**VGI-ALIVE - AnaLysis, Integration, Vision, Engagement
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Crowd-sourced information on building façades - A comparative study on the use of commercial and non-commercial crowdsourcing platforms

Robert Hecht[1], Tim Wendt[2], Martin Behnisch[1]

[1]Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany
[2]Virtual City Systems, Berlin, Germany

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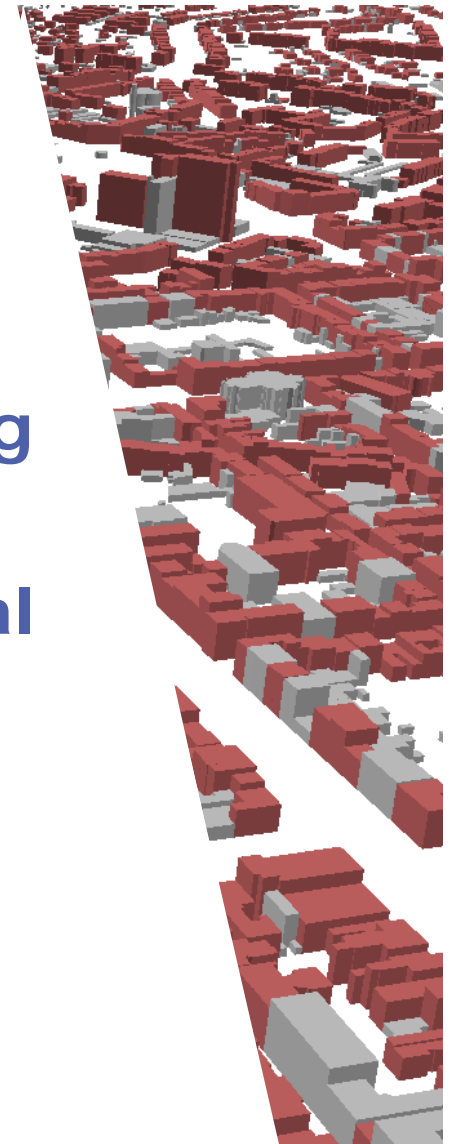
Background

- **Buildings play a key role** (massive, durable, economically and socially relevant) in the urban environment

- **Buildings characterize the settlement structure** in all dimensions (physical, functional, socio-economic)

- Despite the importance of buildings, **complete figures of the entire building stock** and its characteristics is **hardly available**

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Background

- Official topographic maps, data, and services
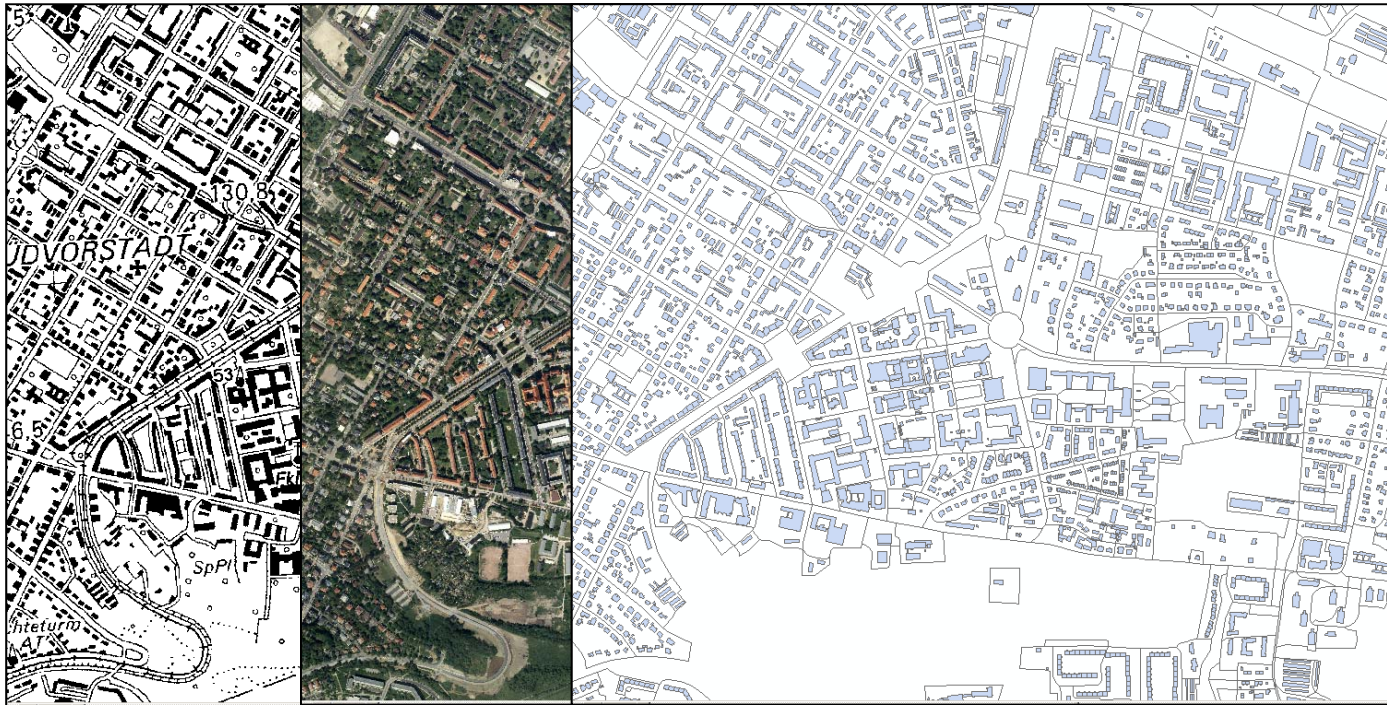
➔ **No explicit information on building characteristics** (building type, height, age, number of storages, façade characteristics etc.)

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Use Case – BIPV for Energy transition

- Assessing the suitability of **non-residential buildings** for the installation of renewable energy systems

- **Facade surfaces** offer great potential for **building-integrated photovoltaics** (BIPV) that replace conventional materials

- **Question:** Which building categories in Germany have the greatest potential for BIPV?
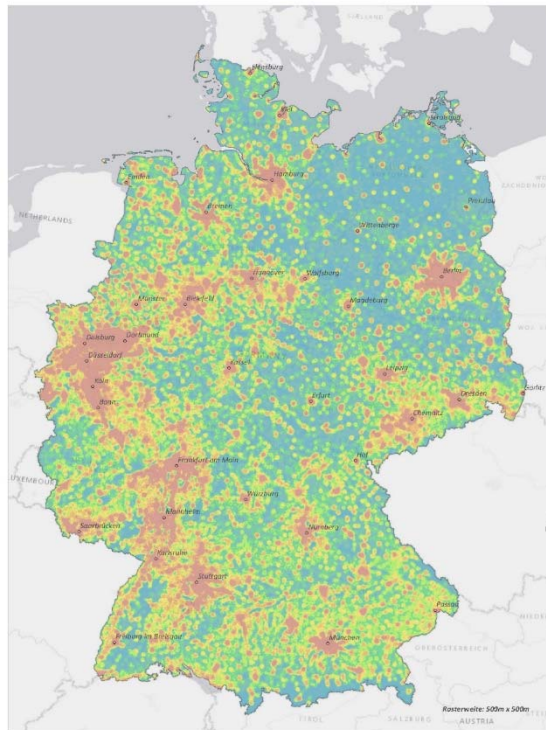

Industrial building with BIPV

Facade analysis (area, orientation)

Summe Fassadenfläche
Deutschland
Summe der Fassadenfläche [m²] in Deutschland
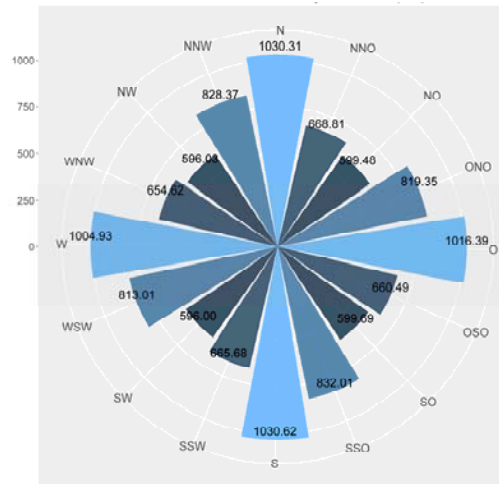
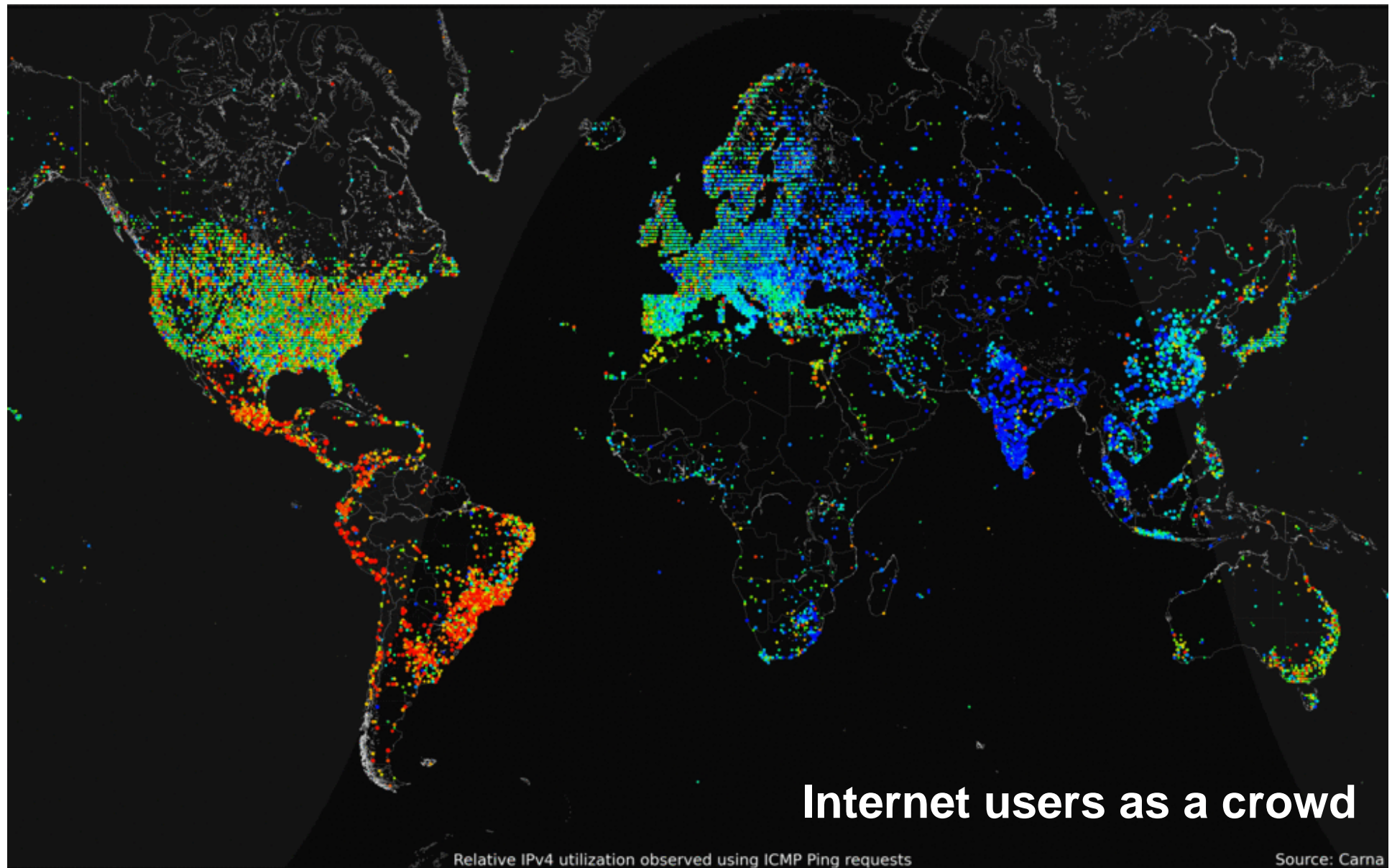- On this basis only rough estimates can be made
- Considering typical facade properties (esp. proportion of windows/doors) would lead to more precise estimates

Internet as a potential image data source

Where people post geotagged photos to Flickr from (orange) and geotagged tweets to Twitter (blue) from.
Source: Eric Fischer

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Relative IPv4 utilization observed using ICMP Ping requests

Source: Carna

Internet users as a crowd
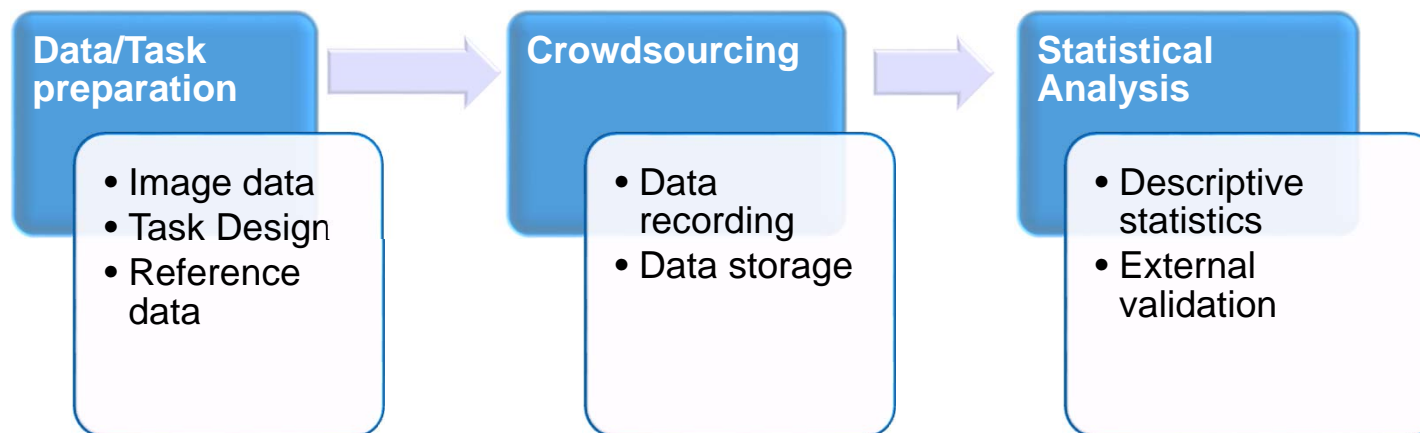
World map of 24-hour relative average utilization of IPv4 addresses observed using ICMP ping requests by Carna botnet, June - October 2012

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Aim of the study

- **Investigating the potential** of crowdsourcing for the collection of façade information (actively collected VGI) from available **geo-coded street view imagery** (e.g. passively collected VGI)
- Development of a **task design**, **processing routines** and **filter approaches**
- **Analyzing data quality** using different crowdsourcing platforms

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Workflow

Data/Task preparation

- Image data
- Task Design
- Reference data

→

Crowdsourcing

- Data recording
- Data storage

→

Statistical Analysis

- Descriptive statistics
- External validation

Used Data

Image data

- **743 photos** of non-residential building facades from Germany (NRW, Thuringia)

- selected from an internal database and partly pre-processed due to data protection reasons (blurring of numberplates, faces etc.)


Reference data

- **For 25% of the photos (n=186)** the proportion of window/door area on the façade (in %) has been manually determined by pixel counts


e.g. 29,31%

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Task Design/Implementation

- **Querying window and door area proportion in %** via response options in 10 % steps (10 selection buttons with a skipping option)
- Multiple annotations by different users (n= 10)
- Implementation in a commercial and non-commercial platform
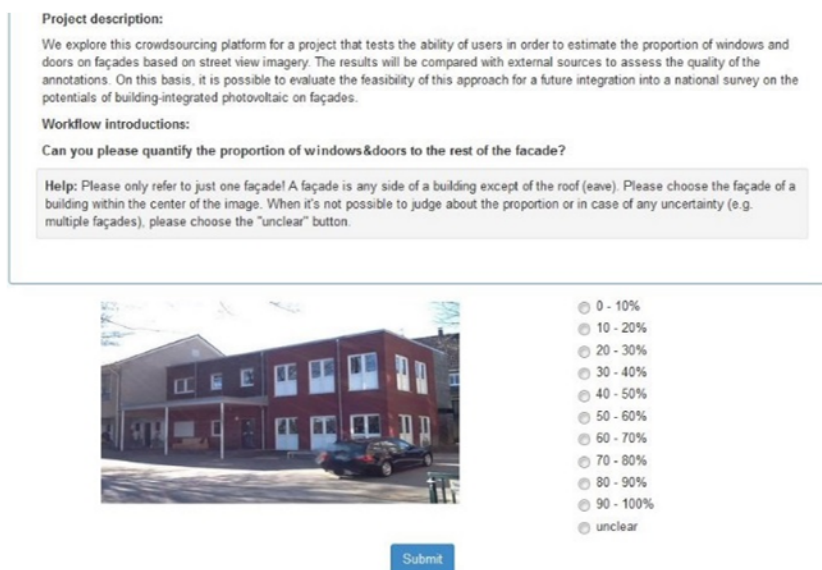
Implemented user interface (MTurk)
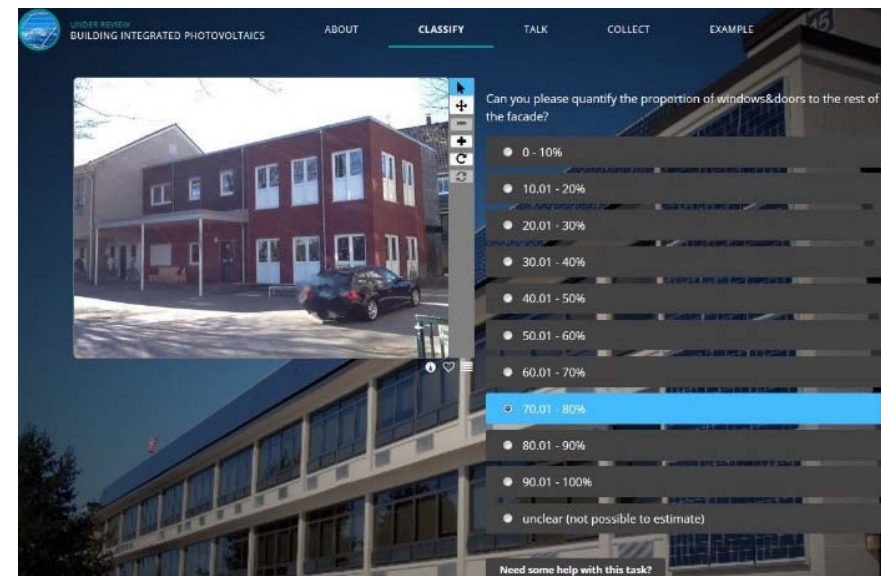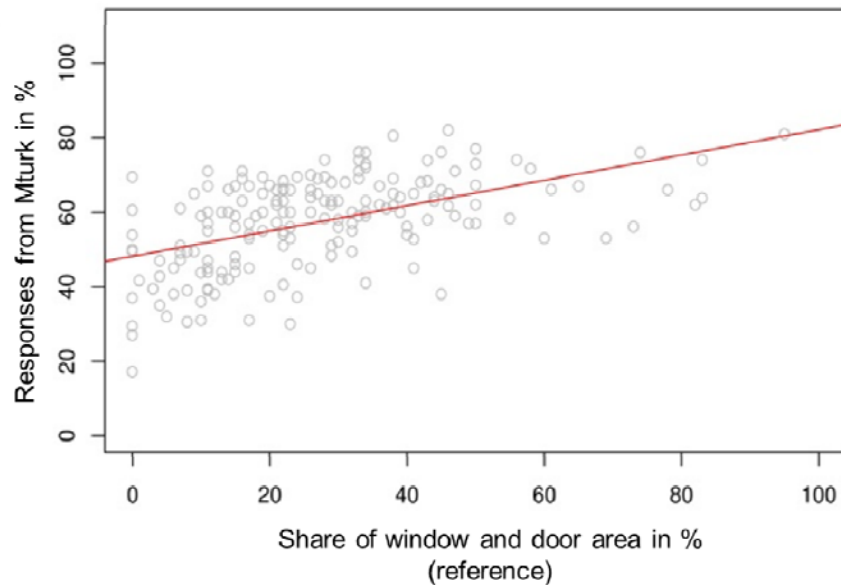

Implemented user interface (Zooniverse)

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Results

Results (descriptive statistics)

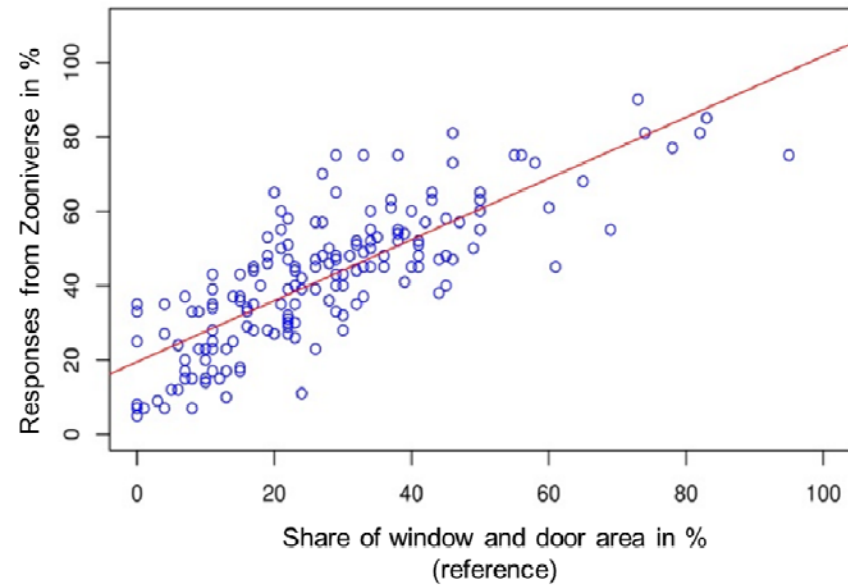|	MTurk	Zooniverse
Duration	59 min	50 days
No. of images	743	743
No. of categories	11	11
No. of annotations	7430	3808
No. of annotators	132	476
Annotations per image (mean)	10,0	5,1
No. of annotations per annotator (mean)	56,3	8,0

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Results (external validation)

	MTurk	Zooniverse
Mean share in % **(reference)**	27,2	27,2
Mean share in % **(crowdsourcing)**	57,4	41,8
Mean difference in p.p. **(crowd - reference)**	**30,2**	**14,6**
SD difference	13,2	10,4

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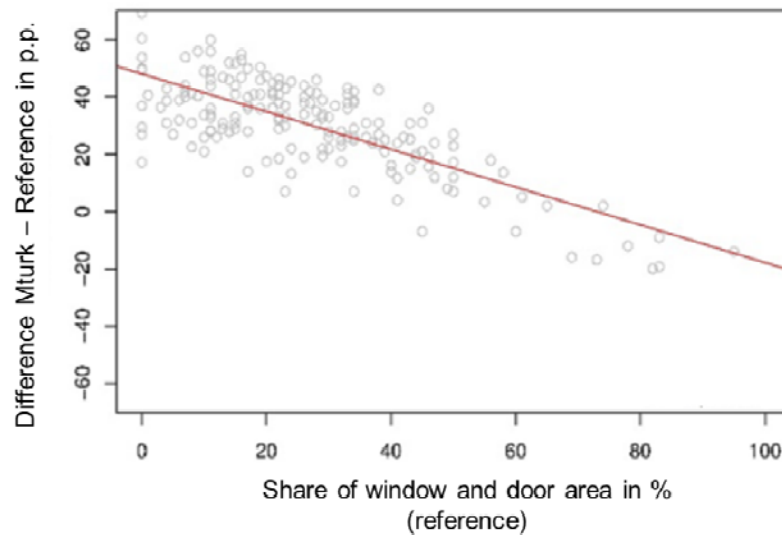
Results (external validation)
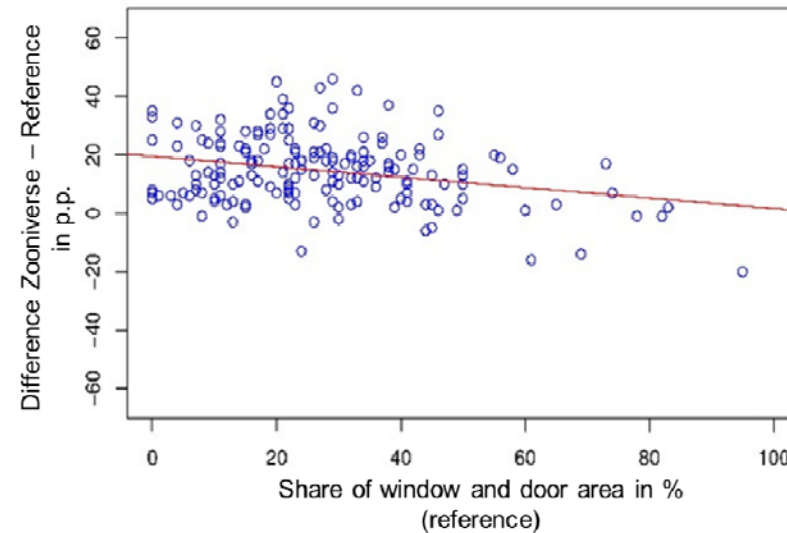

MTurk vs. reference

Zooniverse vs. reference

Results (external validation)

Difference
MTurk - reference

Difference
Zooniverse - reference

Conclusion

- The results allow an initial assessment of the ability of crowdsourcing to derive facade information using different platforms
- We observed:
  - Systematic overestimation of the estimated window/door area for both platforms
  - Magnitude of deviations decreases with increasing window/door area portion
  - Higher accuracies with Zooniverse compared to Mturk

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Outlock

- Further data analysis and experiments needed to explain the causes of misinterpretations and differences (e.g. image quality, task design, unclear definition, origin of the users, incentives)

- Investigating data filtering approaches based on intrinsic quality measures for improving data quality

- Usage of image data from internet platforms (Wikimapia, Mapillary, Flickr, Instagram)

- Testing other building façade characteristics

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Thank you!

Contact

Robert Hecht
Leibniz-Institut für ökologische Raumentwicklung e.V. Dresden
r.hecht@ioer.de
Tel: (0)351 46 79 248

Source: The New Yorker

"On the Internet, nobody knows you're a dog."

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