

Compute a Crowdedness Index on Historical GIS Data

As the fast development of human civilizations, methods to compute crowdedness index of a small scale-area without detailed population data are lacked. This thesis study evaluates current crowdedness indexes and also develops some new index methods based on historical demographical data. These methods are evaluated and tested by case study of a Swedish parish Hög.

The study is focusing on crowdedness index for building firstly. There are two sub crowdedness methods for buildings: the DBSCAN clustering and building crowdedness index method. Clustering analysis groups together points that are having enough number of near neighbor points. Spatial patterns can be identified by distinguishing the similarities and dissimilarities between objects. A building crowdedness index equation measures building crowdedness index in a two dimensional rectangular coordinate system. The calculation process is based on the Euclidian distance between each building object, and also a buffer distance D is needed. Then the index value can be computed by using total population number of buffer area n , divided by the distance between each target point to the original point o .

Then study moves to two sub-methods which computes population crowdedness index. The first one is called social interaction index. It measures index value of an area which works with urban network system. By using distances between buildings along a road network and the number of persons living in each building, the equation can calculate an index value of each building in a road network system. The second method is called betweenness centrality. It measures the extent which node is located between to paths that connect pairs of nodes. The output value of betweenness centrality is for an individual road in a network. Before the calculation process, a street network should be transferred to a connectivity map. Based on the connectivity map, relationships between individual edges by using a betweenness equation could be found.

Lastly, the study moves on crowdedness index for property unit level. But because of the low accuracy of historical demographical data, population value is only stay on property unit level. So the first step of this method is to list all the possible combinations between buildings and population in each property unit. Then by using an equation with building's population value and building's index value, the unit's index can be computed.

The study also developed a set of test experiments to ensure the accuracy of the study. Some conclusions are made based on the study results and test experiments. Those new methods are suitable for most cases. They could give us some satisfactory results, but still need to be developed in the future.

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