Identification of Urban Activity Centers

How Urban Activity Centers (UAC) can be identified from available data in Tokyo?

1. Introduction: urban spatial structure and urban centers
2. Urban Activity Centers (UAC)
3. Data – Person Trip survey 2018
4. UAC identification algorithm (pipeline)
5. References

Tokyo Institute of Technology

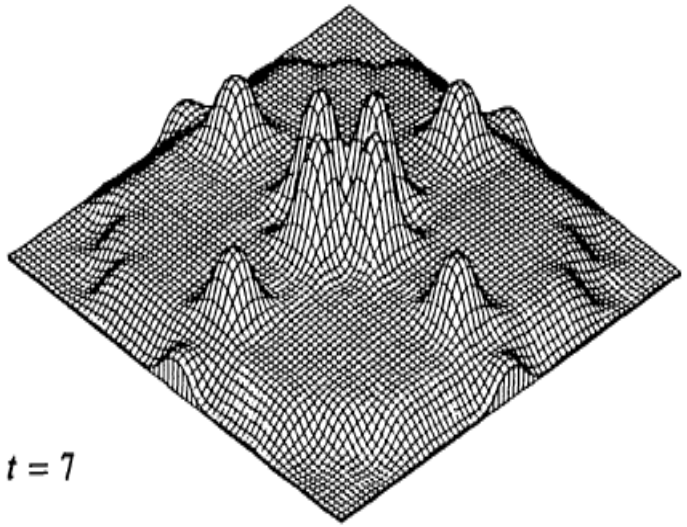
Department of Architecture and Building Engineering

Boratinskii Vadim

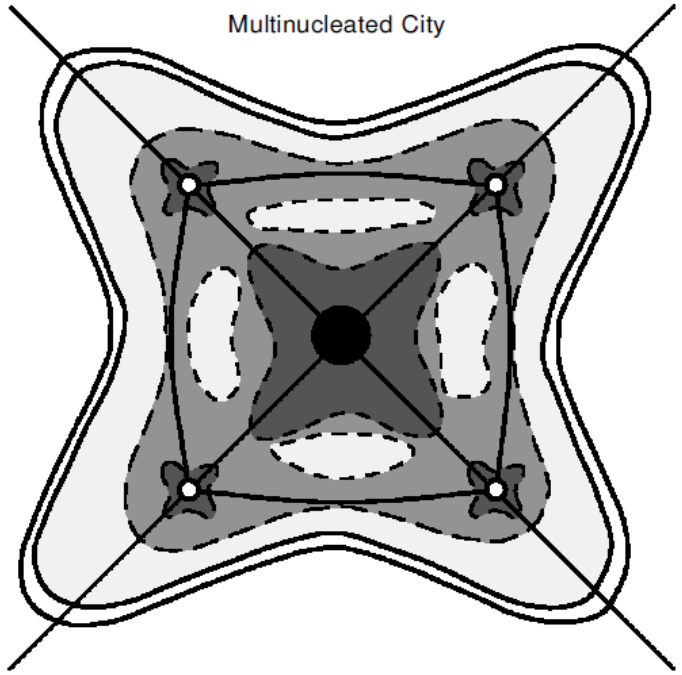
Urban spatial structure and urban centers

Analysis of urban centers as a way to reveal urban spatial structure

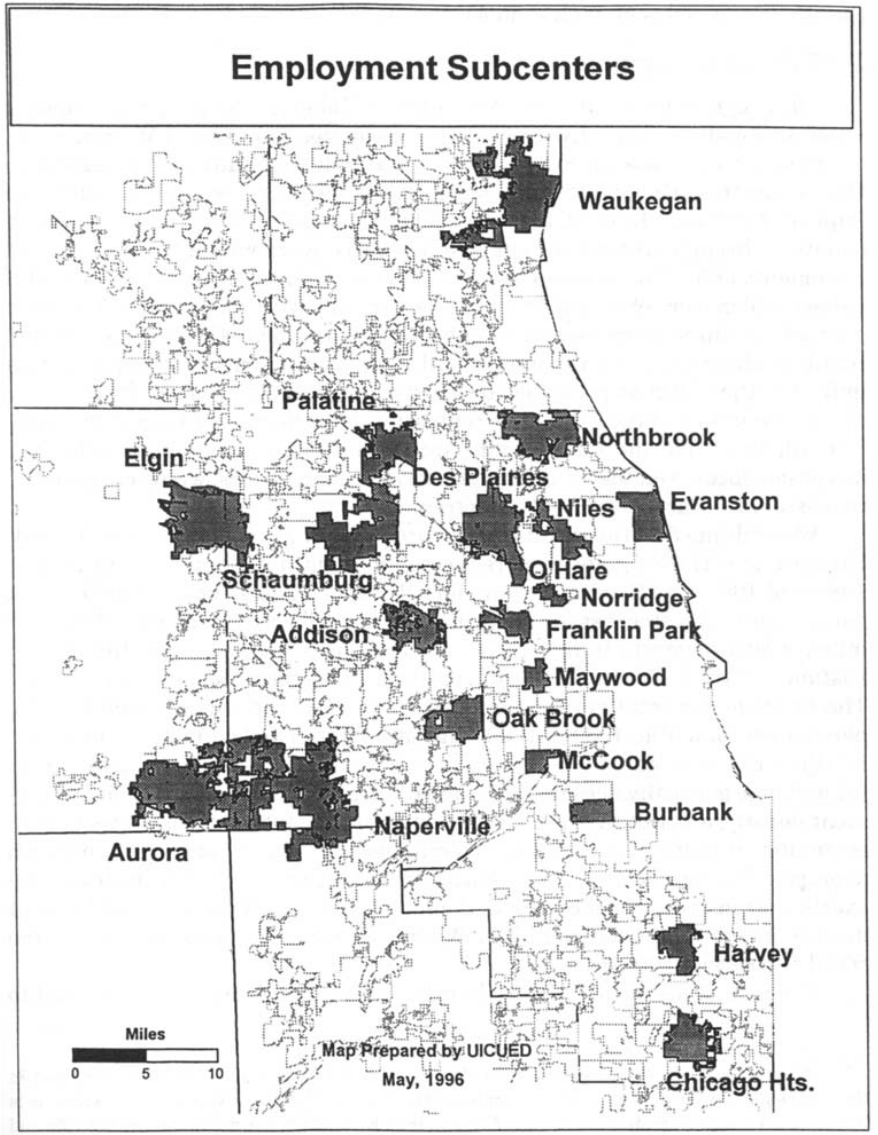
- Started from urban centers as the concentration of **employment** such as
  - Central Business District (CBD)



Beaumont, 1981



Anderson, 1996

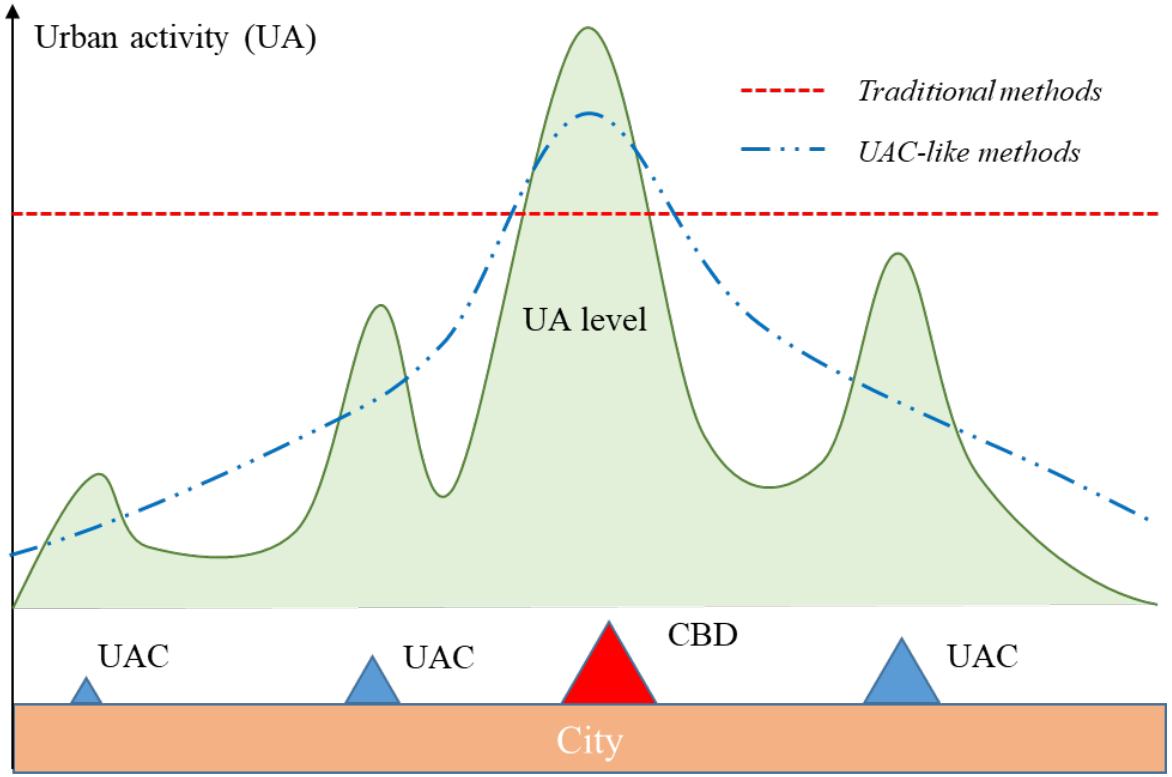


McMillen & McDonald (1997)

Urban Activity Centers

*Areas of a city where the concentration of outside-of-home urban activities is **significantly higher than in the surroundings** irrespective of their location in a city*

- **Different from** traditional methods for delimitation of urban cores such as central business districts (CBD) – not only points of the highest activity level.
- **Applicable for**: city-scale analysis or measures targeting most important nodes, attraction points of a city irrespective of their location and size.



Conceptual scheme of UAC method

Data – Person Trip (PT) survey 2018

Identification of multifunctional **urban activity centers (UAC)**

What data to use?

Mostly used so far:

- Social media and cell phone data, area or revenue of businesses, points of interest, remote sensing…
- (see Riguelle et al., 2007; Frias-Martinez et al., 2012; Goncharov & Nikoghosyan, 2016; Cai et al., 2017)

Newly suggested data:

- **PT-indicator**: the number of trips (visits) whose purpose is related to outside-of-home activities (see Table)

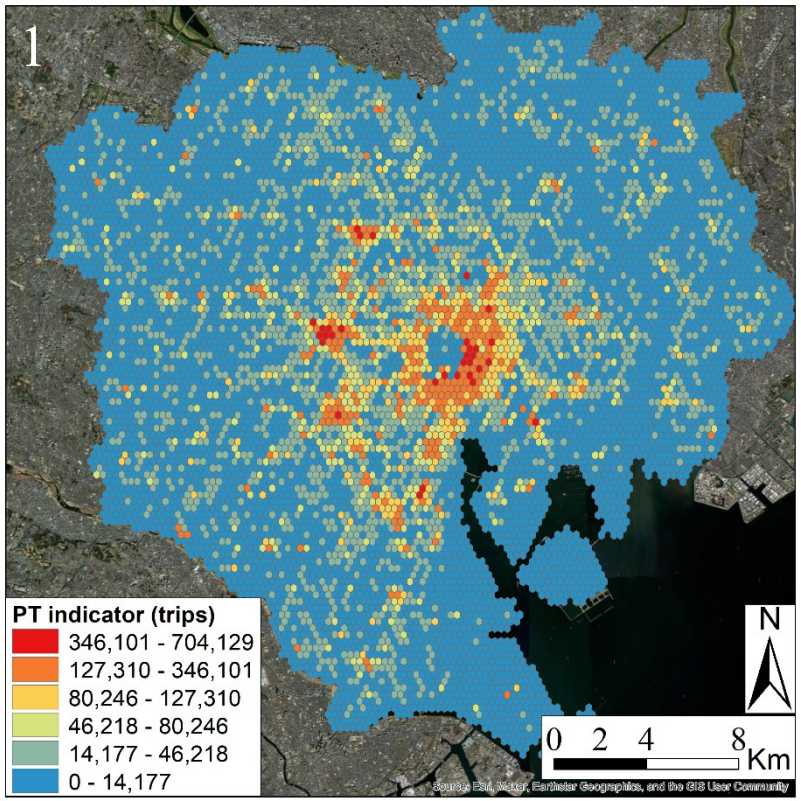
ID	Purpose
1	Work
2	School
3	Daily goods
4	Non-daily goods
5	Food and social
6	Cultural activities
7	Medical
8	Daily services
9	Accompanying others
10	Picking up and dropping off others
11	Other study activities
12	Walking. jogging. and exercise
13	Sightseeing. excursions. and leisure
14	Local activities and volunteers
15	Other private use
16	Meeting. business negotiation
17	Sales. delivery. purchase
18	To other work
19	To home (excluded)
20	Private use
99	Unknown (excluded)

UAC identification algorithm (pipeline)

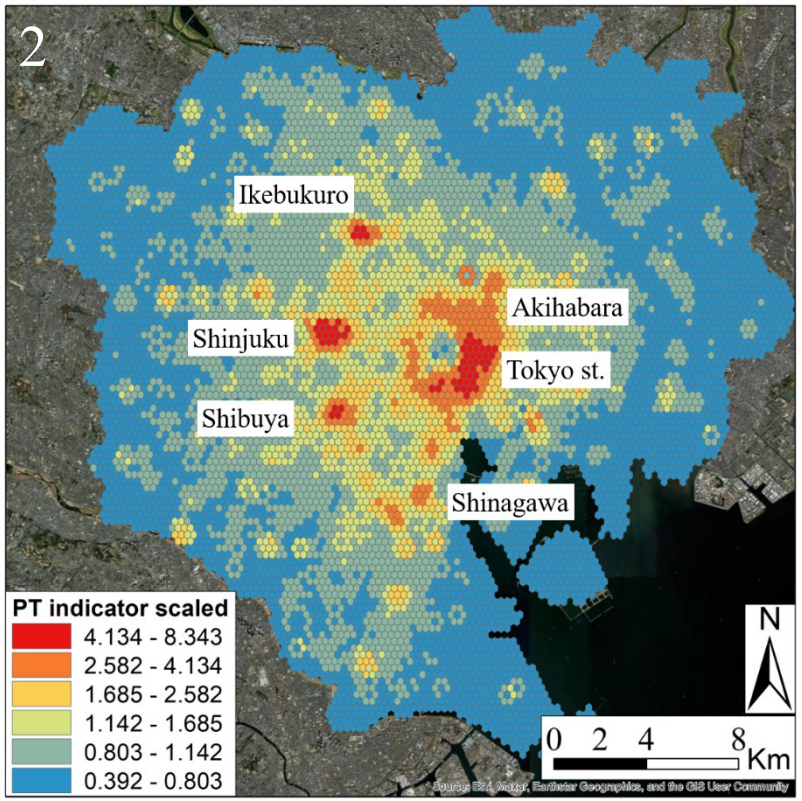
- **Actual distribution of activity**
- **Local activity trend (*y*)** – actual urban activity in neighboring cells.
- **Global activity trend (*X*):** decrease in urban activity density from the city center to the periphery.

- **Spatial autoregression –** to model urban activity based on *X* and *y*
- **Residuals** from autoregression - cells where urban activity is higher than in their surroundings irrespective of the global trend

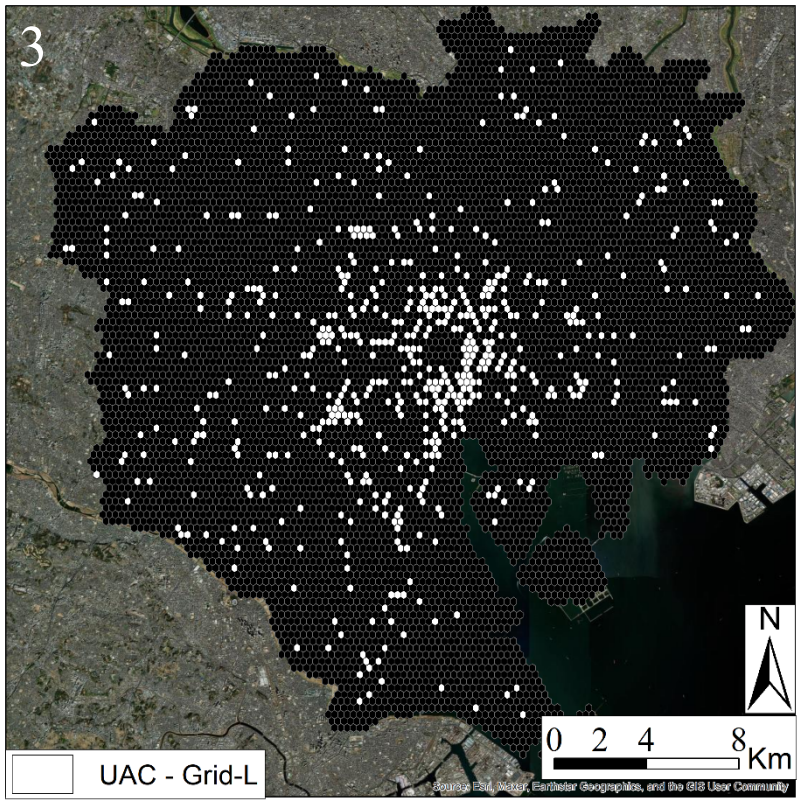
- **UAC. Significant positive residuals** from the model – correspond to the definition of UAC.
- *Published in Boratinskii & Tikhotskaya (2021). Inspired by: McMillen (2001) and Vysokovsky (2005).*



Actual distribution



Modelled distribution



Significant residuals

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