Algorithms for pedestrian paths that reduce both street harassment and distance

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1. INTRODUCTION

Over the years it has been seen how various computer applications have been a fundamental piece to facilitate people's daily activities, such as transportation and mobility, however, during the last period both street harassment and long distances that are generated when transporting us through various paths, have shown the great need for the development of an algorithm that allows the reduction of the previous pair of problems mentioned.

2. PROBLEM

The main objective of this project is the development of an algorithm based on the streets of the city of Medellin, in order to completely eliminate or at least reduce situations of street harassment, which for many years has been one of the main causes of insecurity in the city, affecting both men and women, the latter being the main affected by this situation, in turn through the algorithm it is proposed to reduce the time it takes people to go from one point to another looking for the way in which the distance from the destination is the shortest.

As a final result, it is expected that both problems will be solved through an algorithm, yielding as a final product the safest and shortest path possible provide the user.

3. SOLUTION

As a solution to the problem, Dijkstra's algorithm is used through the Python networkx library, which taking into account the data from the csv file, extracted and converted into a data frame by the Python NumPy extension "Pandas" , allows us to generate the shortest path with the least harassment possible, taking as input an origin X and a destination Y in coordinates that exist in the file (Calles_de_medellin_con_acoso) and in turn graph it.

4. RELATED WORKS

4.1 Always safe

It is an algorithm which was developed to confront the persistent violence against women in Mexico, it was created by a group of activists in the city of Quetaro. The algorithm seeks to generate a mapping to identify the areas where there is a higher incidence of harassment to find the causes and generate actions to, consequently, make this reality visible as a problem that requires public policies in Mexico.

4.2 Harassment map

this algorithm consists of both women and men who have suffered street harassment, through the algorithm can publicly announce these situations and thus other people know it and avoid traveling around the place.

The algorithm makes it possible to report anonymously what the situation was, in what place,

what type of violence and in what time range it occurs approximately.

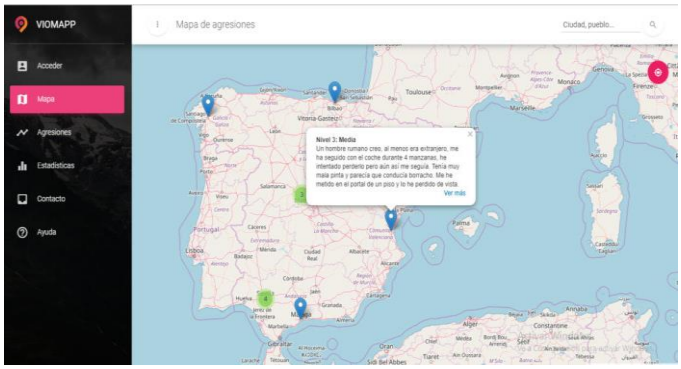
4.3 Safe City

It is an algorithm, which consists of the young women who reside in any of the participating cities marking the point on the map that they wanted to record, indicating if it had seemed a safe or unsafe place, and giving details about their experience and the reasons why. that they felt that way. In addition, they could indicate if they received help or not, and what are the characteristics that, in their opinion, make a place safer.

4.4 Viomapp

It is an application that was designed by the engineer Joaquín Vásquez in Spain, this application uses an algorithm that allows women to record on the map a sexual assault, street harassment or inappropriate behavior that they×have suffered on their usual or night routes.

The main intention of the app is focused on women being able to review a route before traveling it, thus checking if it is an unsafe area, marked with previous incidents by other people.

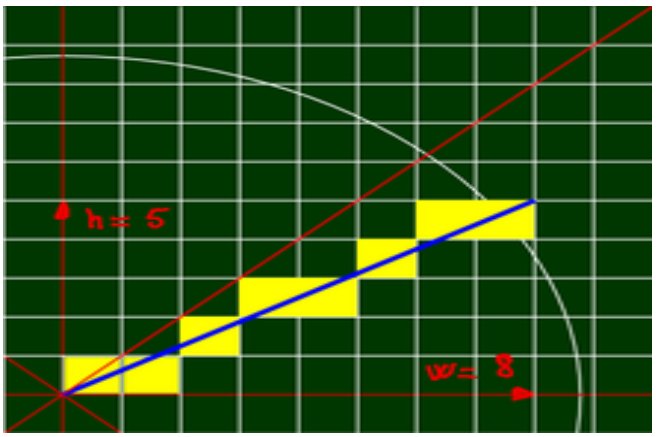


5. ALTERNATIVE SOLUTIONS

a. Bresenha Line Algorithm:

It is a line drawing algorithm that determines the points of an n-dimensional raster that should be selected to form a close approximation of a straight line between two points.

The general idea behind this algorithm is: given an initial endpoint of a line segment, the next grid point it traverses to reach the other endpoint is determined by evaluating where the line segment intersects relative to the midpoint (above or below) of the two possible grid point options.



b. Dijkstra's algorithm:

It is an algorithm that consists of finding the shortest distances from a source vertex to all other vertices in a connected weighted graph. It should be emphasized that the edges must have positive values and that this algorithm does not work for negative values.

The foundation on which this algorithm is based is the principle of optimizing: if the shortest path between vertices “u” and “v” passes through vertex “w”, then the part of the path that goes from “w” to "v" must be the shortest path among all paths from "w" to "v". In this way, the paths of minimum cost are successively built from an initial vertex to each of the vertices of the graph, and the paths obtained are used as part of the new paths.

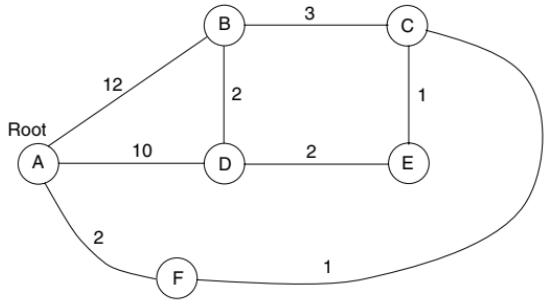


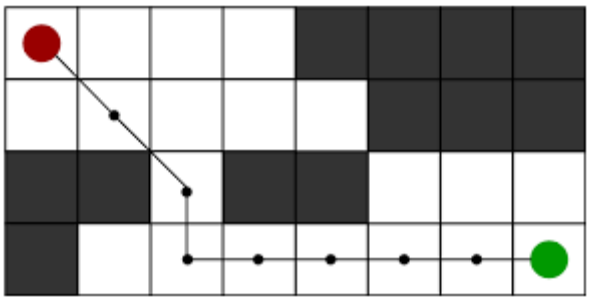
Fig. 4.2. A network graph with link costs indicated

c. A-Star Algorithm:

This algorithm is an improvement developed to the postulates of the Dijkstra algorithm that is responsible for finding the shortest paths within a graph. In this modification, the observation of informed searches within the graph that allow us to make optimal decisions about the paths that must be taken to traverse the graph efficiently is taken as a central point.

For the application of this algorithm we must understand how to proceed to divide the cost of the route. In this case it is divided into two parts where g(n) represents the cost of the path from its origin to some node n within the graph. We also have that h(n) represents the estimated cost of the path from node n to the destination node, calculated by an intelligent guess.

The A-Star algorithm, being specially designed to detect the least expensive paths within a complex graph, is normally used to find short paths between individual pairs of locations. This is why one of its most common applications is to detect geo-locations in which satellite location coordinates are known.



d. Euclidean distance algorithm

It is an algorithm that is based on the application of a mathematical formula that allows to measure the distance in a straight line between two points in an n-dimensional space.

$$d(\mathbf{p},\mathbf{q}) = \sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2 + \cdots + (p_i - q_i)^2 + \cdots + (p_n - q_n)^2}.$$

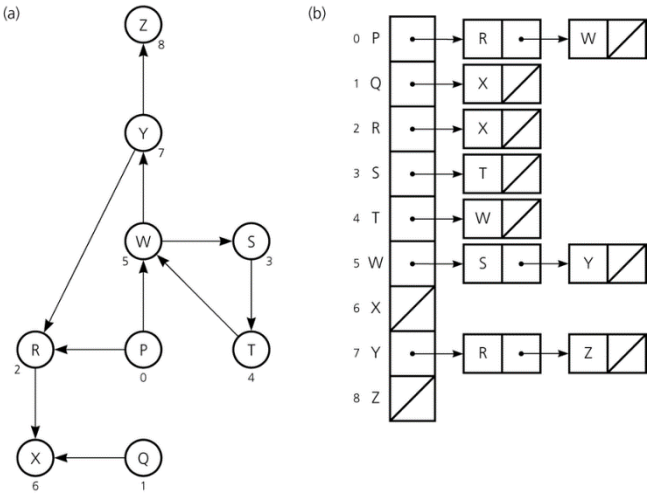
Within the functionalities of the Euclidean distance algorithm, its usefulness to determine the similarity between two things or pairs of data stands out. Proceeding from this, the similarity calculated from this algorithm can be used as an integral part of recommendation query systems. With it we can obtain data schemes that identify elements that have similar characteristics, such as a score or an assessment so that the user of the information can decide. An example of this can be applied in a movie recommendation system so that we obtain suggestions based on the ratings received.

6. DESIGN AND IMPLEMENTATION OF THE ALGORITHM

6.1.Data structures

To represent the map of the city of Medellín, a data frame is used, which analyzes the data from the csv file (calles_de_medellin_con_acoso), and with the help of the networkx library, a list of the edges with their respective vertices is created, which have as attribute both the length and the risk of harassment, considering the point of origin and the point of destination.

https://github.com/jebarriost3/ST0245-002

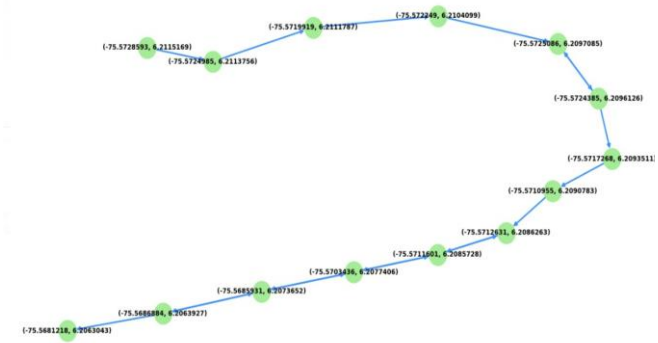


6.2 Algorithms

In this article, an algorithm is proposed for a path that minimizes both the distance and the risk of street sexual harassment.

6.2.1 Algorithm for a path that reduces both the distance and the risk of street sexual harassment

When generating the data frame with the data from the csv file (Calles_de_medellin_con_acoso), a graph is created from the source, destination and weight data, which would be a new variable which is the multiplication of the data from the length and harassment risk columns, to obtain the weight of each edge. After this we convert the data frame into a dictionary and add it as an attribute of the nodes. Finally, through the nexworkx library, the Dijkstra algorithm is called, which searches for the smallest value of the weight variable to obtain the shortest path between the origin and the destination given in the input.



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