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COMPLEX NETWORK INTO GEOGRAPHICAL INFORMATION SYSTEMS

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Abstract: Geographic Information Systems allow geographic data visualization and handling of geographical data, as traffic zone vectors (polygons adopted as a unit of urban mobility study) and hydrography (set of water courses in a region). The data structure representation of complex networks (set of nodes and edges representing a complex system) can be made considering, for example, the traffic zone centroids as the nodes, connected each other in accord of people flow, and river's headwater and outlet as the nodes and water courses as edges. The current work shows a computational schema to a complex network representation in a Geographic Information System.

keywords: Complex Networks, Geographic Information Systems, Urban mobility, Hydrography

1. INTRODUCTION

Networks, structures with nodes connected by edges, can represent several types of data, from Urban Mobility to Hydrography, some of them with complex behaviors.

Urban mobility studies focus on population's commute within an urban area, including, for example, how population groups move across the area and events that may disturb normal circulation, such as natural disasters - as floods in some watercourses [1].

Geographic Information Systems (GIS) allow geographic data visualization and handling of geographical data, as traffic zone vectors (polygons adopted as a unit of urban mobility study) and hydrography (set of watercourses in a region) [2].

This work shows a computational example to a complex network representation in a Geographic Information System, exploring the geographical location of the nodes [3].

2. MATERIAL AND METHOD

According [1], mobility data networks can be gathered by different means, por example, origin-destination surveys (OD), which are expensive and demand professional efforts but draw a consistent scenario for typical daily movements of population groups. Each element (i,j) in the OD matrix represents the number of people that do, in a common day, the travel between i (origin) and j (destination).

In this paper the OD data was from São José dos Campos [4], a municipality in the eastern region of São Paulo state, in the southeastern region of Brazil. Its population summed 629,921 inhabitants in 2010 in a land area of 1,099.6 km2. In this city there are 54 traffic zones.

The Geographical Information System QuantumGIS was used to data visualization.

3. RESULTS AND PERSPECTIVES

Figure 1 shows a network visualization in GIS. There are two *shapefiles*, the first one - a point-type *shapefile* - related to the nodes (Traffic Zones's centroides), and the second one - a line-type *shapefile*, related to the edges. In this urban mobility network two nodes are connected if, and only if, there are at least one travel (in the mobility dataset) between these nodes.

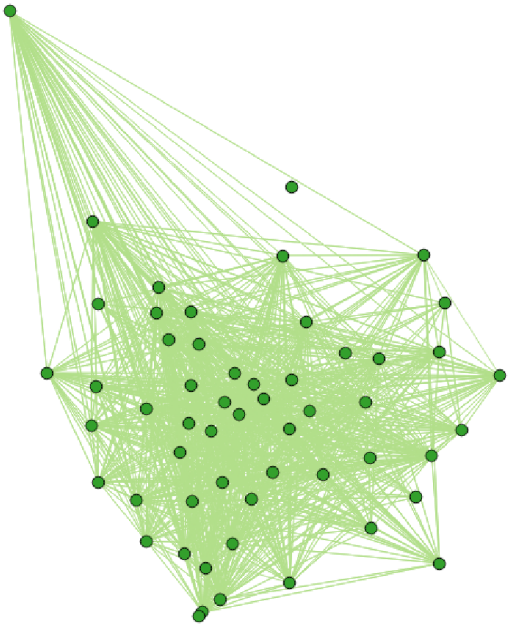

Figure 1 – Complex network of urban mobility - each node represents a (centroide of a) Traffic Zone, and the edges are related to the flow (OD data) between each pair of nodes.

This view shows the topological relationship between the centroids of mobility's spatial units and the people flow.

This is the first phase of a work that will include the results of graph's topological properties in its own display, then will be possible to visualize properties such as vulnerability as a visual property (color, shape, size) of both nodes and edges.

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