The Safest Path

UNIVERSIDAD EAFIT

Team

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Data preparation

https://github.com/Nicorenox/ST0245-02-ProyectoV1-

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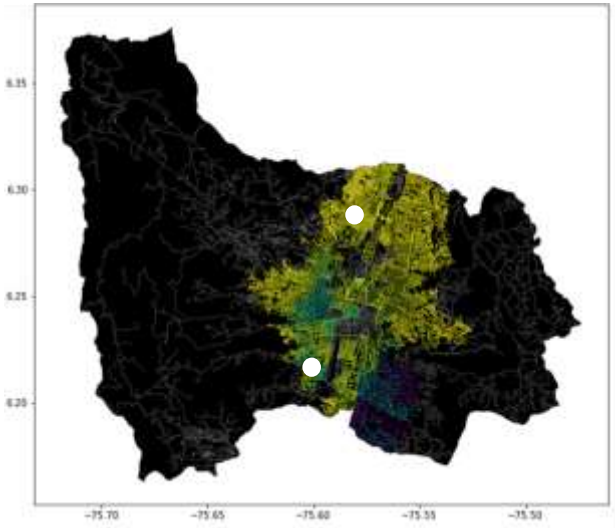
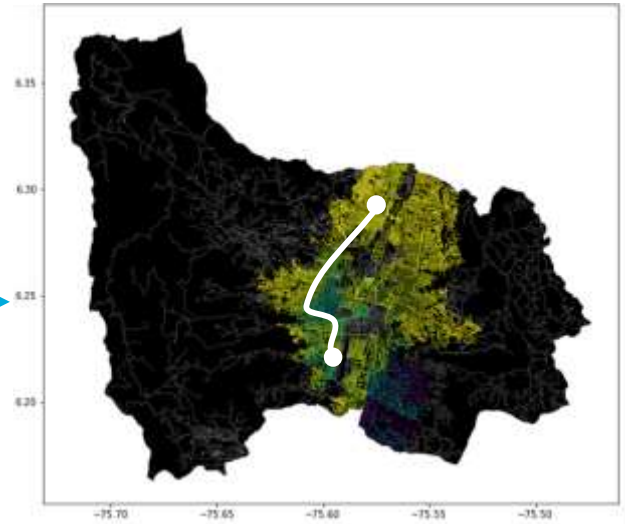
Problem Statement



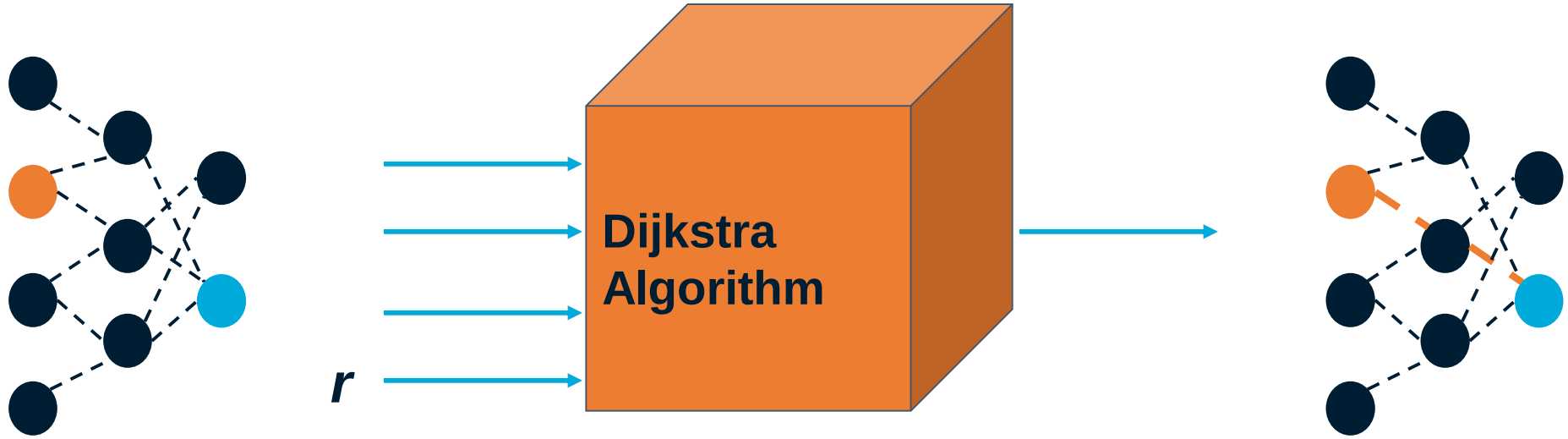
Streets of Medellín, Origin and Destination

Constrained Shortest Path Algorithm



Constrained Shortest Paths

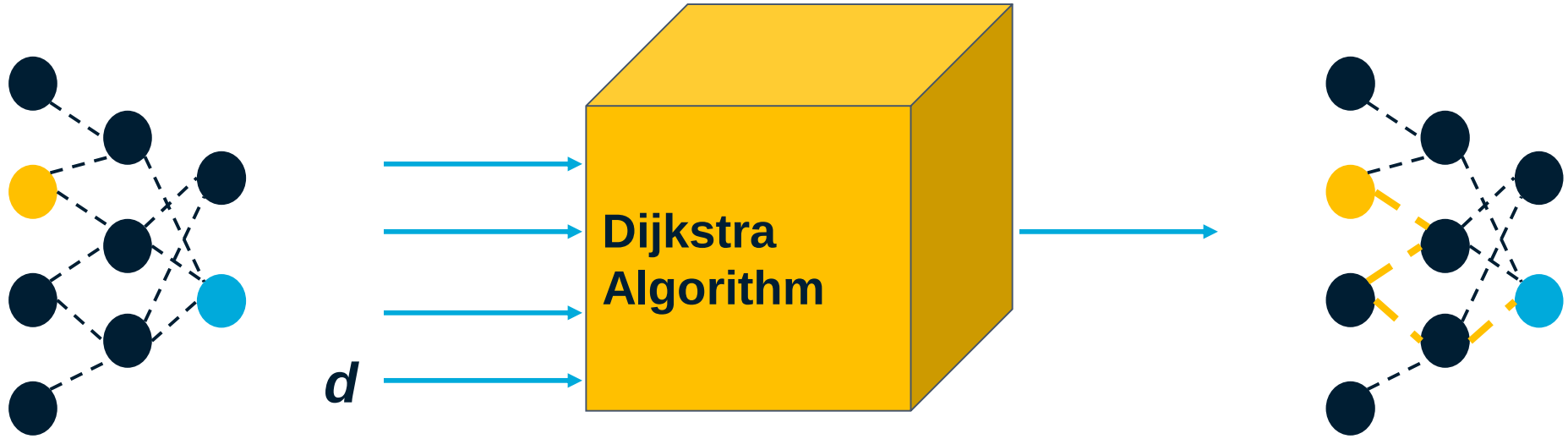
First Algorithm



Streets of Medellín, Origin and Destination

Shortest path without exceeding a weighted-average risk of harassment *r*

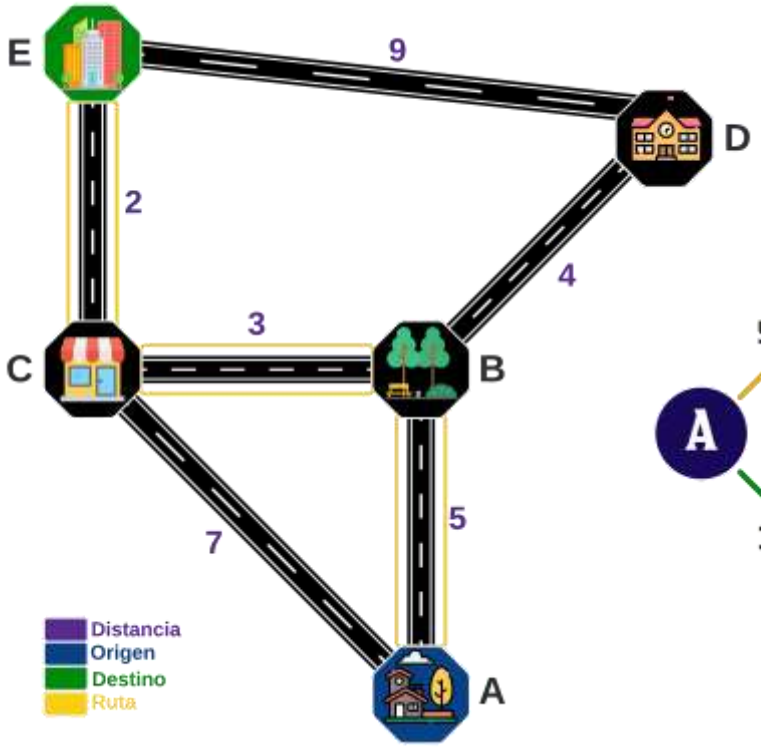
Second Algorithm

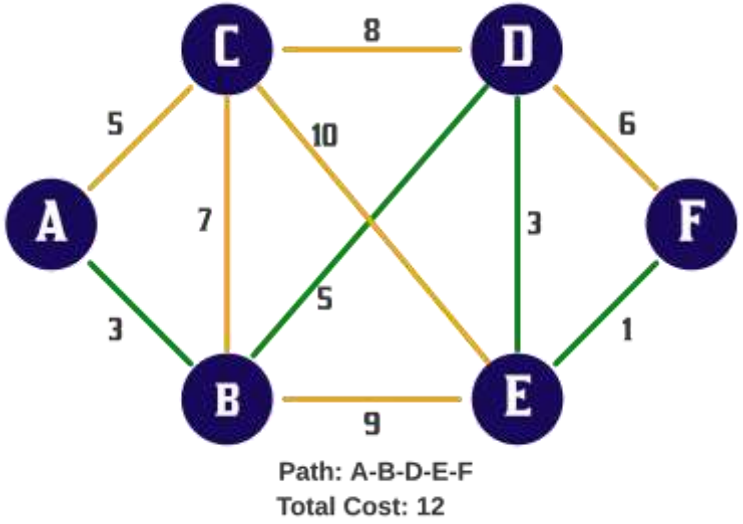


Streets of Medellín, Origin and Destination

Path with the lowest weighted-average risk of harassment without exceeding a distance *d*

Algorithm Explanation





Dijkstra Algorithm for the Constrained Shortest Path

Starting from the source node, in this case A, the algorithm searches the node with the minimum distance in the adjacent nodes, the node with less distance is selected, and so on to reach the final node. This returns the final path and the entire cost of the path.

Graphic Map


Medellín
Santa María
La Hondonada
La Mota
Las Playas
La Gloria
La Palma
Miravalle
Laureles
Granada
Rosales
Fátima
San Joaquín
Loma Hermosa
El Corazón
Betania
San Javier No. 1
Santa Teresita
El Danubio
Las Mercedes
Lorena
La Floresta
El Velódromo
Los Colores
Calasanz Parte Alta
El Pesebre
Palenque
Fuente Clara
Monteclaro
Aures No. 2
El Triunfo
Paris
El Diamante
Altamira
San Martín de Porres
Pedregal
Girardot
Belalcázar
Francisco Antonio Zea
El Progreso
Caribe
Cuarta Brigada
ECOPARQUE CERRO EL VOLADOR
CENTRAL MAYORISTA
La Colina
Guayabal
Cristo Rey
Santa Fé
Tenche
Perpetuo Socorro
Colombia
Villa Carlota
La Aguacatala
La Magnolia
El Poblado
Castropol
La Asomadera No. 1
Colón
Las Palmas
San Benito
Jesús Nazareno
Sevilla
Moravia
Palermo
Miranda
Aranjuez
La Rosa
La Piñuela
Campo Valdés No. 1
Villa del Socorro
Moscú No. 2
Los Angeles
Las Granjas
Santa Inés
San José La Cima No. 2
Villa Hermosa
Manrique Oriental
Gerona
Caicedo
La Milagrosa
Enciso
La Ladera
El Diamante No. 2
El Castillo
Los Balsos No. 2
La Florida
Lalinde
La Asomadera No. 3
Las Lomas No. 2
Cataluña
Miraflores
Los Balsos No. 1
Los Naranjos
El Tesoro
San Lucas
Altos del Poblado
Los Cerros El Vergel
El Pinal
Los Mangos
Versalles No. 2
La Cruz
Llanaditas
Esfuerzos de Paz
Barrios de Jesús
Villa Lilliam
Villa Turbay
Ocho de Marzo
La Sierra

Graphic Map

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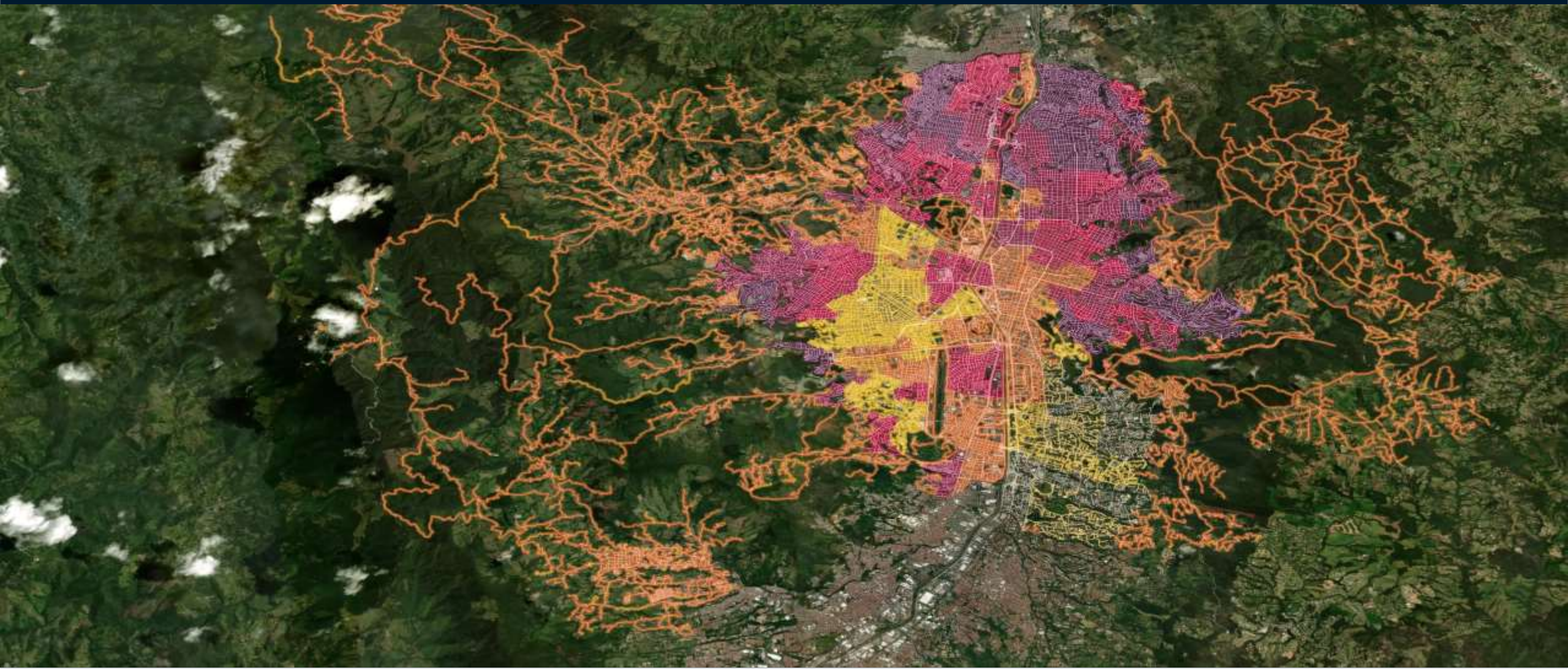
Graphic Map



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Algorithm Complexity

	Time Complexity	Memory Complexity
Dijkstra Algorithm	(E+VlogV)	$O(V^2)$

Time and memory complexity of the Dijkstra Algorithm. Where E is the number of edges in the graph and V is the number of vertices in the graph.

Shortest Path Results

Origin	Destination	Shortest distance (meters)	Without exceeding a weighted-average risk of harassment
Universidad EAFIT	Universidad de Medellín	6088 m	0.84
Universidad de Antioquia	Universidad Nacional	2000 m	0.83
Universidad Nacional	Universidad Luis Amigó	800 m	0.85

Shortest distance obtained without exceeding a weighted average risk of harassment r. The difference in the paths of not exceeding distance or in this case the weighted average risk of harassment are seen in the following images

Lowest Risk Results

Origin	Destination	Weighted-average risk of harassment	Without exceeding a distance (meters)
Universidad EAFIT	Universidad de Medellín	0,63	5000
Universidad de Antioquia	Universidad Nacional	0.3	7000
Universidad Nacional	Universidad Luis Amigó	0.2	6500

The lowest weighted-average risk of harassment was obtained without exceeding a distance d. The difference in the paths of not exceeding weighted average risk or in this case the without exceeding a distance is seen in the following images

Algorithm Results

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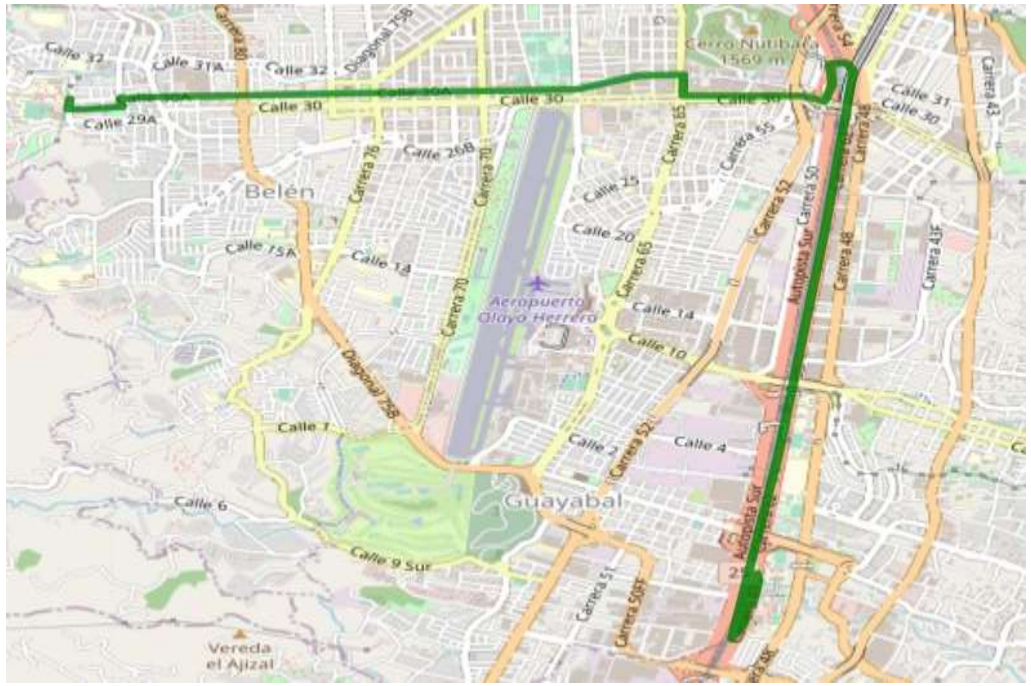
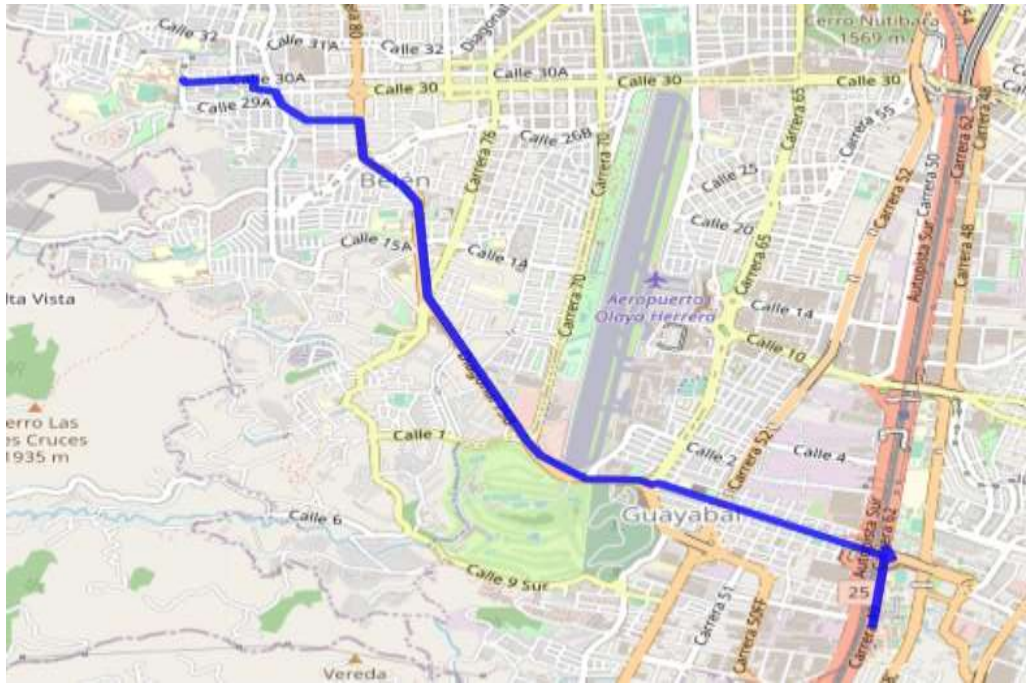
Universidad® de Medellín
Ciencia y Libertad

Path weighted-average risk of harassment



Without exceeding a distance

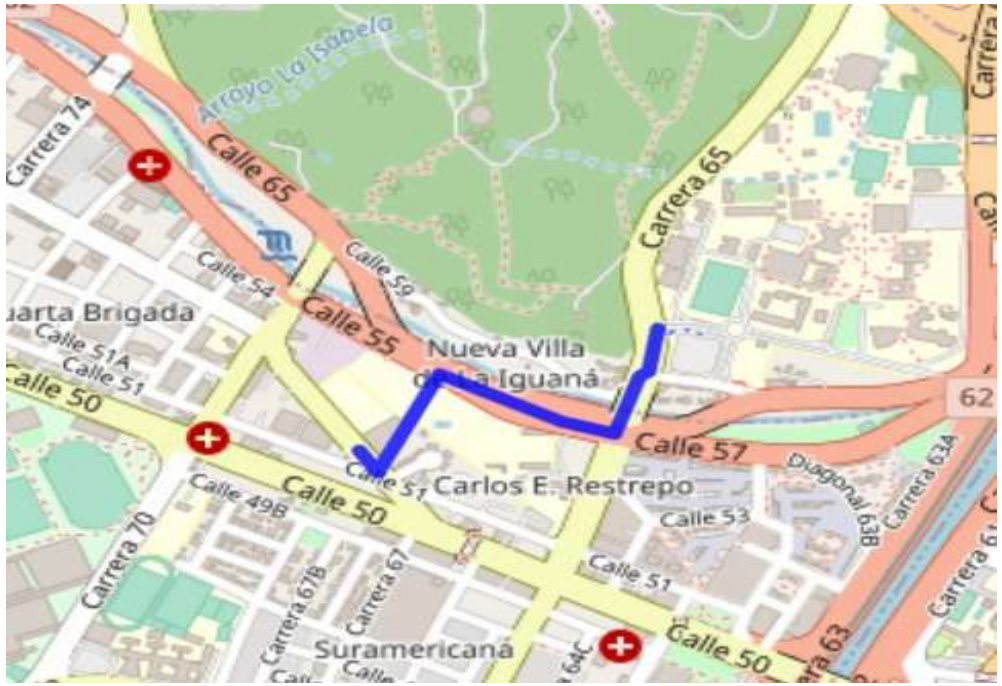


Algorithm Results

UNIVERSIDAD DE ANTIOQUIA → UNIVERSIDAD NACIONAL DE COLOMBIA

Path weighted-average risk of harassment

Without exceeding a distance



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Algorithm Execution Times

Execution Times

UNIVERSIDAD EAFIT® → Universidad® de Medellín Ciencia y Libertad → 9.43 seconds

UNIVERSIDAD DE ANTIOQUIA → UNIVERSIDAD NACIONAL DE COLOMBIA → 9.4 seconds

UNIVERSIDAD NACIONAL DE COLOMBIA → UNIVERSIDAD CATÓLICA LUISAMIGO → 9.36 seconds

THANK YOU!

Supported by

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