputs

Spatial Points

Localities

Docklands

Location of Interest

Landmarks

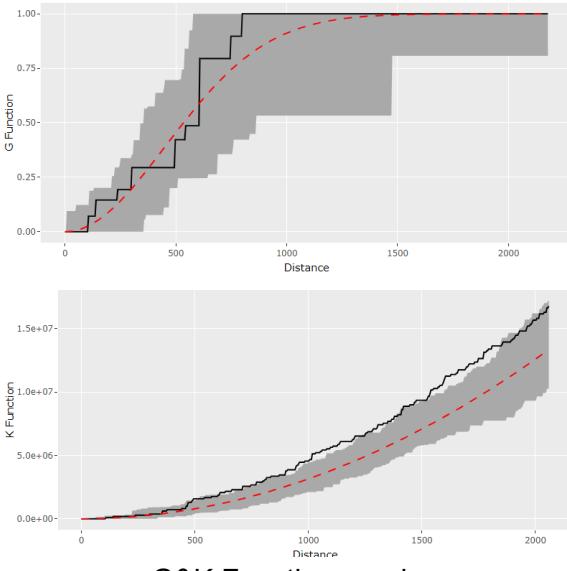
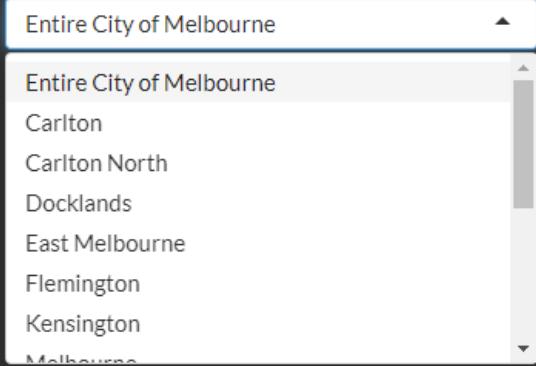
Specific Themes/Sub-Categories

Health Services

Health Services in Entire City of ×  
Melbourne has no spatial  
points to be analysed. The  
analysis has been terminated.

## 2nd Order Spatial Point Pattern Analysis Data Inputs (Error)

Please do take note that some localities together with the location of interest and specific themes/sub-categories to be analysed do not have relevant data to be generated. Therefore an error message will be prompted to terminate the analysis.

Feature	Functionality
 <p data-bbox="351 916 632 983"><b>G&amp;K Function graph visualisation</b></p>	<p>This is the G&amp;K Function graph visualisation of the 2nd Order Spatial Point Pattern Analysis being generated.</p>
<p data-bbox="228 1051 605 1084"><b>G/K Function Variable Inputs</b></p> <p data-bbox="228 1100 372 1129"><b>Spatial Points</b></p> <p data-bbox="228 1145 335 1174"><b>Localities</b></p>  <p data-bbox="203 1574 780 1664"><b>Localities inputs for 2nd Order Spatial Point Pattern Analysis for G&amp;K Function graph visualisation</b></p>	<p>From this drop down list, you can select the localities variable to generate the data.</p> <p>'Entire City of Melbourne' will be the default option.</p> <p>Other options are 'Carlton', 'Carlton North', 'Docklands', 'East Melbourne', 'Flemington', 'Kensington', 'Melbourne', 'North Melbourne', 'Parkville', 'Port Melbourne', 'South Wharf', 'South Yarra', 'SouthBank' and 'West Melbourne'.</p>
	<p>From this drop down list, you can select the location of interest variable to generate the data.</p> <p>'Childcare Centres' will be the default option.</p> <p>Other options are 'Business Establishments', 'Drinking Fountain', 'Landmarks', and 'Public Toilets'.</p>

**Location of Interest**

Business Establishments

Childcare Centres  
Business Establishments  
Drinking Fountain  
Landmarks  
Public Toilets

Please note: The map and data will take a few moments to generate after clicking the button.

Location of Interest inputs for 2nd Order Spatial Point Pattern Analysis for G&K Function graph visualisation

**Location of Interest**

Childcare Centres

**Specific Themes/Sub-Categories**

All

Generate Map and Data Table

Please note: The map and data will take a few moments to generate after clicking the button.

Specific Theme/Sub-categories

Please take note by selecting 'Business Establishments' or 'Landmarks', you have the option of selecting specific themes/sub-categories. Other locations of interest such as

7. Childcare Centres
8. Public Toilets
9. Drinking Fountains

do not have specific themes/sub-categories for you to select and will therefore be disabled. This does not mean you are unable to generate the map and data table results.

**Specific Themes/Sub-Categories**

Community Use

All  
Community Use  
Education Centre  
Health Services  
Industrial  
Leisure/Recreation  
Mixed Use  
Office

Specific Themes/Sub-Categories inputs for 2nd Order Spatial Point Pattern Analysis for G&K Function graph visualisation

From this drop down list, you can select the Specific Themes/Sub-Categories variable to generate the data.

'All' will be the default option.

Other options are 'Community Use', 'Education Centre', 'Health Services', 'Industrial', 'Leisure/Recreation', 'Mixed Use', 'Office', 'Place of Assembly', 'Place of Worship', 'Purpose Built', 'Residential Accommodation', 'Retail', 'Specialist Residential Accommodation', 'Transport', 'Vacant Land' and 'Warehouse/Store'

#### G/K Function Parameters

Select the Confidence to be used

95%

95%

99%

99.9%

generate after clicking the button.

G&K Function parameters for 2nd Order Spatial Point Pattern Analysis graph visualisation

Generate Analysis

Please note: The analysis will take a few minutes to generate after clicking the button.

Generate Analysis Button for 2nd Order Spatial Point Pattern Analysis graph visualisation

From this drop down list, you can select the confidence variable interval to generate the data.

'95%' will be the default option.

The other options are '99%' and '99.9%'.

After selecting the above variable inputs, do remember to click on this 'Generate Analysis' button to generate the data.

## 4. Network Constrained Point Pattern Analysis

**spatial bros** Home Page Data Exploration Spatial Point Pattern Analysis Network Constrained Point Pattern Analysis

### Network Constrained Point Pattern Analysis

Introduction Network Kernel Density Estimation Statistical Functions

#### Welcome to the Network Constrained Point Pattern Analysis!

You will be able to perform network constrained spatial point patterns analysis methods special developed for analysing spatial point event occurs on or alongside network for City of Melbourne, Australia!

There are 2 types of analysis that you can perform

1. Network Kernel Density Estimation
2. G & K Function Analysis

For each of the analysis, we offer you the options of selecting

1. Road Network
2. Pedestrian Network
3. Tram Network

In addition you are allowed to pick your location of interest such as

1. Childcare Centres
2. Business Establishments
3. Drinking Fountains
4. Landmarks
5. Public Toilets

#### Benefits of performing Network Constrained Point Pattern Analysis

1. Accurate analysis: Network Constrained Point Pattern Analysis provides more accurate results compared to traditional point pattern analysis because it accounts for the underlying transportation network. This is particularly important in areas where the transportation network is dense and complex.
2. Better decision-making: Network Constrained Point Pattern Analysis can provide insights into how the network infrastructure affects the spatial distribution of points, which can be valuable for decision-making related to urban planning, transportation planning, and public policy.
3. Improved resource allocation: Network Constrained Point Pattern Analysis can help optimize the allocation of resources, such as improving the accessibility to more drinking fountains/public toilets, by identifying areas with high concentrations of points and areas that are more accessible by the transportation network.

### NETWORK SPATIAL POINT PATTERN ANALYSIS

STEP BY STEP INSTRUCTION

1. SELECT TYPE OF ANALYSIS
2. SELECT TYPE OF NETWORK
3. SELECT POINT OF INTEREST
4. SELECT OTHER PARAMETERS
5. VIEW AND ANALYSE OUTPUT

The Network Constrained Point Pattern Analysis is the fourth page that you will be able to access in our application.

From the Network Constrained Point Pattern Analysis, there are 3 sub tabs that is made available to you for usage:

1. Introduction
2. Network Kernel Density Estimation
3. Statistical Function

The layout of the Network Kernel Density Estimation and Statistical Function tab is similar in nature, with the main visualisation map being on the left and a side panel on the right for the selection of inputs.

## 4.1 Introduction

**spatial bros** Home Page Data Exploration Spatial Point Pattern Analysis Network Constrained Point Pattern Analysis

### Network Constrained Point Pattern Analysis

Introduction Network Kernel Density Estimation Statistical Functions

#### Welcome to the Network Constrained Point Pattern Analysis!

You will be able to perform network constrained spatial point patterns analysis methods special developed for analysing spatial point event occurs on or alongside network for City of Melbourne, Australia!

There are 2 types of analysis that you can perform

1. Network Kernel Density Estimation
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1. Road Network
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In addition you are allowed to pick your location of interest such as

1. Childcare Centres
2. Business Establishments
3. Drinking Fountains
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#### Benefits of performing Network Constrained Point Pattern Analysis

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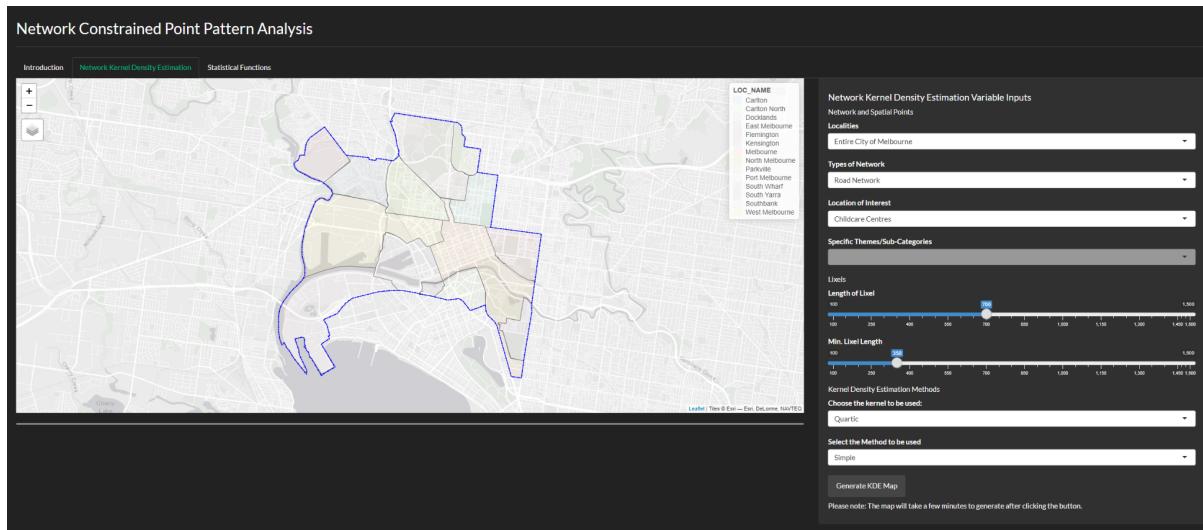
### NETWORK SPATIAL POINT PATTERN ANALYSIS

#### STEP BY STEP INSTRUCTION

1. SELECT TYPE OF ANALYSIS
2. SELECT TYPE OF NETWORK
3. SELECT POINT OF INTEREST
4. SELECT OTHER PARAMETERS
5. VIEW AND ANALYSE OUTPUT

This is the introduction page where you will learn about the types of analysis you are able to perform and also the benefits.

## 4.2 Network Kernel Density Estimation



**Network Kernel Density Estimation main panel**

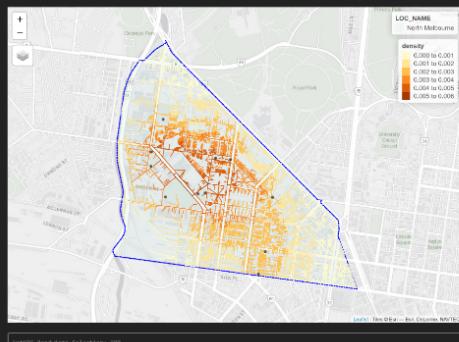
### Network Kernel Density Estimation Map

Network Constrained Spatial Point Pattern Analysis analyses point pattern events that happens alongside a network. We provide several point pattern (such as Business Establishment, Drinking Fountains) and Network (such as Pedestrian or Road) options to explore the effects of spatial point patterns and densities surrounding networks. These could be used to investigate the density of point patterns along networks, such as the amount of drinking fountains along pedestrian routes to inform the planning and installing of more drinking fountains.

To begin your analysis, you can start by

1. Select your choice of locality
2. Select your choice of network
3. Select your location of interest and subcategories/theme if required
4. Select your pixel length - we recommend you to start with 500 metres
5. Select your minimum pixel length - we recommend you to start with 250 metres
6. Select your kernel of choice
7. Select your method of choice
8. Click on 'Generate KDE Map' and you are ready to go!

### Interpreting the Results



A legend will be shown at the top right side of the map. The colour shade intensity of the network will get darker if there is a higher relative density of spatial points specified (location of interest).

On contrary, if the colour shade intensity of the network is lighter, it represents a lower relative density alongside the network

The 'NetKDE Bandwidth Selection' tells us what bandwidth has been selected by the algorithm for bandwidth range between 100 and 900, in steps of 20. The goal is to find the highest possible Cross Validation (CV) score. The larger the bandwidth, the increased amount of smoothing, hence, the CV score has been capped at 900 to reduce the amount of detail lost.

**Network Kernel Density Estimation main panel (instructions and interpreting result)**

This section explains to you what network kernel density estimation is all about with instructions provided on how to perform your analysis. In addition, it also shows u an example on how to interpret the results

## Key Function FAQ

### Lixels

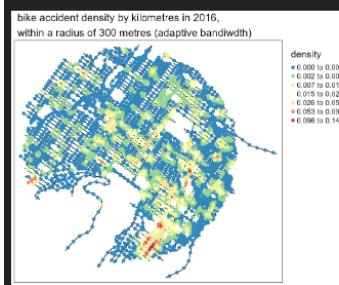


Image credit to [spNetwork](#)

Lixels are point samples along existing network lines to calculate the density of points near the region. 'Length of Lixel' defines the typical length between such point and 'Min. Lixel Length' defines the minimum if the typical length cannot be fulfilled.

## Key Function FAQ

This section describes and addresses the frequently asked question with regards to lixels.

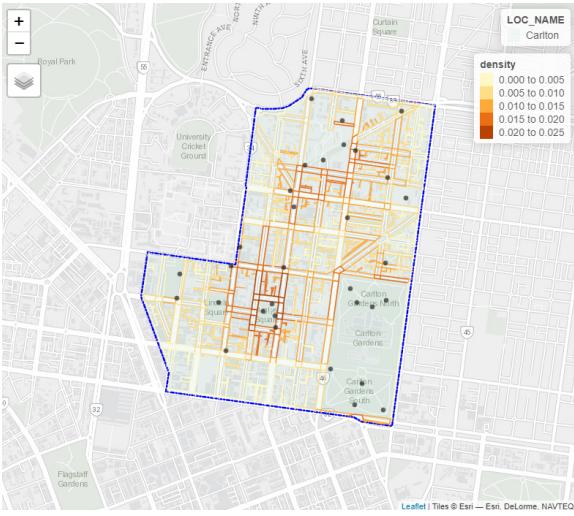
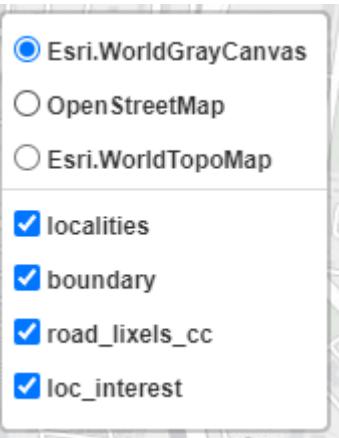
## Kernel Density Estimation Methods

An infographic has been prepared below:

KERNEL	
TYPE	DESCRIPTION
QUARTIC	This kernel has a quartic shape and assigns more weight to points close to the centre than those further away. It has a slower decrease in weight towards the edges than triangular kernel.
TRIANGLE	This kernel has a triangular shape with its maximum at zero and decreases linearly towards the edges. It assigns equal weight to all points within a bandwidth.
TRICUBE	This kernel has a cubic shape and assigns more weight to points close to the center than those further away. It has a slower decrease in weight towards the edges than the triangular kernel.
COSINE	This kernel has a semicircular shape and assigns equal weight to all points within a bandwidth. It is most used in spectral analysis.
TRIWEIGHT	This kernel has a quartic shape and assigns more weight to points close to the center than those further away. It has a slower decrease in weight towards the edges than the tricube kernel.
EPANECHNIKOV	This kernel has a parabolic shape and assigns more weight to points close to the center than those further away. It has a faster decrease in weight towards the edges than tricube and triweight kernels.
UNIFORM	This kernel assigns equal weight to all points within a bandwidth, regardless of their distance from the center. It has a constant weight within the bandwidth and zero weight outside of it.
METHOD	
SIMPLE	This method uses a linear activation function, which simply multiplies the input by a weight and adds a bias term. This is the simplest activation function and is sometimes used in the output layer of a neural network.
CONTINUOUS	This method uses a continuous activation function such as the sigmoid function or the hyperbolic tangent function. These functions smoothly transform the input values into an output value between 0 and 1 (for sigmoid) or -1 and 1 (for hyperbolic tangent).
DISCONTINUOUS	These functions have a constant value for a range of input values and then abruptly switch to another constant value. Discontinuous activation functions are rarely used in neural networks due to their non-smoothness, which can cause optimization problems.

### Explanation for Kernel Type and Method Type

This section will explain to you the difference between each kernel type and method type.

Feature	Functionality
 <p data-bbox="228 848 753 907">Network Kernel Density Estimation Map Visualisation</p>	<p>This map is a visualisation of the Network Kernel Density Estimation Map Visualisation being computed.</p> <p>The LOC_NAME in the legend represents the locality district 'Carlton' being analysed. From the visualisation, you are able to see the district outline, the network outlines and the spatial points.</p> <p>The density legend represents the intensity of network outlines of the spatial points</p>
 <p data-bbox="410 1123 573 1154">Zoom Control</p>	<p>The map visualisation provides the option of zooming in and out. You can click on the '+' icon to zoom further into the map and '-' to zoom further out.</p>
  <p data-bbox="372 1394 658 1769"> <input checked="" type="radio"/> Esri.WorldGrayCanvas  <input type="radio"/> OpenStreetMap  <input type="radio"/> Esri.WorldTopoMap  <input checked="" type="checkbox"/> localities  <input checked="" type="checkbox"/> boundary  <input checked="" type="checkbox"/> road_lixels_cc  <input checked="" type="checkbox"/> loc_interest     </p> <p data-bbox="399 1810 621 1841">Base Map Control</p>	<p>When you hover your cursor over to this icon, this menu will appear where you are able to select your desired base map from Esri.WorldGrayCanvas to OpenStreetMap to Esri.WorldTopoMap.</p> <p>You will also have the option of selecting and deselecting options such as 'localities', 'boundary', 'road_lixels_cc' and 'loc_interest' which are the Melbourne's city boundary outline, network type and location of interests.</p>

**Network Kernel Density Estimation Variable Inputs**

Network and Spatial Points

**Localities**

Carlton

**Types of Network**

Road Network

**Location of Interest**

Drinking Fountain

**Specific Themes/Sub-Categories**

Lixels

**Length of Lixel**



A horizontal slider for 'Length of Lixel' ranging from 100 to 1,500. The current value is set at 700.

100      250      400      550      700      850      1,000      1,150      1,300      1,450      1,500

**Min. Lixel Length**



A horizontal slider for 'Min. Lixel Length' ranging from 100 to 1,500. The current value is set at 350.

100      250      400      550      700      850      1,000      1,150      1,300      1,450      1,500

**Kernel Density Estimation Methods**

**Choose the kernel to be used:**

Quartic

**Select the Method to be used**

Simple

**Generate KDE Map**

Please note: The map will take a few minutes to generate after clicking the button.

**Network Kernel Density Estimation Side Panel**

**Network Kernel Density Estimation Variable Inputs**

Network and Spatial Points

**Localities**

Docklands

**Types of Network**

Road Network

**Location of Interest**

Landmarks

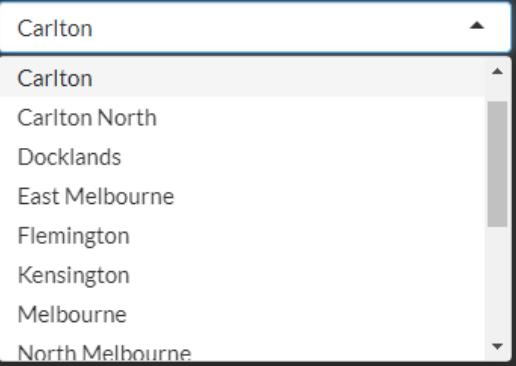
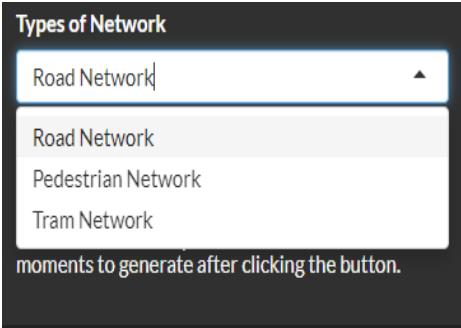
**Specific Themes/Sub-Categories**

Health Services

Health Services in Entire City of ×  
Melbourne has no spatial  
points to be analysed. The  
analysis has been terminated.

### **Network Kernel Density Estimation Analysis Data Inputs (Error)**

Please do take note that some localities together with the location of interest and specific themes/sub-categories to be analysed do not have relevant data to be generated. Therefore an error message will be prompted to terminate the analysis

Feature	Functionality
<p><b>Network Kernel Density Estimation Variable Inputs</b></p> <p>Network and Spatial Points</p> <p><b>Localities</b></p>  <p>Localities inputs for Network Kernel Density Estimation</p>	<p>From this drop down list, you can select the localities variable to generate the data.</p> <p>‘Entire City of Melbourne’ will be the default option.</p> <p>Other options are ‘Carlton’, ‘Carlton North’, ‘Docklands’, ‘East Melbourne’, ‘Flemington’, ‘Kesington’, ‘Melbourne’, ‘North Melbourne’, ‘Parkville’, ‘Port Melbourne’, ‘South Wharf’, ‘South Yarra’, ‘SouthBank’ and ‘West Melbourne’.</p>
 <p>Type of Network inputs for Network Kernel Density Estimation</p>	<p>From this drop down list, you can select the type of network variable to generate the data.</p> <p>‘Road Network’ will be the default option.</p> <p>Other options are ‘Pedestrian Network’ and ‘Tram Network’.</p>

**Location of Interest**

- Business Establishments
- Childcare Centres
- Business Establishments
- Drinking Fountain
- Landmarks
- Public Toilets

Please note: The map and data will take a few moments to generate after clicking the button.

Location of Interest inputs for Network Kernel Density Estimation

From this drop down list, you can select the location of interest variable to generate the data.

'Childcare Centres' will be the default option.

Other options are 'Business Establishments', 'Drinking Fountain', 'Landmarks', and 'Public Toilets'.

**Specific Themes/Sub-Categories**

- All
- Community Use
- Education Centre
- Health Services
- Industrial
- Leisure/Recreation
- Mixed Use
- Office

Please note: The map and data will take a few moments to generate after clicking the button.

Specific Themes/Sub-Categories inputs for Network Kernel Density Estimation

From this drop down list, you can select the Specific Themes/Sub-Categories variable to generate the data.

'All' will be the default option.

Other options are 'Community Use', 'Education Centre', 'Health Services', 'Industrial', 'Leisure/Recreation', 'Mixed Use', 'Office', 'Place of Assembly', 'Place of Worship', 'Purpose Built', 'Residential Accommodation', 'Retail', 'Specialist Residential Accommodation', 'Transport', 'Vacant Land' and 'Warehouse/Store'

**Location of Interest**

Childcare Centres

**Specific Themes/Sub-Categories**

All

Generate Map and Data Table

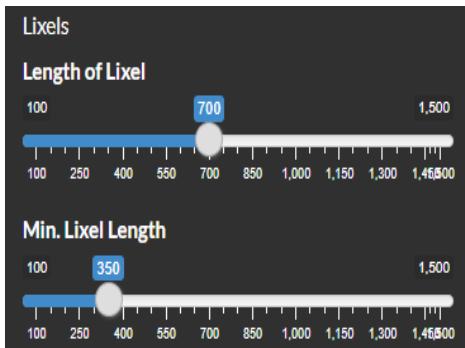
Please note: The map and data will take a few moments to generate after clicking the button.

Specific Theme/Sub-categories

Please take note by selecting 'Business Establishments' or 'Landmarks', you have the option of selecting specific themes/sub-categories. Other locations of interest such as

10. Childcare Centres
11. Public Toilets
12. Drinking Fountains

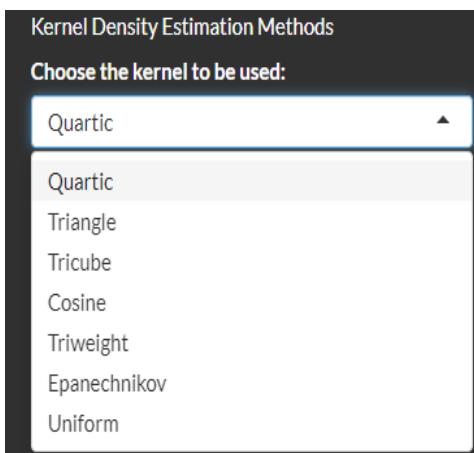
do not have specific themes/sub-categories for you to select and will therefore be disabled. This does not mean you are unable to generate the map and data table results.



Length of Lixel, Minimum Lixel Lengthfor Network Kernel Density Estimation

From these 2 sliders, you can select the distance of the length of lixel and minimum lixel length in metres from 0 to 1500.

The default length will be 700m for length of lixel and 350m for min lixel length

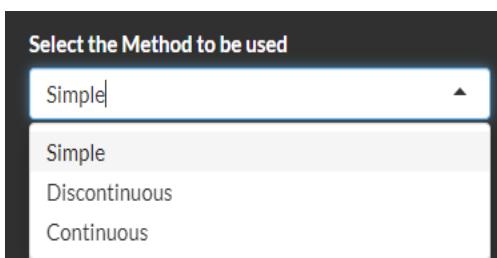


Kernel Method used for Network Kernel Density Estimation

From this drop down list, you can select the Kernel method variable to generate the data.

'Quartic' will be the default option.

The other options are 'Triangle', 'Tricube', 'Cosine', 'Triweight', 'Epanechnikov' and 'Uniform'

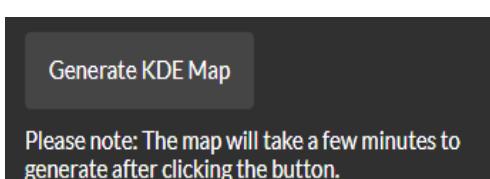


Method to be used for Network Kernel Density Estimation

From this drop down list, you can select the method variable to generate the data.

'Simple' will be the default option.

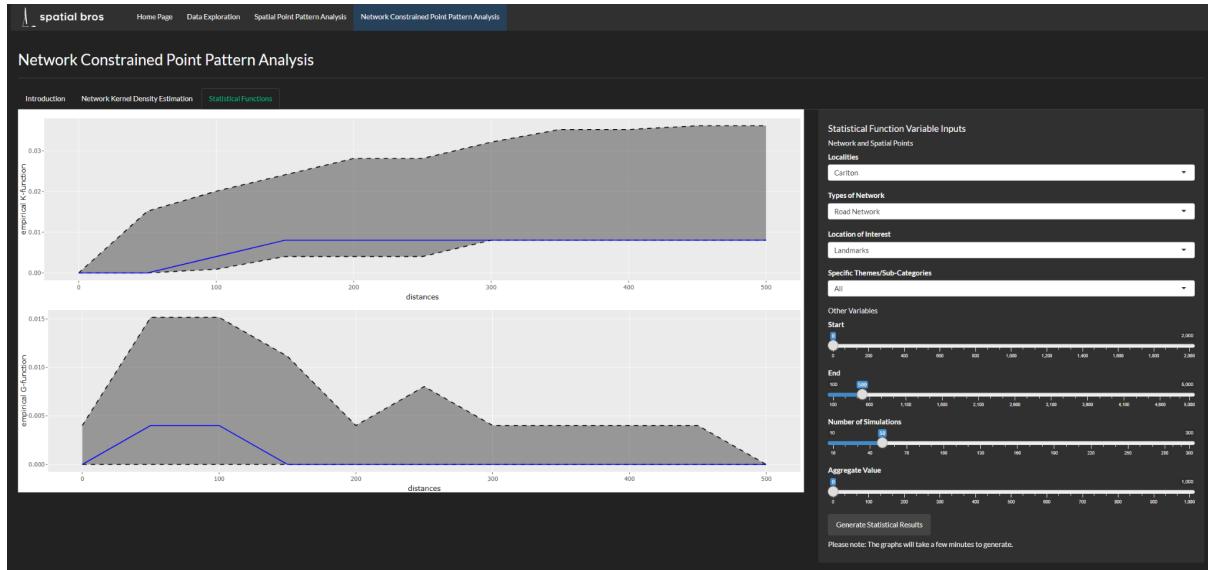
The other options are 'Continuous' and 'Discontinuous'.



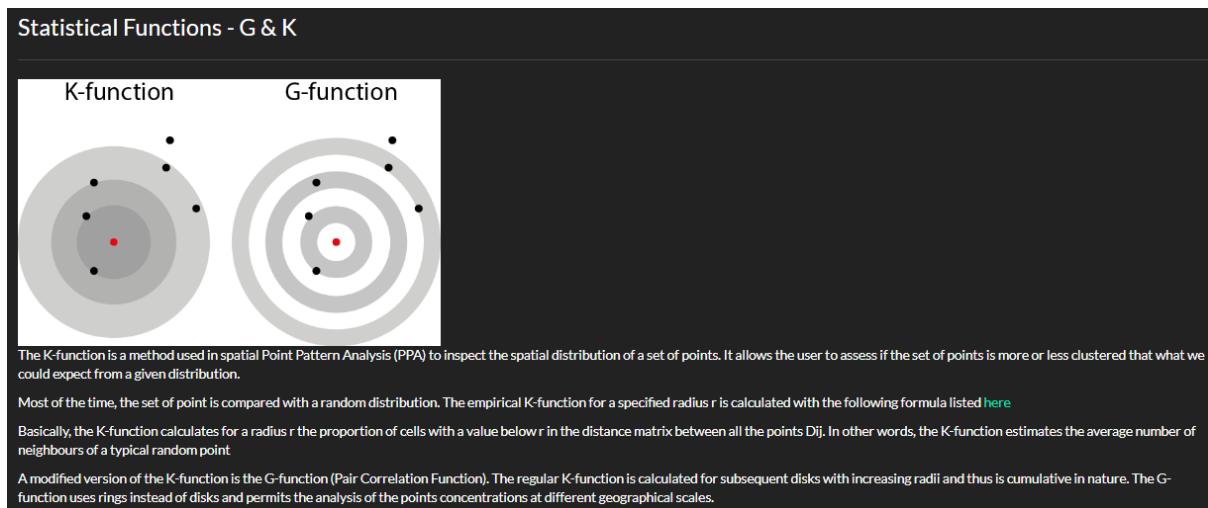
Generate KDE Map button for Network Kernel Density Estimation

After selecting the above variable inputs, do remember to click on this 'Generate KDE Map' button to generate the data.

## 4.3 Statistical Function



**Statistical Function Main Panel**



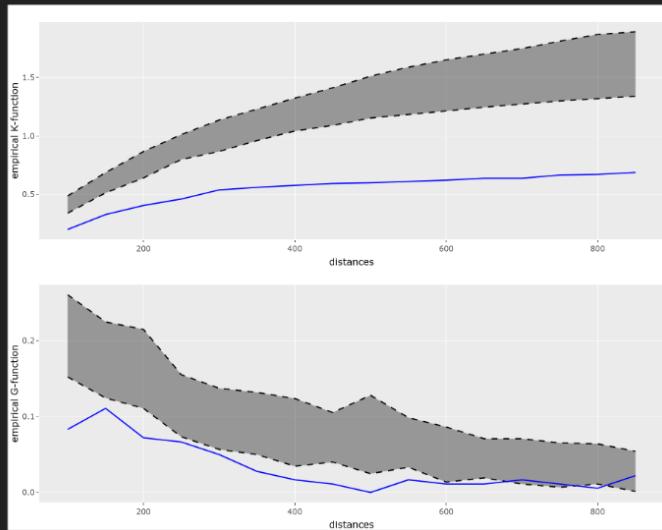
### Statistical Function G & K Concept

This section explains to you the concept with regards to G & K function for network constraint point pattern analysis.

To begin your analysis, you can start by:

1. Select your choice of network
2. Select your location of interest
3. Select your start value in (metres). We will recommend you to start with 0 to begin.
4. Select your end value in (metres). We will recommend you to end with 500 metres to begin.
5. Select your number of simulations. We will recommend you to start with 50 simulations to begin.
6. Select your aggregate value. We will recommend you to start with 0 to begin.
7. Click on 'Generate Statistical Results' and you are ready to go!

## Interpreting the Results



Observed values - Black Line

Upper plot - K function, lower plot - G function, the plot is interactive, you may mouse over at various points in the graph to inspect the exact values

Hypothesis:

H0: The distribution of spatial points are randomly distributed

H1: The distribution of spatial points are not randomly distributed

The grey area represents the function 'envelope'. The 'blue' line represents the empirical function value

In the event if the observed value is above the envelope, we can reject the null hypothesis (H0) as the value is statistically significant. We can conclude that the spatial points resemble a clustered distribution

In the event if the observed value is below the envelope, we can reject the null hypothesis (H0) as the value is statistically significant. We can conclude that the spatial points resemble a dispersed distribution

On contrary, if the observed value is inside the envelope, we cannot reject the null hypothesis (H1) as the value is not statistically significant. We can conclude the spatial points resemble a random distribution

Note: the distances relates to the distance at which the spatial points exhibits a certain pattern

## Statistical Function G & K (Instructions & Interpreting Results)

This section explains the steps involved in aiding you to perform your own analysis. On top of that, it guides you on how you can interpret your own results with examples provided.

## Key Function FAQ

### Start/End

Distances for statistical analysis to be run and plotted

### Number of Simulations

How many simulations to run the statistical analysis. The more simulations, the more accurate the results will be.

### Aggregate Value

Points within that radius will be aggregated (in metres)

o - Null (no aggregation) | >0 - Aggregation of points

## Key Function FAQ

This section will explain to you some of the frequently asked questions and address your doubts regarding the network constrained point pattern G & K function analysis.

### Statistical Function Variable Inputs

Network and Spatial Points

#### Localities

Docklands

#### Types of Network

Road Network

#### Location of Interest

Landmarks

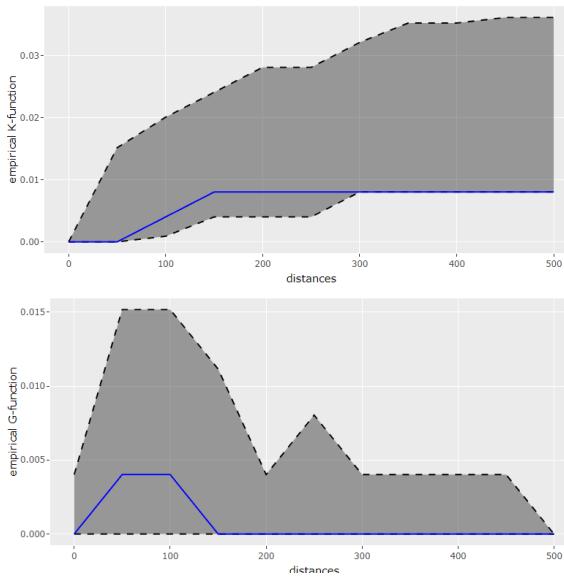
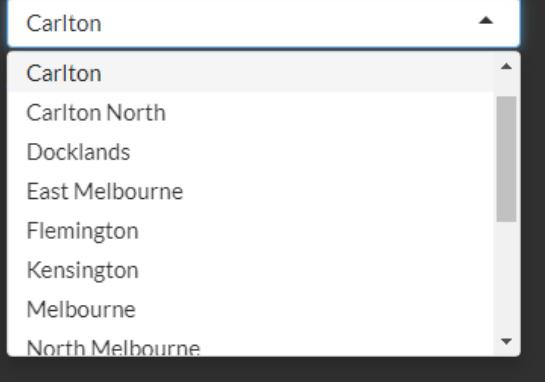
#### Specific Themes/Sub-Categories

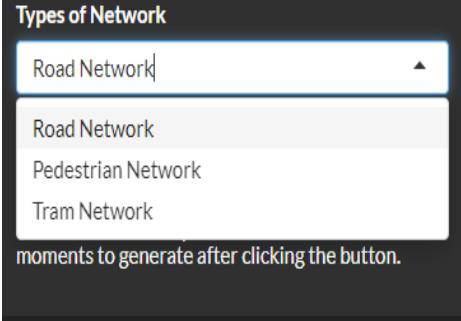
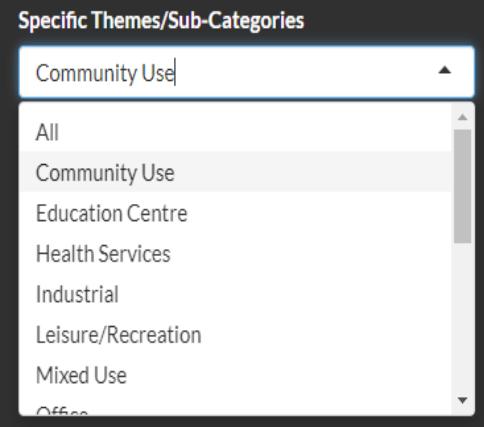
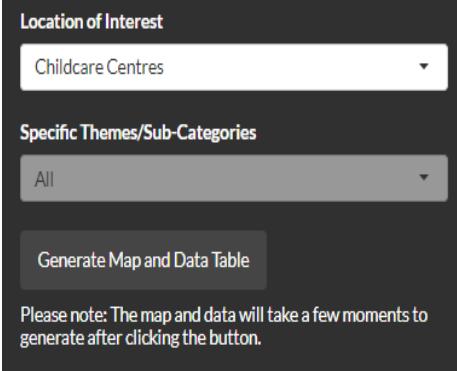
Health Services

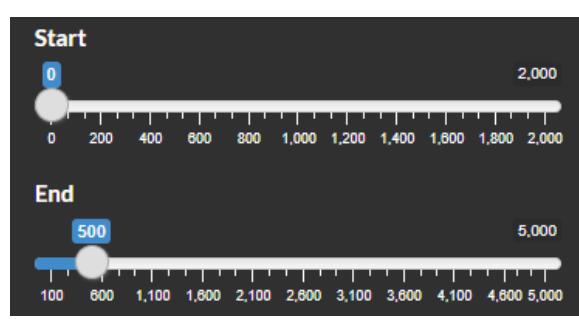
Health Services in Entire City of x  
Melbourne has no spatial  
points to be analysed. The  
analysis has been terminated.

## Statistical G & K Function Analysis Data Inputs (Error)

Please do take note that some localities together with the location of interest and specific themes/sub-categories to be analysed do not have relevant data to be generated. Therefore an error message will be prompted to terminate the analysis

Feature	Functionality
 <p data-bbox="351 916 628 983"><b>G&amp;K Function graph visualisation</b></p>	<p>This is the G&amp;K Function graph visualisation of the Network Constrained Point Pattern Analysis</p>
<p data-bbox="235 1064 688 1131"><b>Network Kernel Density Estimation Variable Inputs</b></p> <p data-bbox="235 1140 513 1170">Network and Spatial Points</p> <p data-bbox="235 1185 338 1215"><b>Localities</b></p>  <p data-bbox="224 1626 760 1693"><b>Localities inputs for G&amp;K Function graph visualisation</b></p>	<p>From this drop down list, you can select the localities variable to generate the data.</p> <p>'Entire City of Melbourne' will be the default option.</p> <p>Other options are 'Carlton', 'Carlton North', 'Docklands', 'East Melbourne', 'Flemington', 'Kensington', 'Melbourne', 'North Melbourne', 'Parkville', 'Port Melbourne', 'South Wharf', 'South Yarra', 'SouthBank' and 'West Melbourne'.</p>

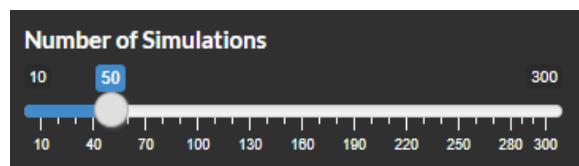
 <p>Type of Network inputs for G&amp;K Function graph visualisation</p>	<p>From this drop down list, you can select the type of network variable to generate the data.</p> <p>'Road Network' will be the default option.</p> <p>Other options are 'Pedestrian Network' and 'Tram Network'.</p>
 <p>Specific Themes/Sub-Categories inputs for G&amp;K Function graph visualisation</p>	<p>From this drop down list, you can select the Specific Themes/Sub-Categories variable to generate the data.</p> <p>'All' will be the default option.</p> <p>Other options are 'Community Use', 'Education Centre', 'Health Services', 'Industrial', 'Leisure/Recreation', 'Mixed Use', 'Office', 'Place of Assembly', 'Place of Worship', 'Purpose Built', 'Residential Accommodation', 'Retail', 'Specialist Residential Accommodation', 'Transport', 'Vacant Land' and 'Warehouse/Store'</p>
 <p>Specific Theme/Sub-categories</p>	<p>Please take note by selecting 'Business Establishments' or 'Landmarks', you have the option of selecting specific themes/sub-categories. Other locations of interest such as</p> <ul style="list-style-type: none"> <li>13. Childcare Centres</li> <li>14. Public Toilets</li> <li>15. Drinking Fountains</li> </ul> <p>do not have specific themes/sub-categories for you to select and will therefore be disabled. This does not mean you are unable to generate the map and data table results.</p>



Other Variables inputs for G&K  
Function graph  
visualisation

From these 2 sliders, you can select the start and end distance of the network from 0 to 2000 and 0 to 5000 metres respectively.

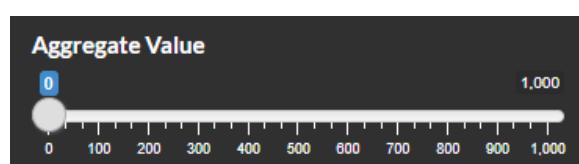
The default length will be 100m for start and 500m for end.



Number of Simulation inputs for  
G&K Function graph  
visualisation

From this slider, you can select the number of simulations for the function from 0 to 300.

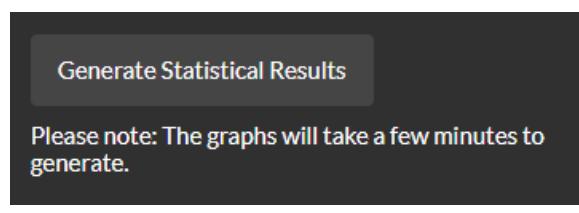
The default number of simulations will be 50.



Aggregate Value inputs for G&K  
Function graph  
visualisation

From this slider, you can select the aggregate value for the function from 0 to 1000.

The default aggregate value will be 0.



Generate Statistical Result for G & K  
Function graph visualisation

After selecting the above variable inputs, do remember to click on this 'Generate Statistical Results' button to generate the function results.

We hope you have a good time enjoying our application!

The End