Fassade

MIT Researchers create new Urban Network Analysis toolbox

MIT researchers have created a new Urban Network Analysis (UNA) toolbox that enables urban designers and planners to describe the spatial patterns of cities using mathematical network analysis methods. Such tools can support better informed and more resilient urban design and planning in a context of rapid urbanization. "Network centrality measures are useful predictors for a number of interesting urban phenomeona", explains Andres Sevtsuk, the principal investigator of the City Form Research Group at MIT that produced the toolbox. "They help explain, for instance, on which sreets or buildings one is most likely to find local commerce, where foot or vehicular traffic is expected to be highest, and why city land values vary from one location to another."

The Urban Network Analysi

Network analysis is widely used in the study of social netoworks, such as Facebook friends or phonebook connections, but so far fairly little in the spatial analysis of cities. While the study of spatial networks goes back to Euler and his famous puzzle of Königsberg's seven bridges in the 18th century, there were, until recently, no freely accessible tools available for city planners to calculate computation-intensive spatial centrality measures on dense networks of city streets and buildings. The new toolbox, which is distributed as free and open-source plugin-in for ArcGIS, allows urban designers and planners to compute five types of graph analysis measures on spatial networks: Reach; Gravity; Betweenness; Closeness; and Straightness. "The Reach measure, for instance, can be used to estimate how many destinations of a particular type – buildings, residents, jobs, transit stations etc. – can be reached within a given walking radius from each building along the actual circulation routes in the area", said Michael Mekonnen, a course six sophomore who worked on the project. "The Betweenness measure, on the other hand, can be used to quantify the number of potential passersby at each building."

The tools incorporate three important features that make network analysis particularly suited for urban street networks. First, they account for geometry and distances in the input networks, distinguishing shorter links from longer links as part of the analysis computations. Second, unlike previous software tools that operate with two network elements (nodes and edges), the UNA tools include a third network element – buildings –

which are used as the spatial units of analysis for all measures. Two neighboring buildings on the same street segments can therefore obtain different accessibility results. And third, the UNA tools optionally allow buildings to be weighted according to their particular characteristics - more voluminous, more populated, or otherwise more important buildings can be specified to have a proportionately stronger effect on the analysis outcomes, yielding more accurate and reliable results to any of the specified measures.

The toolbox offers a powerful set of analysis options to quantify how centrally each building is positioned in an urban environment and how easily a user can access different amenities from each location. It offers a novel methodology for tracking the growth and change of cities in the rapidly urbanizing world and offers analytic support for their designers and policy makers.

The UNA toolbox can be downloaded from the group's website.

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http://cityform.mit.edu/projects/
urban-network-analysis.html