

Rich-VGI

enRICHment of volunteered geographic information some considerations

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HEIDELBERG CENTER
FOR THE ENVIRONMENT

Thanks to the organizers

- AGILE Local Team Lisbon
- AGILE Secretary & Council

RichVGI Orga. Committee

- Jamal Jokar Arsanjani
- Hongchao Fan
- Peter Mooney
- Joao Porto de Alberquerque
- Alexander Zipf

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Aim of the workshop

- Discussions and exchange of research experiences, approaches, and algorithms for enriching VGI data,
- Understanding the state of the art in the area of VGI enrichment,
- Identifying current knowledge gaps which will help us to clearly outline some short-term and long-term VGI enrichment research goals and themes.

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What means enRICHing? Two perspectives

- | | |
|--|---|
| <ul style="list-style-type: none"> • Poor data -> Rich data <ul style="list-style-type: none"> – VGI with little quality <ul style="list-style-type: none"> • Richer semantics, geometry, better quality... • WHO & HOW? <ul style="list-style-type: none"> – Through the community: <ul style="list-style-type: none"> » Enhance data model, tools, workflow, awareness,.. – Through algorithms: <ul style="list-style-type: none"> » data fusion, machine learning etc. | <ul style="list-style-type: none"> • Rich data -> better knowledge <ul style="list-style-type: none"> – VGI as big data to be mined for new insights • WHO & HOW? <ul style="list-style-type: none"> – Exploratory Data mining – Hypothesis testing – ... |
|--|---|

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enRIChing...

- **semantics**

- more „different“ attributes
- higher quality (e.g. completeness, actuality, resolution, semantic accuracy, compliance to specification..)

- **geometry**

- more geometries (at instance level)
- more complex geometry types (e.g. curves, 3D,..)
- (better resolution /scale...)

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enRIChing

- **The „practical“ side:**

- Developing „richer APP“s
 - through incorporating different VGI data streams
 - (without much data mining or similar)

i.e.: just using the richer data that is there for applications that were (nearly) not possible earlier (because of lack of data):

- e.g. recommender systems for tourism,
- specialized routing
- specialized / improved maps

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enRIChing

- **the Input side**

- Richer technical sensors
 - (in the „hands“ of the crowd)
- Unprecedented availability of
 - open data &
 - social media
- More and more people have access to technology and relevant education

Do we as scientists have to care for enriching the data? – it seems to happen anyway?

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Knowledge Gap?

- YOUR interpretation of enRIChing VGI?

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Conceptual VGI Data Quality

- **Def. Richness:**
Amount and variety of dimensions that are included in the description of the real-world entity.
- **Indicators:**
e.g.: Number of attributes describing a feature.
- Ballatore, A. & A. Zipf (2015): A Conceptual Quality Framework for Volunteered Geographic Information. COSIT 2015, Santa Fe, USA. (accepted)

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Measuring Richness - Data Quality

- Many Indicators for VGI Data Quality
 - Extrinsic & intrinsic indicators for the well known GI quality dimensions (positional accuracy, attribute accuracy, logical consistency, completeness, lineage)
- Richness - conceptual! (Ballatore & Zipf)
- Other interpretations for richness?
 - E.g. „Rich“ facade models in 3D City Models
 - ...?
- Your Ideas for measuring richness?

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OSM <Quality> Research Overview

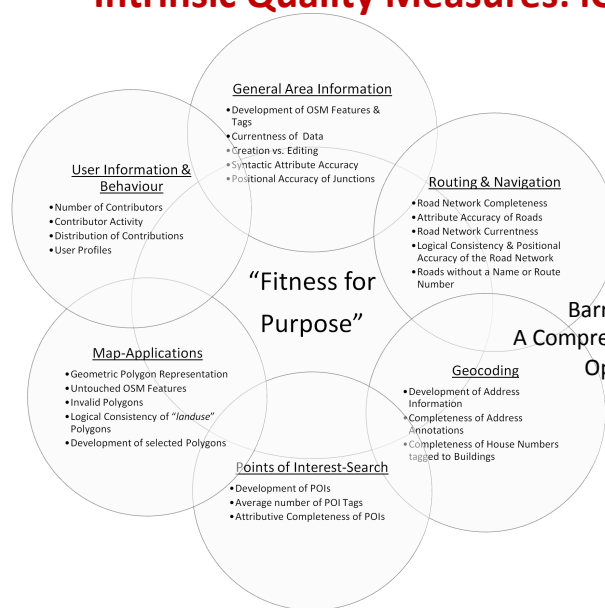
- Jokar Arsanjani, J., Zipf, A., Mooney, P., Helbich, M., (2015):
An introduction to OpenStreetMap in GIScience: Experiences, Research, Applications.
In: Jokar Arsanjani, J., Zipf, A., Mooney, P., Helbich, M., (eds):
OpenStreetMap in GIScience: experiences, research, applications. ISBN:978-3-319-14279-1, Springer Press.

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Intrinsic Quality Measures: iOSManalyser



Barron, C., Neis, P. & Zipf, A. (2013):
A Comprehensive Framework for Intrinsic
OpenStreetMap Quality Analysis. ,
Transactions in GIS,
DOI: 10.1111/tgis.12073.



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enRICHing Examples

GIScience Heidelberg

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from „poor“ VGI to „better“ VGI Examples from GIScience Heidelberg

Richer Semantics

- OSM-3D
- IndoorOSM
- Accessibility (Wheelchair)
- Traffic information (TMC)
- Disaster Mapping (defining elements at risk)
- land cover & land use
- ...

Richer Geometry

- OSM-3D
- Interpolating House numbers
- Deriving building information
- Wheelchair Routing networks
- Agriculture routing networks
- Agricultural fields
- LCLU
- ...

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from RichVGI to knowledge Examples from GIScience Heidelberg

- Flickr Fotos
 - Floods, traffic infrastructure, tourism activities...
- Twitter
 - flood, typhoon, human mobility pattern, event detection, --
- Foursquare Check-ins
 - Human mobility
- OSM
 - urban areas, land use, population distribution
- Citizen Science
 - Biodiversity, validate data
- Emotion Sensing Devices
 - PsychoGeography, UrbanEmotions



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A.) enRICHing „poor“ VGI

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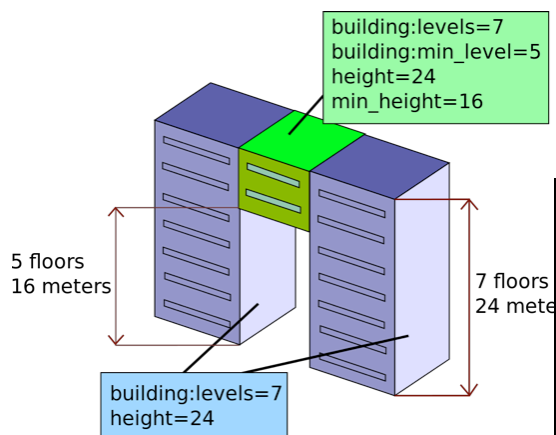
Goetz, M. & Zipf, A. (2013): The Evolution of Geo-Crowdsourcing: Bringing Volunteered Geographic Information to the Third Dimension. In: Sui, D.Z., Elwood, S. & Goodchild, M.F. (eds.): Crowdsourcing Geographic Knowledge. Volunteered Geographic Information (VGI) in Theory and Practice. Berlin: Springer. 2013.

OSM-3D.org



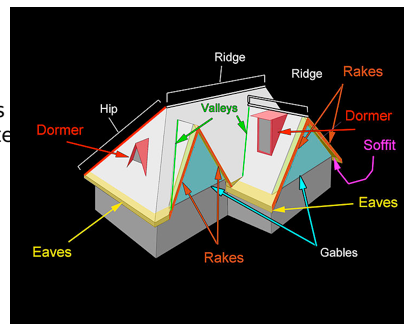
OSM-3D

Goetz, M. & Zipf, A. (2012): Towards Defining a Framework for the Automatic Derivation of 3D CityGML Models from Volunteered Geographic Information. Int. Journal of 3-D Information Modeling (IJ3DIM), Vol.1(2), pp. 1-16.



http://wiki.openstreetmap.org/wiki/3D_tagging

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OpenBuildingModels.uni-hd.de

- What?
 - Free-to-use repository for rich 3D architectural building models
 - Link 3D models to OSM or use them for other applications
- Why?
 - Not each building is taggable...



Uden, M. & Zipf, A. (2012): OpenBuildingModels - Towards a platform for crowdsourcing virtual 3D cities. 7th 3D GeoInfo Conference. Quebec City, QC, Canada.

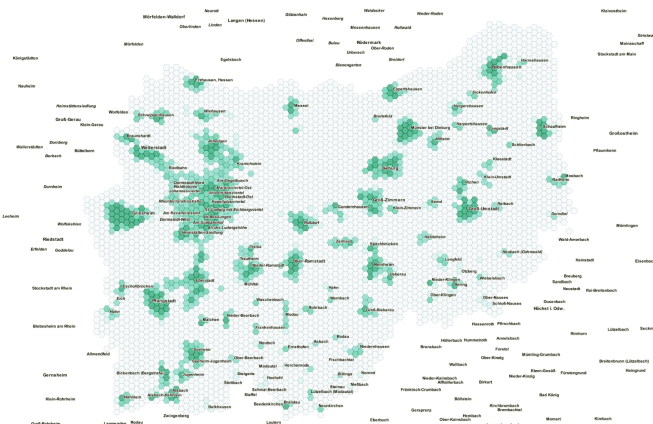
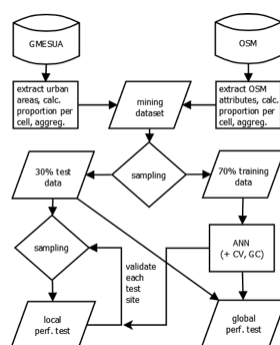
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(Machine) Learning urban areas from OSM



Mining urban land use patterns from volunteered geographic information by means of genetic algorithms and artificial neural networks; Hagenauer & Helbig; JGIS 2012

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Improving OSM in rural areas using telematics data from agricultural machines

- Telematics data from harvesters...
 - Rural streets
 - Field boundaries
 - Access points to fields

Lauer, J.; Richter, L.; Ellersiek, T.; Zipf, A. (2014):
[TeleAgro+ - Analysis Framework for Agricultural Telematics Data](#),
 IWCTS '14, SIGSPATIAL '14,
 Dallas/Fort Worth, TX, USA.

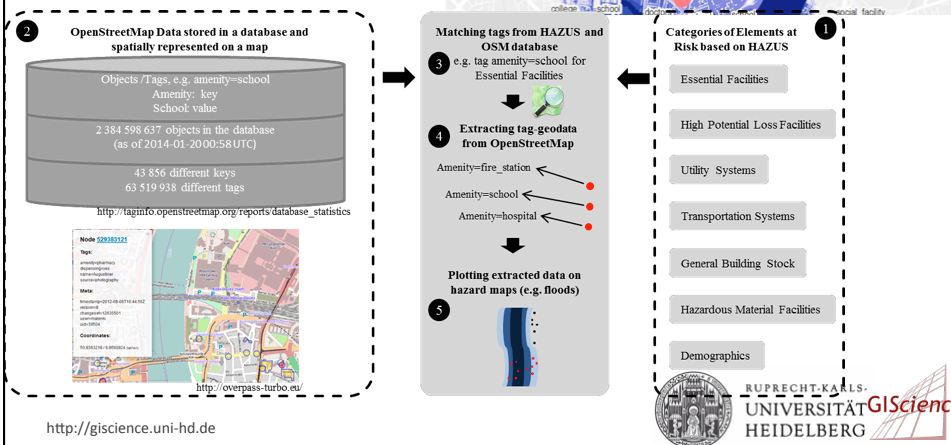
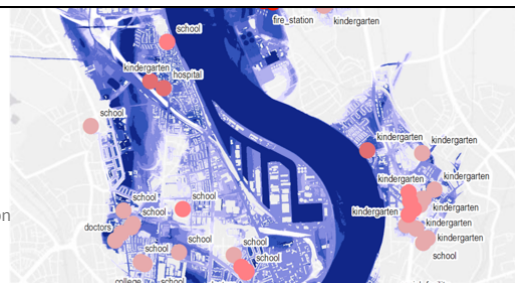
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Identifying elements at risk

Schelhorn, S., Albuquerque, J.P., Zipf, A., Leiner, R. & Herfort, B. (2014): Identifying Elements at Risk from OpenStreetMap: The Case of Flooding. 11th Int. Conf. on Info. Systems for Crisis Response and Management (ISCRAM) Pennsylvania



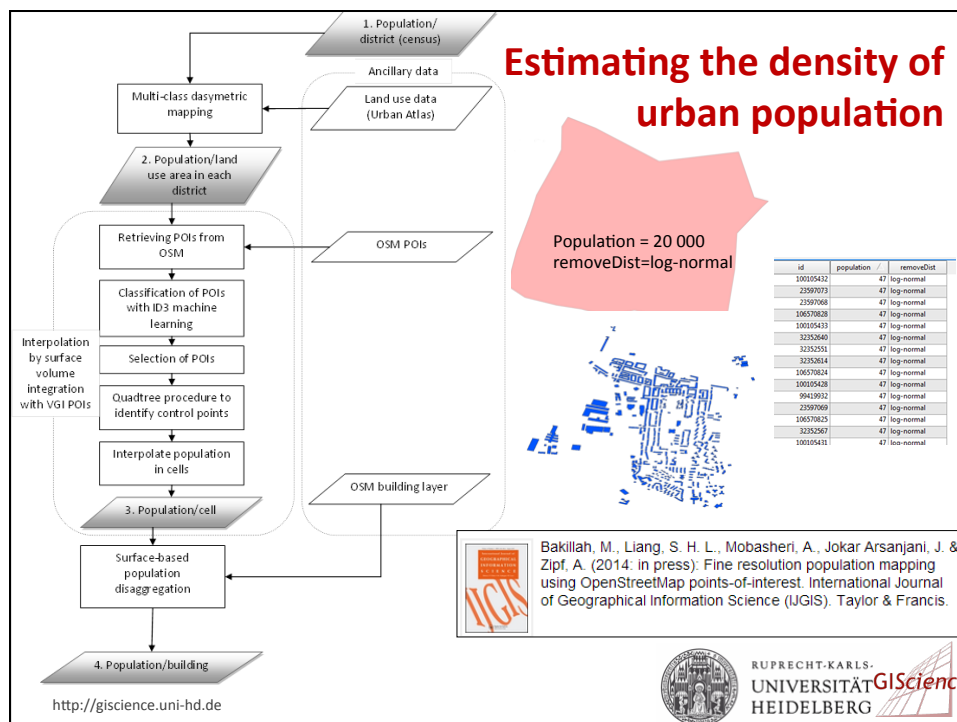
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B: Learning new knowledge from Rich VGI

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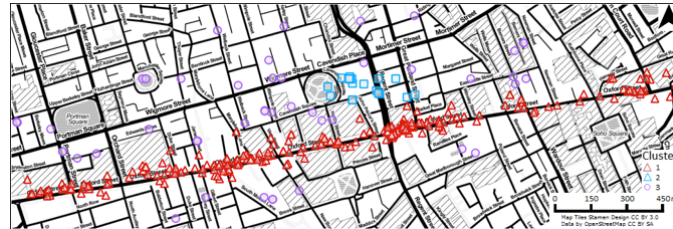


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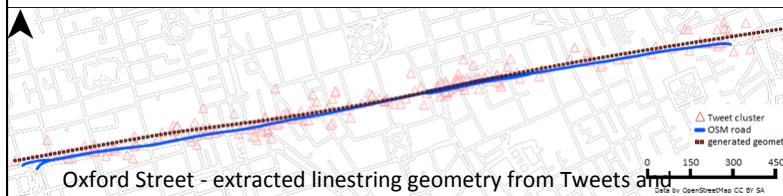


Social Media Analysis

Steiger, E., Lauer, J.,
Ellersiek, T., Zipf, A.
(2014): Towards a
framework for
automatic geographic
feature extraction
from Twitter.
GIScience Conf.,
Vienna.



LDA topic associated words "oxford" and "street" for georeferenced Tweets in London after applying DBSCAN clustering (n = 1186).



Oxford Street - extracted linestring geometry from Tweets and comparison with OSM road (Hausdorff distance = 0.0030468)

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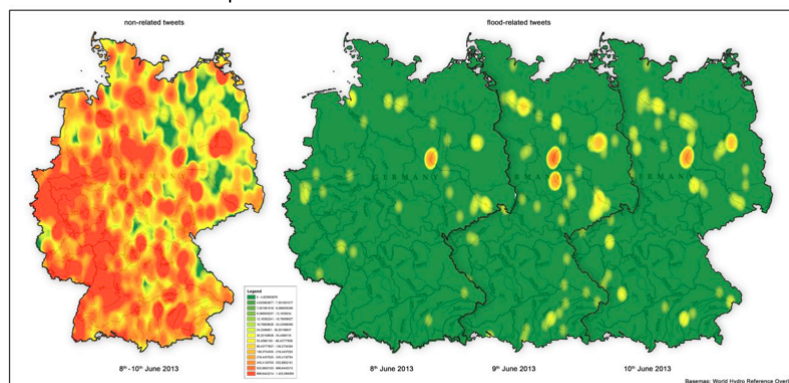


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Social Media in Disaster Management

Spatial distribution of flood-related and non-related tweets



Porto de Albuquerque, J., B. Herfort, A. Brenning, A. Zipf (2014): A Geographic Approach for Combining Social Media and Authoritative Data towards Improving Information Extraction for Disaster Management. International Journal of Geographical Information Science (IJGIS).

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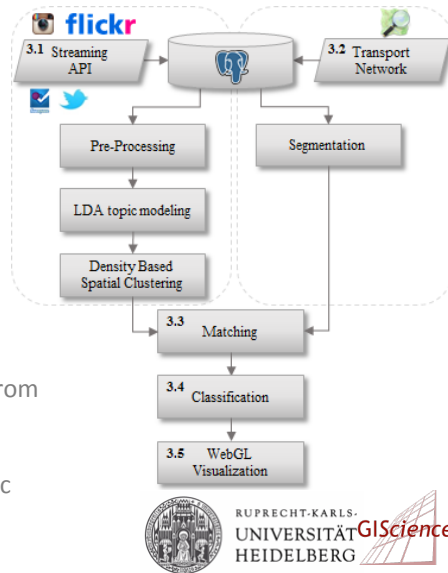


Social Media Analysis



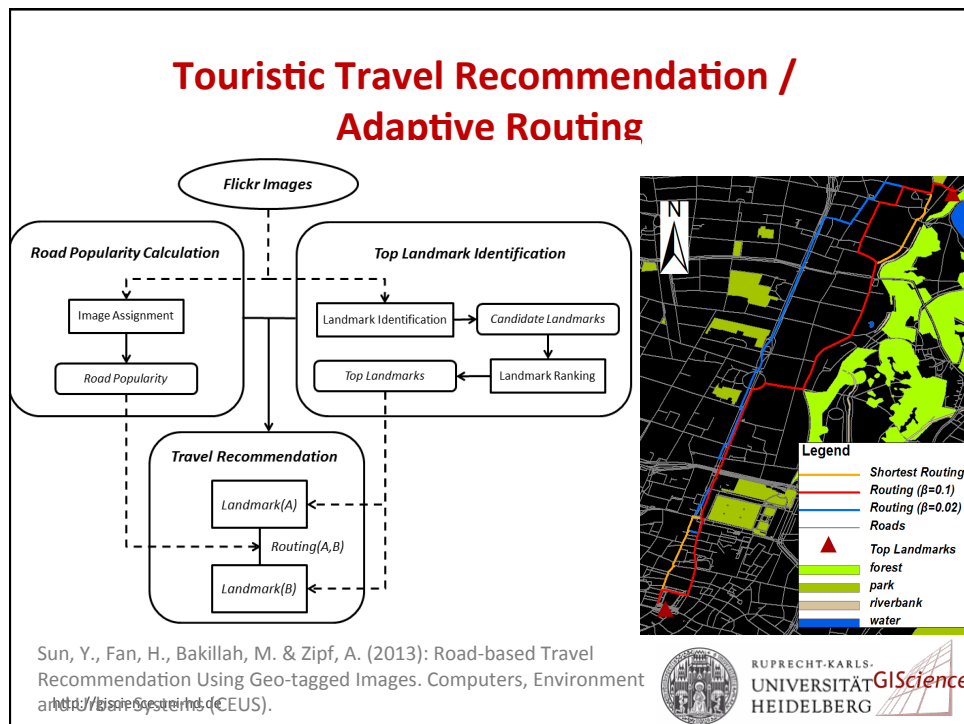
Steiger, E. Ellersiek, T. Zipf, A. (2014):
Explorative public transport flow analysis from
uncertain social media data. Third ACM
SIGSPATIAL International Workshop on
Crowdsourced and Volunteered Geographic
Information (GEOCROWD) 2014.

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C: Rich Applications?

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Discussion

- What is YOUR interpretation of enRICHing VGI?
- Where is the knowledge Gap?