A Spatially-Explicit Big Data application for the Computation and Evaluation of Public Transport Accessibility in Tel Aviv-Yafo

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Accessibility, particularly for users of public transport, is an important consideration in sustainable mobility policies. Various accessibility measures have been suggested in the literature, most at coarse aggregate spatial resolutions of zones or neighborhoods. Based on recently available urban GIS, we suggest that accessibility can and should be measured from the viewpoint of a human being traversing the transportation network from one building as origin to another at the destination. We estimate transport accessibility by car and by public transport based on mode-specific travel times and corresponding paths, including walking and waiting, at the resolution of individual buildings. Our application utilizes graph databases and parallel computing to allow fast construction of high-resolution accessibility maps for an entire metropolitan area with its 100-1000K buildings.

The application is tested and applied in a case study involving the evaluation of the 2011 bus line reform in the city of Tel-Aviv. Specifically, we demonstrate that the reform increased both the average accessibility for the entire city and had a minor impact on its equity mainly attributed to longer trips. Still the reform increased accessibility, mainly to origins which previously had lower accessibility levels. The results further show essential dependence of accessibility estimates on spatial resolution - unless spatially explicit representation of the trip is enabled, biased estimates can arise. The new approach and fast computational method can be employed for investigating the distributional effects of transportation infrastructure investments and, further, for interactive planning and agent-based simulation of the urban transport network.

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Planning Post-Disaster Urban Recovery Using Synthetic Big Data

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This paper illustrates how synthetic big data can be generated in order to meet the planning challenges of urban recovery in the aftermath of a disaster. Small areal statistical units are decomposed into households and individuals using a GIS buildings data layer. Households and individuals are then profiled with socio-economic attributes and combined with an agent based simulation model in order to create dynamics. The resultant data is 'big' in terms of volume, variety and versatility. It allows for different layers of spatial information to be populated and embellished with synthetic attributes. The data decomposition process involves moving from a database describing only hundreds or thousands of spatial units to one containing records of millions of buildings and individuals over time.

The method is illustrated in the context of a hypothetical earthquake in downtown Jerusalem. Agents interact with each other and their built