



IS415 Geospatial Analytics and Application

[Thailand Road Accidents Dashboard with R Shiny](#)

User Guide

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1. Homepage

Here's a quick introduction to how to navigate around our application!

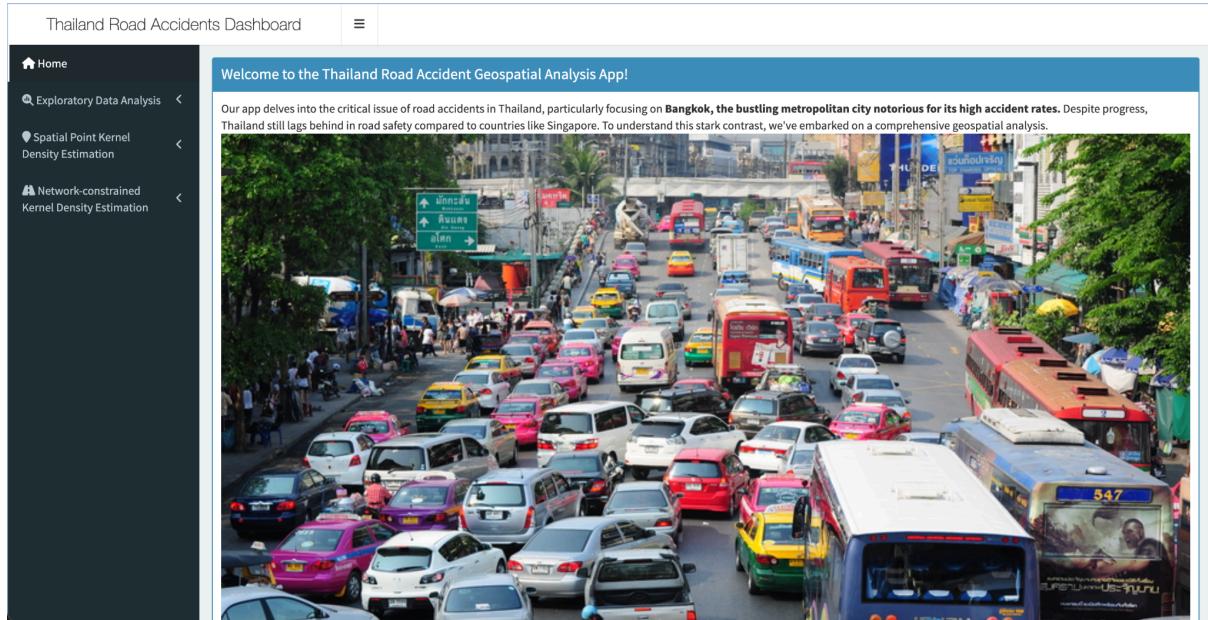


Figure 1. Home Interface

Loading into the app will land you on our homepage, where we have a brief summary of our application - overview, motivation, key features, future prospects, and ending note.

On the left we have a sidebar, with the headers Exploratory Data Analysis, Spatial Point Kernel Density Estimation, and Network-constrained Kernel Density Estimation, the three main sections of our application. Clicking on each of the header will expand the dropdown menu, showing the respective sub-sections like Basic Distribution, Ranking etc.

2. Exploratory Data Analysis

You will find four sub-sections under Exploratory Data Analysis:

1. Basic Distribution
2. Ranking
3. Spatial Points
4. Road Network

2.1. Basic Distribution

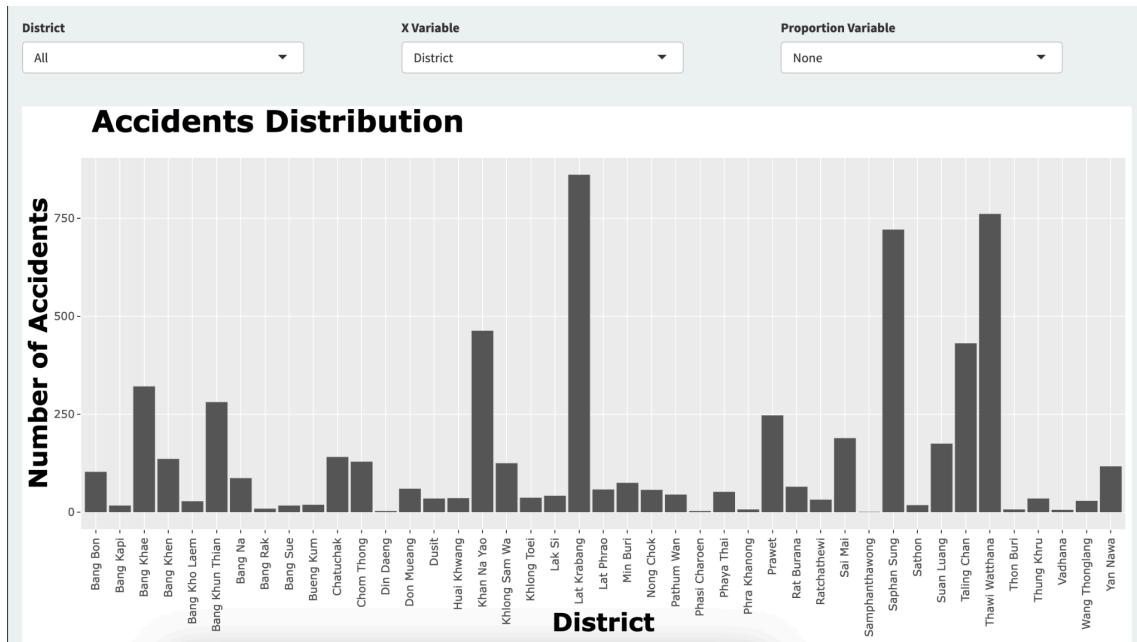


Figure 2. Bar Chart displaying the Accidents Distribution on Basic Distribution sub-section Interface

In this section, you can view the distribution of the data points (road accident spots) by the different variables by choosing from the dropdown under “X Variable”, as well as choose a specific district to zoom into under “District”.

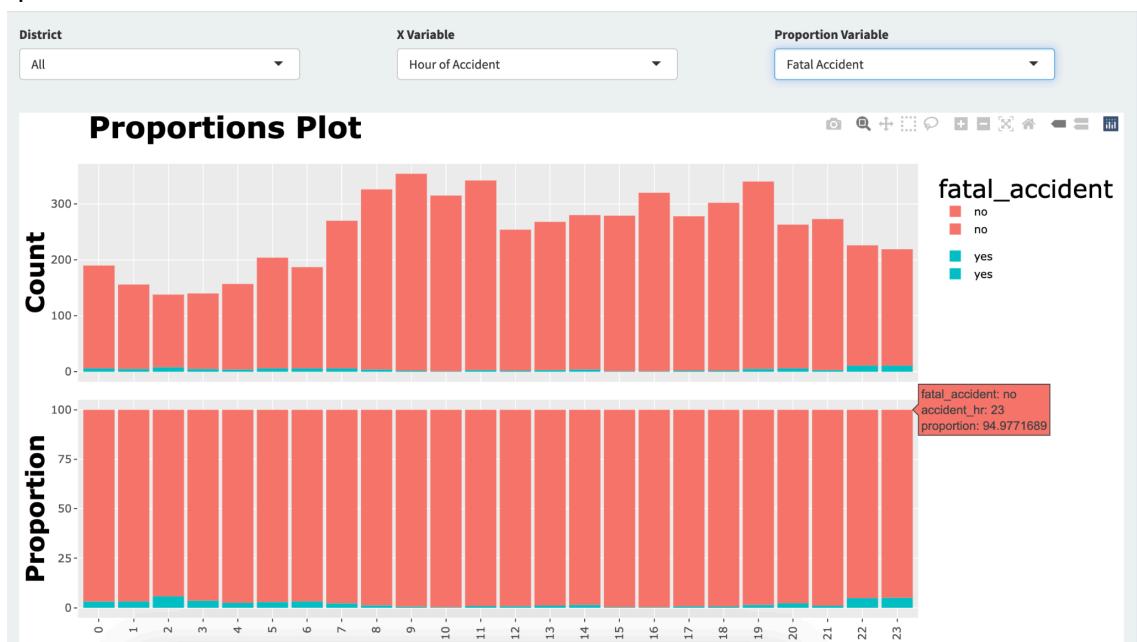


Figure 3. Proportions Plot on Basic Distribution sub-section Interface

The default value for the “**Proportion Variable**” filter is “None”, Choosing a value will add another dimension to the current plot, showing the breakdown of each variable X by another, where you can view the exact value by mousing over the plot.

2.2. Ranking

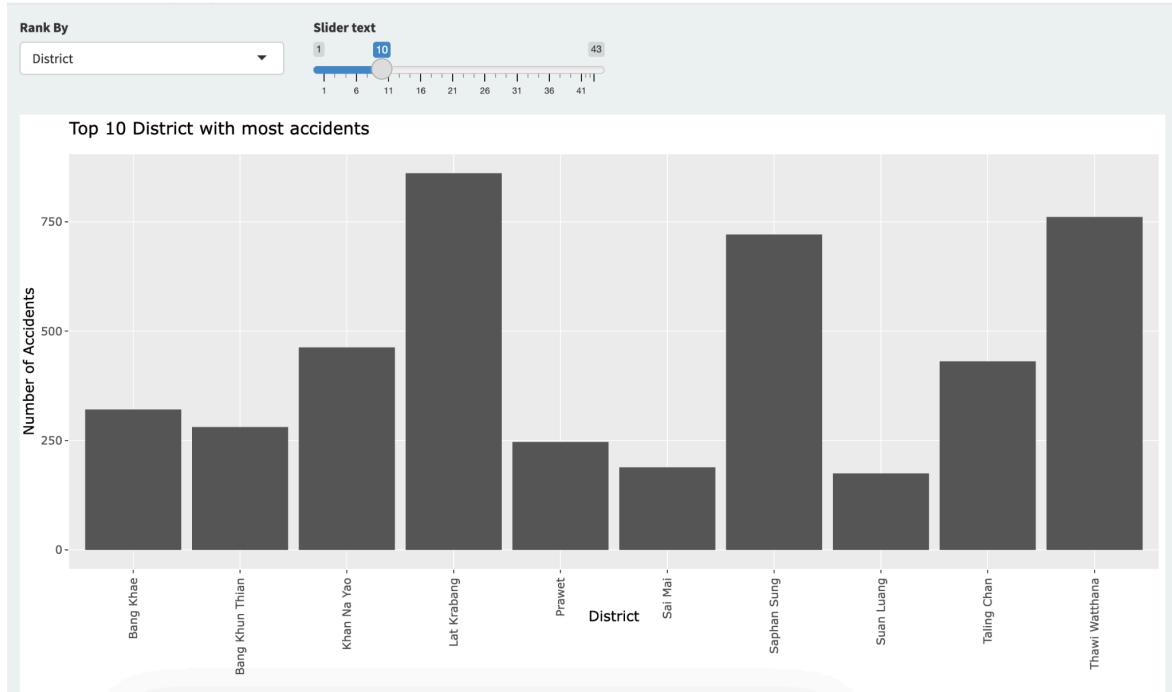


Figure 4. Top X selected ranked variable with most accidents

The purpose of this section is to visualise the distribution of data points ranked according to the variable specified. There are two filters, mainly:

- **Rank By:** The variable you would like to rank the data points by.
- **Top X:** Top X number of categories in the selected variable with the most data points. Max of the slider is adjusted by the maximum number of categories in that particular variable.

The example above shows the top 10 districts in terms of accident numbers.

2.3. Spatial Points

This section allows for exploration of the main dataset, consisting of all the road accidents between 2019 to 2022. The filters available are:

The interface consists of several filter sections:

- District:** A dropdown menu set to "All".
- Weather Condition:** A dropdown menu set to "Both".
- Fatal Accident:** A dropdown menu set to "Both".
- Vehicle Categories:** A dropdown menu set to "All".
- Accident Categories:** A dropdown menu set to "All".
- Years:** A horizontal slider with markers for 2019 and 2022.
- Day of week:** A dropdown menu with options: Mon, Sun, Fri, Thu, Sat, Wed, Tue.
- Hour of Accident:** A grid of numbers from 0 to 24.
- Road Description:** A dropdown menu set to "All".
- Slope Description:** A dropdown menu set to "All".
- Colour Dots By:** A dropdown menu set to "None".

Figure 5. Filters for Spatial Points sub-section Interface

Name of Filter	Description	Data Type
District	Zoom in on specific districts	Factor
Fatal Accident	Whether the accident contains any casualty	Boolean
Vehicle Categories	The type of the main vehicle involved in the accident, E.g. Two-wheeled, Four-wheeled.	Factor
Accident Categories	Main factor that contributed to the accident.	Factor
Years	Slider to select year range, from 2019 to 2022.	Factor
Day of week	The day of the week the accident happened. E.g. Monday, Sunday.	Factor
Hour of Accident	The hour the accident happened, 0 to 24.	Factor
Road Description	Type of road the accident happened on.	Factor
Slope Description	Whether there's slope.	Factor
Colour Dots By	Visual filter, colour the points on the map based on the selected variable.	-

Table 1. Description and Data Type for respective filters

The resulting map will be as such:

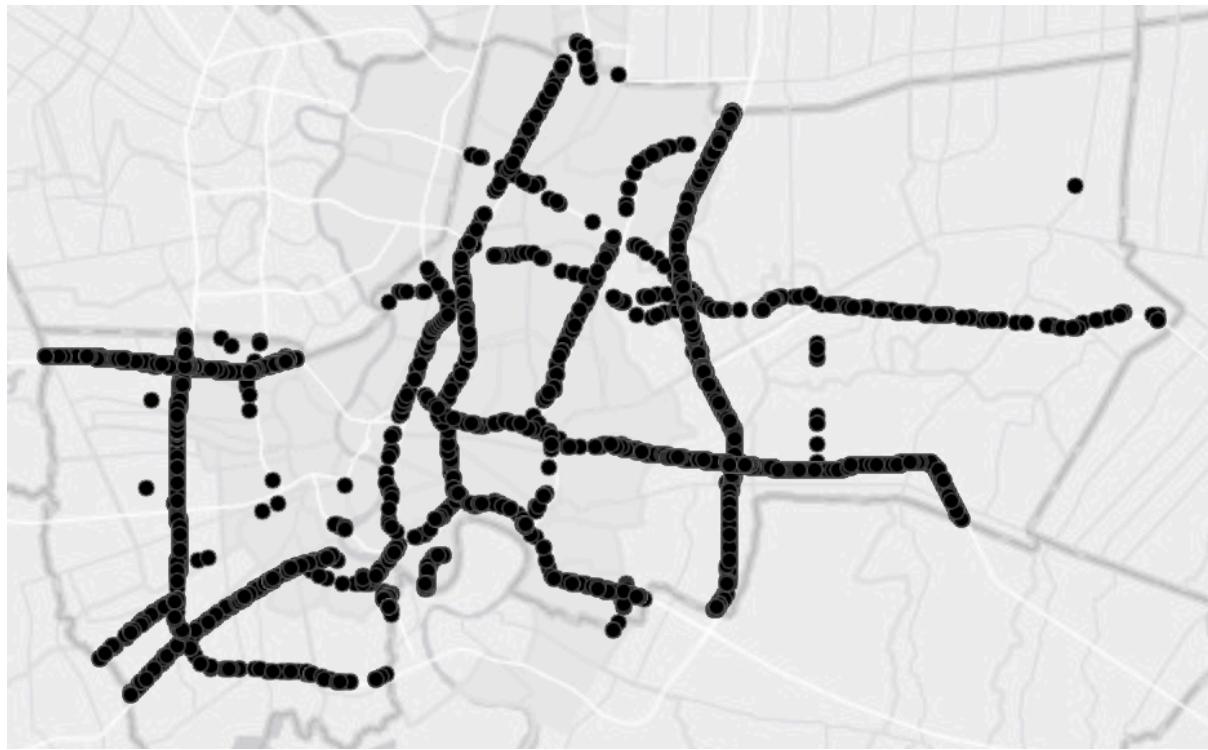


Figure 6. Spatial Points Map

With an accompanying data table of the selected data points:

district	province	weather_condition	road_description	slope_description	accident_categories	vehicle_categories	fatal_accident	year	weekday
Dusit	Bangkok	no	wide curve	other	others	two_wheeled	no	2019	Mon
Dusit	Bangkok	no	other	other	others	two_wheeled	no	2019	Mon
Dusit	Bangkok	no	wide curve	other	others	two_wheeled	no	2021	Sun
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Fri
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Mon
Dusit	Bangkok	no	merge lane	other	others	four_wheeled	no	2021	Thu
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Sat
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Thu
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Wed
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Tue
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Wed
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Thu
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Wed
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Sat
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2021	Sun
Dusit	Bangkok	no	y-intersection	other	others	two_wheeled	no	2021	Sun
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2022	Sat
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2022	Mon
Dusit	Bangkok	no	straight road	other	others	two_wheeled	no	2022	Tue

Figure 7. Data Table

2.4. Road Network

This section allows for exploration of the OSM road dataset, consisting of all the road networks in Bangkok. The filters available are:

- **District:** For viewing roads for specific districts.
- **Bridge:** Whether the road is on a bridge.
- **Tunnel:** Whether the road is in a tunnel.

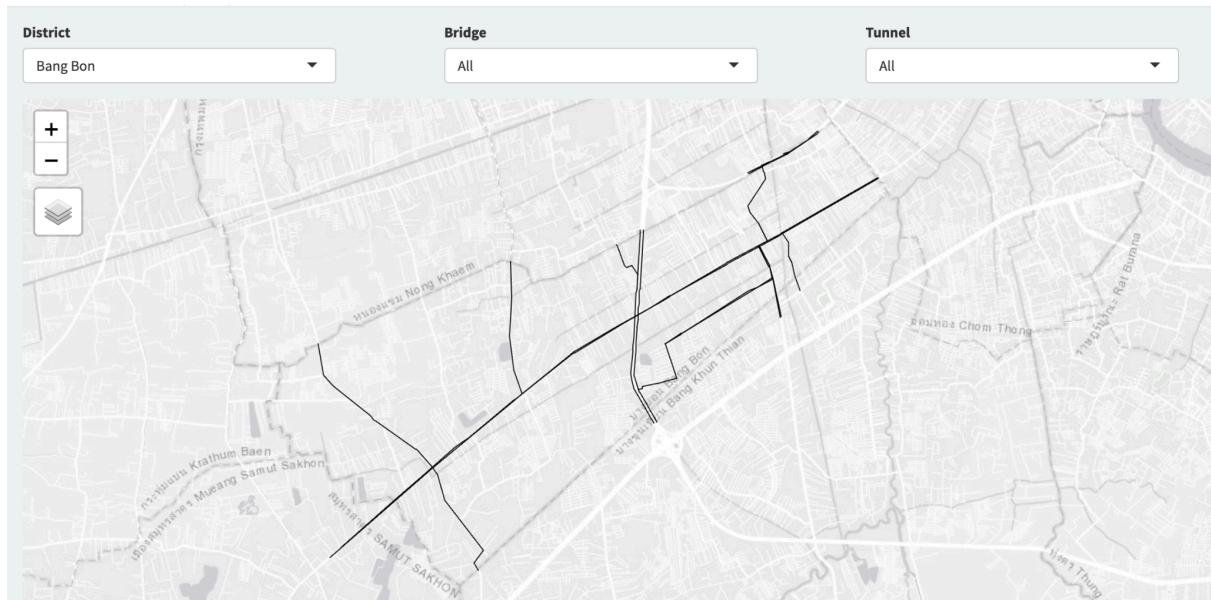


Figure 8. Road Network

3. Spatial Point Kernel Density Estimation

You will find two sub-sections under Spatial Point Kernel Density Estimation:

1. 1st Order Kernel Density Estimation
2. 2nd Order Kernel Density Estimation

3.1. 1st Order Kernel Density Estimation

This section provides the functionalities for users to generate both the Kernel Density Map and conduct the Clark-Evans test.

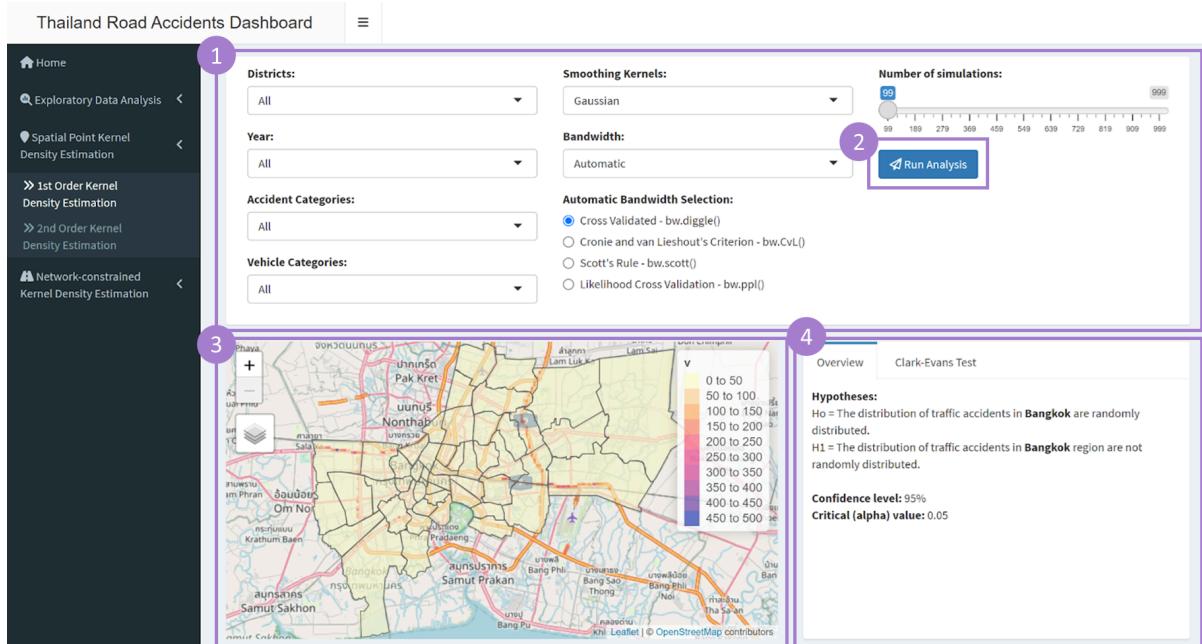


Figure 9. 1st Order Kernel Density Estimation sub-section Interface

Steps

1. Select the appropriate filters *
2. Click on “Run Analysis” button to generate the Kernel Density Map and Clarks-Evans Test results
3. The generated Kernel Density Map will be displayed on the page
4. Click on the Clarks-Evans Test tab to view the test results and interpretations

* Note: For Step 1, please refer to [Appendix 1](#) for a comprehensive list of descriptions available options

3.2. 2nd Order Kernel Density Estimation

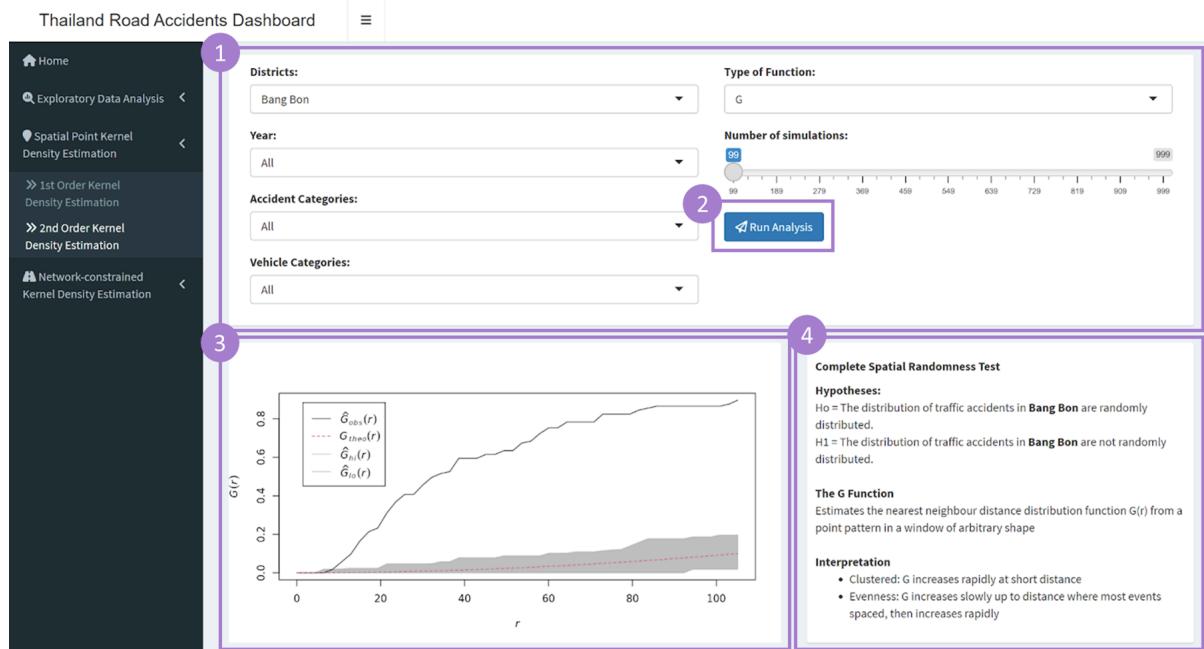


Figure 10. 2nd Order Kernel Density Estimation sub-section Interface

Steps

1. Select the appropriate filters *
2. Click on “Run Analysis” button to generate the function plot and Complete Spatial Randomness test results
3. The generated function plot will be displayed on the page
4. The description and interpretations of the selected function will be displayed on the bottom right panel

* Note: For Step 1, please refer to [Appendix 2](#) for a comprehensive list of descriptions available options

4. Network-constrained Kernel Density Estimation

You will find two sub-sections under Network-constrained Kernel Density Estimation:

1. Network-constrained Kernel Density Estimation
2. Network-constrained G and K Functions Analysis

4.1. Network-constrained Kernel Density Estimation

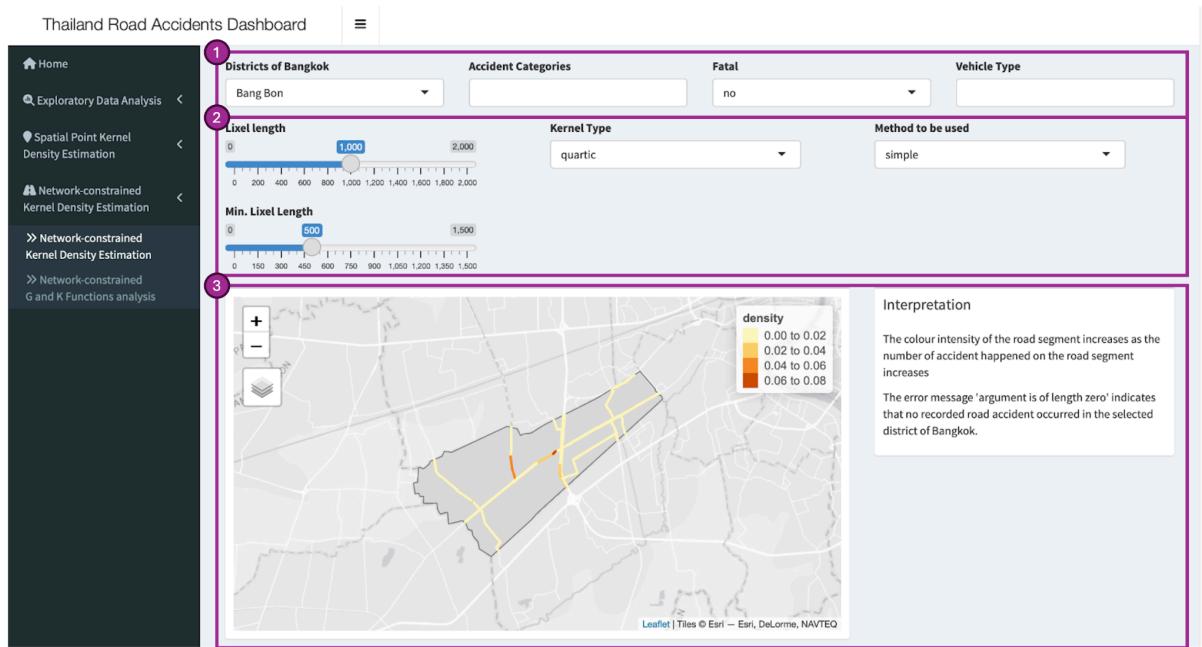


Figure 11. Network-constrained Kernel Density Estimation sub-section Interface

Steps:

1. Select the appropriate filters from the 1st row *
2. Select the values for the kernel parameters of the function *
3. The generated kernel density distribution plots would be displayed on the allocated space below. Users could interpret the graph based on the written interpretation rules stated in the neighbouring box.

* Note: For Steps 1 and 2, please refer to [Appendix 3](#) for a comprehensive list of descriptions available options

4.2. Network-constrained G and K Functions analysis

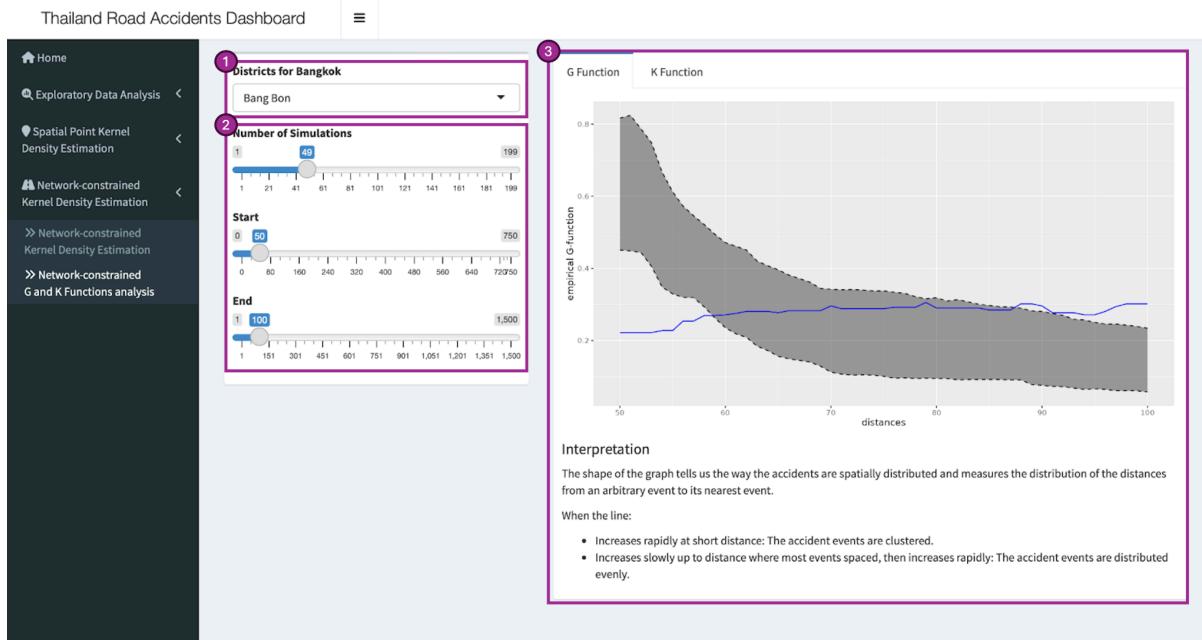


Figure 12. Network-constrained G and K Functions analysis sub-section Interface

Steps:

1. Select the specific district you are interested in *
2. Select the values for the function parameters *
3. The generated function plots would be allocated in the box on the right side.
Interpretation rules are included below aid in interpretation of the generated function plot.

* Note: For Steps 1 and 2, please refer to [Appendix 4](#) for a comprehensive list of descriptions available options

Appendix

Appendix 1: Filters for 1st Order Kernel Density Estimation sub-section Interface

Name of Filter	Description	Options available
Districts	Filter data based on districts.	<p>Default option is "All". Alternative options include the 43 districts:</p> <ul style="list-style-type: none">● Dusit● Nong Chok● Bang Rak● Bang Khen● Bang Kapi● Pathum Wan● Phra Khanong● Min Buri● Lat Krabang● Yan Nawa● Samphanthawong● Phaya Thai● Thon Buri● Huai Khwang● Taling Chan● Bang Khun Thian● Phasi Charoen● Rat Burana● Din Daeng● Bueng Kum● Sathon● Bang Sue● Chatuchak● Bang Kho Laem● Prawet● Khlong Toei● Suan Luang● Chom Thong● Don Mueang● Ratchathewi● Lat Phrao● Vadhana● Bang Khae● Lak Si● Sai Mai● Khan Na Yao

		<ul style="list-style-type: none"> • Saphan Sung • Wang Thonglang • Khlong Sam Wa • Bang Na • Thawi Watthana • Thung Khru • Bang Bon
Year	Filter data by a specific year or time period.	<p>Default option is "All". Alternative options are:</p> <ul style="list-style-type: none"> • 2019 • 2020 • 2021 • 2022
Accident Categories	Filter data based on the types of accidents.	<p>Default option is "All". Alternative options are:</p> <ul style="list-style-type: none"> • speeding • driver_factors • traffic_violations • external_factors • others
Vehicle Categories	Filter data by types of vehicles involved in the accidents.	<p>Default option is "All". Alternative options are:</p> <ul style="list-style-type: none"> • two_wheeled • four_wheeled • heavy_duty • others
Smoothing Kernels	Apply smoothing techniques to the Kernel Density Map	<p>Default option is "Gaussian". Alternative options are:</p> <ul style="list-style-type: none"> • Epanechnikov • Quartic • Disc
Bandwidth	Adjust the bandwidth parameter for smoothing kernel functions.	<p>Default option is "Automatic". Alternative options are:</p> <ul style="list-style-type: none"> • Fixed • Adaptive <p>When users select "Automatic" bandwidth, they will need to select the type of Automatic Bandwidth:</p>

		<ul style="list-style-type: none"> • Default option is Cross Validated - bw.diggle() • Cronie and van Lieshout's Criterion - bw.CvL() • Scott's Rule - bw.scott() • Likelihood Cross Validation - bw.ppl() <p>When users select "Fixed" bandwidth, they will need to drag the slider input to indicate the Fixed Bandwidth (in km).</p> <ul style="list-style-type: none"> • Default value is 2. • Accept any value ranging from 99 to 999.
Number of simulations	Control the number of simulations for Clarks Evan Test.	Default value is 99. Accept any value ranging from 99 to 999.

Appendix 2: Filters for 2nd Order Kernel Density Estimation sub-section Interface

Name of Filter	Description	Options available
Districts	Filter data based on districts.	Default option is "All". Alternative options include the 43 districts: <ul style="list-style-type: none"> • Dusit • Nong Chok • Bang Rak • Bang Khen • Bang Kapi • Pathum Wan • Phra Khanong • Min Buri • Lat Krabang • Yan Nawa • Samphanthawong • Phaya Thai • Thon Buri • Huai Khwang • Taling Chan • Bang Khun Thian • Phasi Charoen • Rat Burana • Din Daeng • Bueng Kum

		<ul style="list-style-type: none"> ● Sathon ● Bang Sue ● Chatuchak ● Bang Kho Laem ● Prawet ● Khlong Toei ● Suan Luang ● Chom Thong ● Don Mueang ● Ratchathewi ● Lat Phrao ● Vadhana ● Bang Khae ● Lak Si ● Sai Mai ● Khan Na Yao ● Saphan Sung ● Wang Thonglang ● Khlong Sam Wa ● Bang Na ● Thawi Watthana ● Thung Khru ● Bang Bon
Year	Filter data by a specific year or time period.	<p>Default option is "All". Alternative options are:</p> <ul style="list-style-type: none"> ● 2019 ● 2020 ● 2021 ● 2022
Accident Categories	Filter data based on the types of accidents.	<p>Default option is "All". Alternative options are:</p> <ul style="list-style-type: none"> ● speeding ● driver_factors ● traffic_violations ● external_factors ● others
Vehicle Categories	Filter data by types of vehicles involved in the accidents.	<p>Default option is "All". Alternative options are:</p> <ul style="list-style-type: none"> ● two_wheeled ● four_wheeled ● heavy_duty

		<ul style="list-style-type: none"> • others
Type of Function	Select the type of function for Complete Spatial Randomness (CSR) test	<p>Default option is "G". Alternative options are:</p> <ul style="list-style-type: none"> • F • K • L
Number of simulations	Control the number of simulations for Clarks Evan Test.	<p>Default value is 99. Accept any value ranging from 99 to 999.</p>

Appendix 3: Filters for Network-constrained Kernel Density Estimation sub-section Interface

Name of Filter	Description	Options available
Districts of Bangkok	Filter data based on districts.	<p>Default option is “Bang Bon”. Alternative options include other 42 districts:</p> <ul style="list-style-type: none"> • Dusit • Nong Chok • Bang Rak • Bang Khen • Bang Kapi • Pathum Wan • Phra Khanong • Min Buri • Lat Krabang • Yan Nawa • Samphanthawong • Phaya Thai • Thon Buri • Huai Khwang • Taling Chan • Bang Khun Thian • Phasi Charoen • Rat Burana • Din Daeng • Bueng Kum • Sathon • Bang Sue • Chatuchak • Bang Kho Laem • Prawet • Khlong Toei

		<ul style="list-style-type: none"> • Suan Luang • Chom Thong • Don Mueang • Ratchathewi • Lat Phrao • Vadhana • Bang Khae • Lak Si • Sai Mai • Khan Na Yao • Saphan Sung • Wang Thonglang • Khlong Sam Wa • Bang Na • Thawi Watthana • Thung Khru
Accident Categories	Filter data based on the types of accidents.	<p>No default option. Alternative options are:</p> <ul style="list-style-type: none"> • speeding • driver_factors • traffic_violations • external_factors • others
Fatal	Filter data based on whether accident is fatal or not	<p>Default option is "no". Alternative option is:</p> <ul style="list-style-type: none"> • yes
Vehicle Type	Filter data by types of vehicles involved in the accidents.	<p>No default option. Alternative options are:</p> <ul style="list-style-type: none"> • two_wheeled • four_wheeled • heavy_duty • others
Lixel length	Control the lixel length	<p>Default value is 1000. Accept any value ranging from 0 to 2000.</p>
Min. Lixel Length	Control the minimum lixel length	<p>Default value is 500. Accept any value ranging from 0 to 1500.</p>
Kernel Type	Select the name of the kernel to use.	<p>Default option is “quartic”. Alternative options are:</p> <ul style="list-style-type: none"> • triangle

		<ul style="list-style-type: none"> • tricube • gaussian • cosine • triweight • epanechnikov • uniform
Method to be used	Select the method to use to calculate NKDE	<p>Default option is "simple". Alternative options are:</p> <ul style="list-style-type: none"> • Discontinuous • continuous

Appendix 4: Filters for Network-constrained G and K Functions analysis sub-section Interface

Name of Filter	Description	Options available
Districts of Bangkok	Filter data based on districts.	<p>Default option is "Bang Bon". Alternative options include other 42 districts:</p> <ul style="list-style-type: none"> • Dusit • Nong Chok • Bang Rak • Bang Khen • Bang Kapi • Pathum Wan • Phra Khanong • Min Buri • Lat Krabang • Yan Nawa • Samphanthawong • Phaya Thai • Thon Buri • Huai Khwang • Taling Chan • Bang Khun Thian • Phasi Charoen • Rat Burana • Din Daeng • Bueng Kum • Sathon • Bang Sue • Chatuchak • Bang Kho Laem • Prawet

		<ul style="list-style-type: none"> ● Khlong Toei ● Suan Luang ● Chom Thong ● Don Mueang ● Ratchathewi ● Lat Phrao ● Vadhana ● Bang Khae ● Lak Si ● Sai Mai ● Khan Na Yao ● Saphan Sung ● Wang Thonglang ● Khlong Sam Wa ● Bang Na ● Thawi Watthana ● Thung Khru
Number of Simulations	Control the number of simulations for G and K Function	Default value is 49. Accept any value ranging from 1 to 199.
Start	Choose the Start Distance of G and K Function chart	Default value is 50. Accept any value ranging from 0 to 750.
End	Choose the End Distance of G and K Function chart	Default value is 100. Accept any value ranging from 1 to 1500.