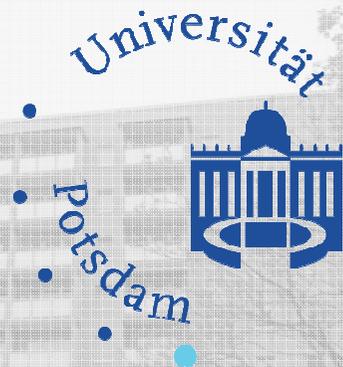


Geosimulation of urban housing market conditions: A Preliminary investigation



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Objectives

- Study is groundwork for prototype creation.
- Evaluation of software for geosimulation, such as multi agent systems (MAS) or cellular automata (CA).
- Suitability to geosimulate housing market conditions (housing rents).
- Setting up a generic conceptional process framework for a housing rent appraisal simulation.



Geosimulation

- Geosimulation as “urban geosimulation” (Torrens & Benenson 2004): Spatially-related automata as basis.
- Cellular automata (CA), and agent-based modeling approaches as multiagent systems (MAS).
- Geosimulation models are based on spatially non modifiable objects e.g. homes or households.
- Urban simulation models in a traditional sense: Scale of aggregation (e.g. census tracts, administrative boundaries etc.).

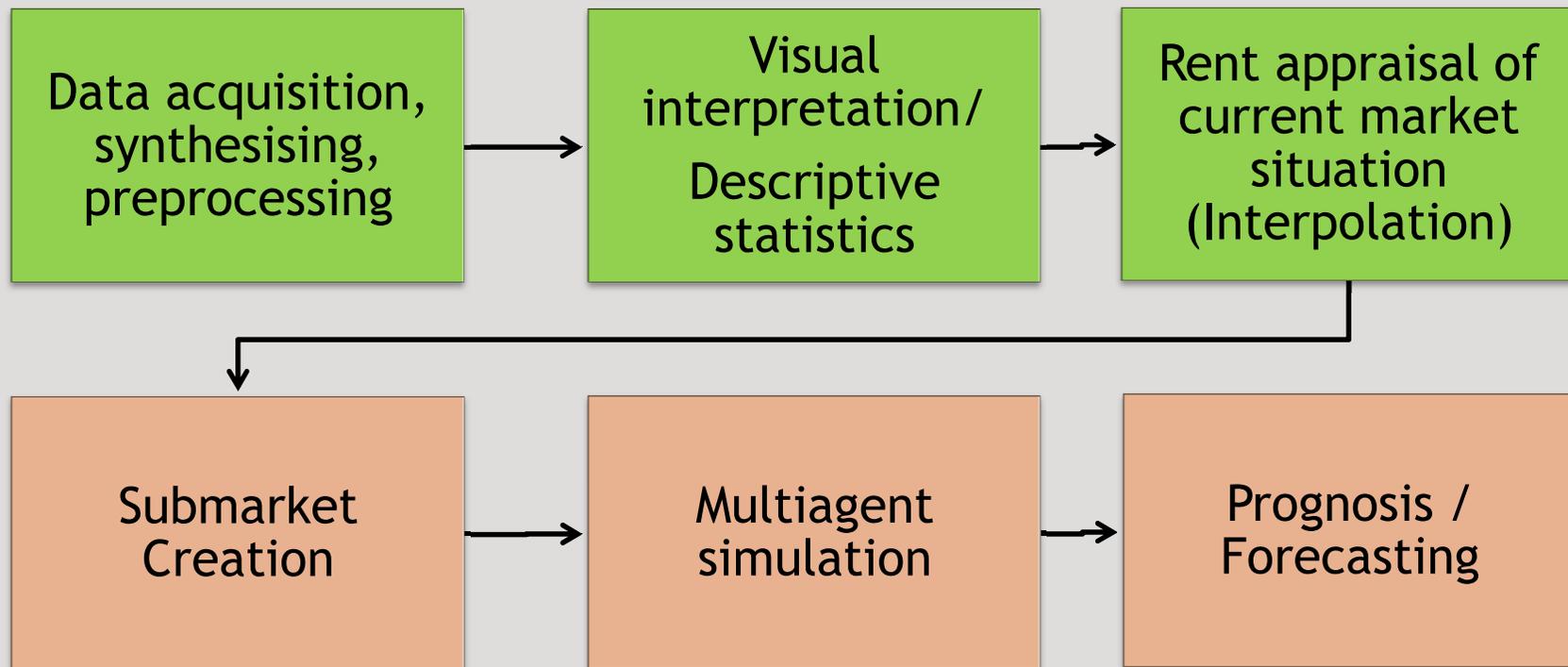


Conceptual Process Framework For A Housing Rent Appraisal Simulation

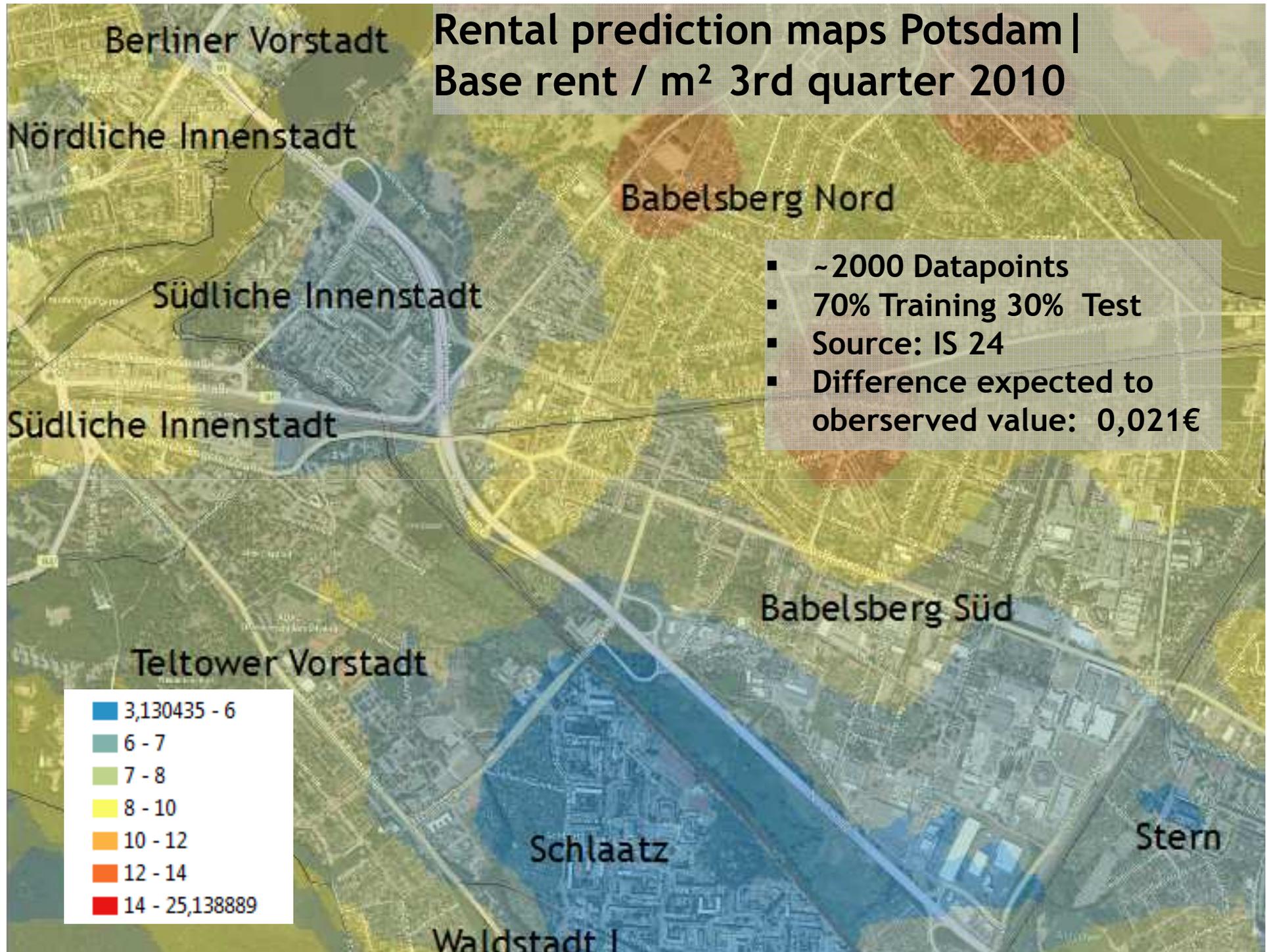
- Housing market models in general concentrate on modeling effects on the housing price but not on housing rent.
- Adaption of existing models to simulate effects on housing market rents in “core cities” of urban areas | Nomenclature of the BBSR (2011).
- Common approaches:
 1. Hedonic approaches where the bundle of the overall housing price is broken down in different prices, often OLS methods (Ordinary least square).
 2. Geographically weighted regression analysis (GWR).
 3. Interpolation (Moving window kriging).



Conceptional process framework for a housing rent appraisal simulation



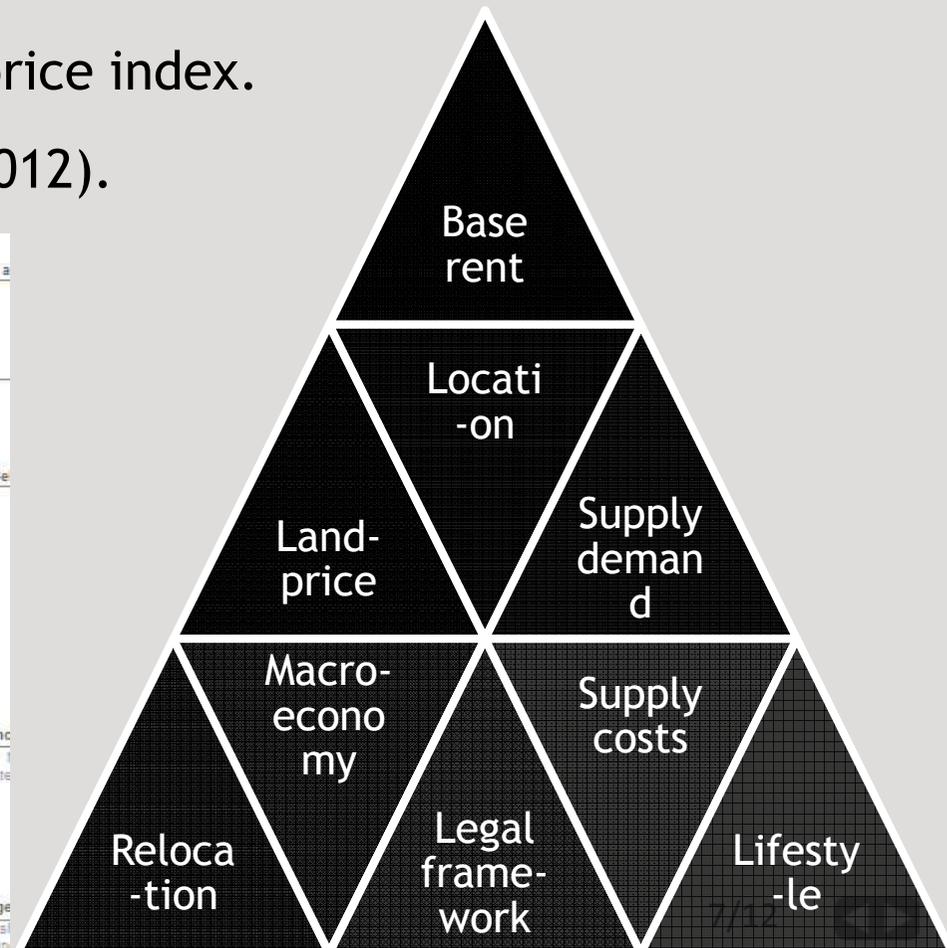
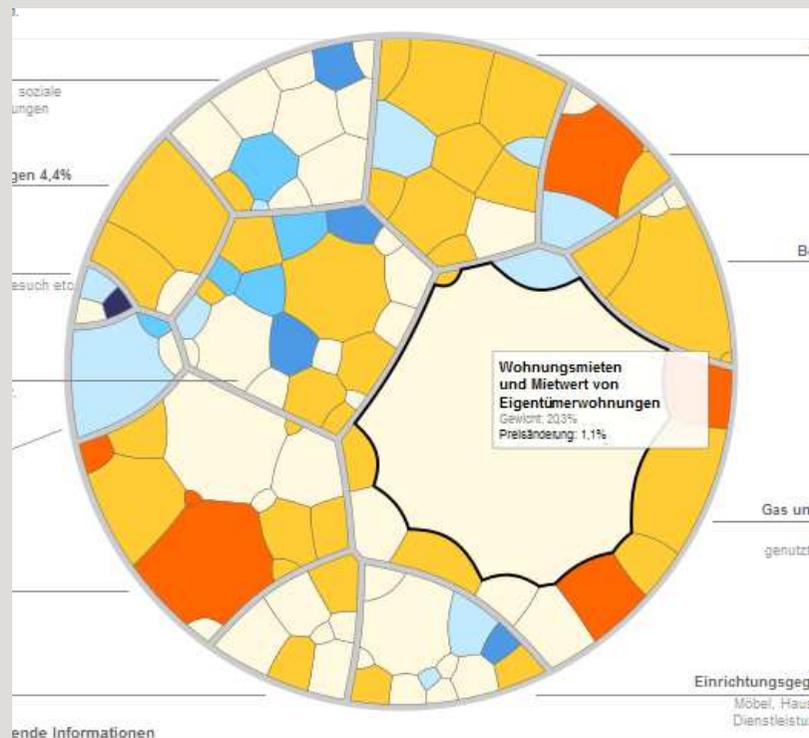
Rental prediction maps Potsdam | Base rent / m² 3rd quarter 2010



- ~2000 Datapoints
- 70% Training 30% Test
- Source: IS 24
- Difference expected to observed value: 0,021€

Factors for the formation of base rents ?

- Expert group (Potsdam 22) in Potsdam targetted and weighted ~ influence factors on rent formation.
- 20 % influence on consumer price index.
- Price caleidoscop (DeStatis, 2012).



Methodology Of A Two Step Evaluation Process

- The evaluation of simulation systems is important groundwork for setting up a prototype simulation.
- Two step evaluation process:
 1. First a criteria-based search process is done searching for geosimulation software. Criteria have been taken from guidelines suggested by Smith et al. (Smith et al., 2007)
 2. Simplified form of a cost benefit analysis as performed. cost-benefit analysis introduced by Zangemeister (Zangemeister, 1973). Criteria simulation software has to possess to fulfill a certain function were scored in a 5 point scale according to their relevance to achieve a certain target. Summing the overall scores a cost benefit is calculated for each geosimulation system.



Evaluated software systems

- **UrbanSim/OPUS (Open platform for urban simulation)** is a modular open source simulation software system for the analysis of urban development. (Waddell, 2010) at the University of Berkley.
- **MAGI (Multi-Agent Geosimulation Infrastructure)**, an agent-based simulation software with tight GIS coupling.
- **Agent Analyst** is an extension of ESRI ArcGIS developed by the U.S. Argonne National Laboratory's Center for Complex Adaptive Agent Systems Simulation.

Not accessible:

- **OBEUS (Object based environment for urban simulation)** has a special status as it aims to implement the Geographic Automata.
- **REGISTA (Reality Emulating Geographical Information System for Territorial Analysis)** is a CA-GIS concept presented by Blečić et al. (Blečić et al., 2009).



Methodology Of A Two Step Evaluation Process

- Evaluated criteria:
- License: Open Source, Closed source, Shareware, Freeware or Unknown.
- Import Export functions.
- Help system: Documentation, “How-to”, and Community.
- Degree of maintenance: is the system actual, out date.
- Programming: Scripting / Objectbased, necessary programming knowledge.
- User interface: GUI and/or command line.
- Results: Visualization.
- Complexity of data requirements: Minimum to maximum data requirements.
- Availability of real estate models (model templates).



Results and outlook

- Lacks not recognized at the first glance could be identified in the evaluation process | Most projects seem to be in a permanent experimental status within an academic domain, few operational models exist.
- Learning curve for all the systems is steep and all the evaluated systems lack a satisfying visualization of simulation results.
- In assumption that a big research team consisting of about 4 persons can set up a prototype, UrbanSim would be the software of choice for prototype creation. Repast (without Agent Analyst) and Magi are the authors' first choices for prototype development.
- Prototype development is on the way based on the experiences gained.



Thank you for your attention!

Questions? Suggestions? Comments?

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<http://www.geographie.uni-potsdam.de/>

