Section 1

Urban Big Data

DEFINITION

Big Data is an expression of the first decade of the 21st century. Data are components of information, and information is a building block for knowledge. As such, data can be seen as the raw material for future architecture. The amount of data available for urban planners, city governments, and the general public is exploding. In fact, all of these groups generate data in rapidly increasing amounts. The challenge, thus, shifts from producing data to organising and extracting data in meaningful ways. The overwhelming majority of data refers to the past. The carefully collected, structured, verified, and stored data generated by trained specialists of the past are increasingly supplemented by less structured, less verified and cloud based data generated by millions of people and billions of sensors.

Today's planning attempts are hindered by the non-availability of data respectively by the difficulties to analyse this data. This often leads to the abandoning of the necessary integration of data into the planning process, or to the sometimes arbitrary selection of data based on their availability. We propose to accept the fact that organisations, agencies, private collectors and others have reasons not to give access to the data they selected based on measurements, surveys, and data mining in the past. Yet we are convinced that there is a fast approaching paradigm shift towards the useful and effective mining, selection, and recording of relevant data.

For future design, sensing and measuring techniques used in engineering for specific purposes will form an important supplement to volunteered data originating from crowdsourcing, smartphone locations, transportation and other data that are released voluntarily by the persons collecting them. To the combination of all this data we refer to as Big Data.

Big Data City

Big Data City is an interdisciplinary project, with the central idea of an urban design method based on advanced data analytics. By closing the gap between urban sensing, data analytics and design, this project provides the basis for the coupling of urban planning with smart cities management, thus increasing the urban data security and the resilience of the city. Big Data City contains several sub projects that might closely interact with High Density Mixed Use City and Urban Environmental Resilience. The scope of the project allows for interdisciplinary as well as cross-cultural research.

Urban planning decisions must derive from facts and from the best possible decision base. The reasons for decisions should be knowledge, meaningful information, and exacting data. Today and in the future, so-called Big Data is expected to provide an exponentially growing source for high-quality decisions. Unlike approaches that employ Big Data only to analyse existing situations, we transcend that retrospective view by integrating advanced data analytics into the urban design and planning process. Thereby interactivity will be maintained to avoid entirely data driven designs.

From Data Analysis to City Design

Designers of the content of a library need to select from the available books and media, and only this selection makes the library special, as compared to the total availability of all books by other means. In analogy to this,

- The Big Data City project collects (and creates) only designs that contain knowledge that is generalizable to be used for other planning projects.
- The (dynamic) Big Data City library can be customized immediately for new projects (only aspects/books that are relevant are used).
- Big Data City provides a framework for such a new library (based on the Simulation Platform of the FCL).

The responsibility of the Big Data City design researchers thus shifts from the careful selection of data for a specific purpose towards designing the algorithms to extract meaningful data from a multitude of sources with less controllable sparse and heterogeneous data quality.

Big data design methods

In order to make data analytics available to design, the main task shifts from data collection to extracting relevant information and knowledge from data and in addition to use the extracted information for actual design decision-making, thus switching from analysis into synthesis. The primary methodological steps are the following:

- Analysing, categorizing and formulating different data types as urban design decision-making elements.
- Defining and implementing visual interaction techniques that allow applying the decision-making elements in the design process.
- Test and iteratively improve above techniques with existing datasets.
- Integrate the techniques in a real-world design scenario for validation (e.g. through a Design Research Studio or an agency/ industry collaboration).
- Synthesis of informed planning

Big Data City will investigate the forces influencing the urban geometry and the correlations of urban functions with properties of this geometry by the workstreams (WS) listed in the following:

WS 1: Flows and design. Urban flows analysis and their integration towards design, data mining on Big Data, applying findings from logistics, transportation, economics and material flows analysis. High-end dynamic design support visualisations.

WS 2: Security and design. A fundamental human need is to live in a secure environment. In highly networked cities, security aspects expand to other important areas such as energy and data security. The development of strategies for the design of resilient centralised/decentralised networks and related aspects is a crucial issue for future cities.

WS 3: Energy and design. Shifting from centralised energy supply towards a mix of decentralised and centralised energy generation and supply will create a wealth of data that must form the basis for future design and its interaction with the geometry on the urban scale and on the building and architectural scale.

WS 4: Governance and design. The impacts of governing bodies, election results, opinion leaders, decision leaders, people‘s reactions to government decisions, people’s evaluation and usage of their environment on urban form and development become filtering mechanisms for Big Data and for urban planning.

WS 5: Health and design. Evidence of interdependencies between the city’s form and the health of its citizens has been gathered in the past in an anecdotal way. By using larger data sets, a big enough cohort can be created to derive ‘proper’ facts.

Ordering this evidence and using it as one input for future design is a necessity.

WS 6: Transportation and design. Readily available transportation data is expanding in volume rapidly and will form the basis for analysis and design input. Clarification of the close relation between transportation and planning will be a result.

WS 7: Planning and Big Data. The basis of a computational evidence informed planning (CEIP) are quantitative methods, which allow the generalization of insights from the analysis of existing cities or districts. This makes these results available for future planning, respectively for the computational evaluation of planning proposals based on past studies.

Urban Big Data Design Team

- Urban planner and designer
- Sociologist
- Economist
- GIS specialist and spatial statistician
- Software engineer
- Social Scientist
- A Generalist who connects all work streams