SMU
SINGAPORE MANAGEMENT UNIVERSITY

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).

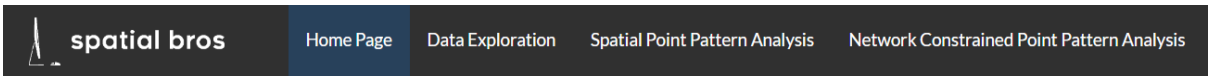
Our application will assist users with two kinds of Point Pattern Analysis: Spatial Point Patterns Analysis and Network-Constrained Point Patterns Analysis.

Application Link

spatial bros

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

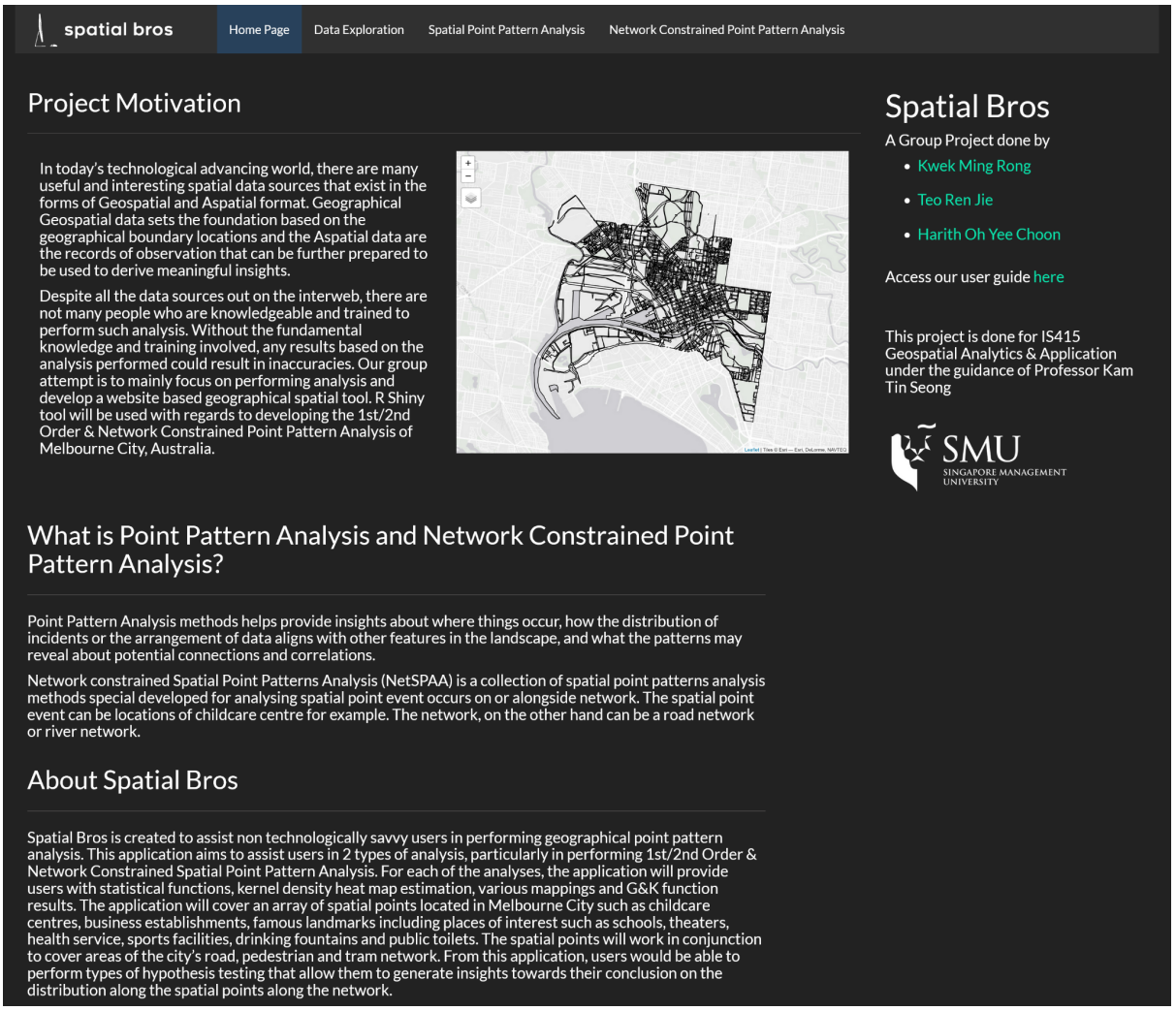
Navigation Bar



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



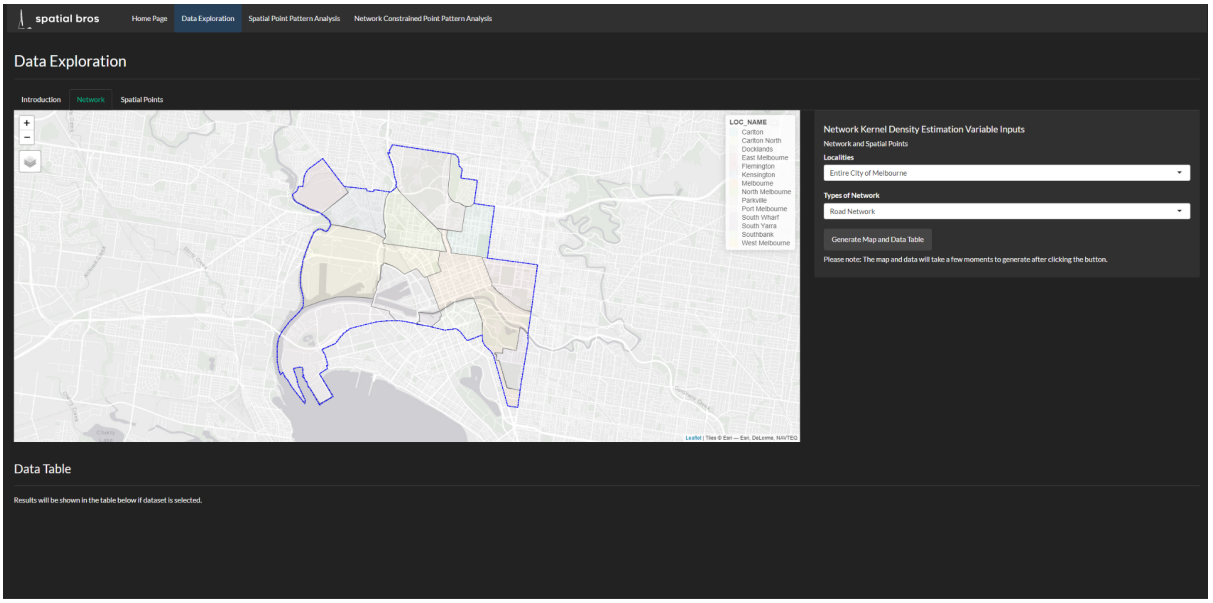
The home page will be the first thing you will see when you access our application.

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



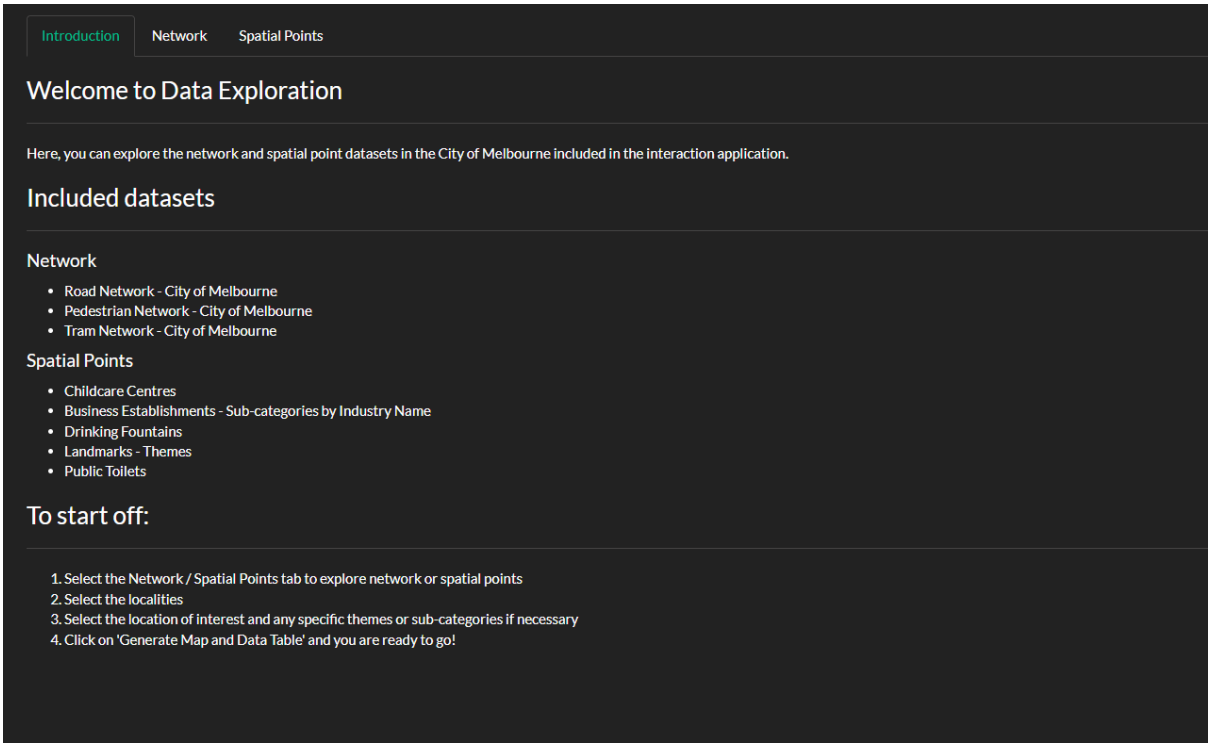
The Data Exploration is the second page that you will be able to access in our application.

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.

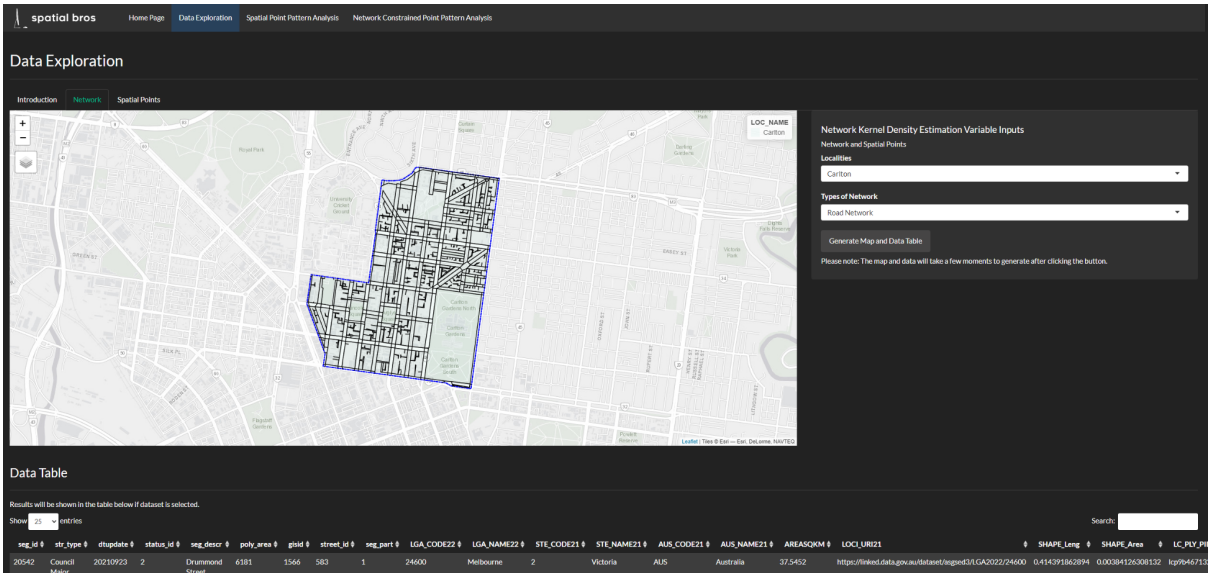
2.1 Introduction



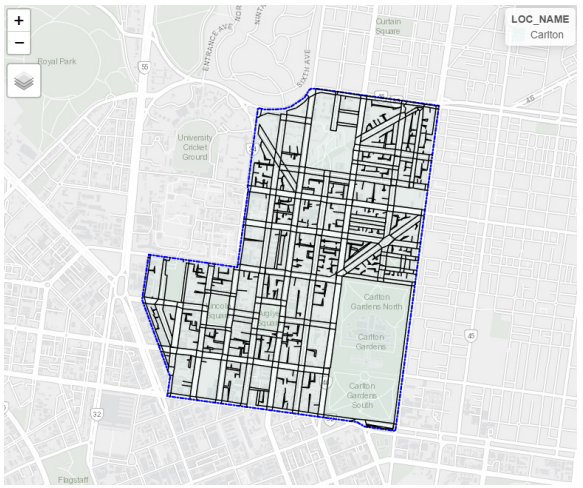
Data Exploration Introduction

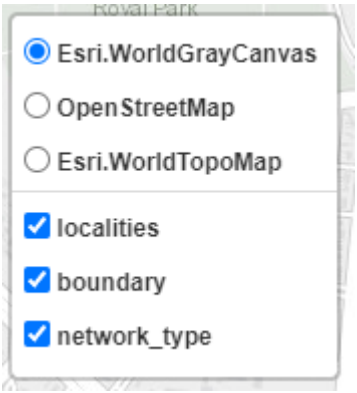
This is the data exploration introduction tab where you will learn about what are the available datasets included in this application. In addition, we also provide you a brief overview of how you can navigate around the data exploration section.

2.2 Network



Data Exploration Network Main Panel

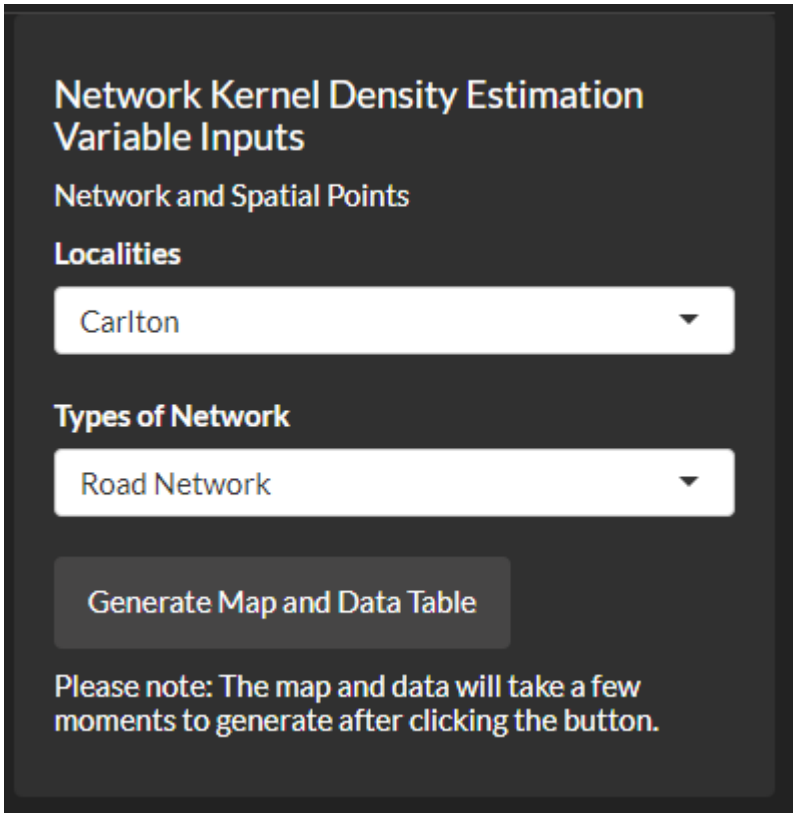
Feature	Functionality
 Map Visualization	This map is a visualisation of the Data Exploration Network being computed. The LOC_NAME in the legend represents the locality district 'Carlton' being analysed. From the visualisation, you are able to see the district outline and the network outlines.
 Zoom Control	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.



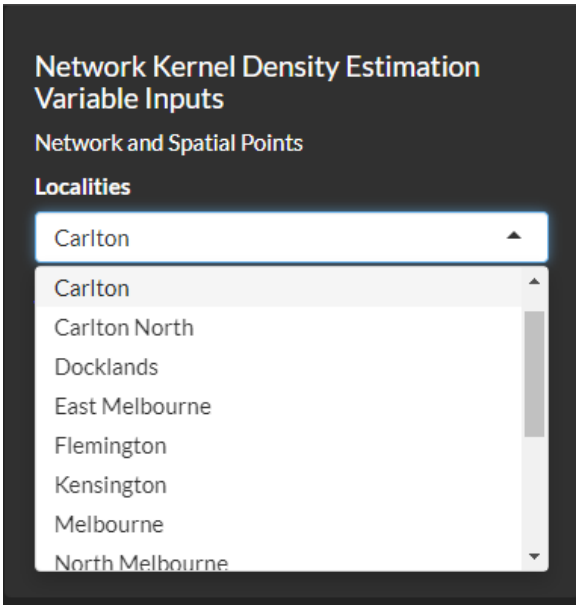
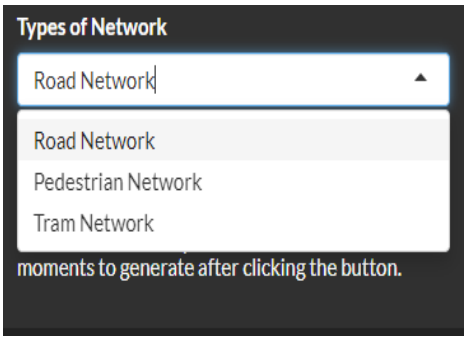
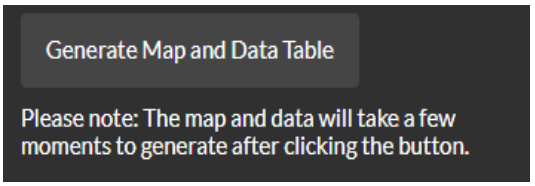
Base Map Control

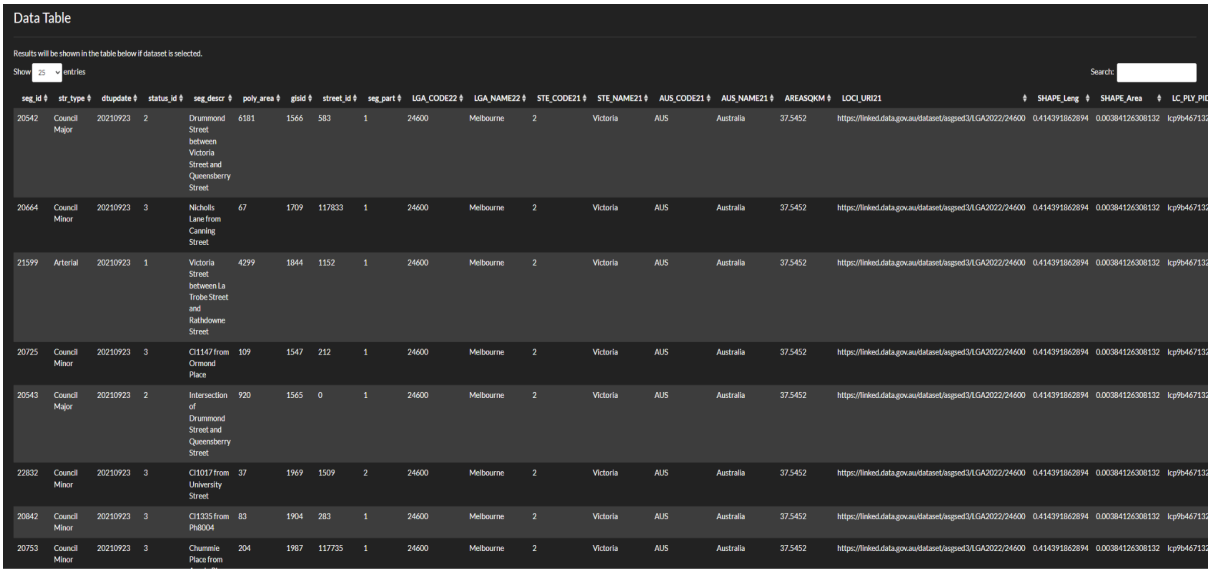
When you hover your cursor over to this icon, this menu will appear where you are able to select your desired base map from Esri.WorldGrayCanvas to OpenStreetMap to Esri.WorldTopoMap.

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 Data Exploration Side Panel

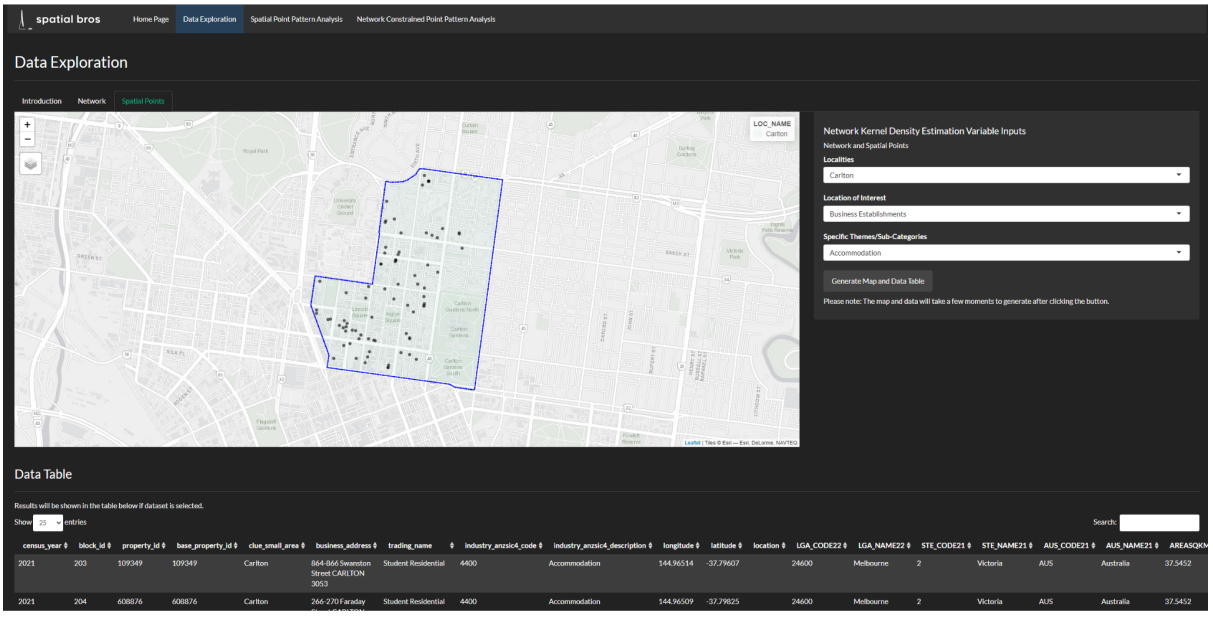
Feature	Functionality
 Localities inputs for Data Exploration Network Kernel Density Estimation	From this drop down list, you can select the localities variable to generate the data. 'Entire City of Melbourne' will be the default option. Other options are 'Carlton', 'Carlton North', 'Docklands', 'East Melbourne', 'Flemington', 'Kesington', 'Melbourne', 'North Melbourne', 'Parkville', 'Port Melbourne', 'South Wharf', 'South Yarra', 'SouthBank' and 'West Melbourne'.
 Type of Network inputs for Data Exploration Network Kernel Density Estimation	From this drop down list, you can select the type of network variable to generate the data. 'Road Network' will be the default option. Other options are 'Pedestrian Network' and 'Tram Network'.
 Generate Map and Data Table Button	After selecting the above variable inputs, do remember to click on this 'Generate Map and Data Table' button to generate the data.



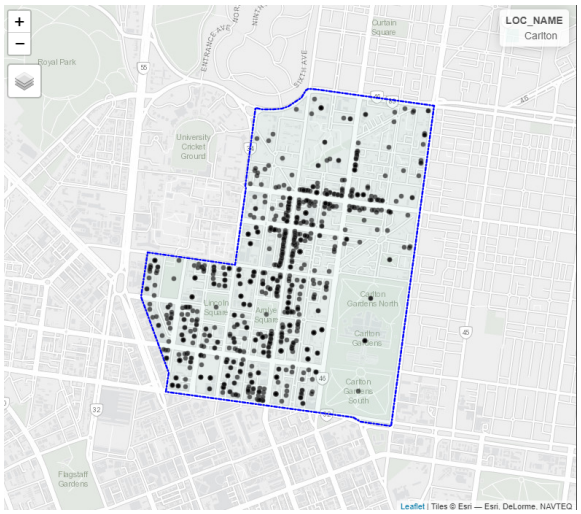
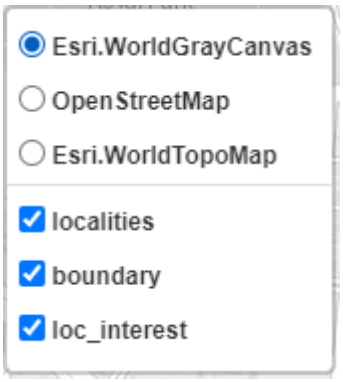
Data Table Generated

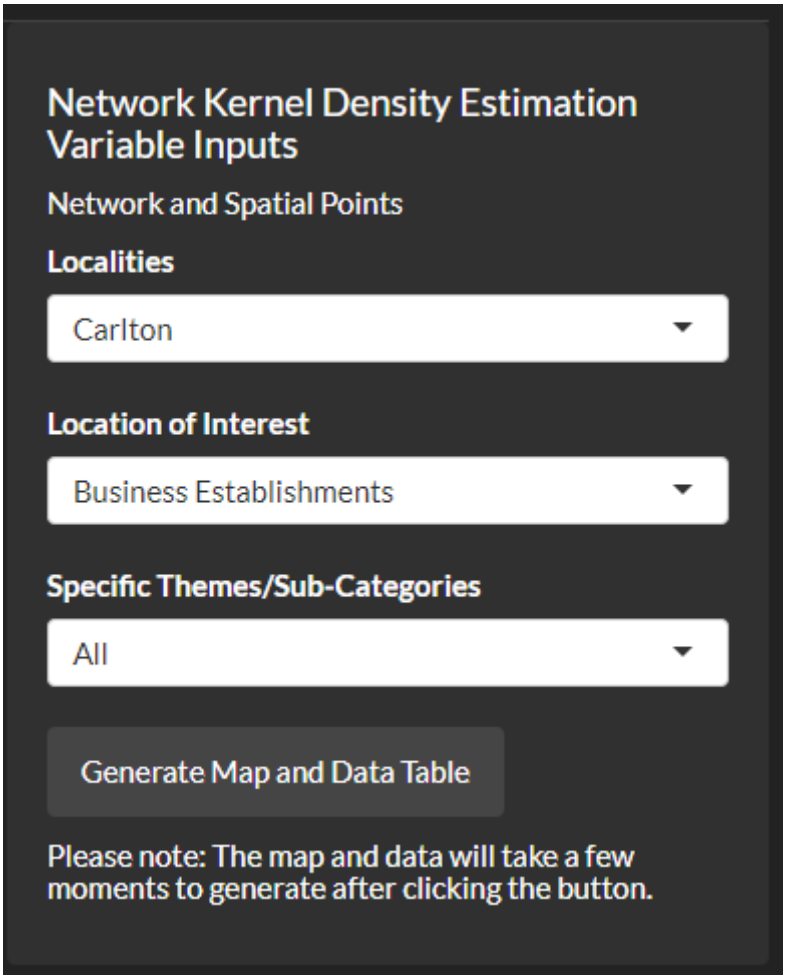
This will be the data table that will be generated upon clicking the ‘Generate Map and Data Table’ button. Pages will be split with 25 entries as default. The table comprises of columns such as ‘seg_id’, ‘str_type’, ‘dtupdate’, ‘status_id’, ‘seg_descr’, ‘poly_area’, ‘gisid’,’ street_id’, ‘seg_part’, ‘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

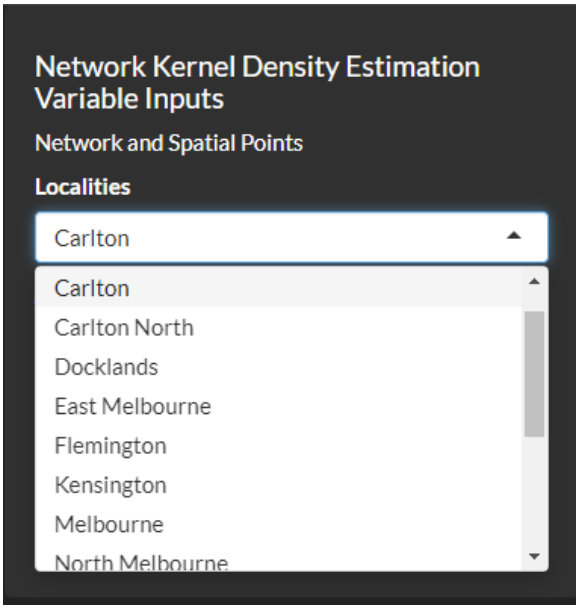


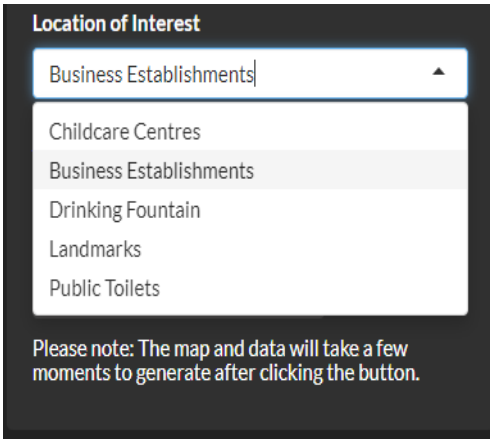
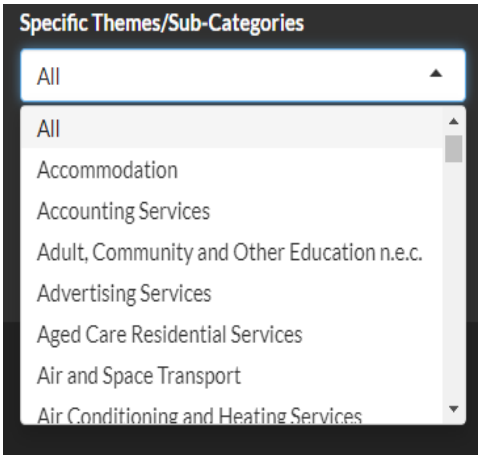
Data Exploration Spatial Point Main Panel

Feature	Functionality
 Map Visualization	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.
 Zoom Control	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.
  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 'loc_interest' which are the Melbourne's city boundary outline, the network type outline and lastly the point of interest.



Spatial Points Data Exploration Side Panel

Feature	Functionality
 Localities inputs for Data Exploration Network Kernel Density Estimation	From this drop down list, you can select the localities variable to generate the data. 'Entire City of Melbourne' will be the default option. 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'.

 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"

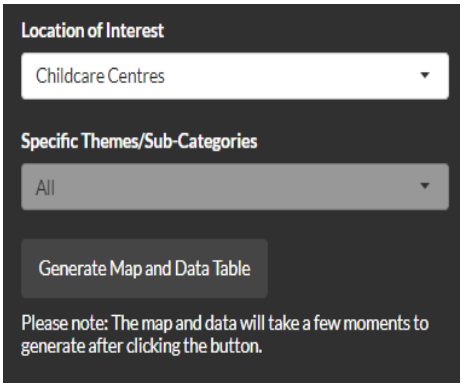
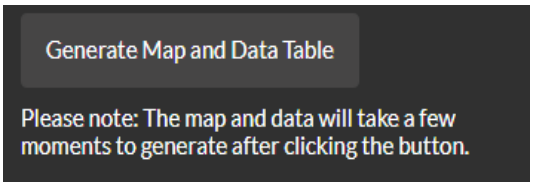
	[181] "Professional Photographic Services" [182] "Other Agriculture and Fishing Support Services" [183] "Alternative Health Services" [184] "Electronic (except Domestic Appliance) and Precision Equipment Repair and Maint" [185] "Other Professional and Scientific Equipment Manufacturing" [186] "Other 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"

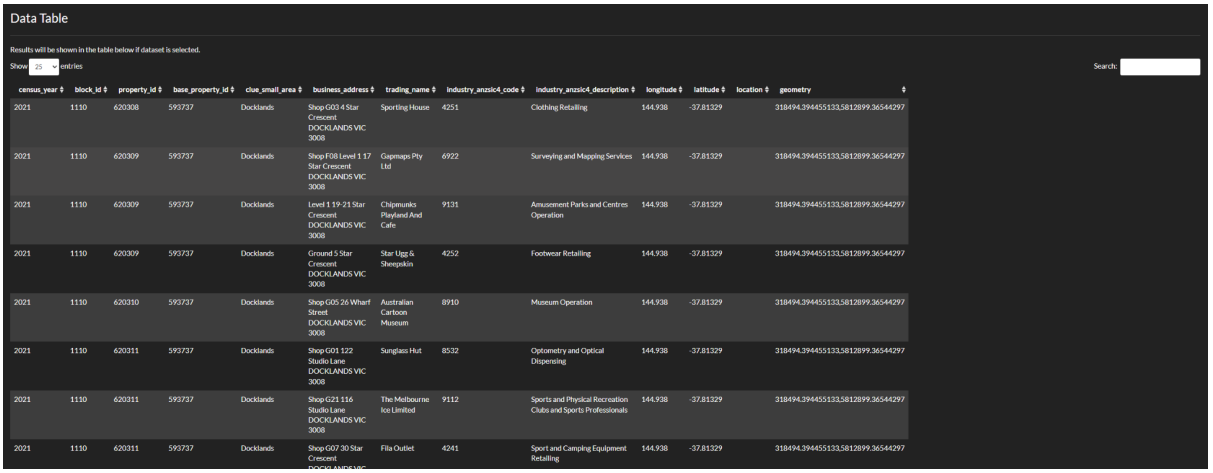
	[295] "Manchester and Other Textile Goods Retailing" [296] "Grape Growing" [297] "Zoological and Botanical Gardens Operation" [298] "Cable and Other Subscription Broadcasting" [299] "Other Publishing (except Software, Music and Internet)" [300] "Forestry Support Services" [301] "Motor Vehicle New Part 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"
 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 1. Childcare Centres 2. Public Toilets 3. 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.
 Generate Map and Data Table Button	After selecting the above variable inputs, do remember to click on this 'Generate Map and Data Table' button to generate the data.

Data Exploration Data Inputs (Error)

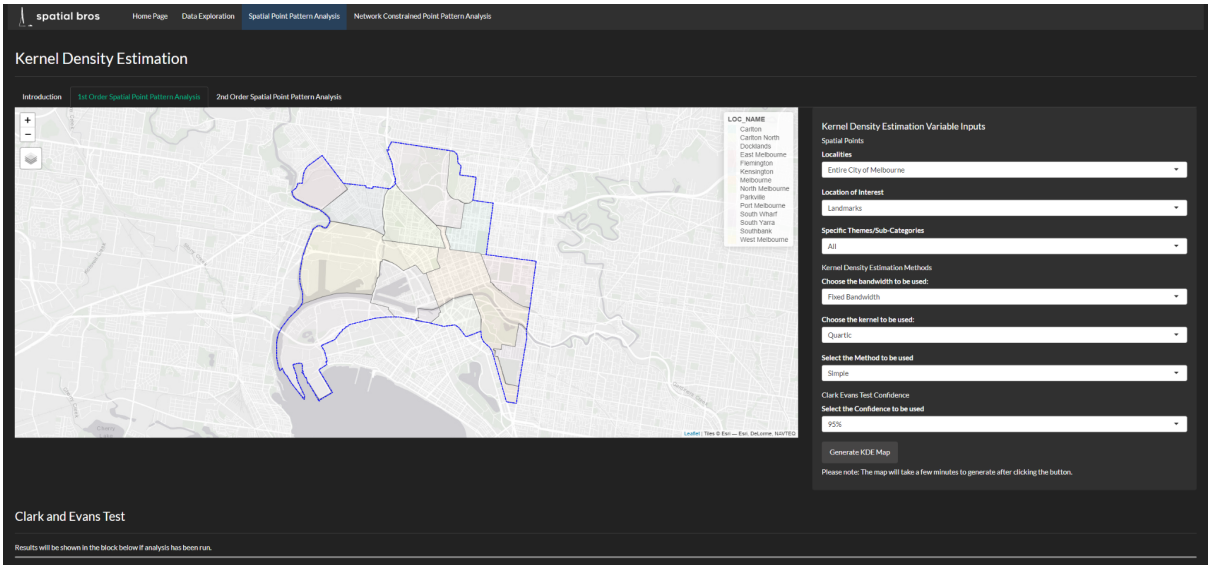
Please do take note that some localities together with the location of interest and specific themes/sub-categories to be analysed do not have relevant data to be generated. Therefore an error message will be prompted to terminate the analysis



Data Table 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



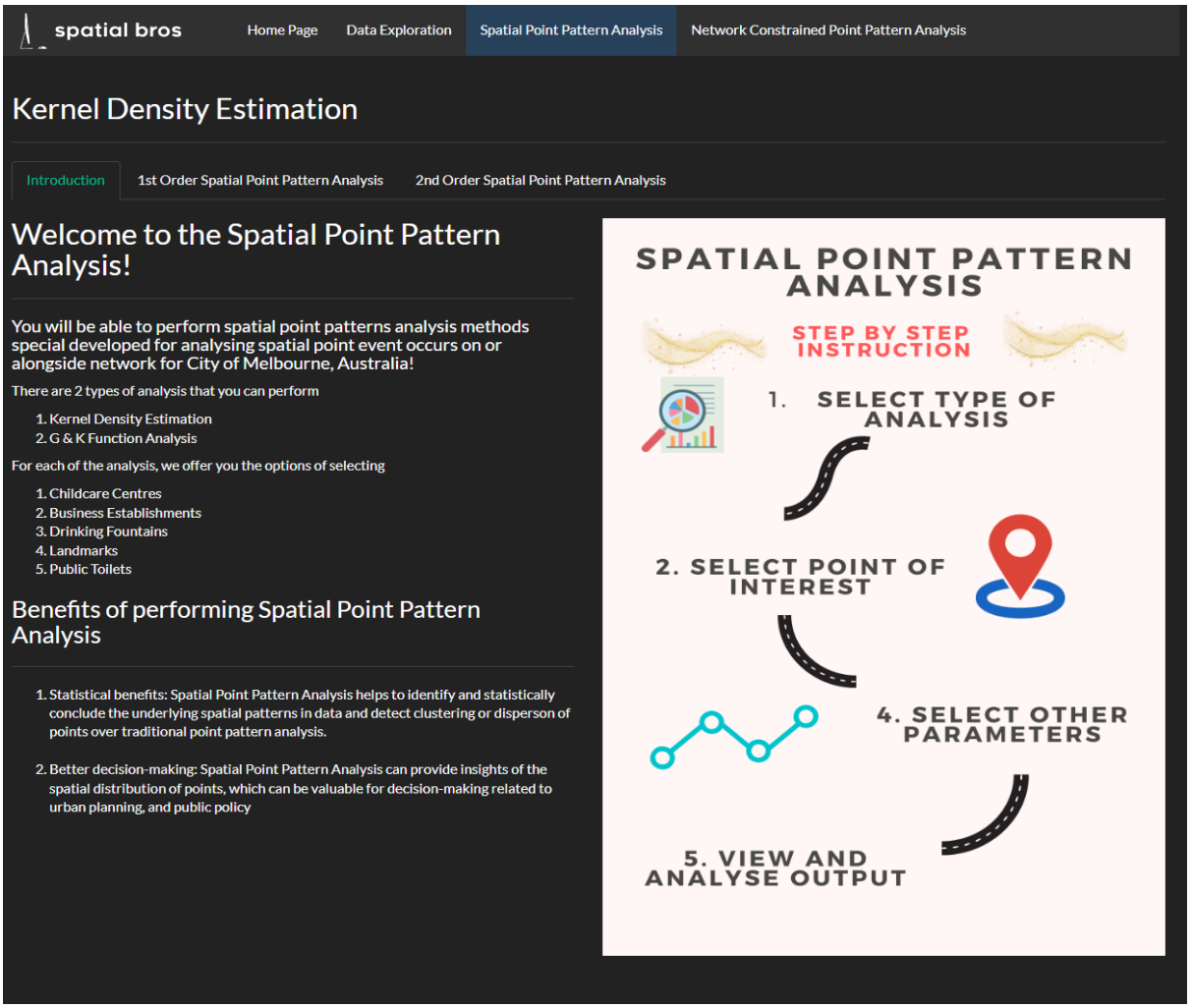
The Spatial Point Pattern Analysis is the third page that you will be able to access in our application.

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.

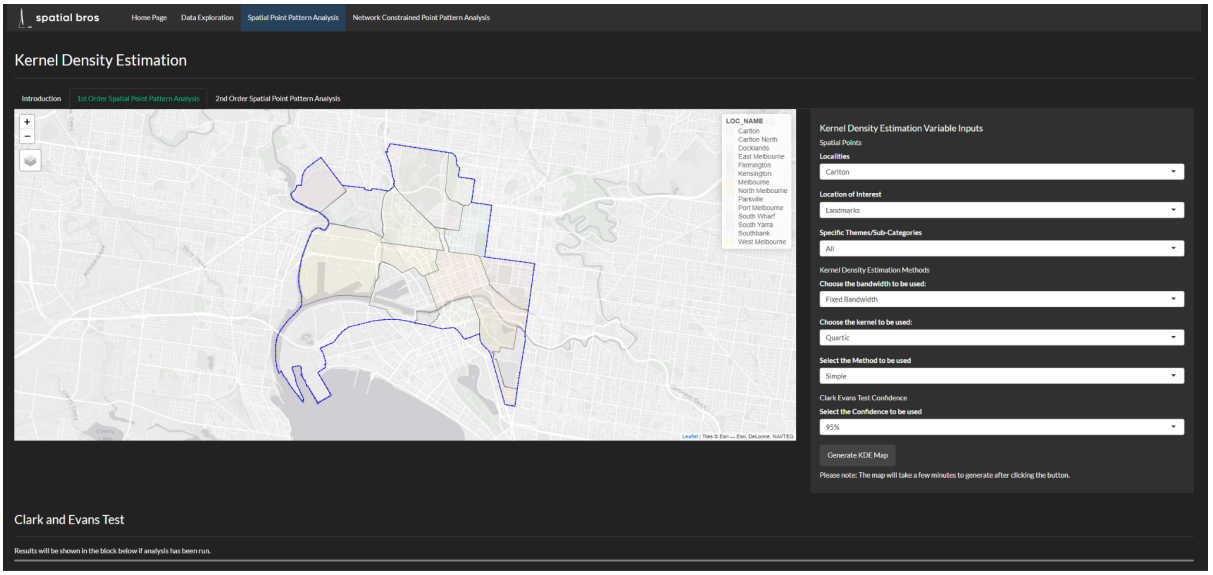
3.1 Introduction



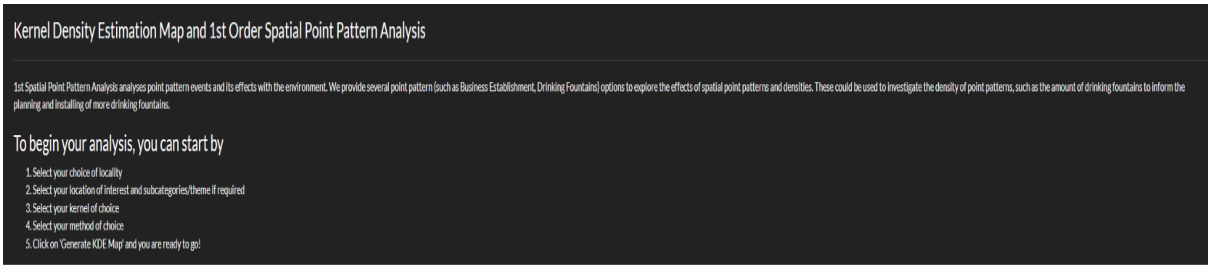
1st/2nd Order Spatial Point Pattern Analysis Introduction

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.

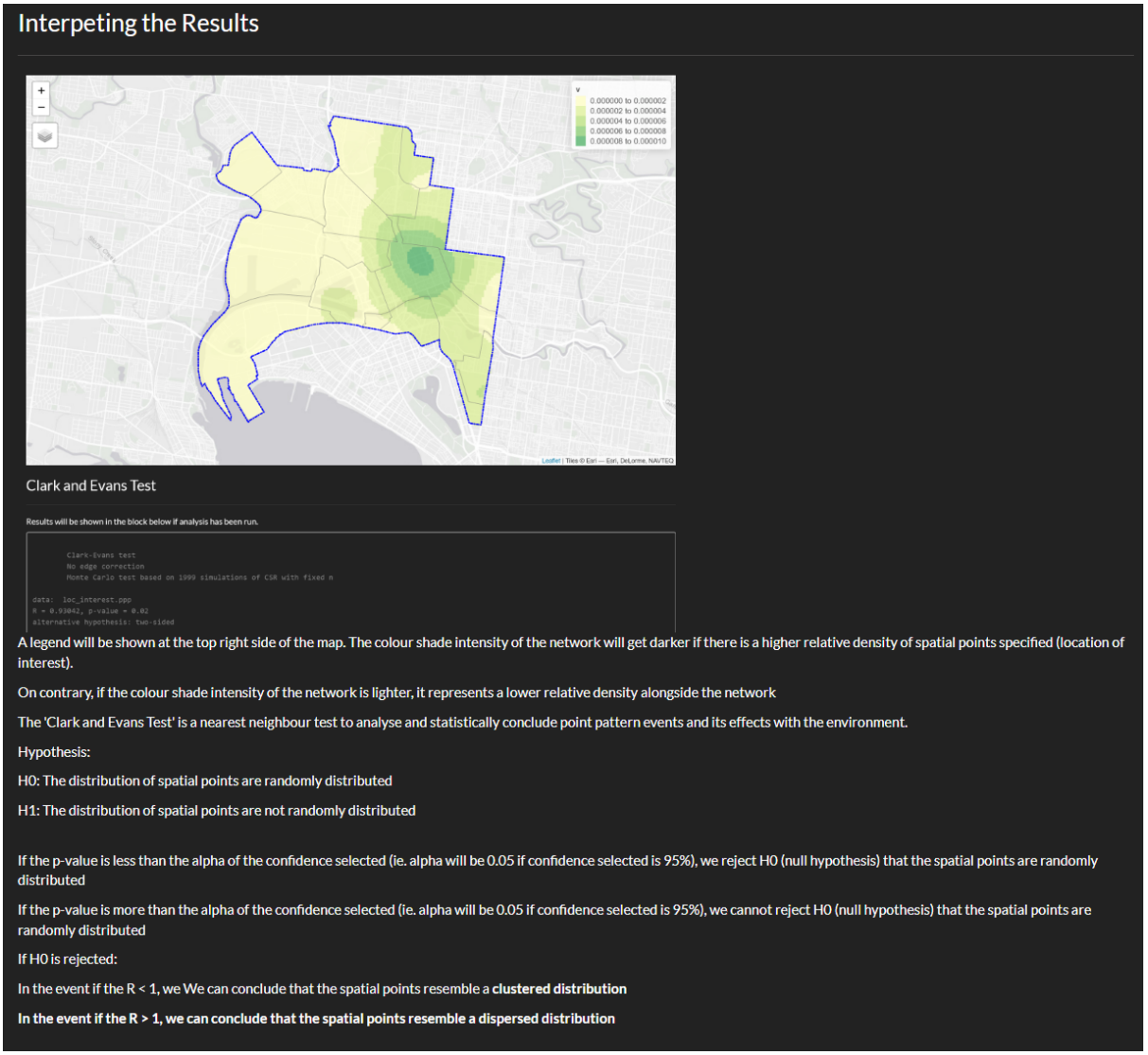
3.2 1st Order Spatial Point Pattern Analysis



1st Order Spatial Point Pattern Analysis Main Panel

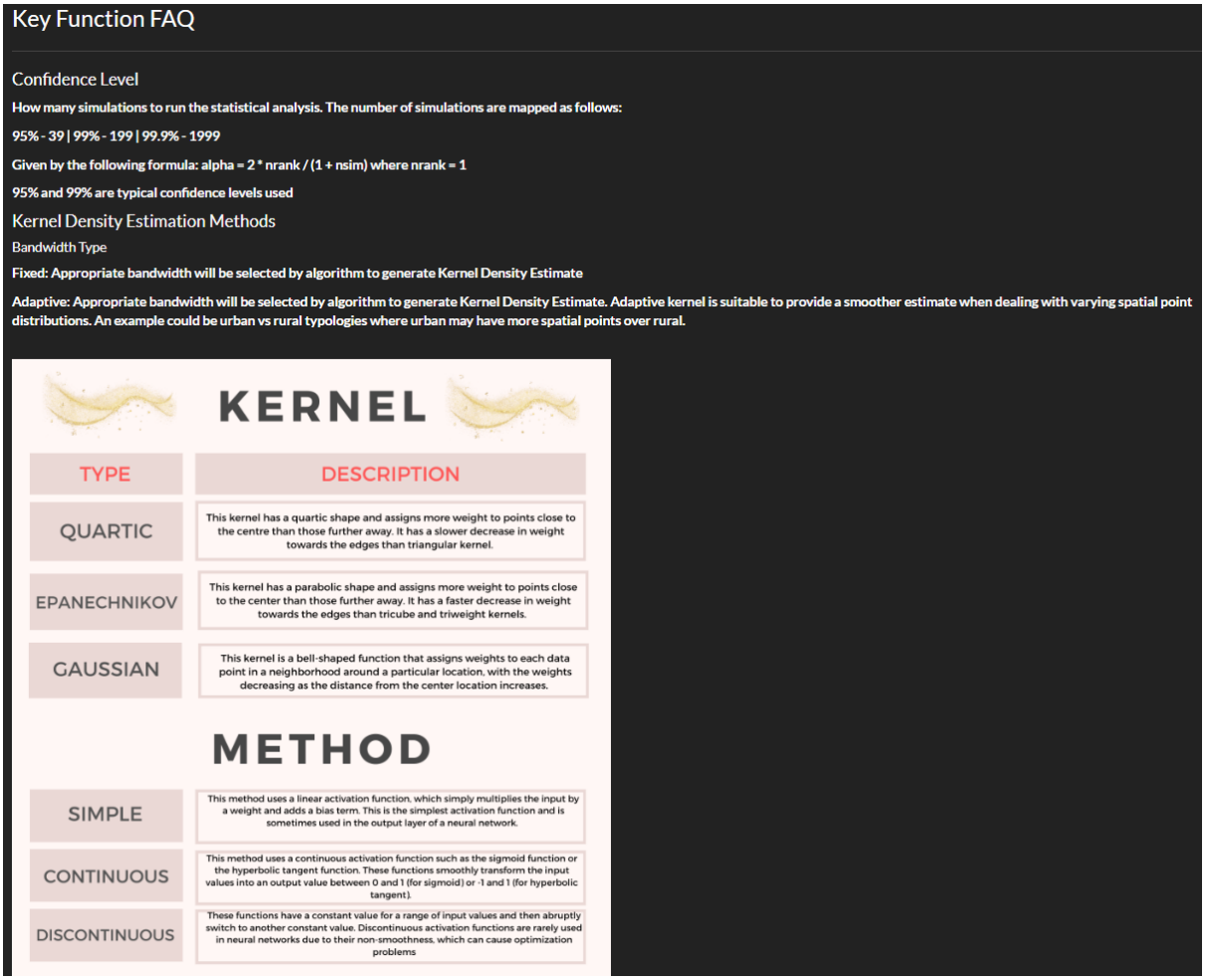


Kernel Density Estimation explanation and 1st Order Spatial Point Pattern Analysis instructions



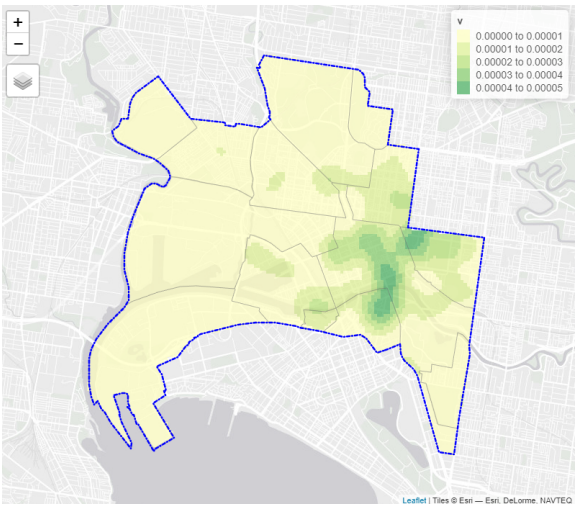
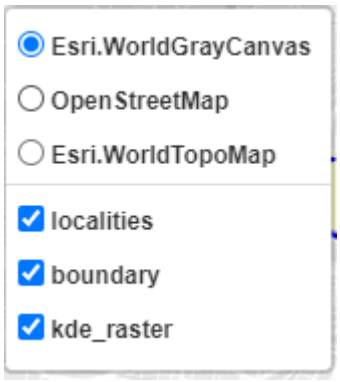
Interpretation of the results of 1st order spatial point analysis

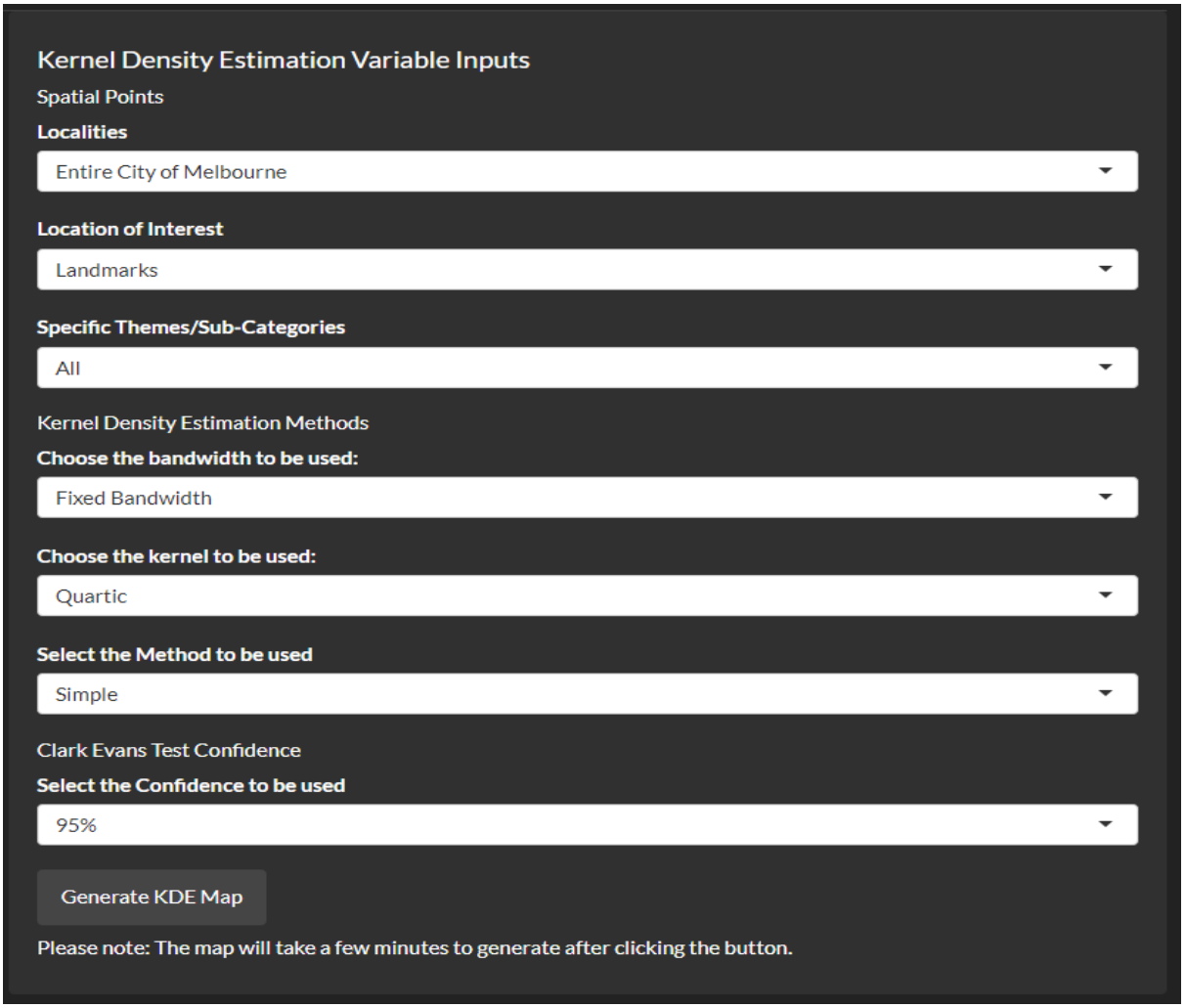
An example map will be shown on how to interpret the above results when you decide to try your own analysis. In addition, it further explains and concludes the hypothesis results based on H0, H1.



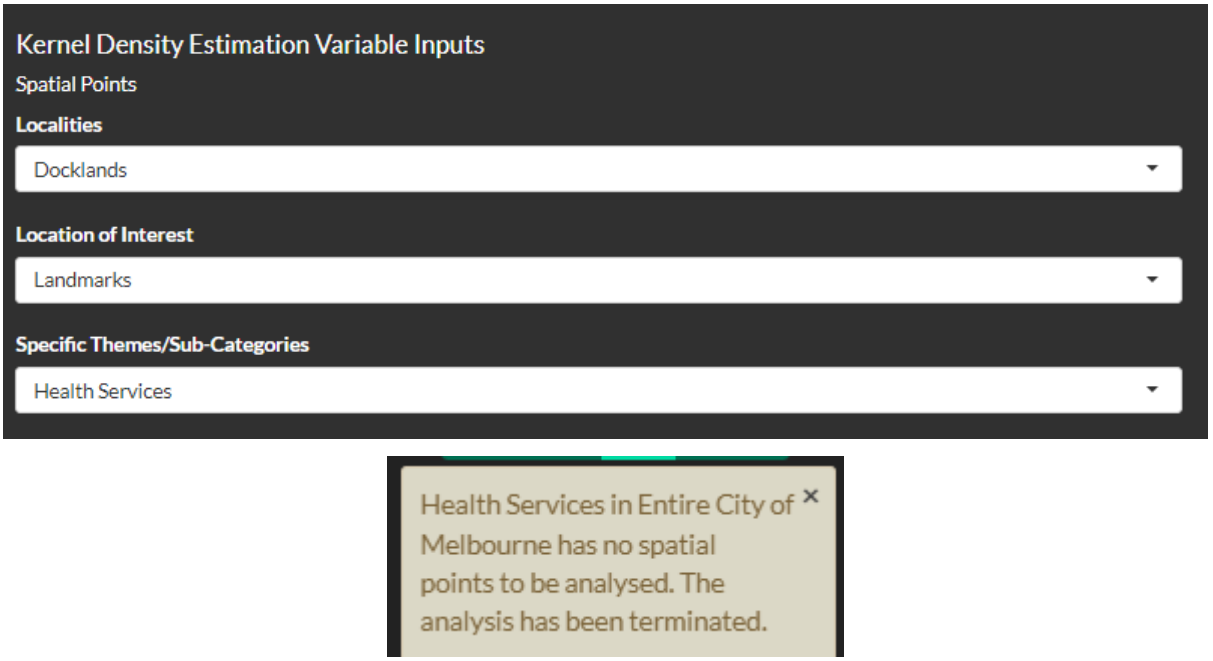
FAQ and explanation for Kernel Type and Method Type

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
 Map Visualization	This map is a visualisation of the 1st Order Spatial Point Pattern Analysis being generated. 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.
 Zoom Control	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.
  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 'kde_raster' which are the Melbourne's city boundary outline, the localities location of interest and lastly the intensity of the location of interest.

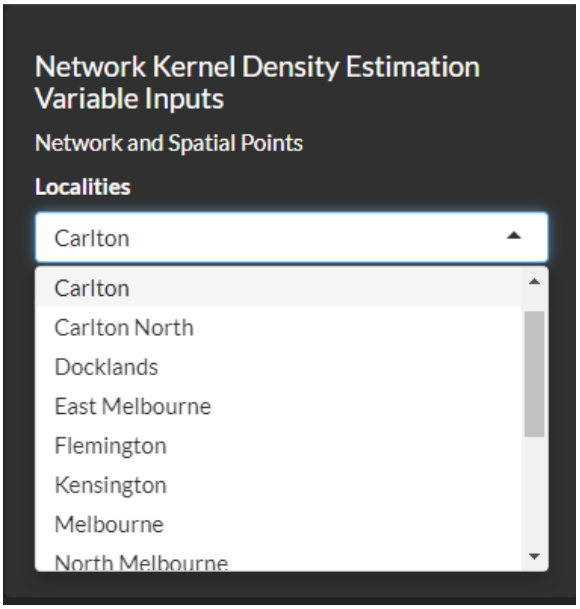
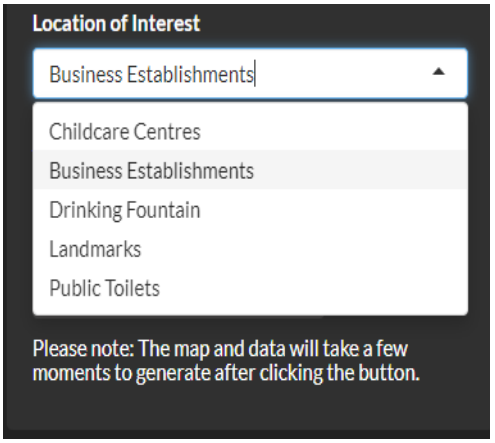


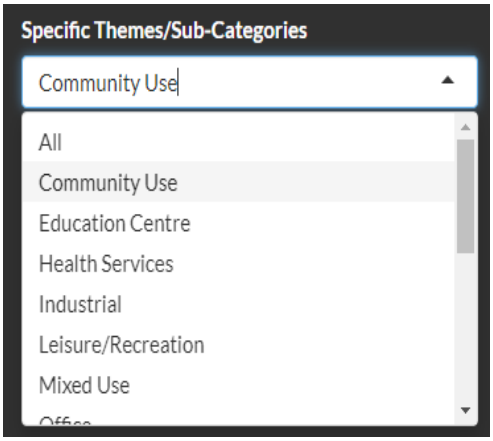
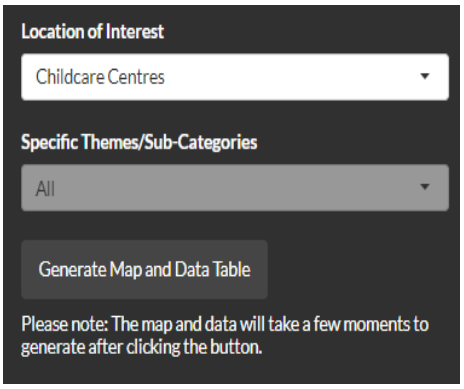
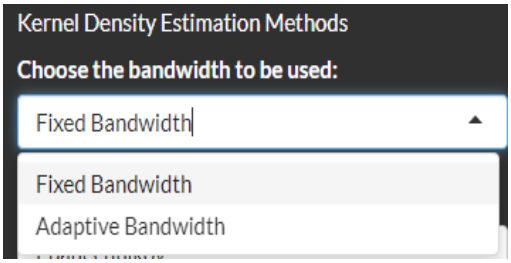
1st Order Spatial Point Pattern Analysis Side Panel

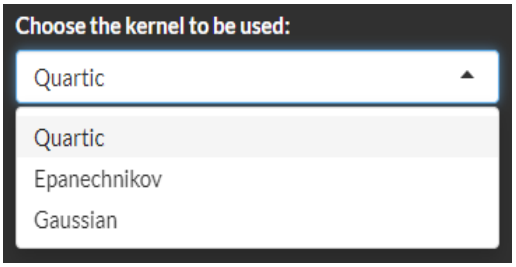
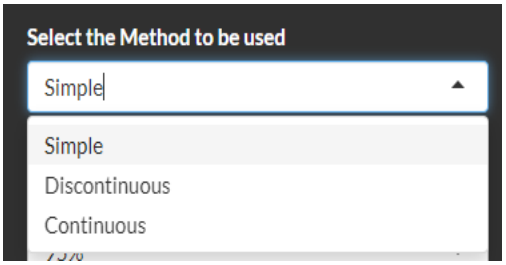
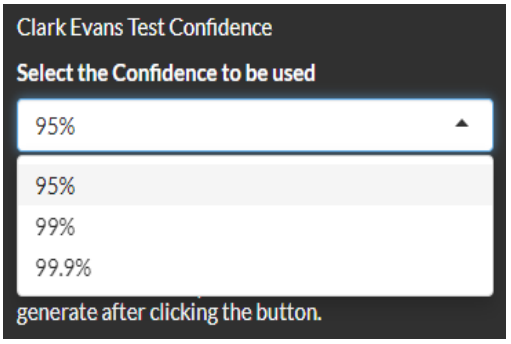
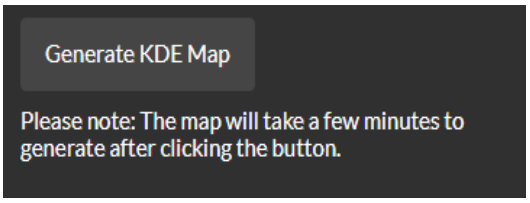


1st Order Spatial Point Pattern Analysis Data Inputs (Error)

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
 Localities inputs for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation	From this drop down list, you can select the localities variable to generate the data. 'Entire City of Melbourne' will be the default option. 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'.
 Location of Interest inputs for 1st Order Spatial Point Pattern Analysis 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'.

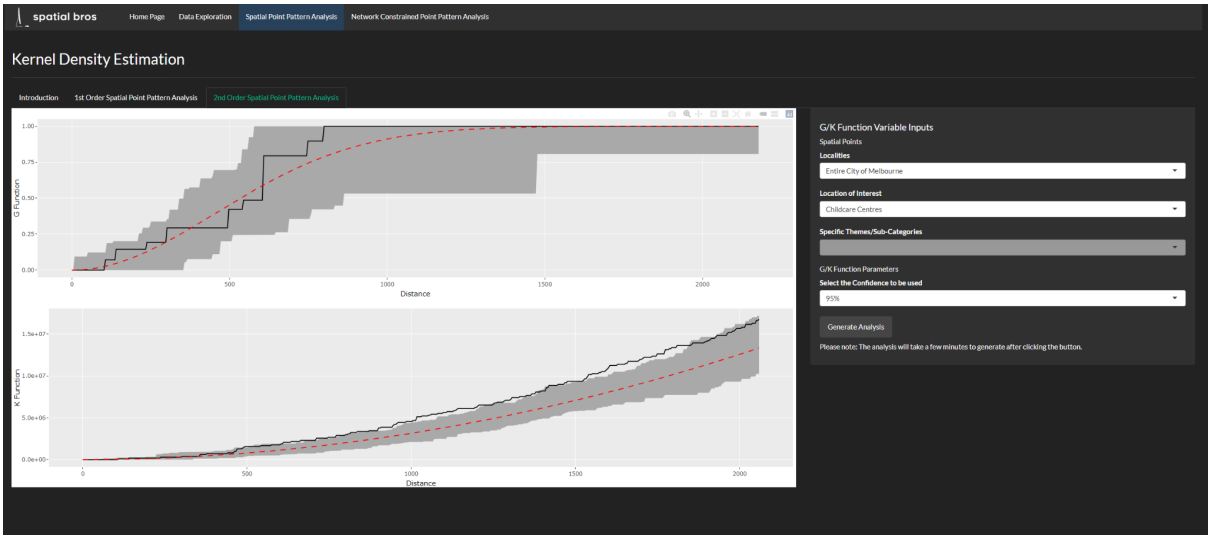
 Specific Themes/Sub-Categories inputs for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation	From this drop down list, you can select the Specific Themes/Sub-Categories variable to generate the data. 'All' will be the default option. Other options are 'Community Use', 'Education 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'
 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 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.
 Bandwidth method for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation	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'.

 Kernel method for 1st Order Spatial Point Pattern Analysis 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 'Epanechnikov' and 'Gaussian'
 Method to be used for 1st Order Spatial Point Pattern Analysis 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'.
 Clark Evans Test Confidence for 1st Order Spatial Point Pattern Analysis Network Kernel Density Estimation	From this drop down list, you can select the Clark Evans Test Confidence variable interval to generate the data. '95%' will be the default option. The other options are '99%' and '99.9%'.
 Generate KDE Map Button	After selecting the above variable inputs, do remember to click on this 'Generate KDE Map' button to generate the data.

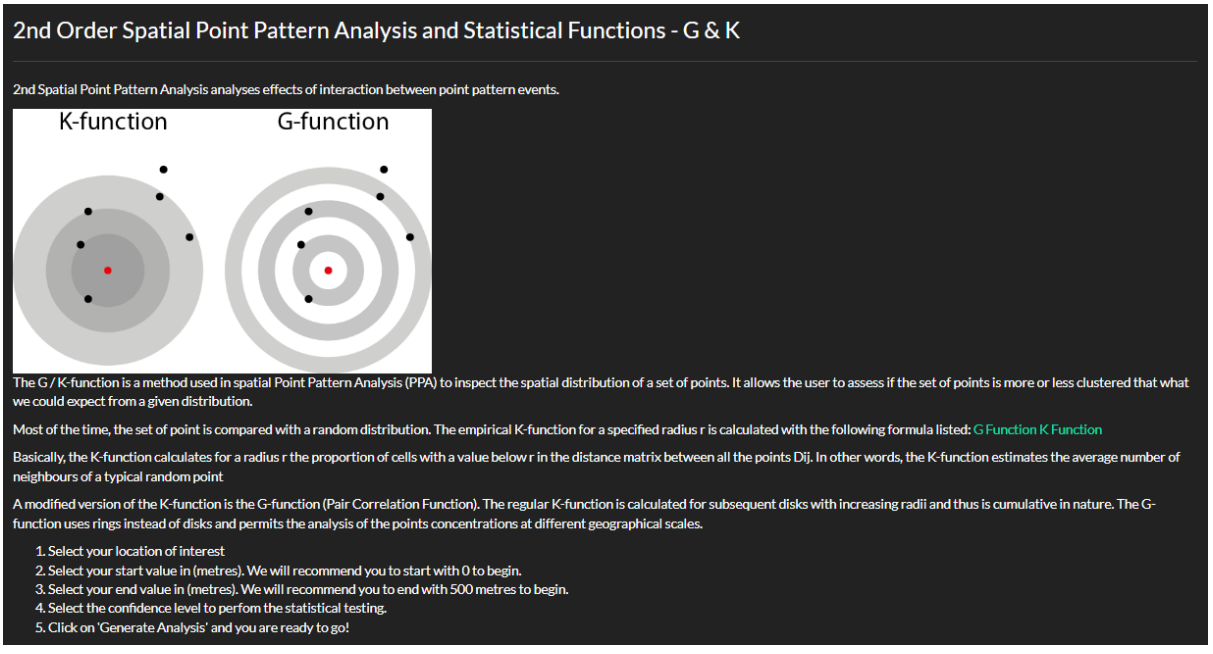
Clark and Evans Test Results

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

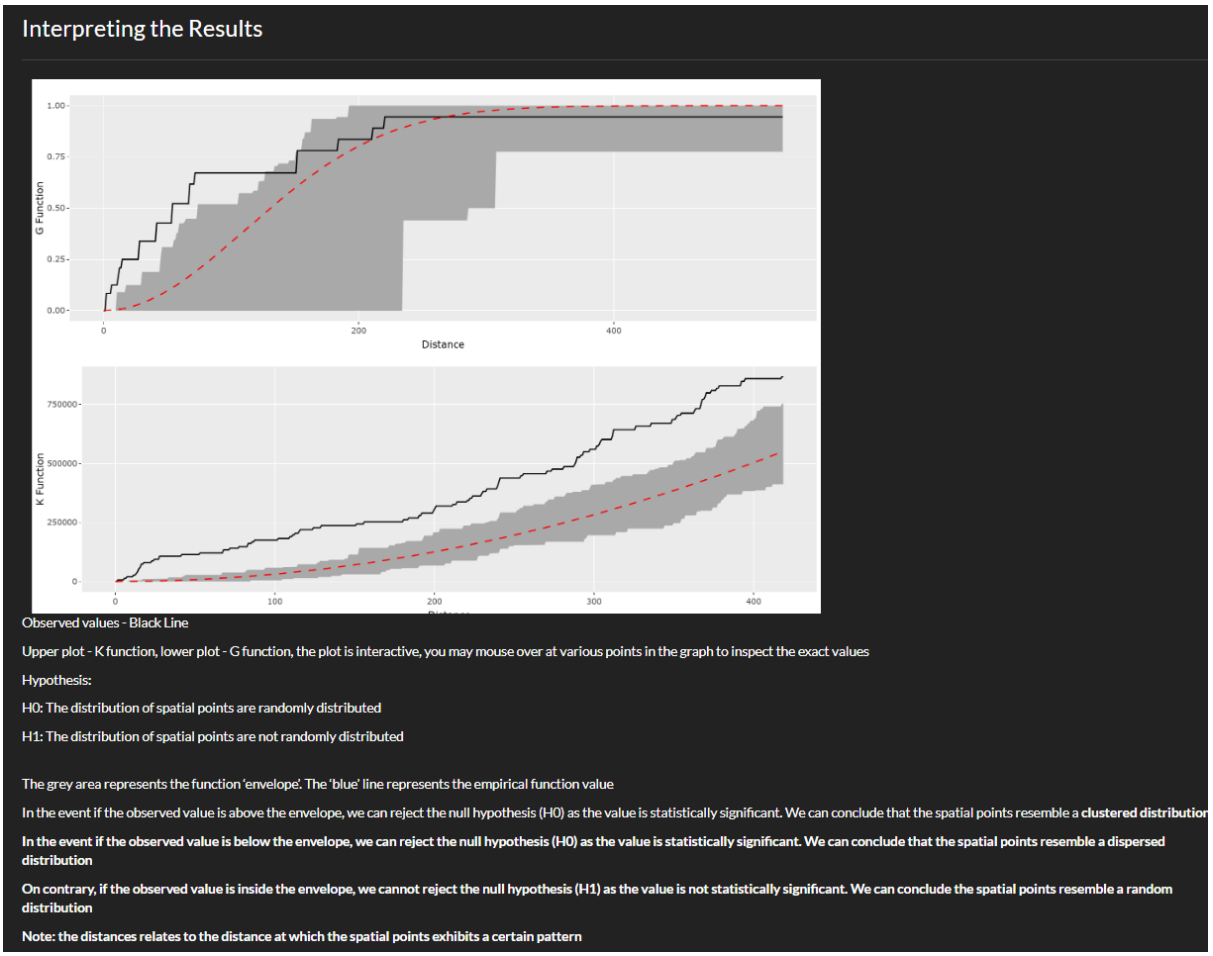


2nd Order Spatial Point Pattern Analysis Main Panel



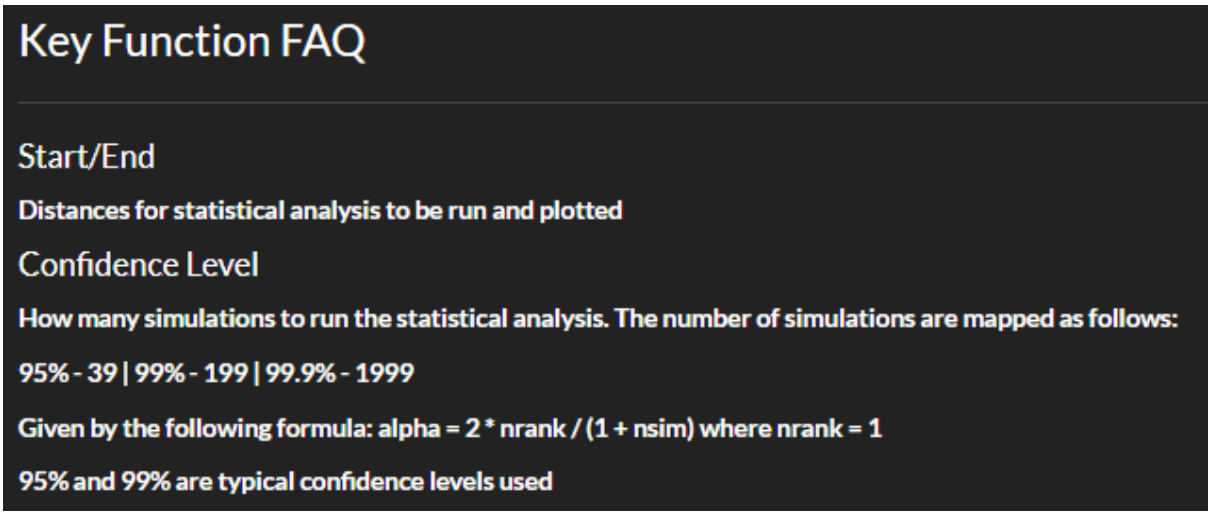
2nd Order Spatial Point Pattern Instructions and Explanations

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.



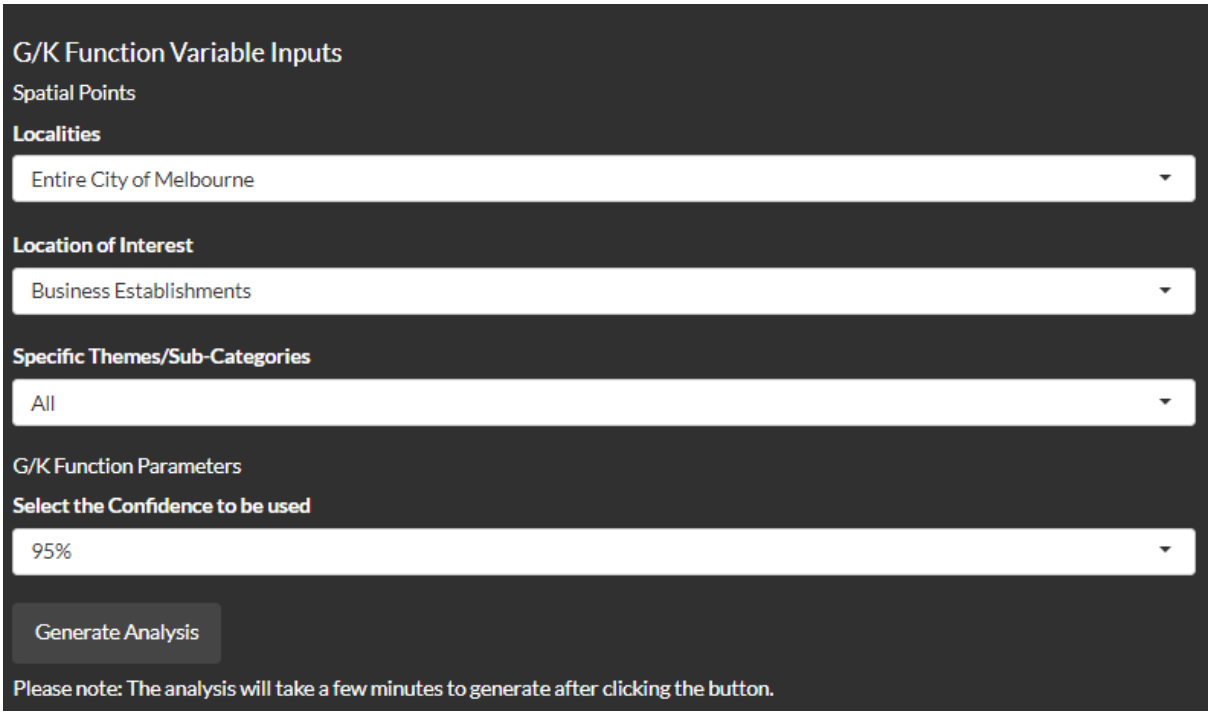
Interpretation of the results of 2nd order spatial point analysis

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.

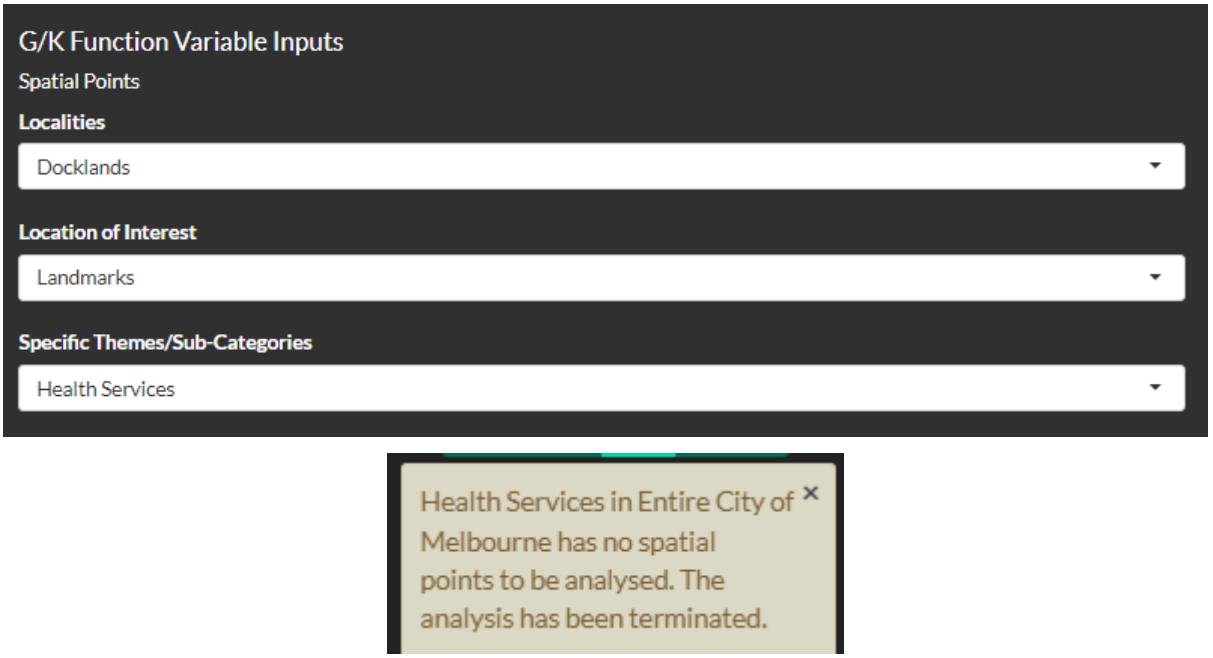


Key Function FAQ

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

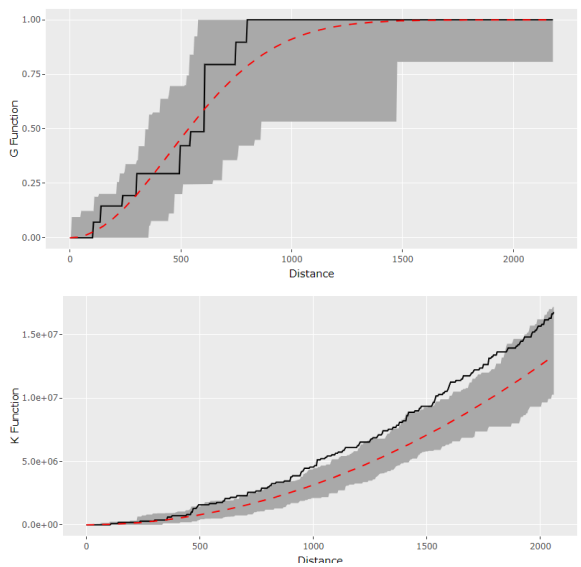
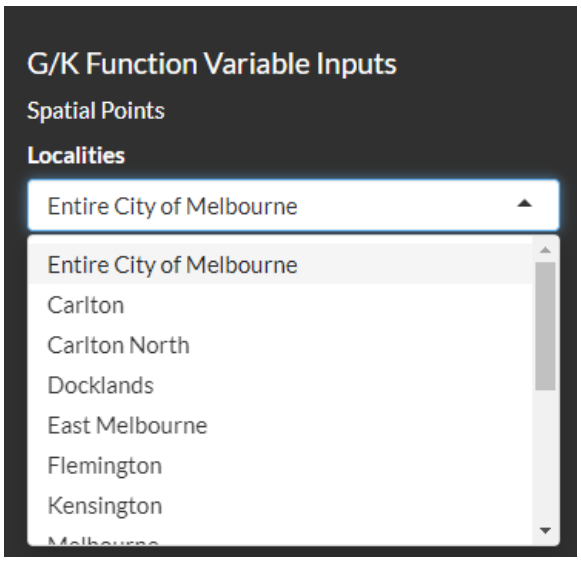


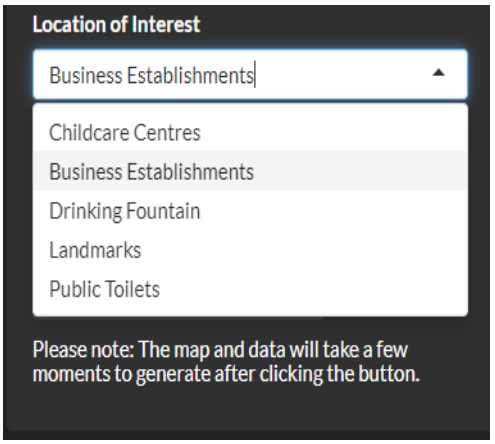
2nd Order Spatial Point Pattern Analysis Side Panel

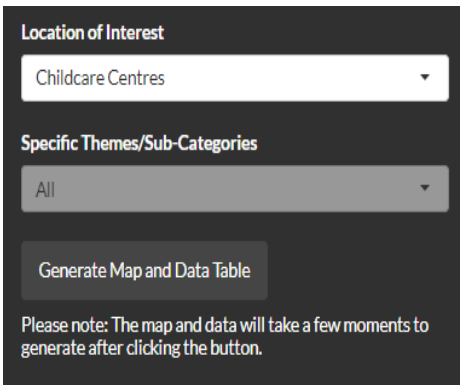


2nd Order Spatial Point Pattern Analysis Data Inputs (Error)

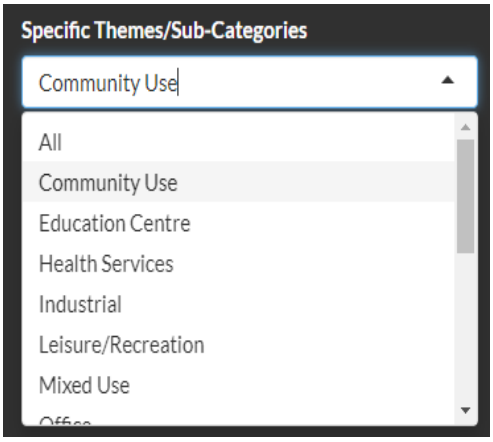
Please do take note that some localities together with the location of interest and specific themes/sub-categories to be analysed do not have relevant data to be generated. Therefore an error message will be prompted to terminate the analysis.

Feature	Functionality
 G&K Function graph visualisation	This is the G&K Function graph visualisation of the 2nd Order Spatial Point Pattern Analysis being generated.
 Localities inputs for 2nd Order Spatial Point Pattern Analysis for G&K Function graph visualisation	From this drop down list, you can select the localities variable to generate the data. 'Entire City of Melbourne' will be the default option. 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'.
	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'.

<table>
<tr>
<td> 

Location of Interest inputs for 2nd Order Spatial Point Pattern Analysis for G&K Function graph visualisation</td>
<td></td>
</tr>
<tr>
<td> 

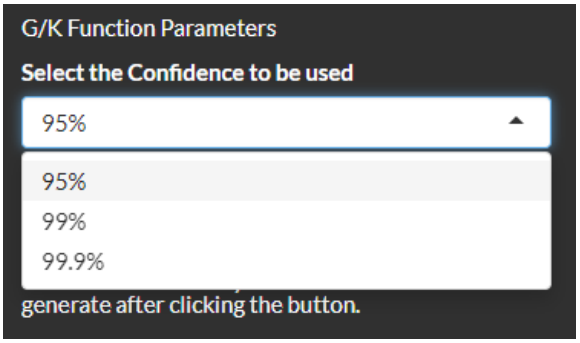
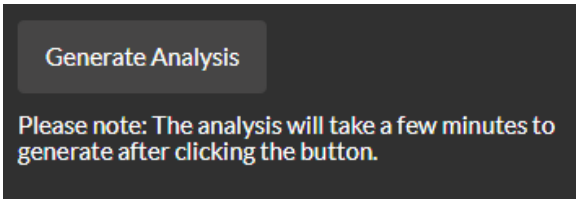
Specific Theme/Sub-categories</td>
<td>Please take note by selecting ‘Business Establishments’ or ‘Landmarks’, you have the option of selecting specific themes/sub-categories. Other locations of interest such as
7. Childcare Centres
8. Public Toilets
9. Drinking Fountains

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.</td>
</tr>
<tr>
<td> 

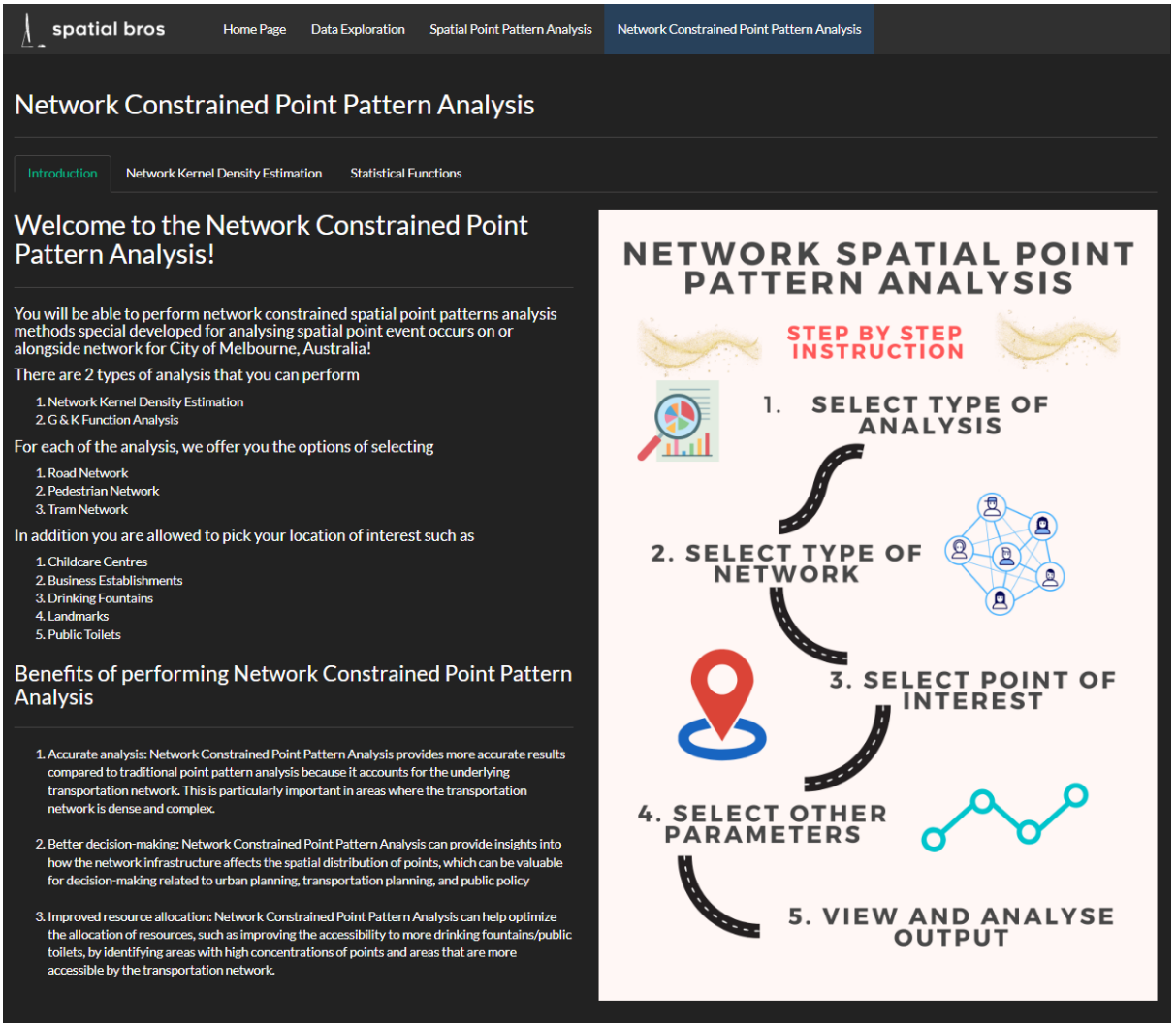
Specific Themes/Sub-Categories inputs for 2nd Order Spatial Point Pattern Analysis for G&K Function graph visualisation</td>
<td>From this drop down list, you can select the Specific Themes/Sub-Categories variable to generate the data.

‘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’</td>
</tr>
</table>

 G&K Function parameters 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%'.
 Generate Analysis Button for 2nd Order Spatial Point Pattern Analysis graph visualisation	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



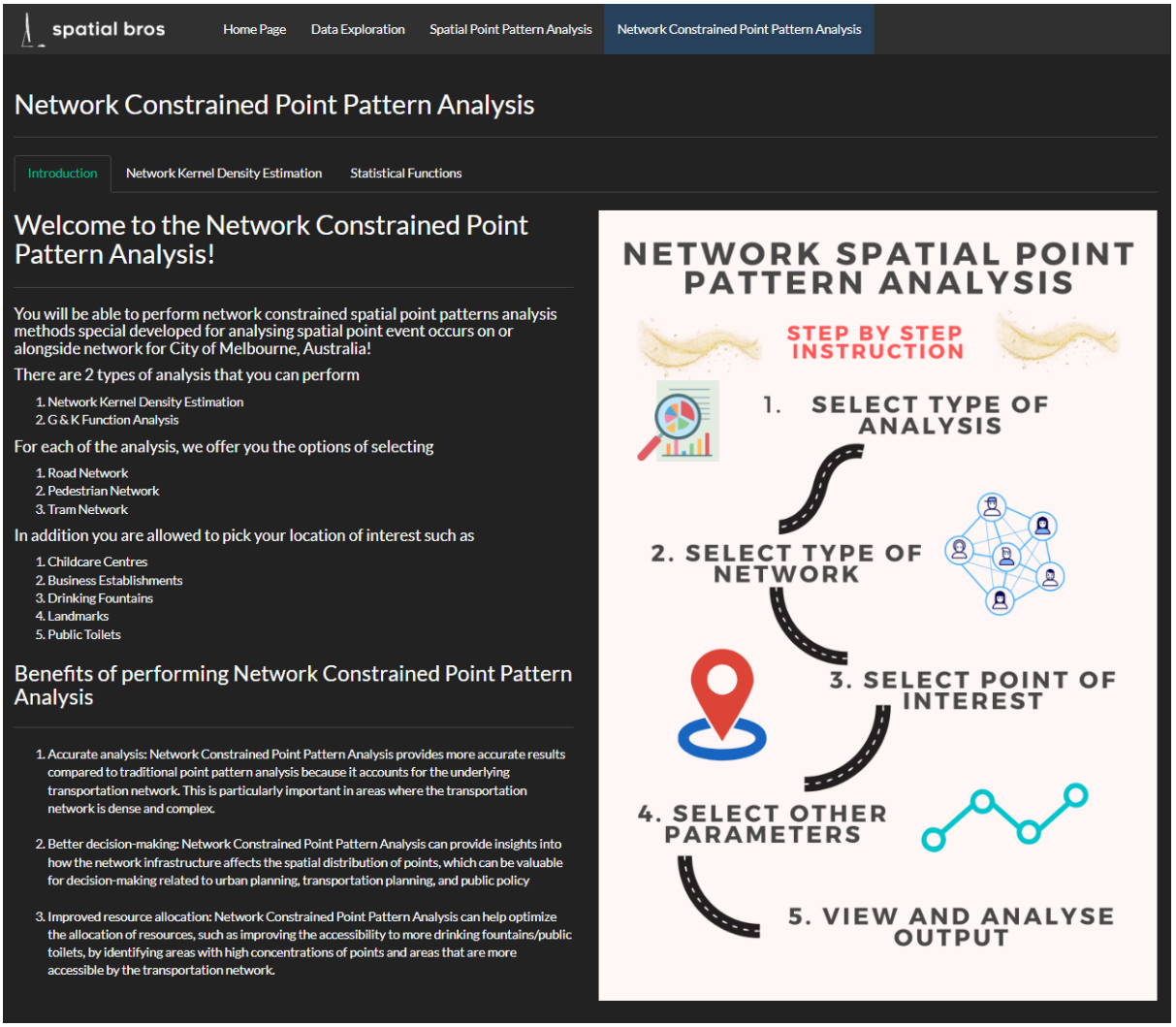
The Network Constrained Point Pattern Analysis is the fourth page that you will be able to access in our application.

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

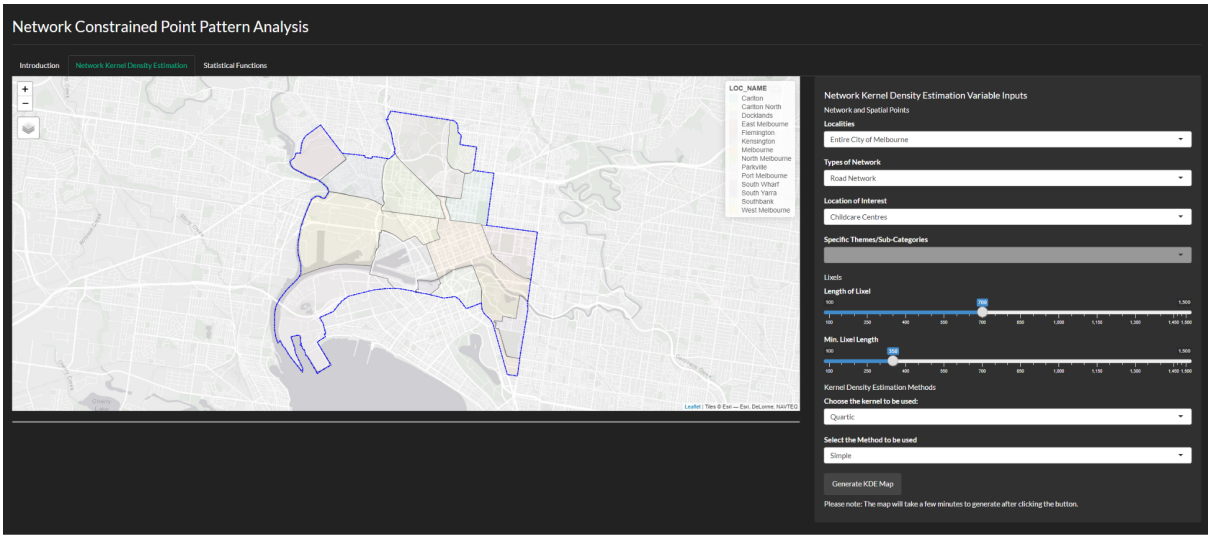
The layout of the Network Kernel Density Estimation and Statistical Function tab is similar in nature, with the main visualisation map being on the left and a side panel on the right for the selection of inputs.

4.1 Introduction

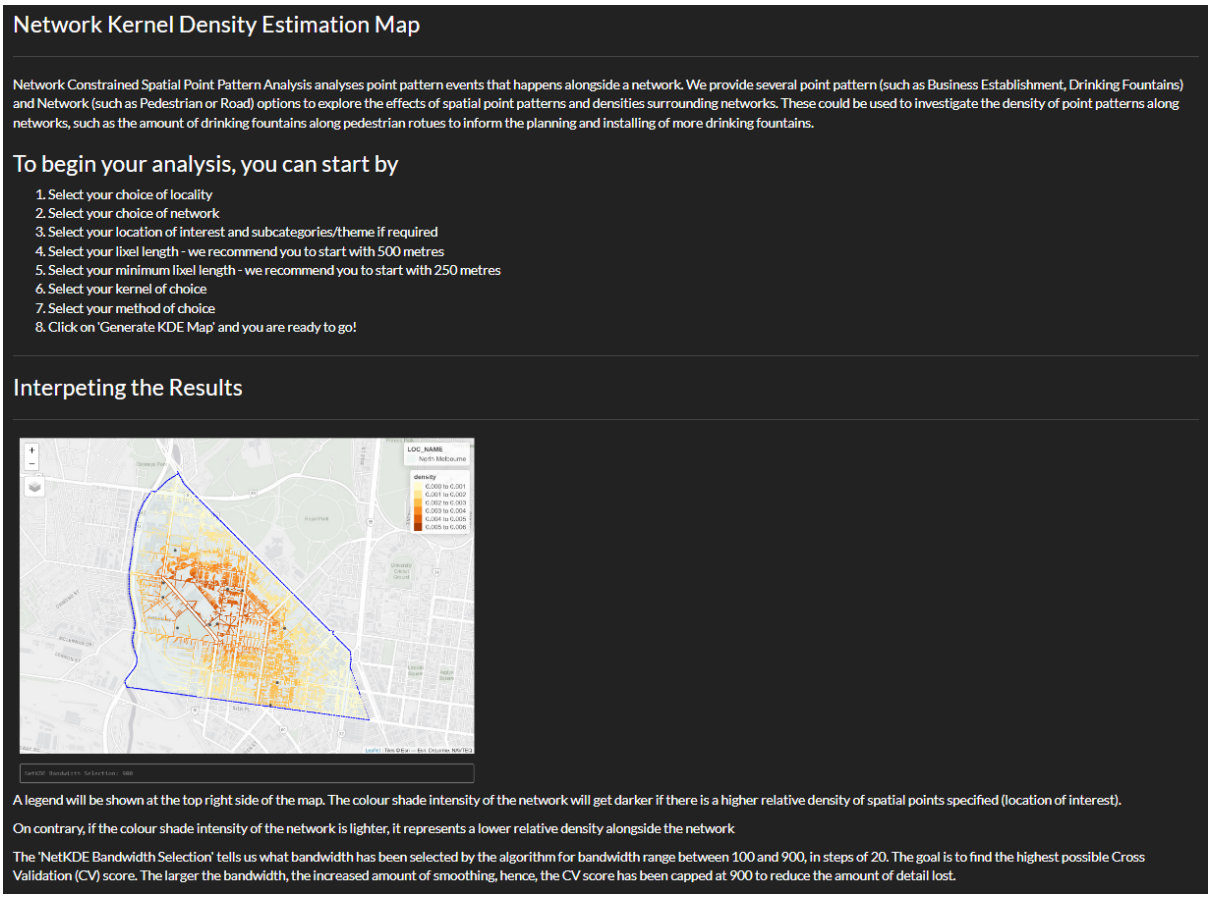


This is the introduction page where you will learn about the types of analysis you are able to perform and also the benefits.

4.2 Network Kernel Density Estimation

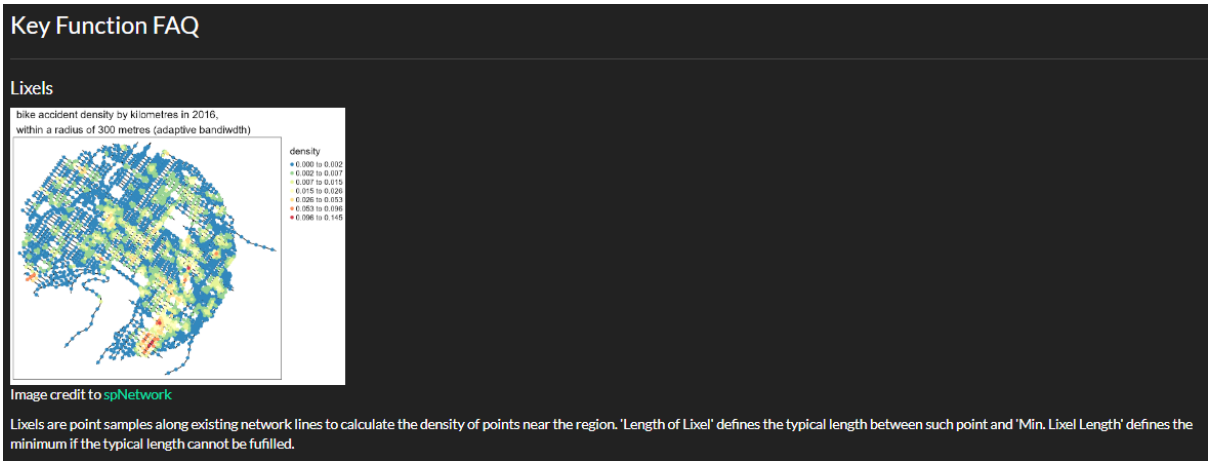


Network Kernel Density Estimation main panel



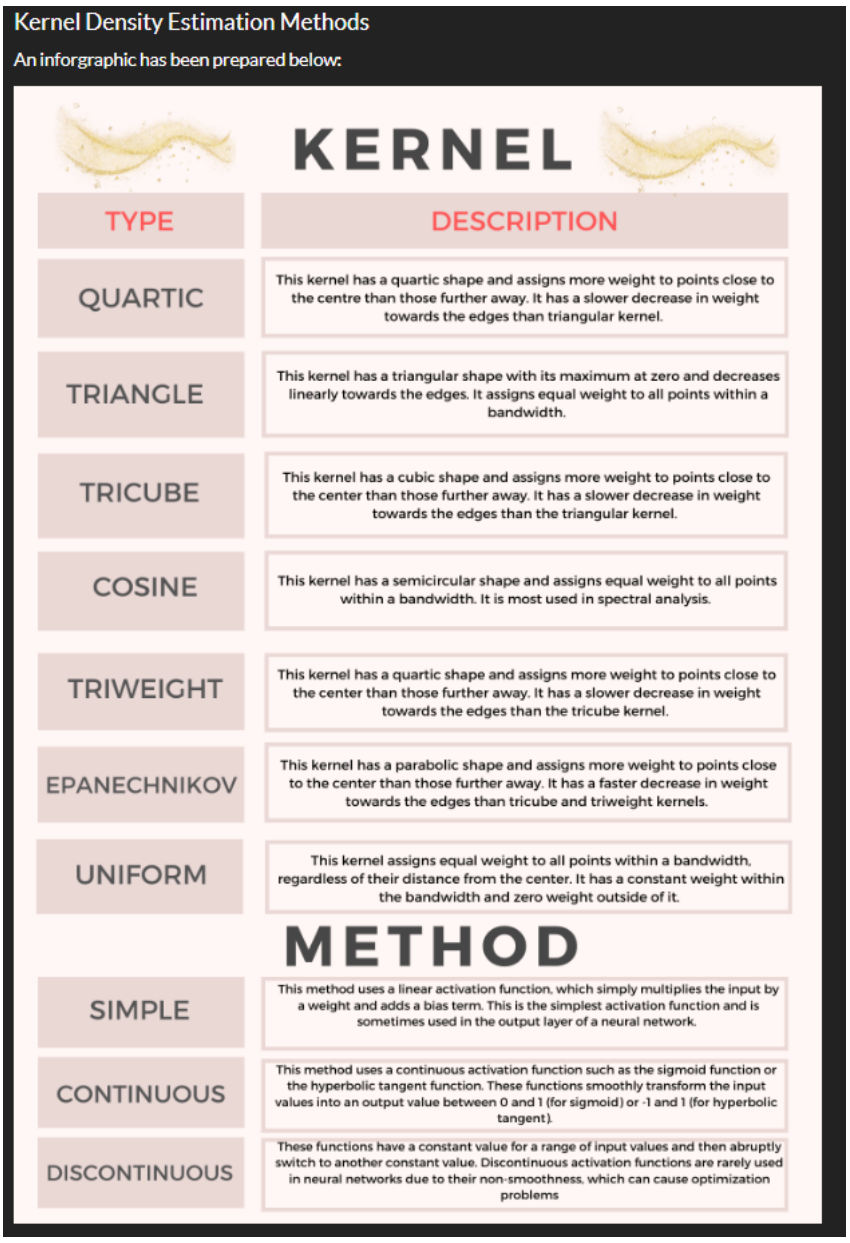
Network Kernel Density Estimation main panel (instructions and interpreting result)

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



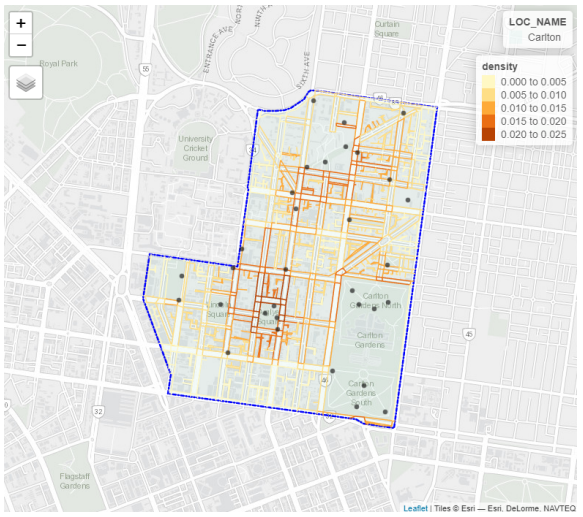
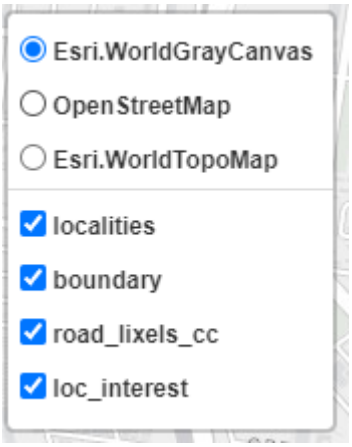
Key Function FAQ

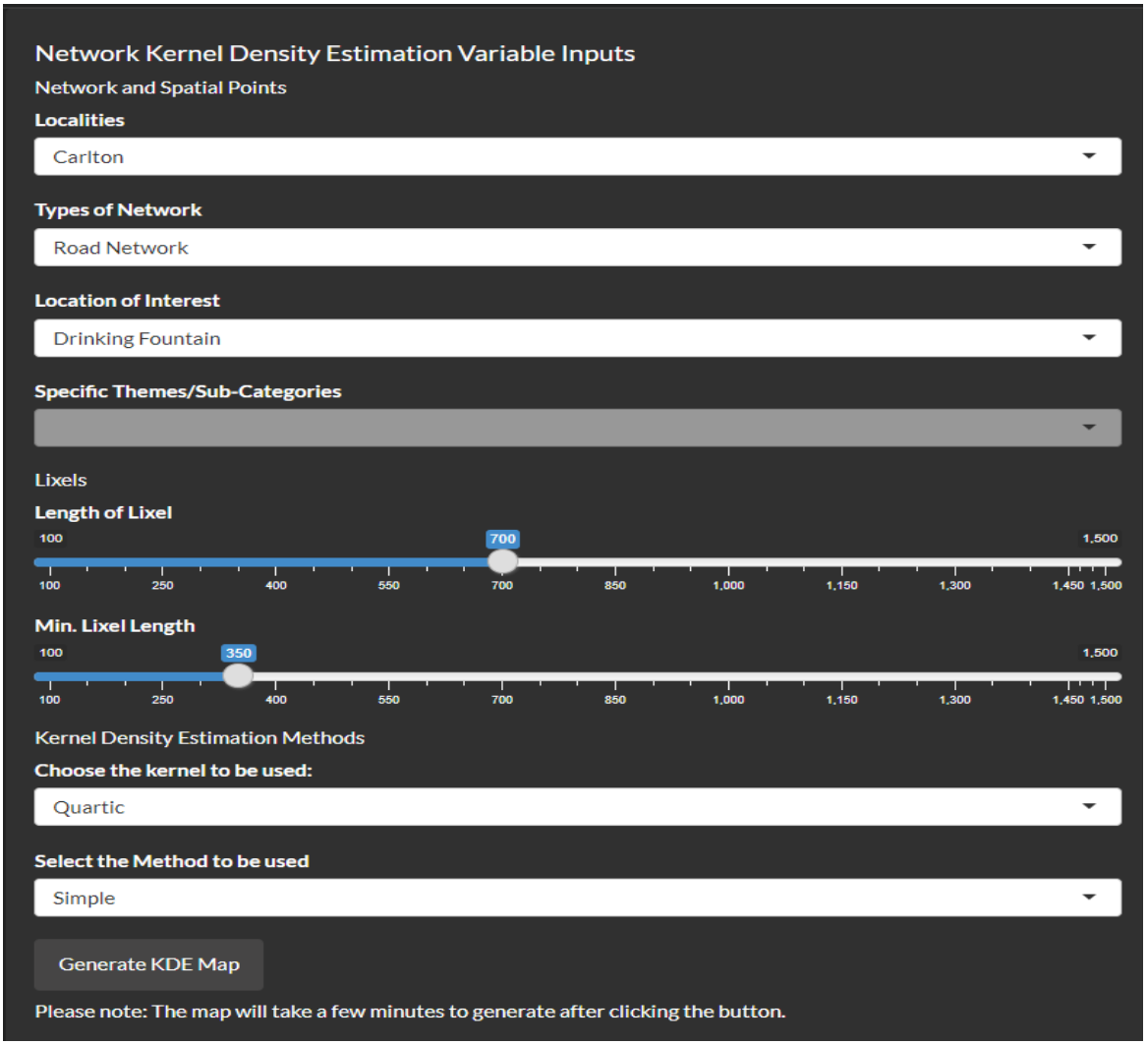
This section describes and addresses the frequently asked question with regards to lixels.



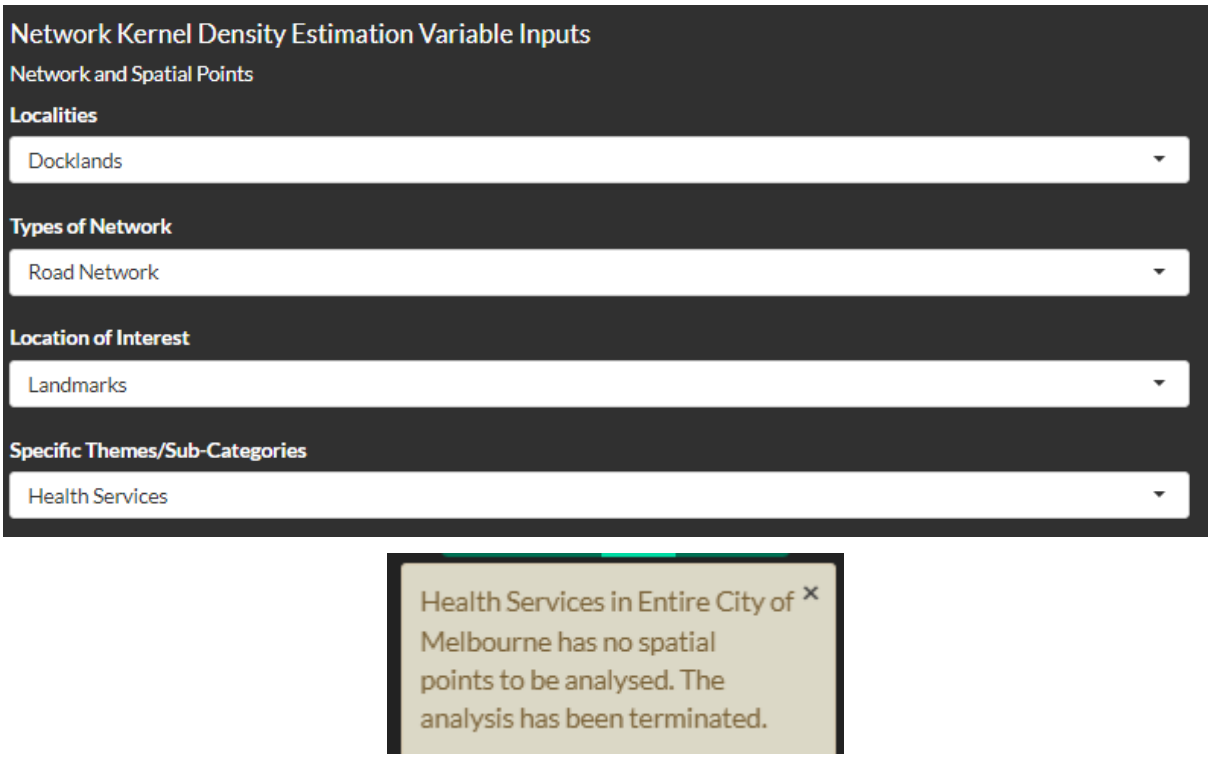
Explanation for Kernel Type and Method Type

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

Feature	Functionality
 Network Kernel Density Estimation Map Visualisation	This map is a visualisation of the Network Kernel Density Estimation Map Visualisation 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. The density legend represents the intensity of network outlines of the spatial points
 Zoom Control	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.
  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','road_lixels_cc' and 'loc_interest' which are the Melbourne's city boundary outline, network type and location of interests.

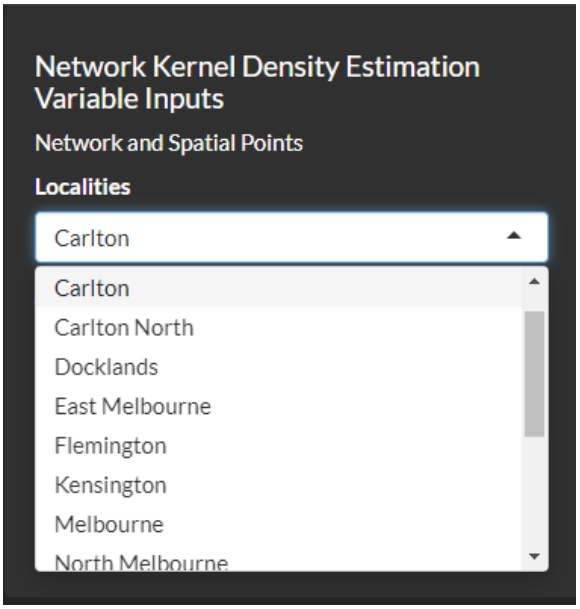
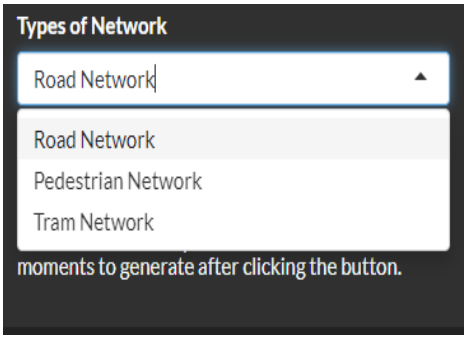


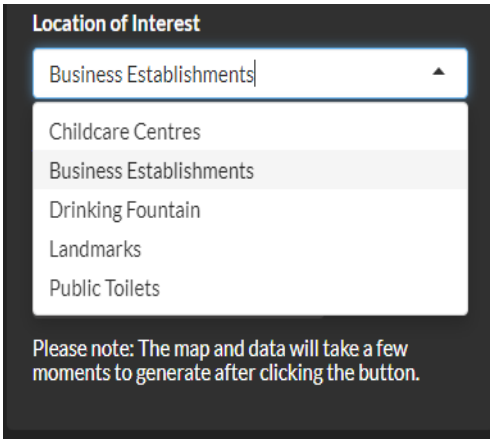
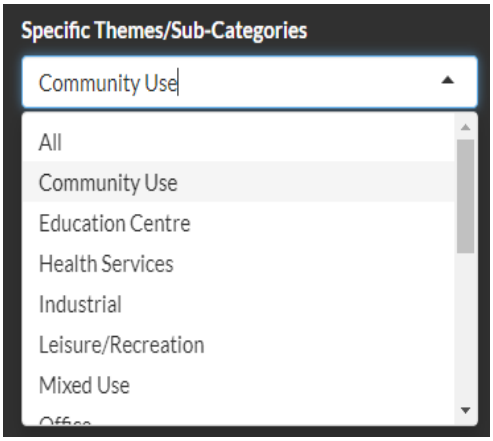
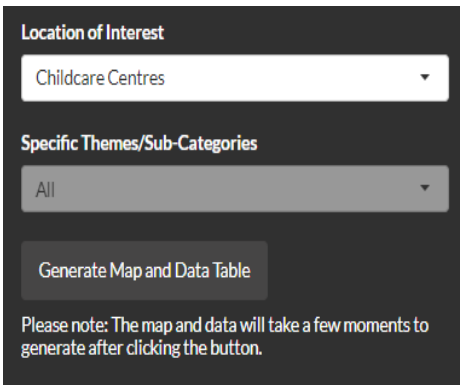
Network Kernel Density Estimation Side Panel

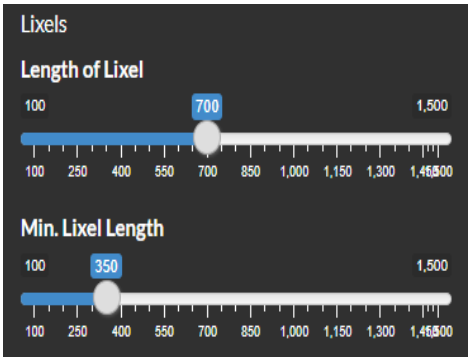
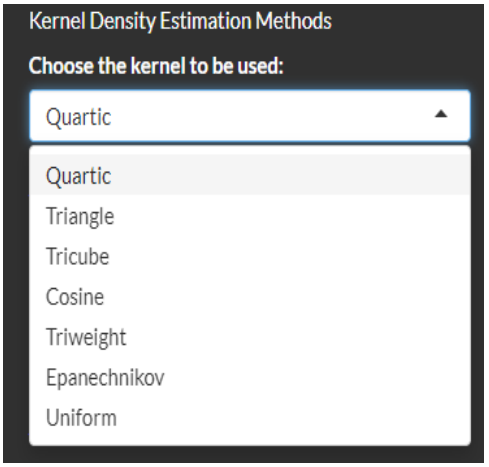
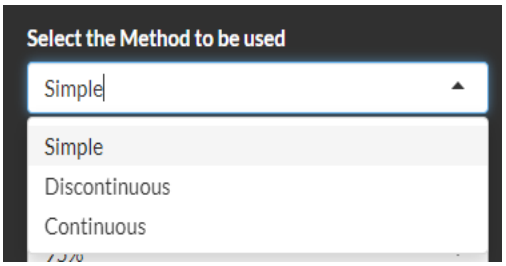
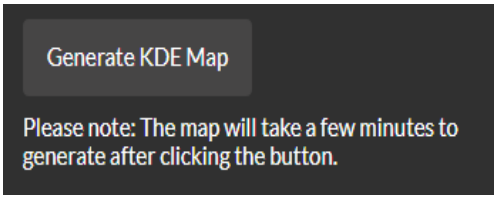


Network Kernel Density Estimation Analysis Data Inputs (Error)

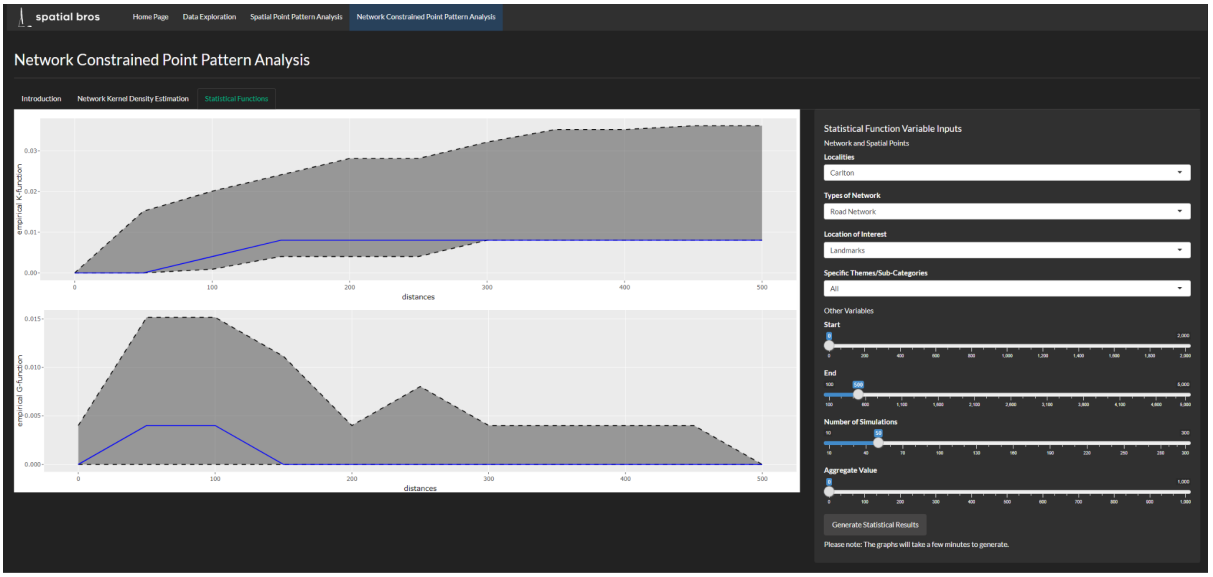
Please do take note that some localities together with the location of interest and specific themes/sub-categories to be analysed do not have relevant data to be generated. Therefore an error message will be prompted to terminate the analysis

Feature	Functionality
 Localities inputs for Network Kernel Density Estimation	From this drop down list, you can select the localities variable to generate the data. 'Entire City of Melbourne' will be the default option. 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'.
 Type of Network inputs for Network Kernel Density Estimation	From this drop down list, you can select the type of network variable to generate the data. 'Road Network' will be the default option. Other options are 'Pedestrian Network' and 'Tram Network'.

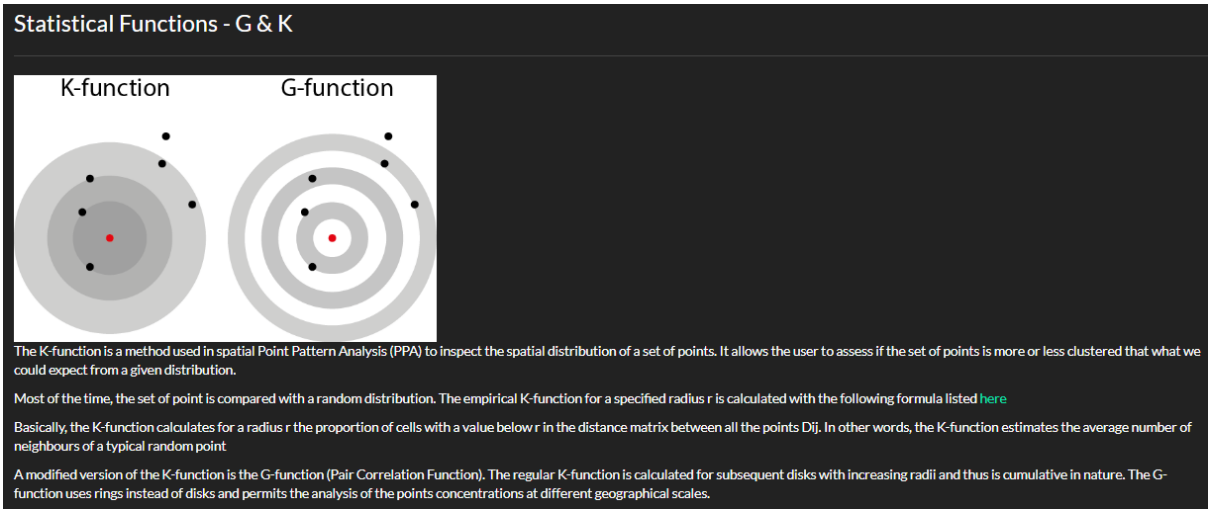
 Location of Interest inputs for Network Kernel Density Estimation	From this drop down list, you can select the location of interest variable to generate the data. 'Childcare Centres' will be the default option. Other options are 'Business Establishments', 'Drinking Fountain', 'Landmarks', and 'Public Toilets'.
 Specific Themes/Sub-Categories 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'
 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



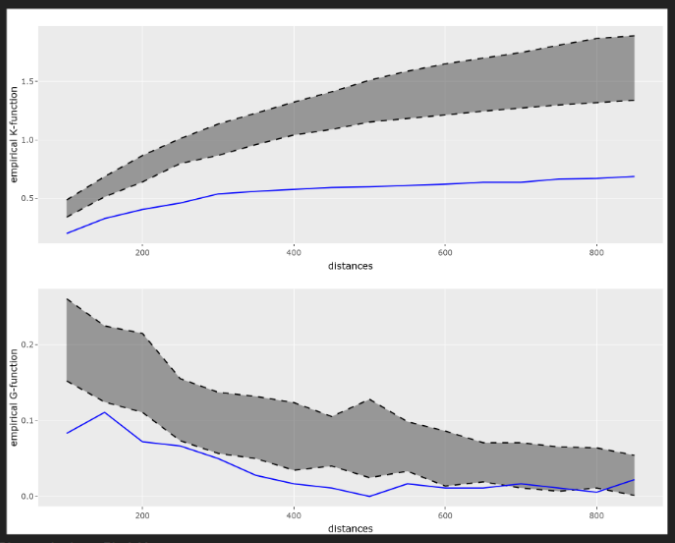
Statistical Function G & K Concept

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**

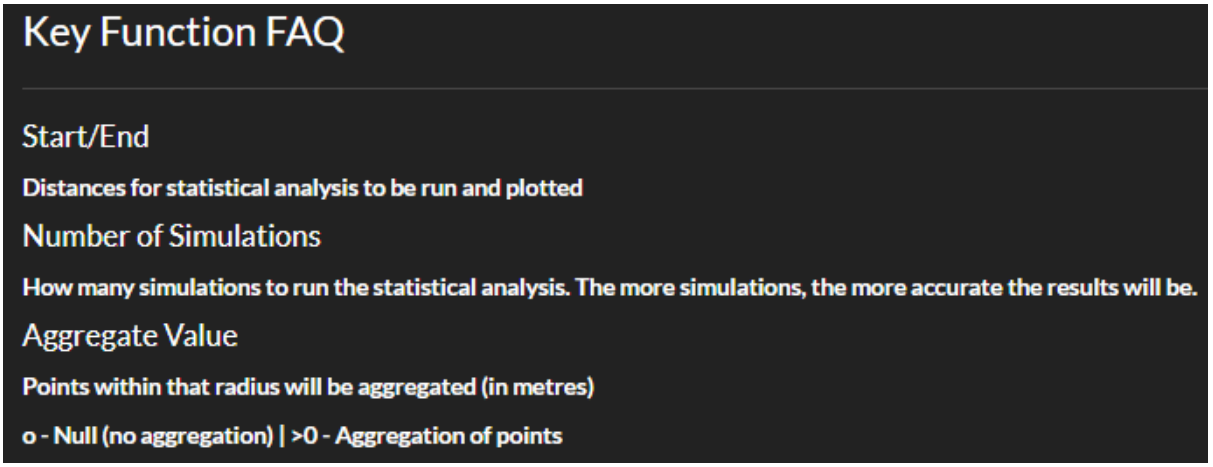
In the event if the observed value is below the envelope, we can reject the null hypothesis (H0) as the value is statistically significant. We can conclude that the spatial points resemble a dispersed distribution

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

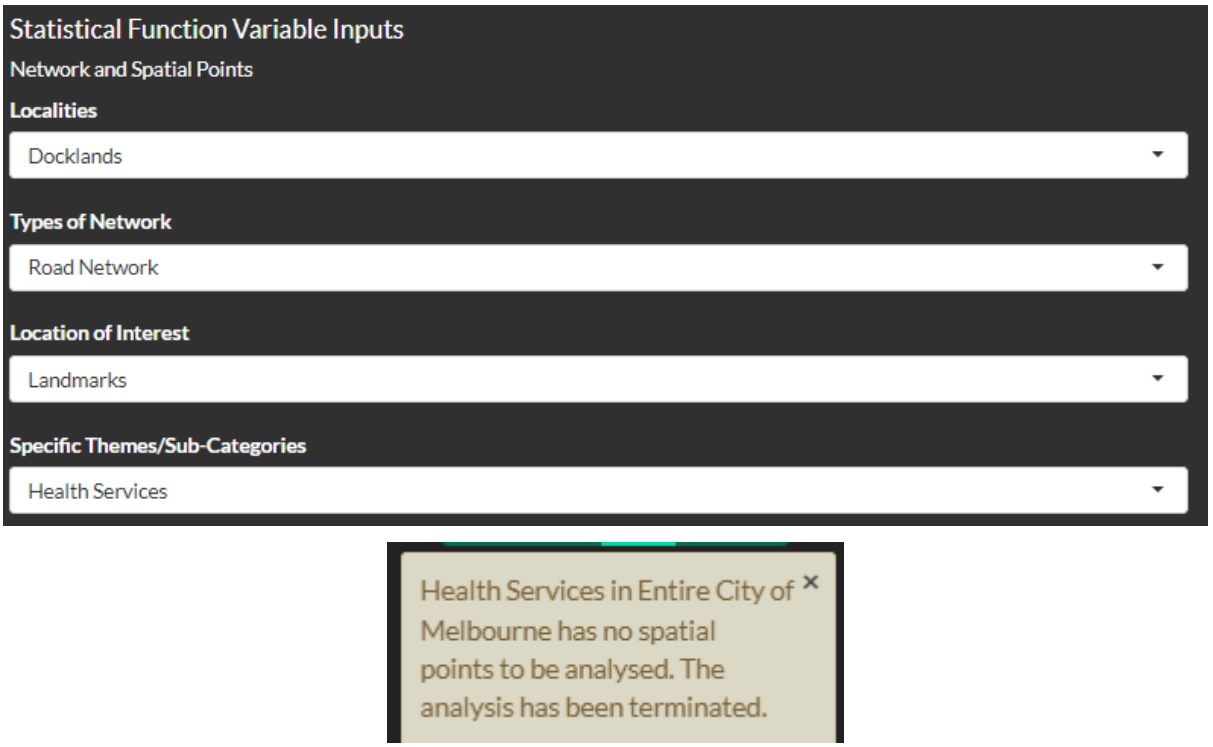
Statistical Function G & K
(Instructions & Interpreting Results)

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.



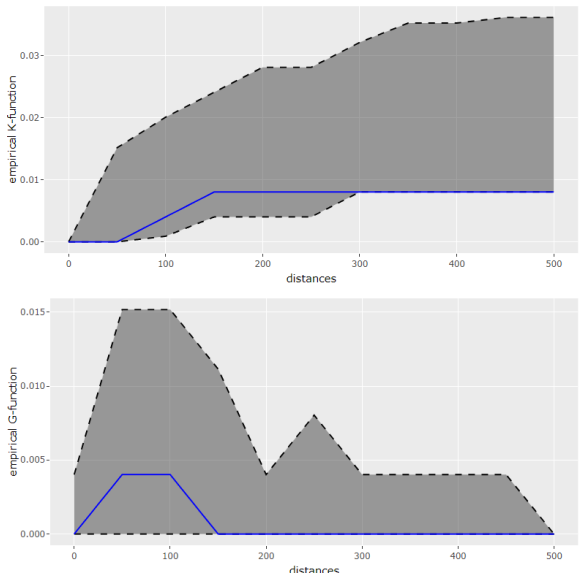
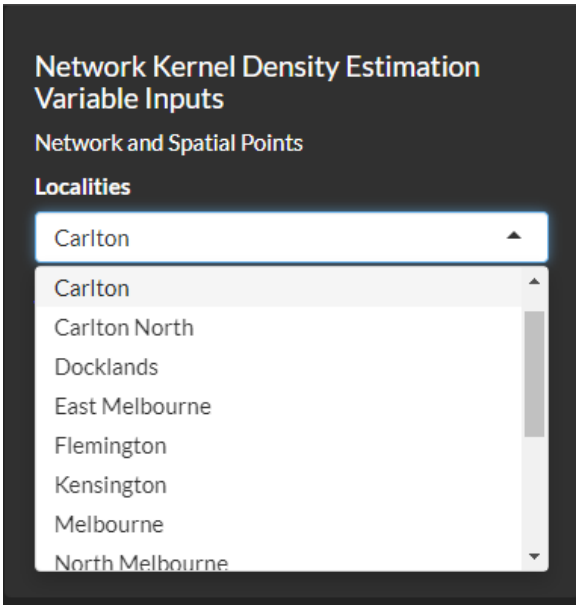
Key Function FAQ

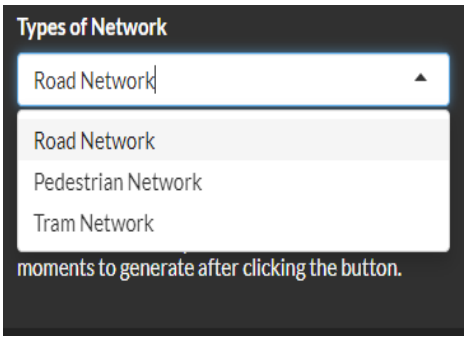
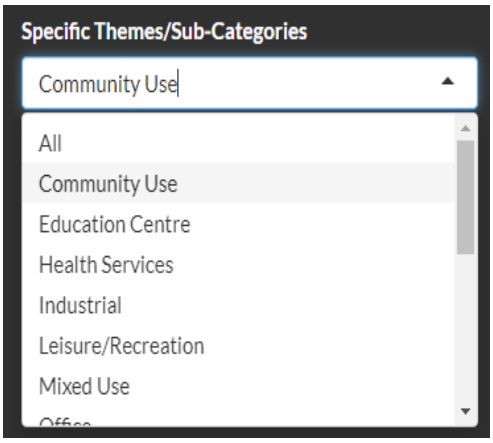
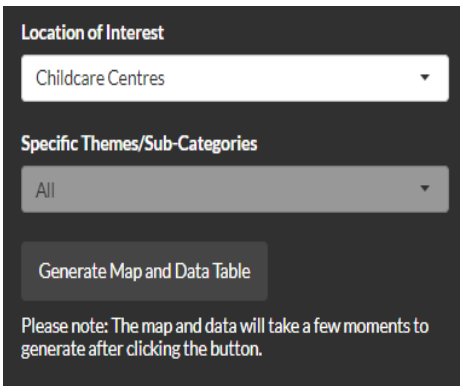
This section will explain to you some of the frequently asked questions and address your doubts regarding the network constrained point pattern G & K function analysis.

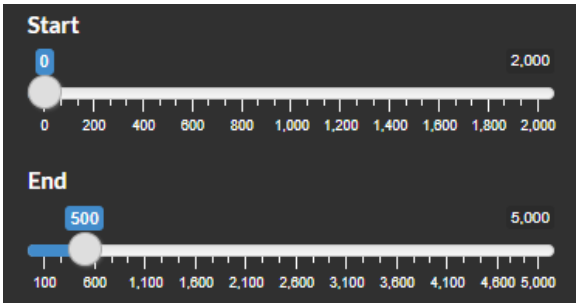
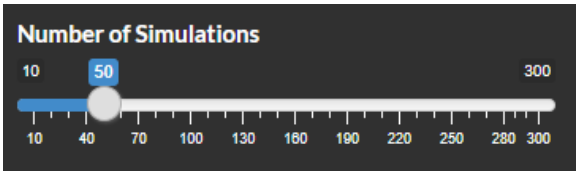
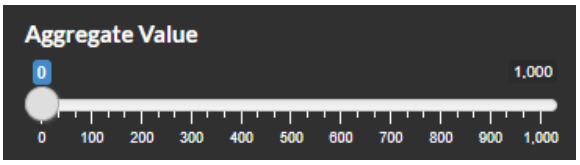
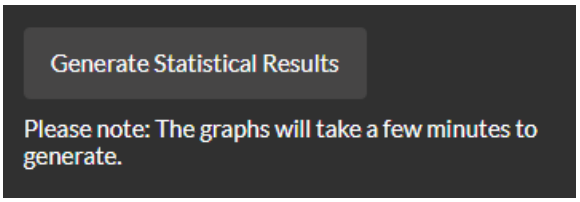


Statistical G & K Function Analysis Data Inputs (Error)

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
 G&K Function graph visualisation	This is the G&K Function graph visualisation of the Network Constrained Point Pattern Analysis
 Localities inputs for G&K Function graph visualisation	From this drop down list, you can select the localities variable to generate the data. 'Entire City of Melbourne' will be the default option. 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'.

 Type of Network inputs for G&K Function graph visualisation	From this drop down list, you can select the type of network variable to generate the data. 'Road Network' will be the default option. Other options are 'Pedestrian Network' and 'Tram Network'.
 Specific Themes/Sub-Categories inputs 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'
 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 13. Childcare Centres 14. Public Toilets 15. 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.

 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 b e 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