

Towards Human Computation in GI

Merging Crowd Computing with Artificial Intelligence



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<http://uni-heidelberg.de/gis>



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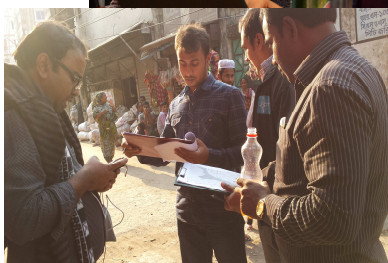
Geographic Information from the Crowd

Remote mapping from all around the world



Field mapping
unleashing local
knowledge

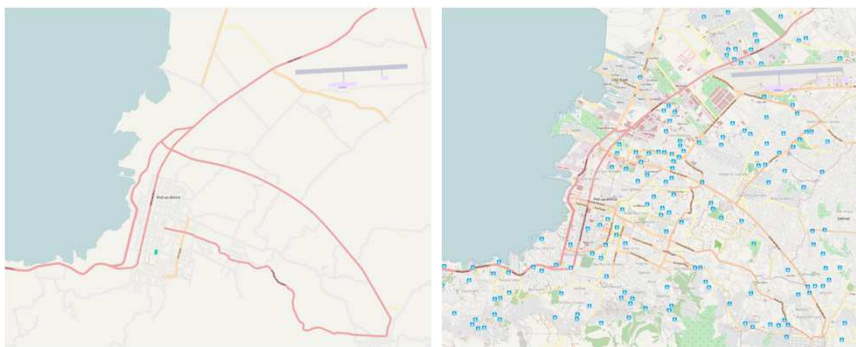
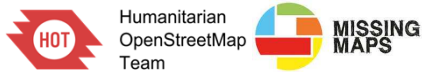
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Humanitarian Mapping

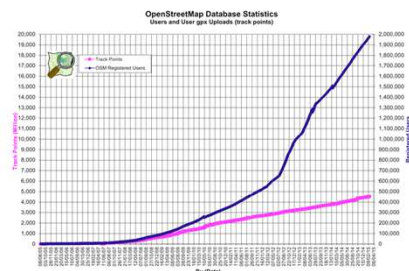
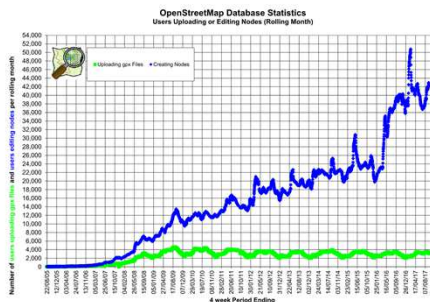
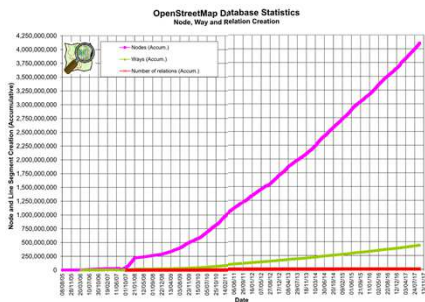


OSM Haiti Map – before - and 1 week after - earthquake 2010

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A growing & active OpenStreetMap Community



wiki.openstreetmap.org/wiki/Stats

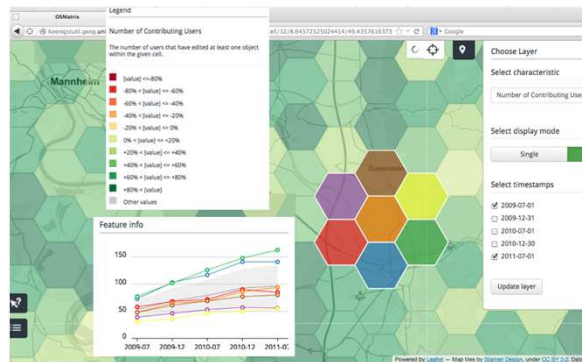
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Spatial Data Quality: some dimensions

- Completeness
- Lineage
- Logical Consistency
- Positional Accuracy
- Attribute Accuracy
- etc...

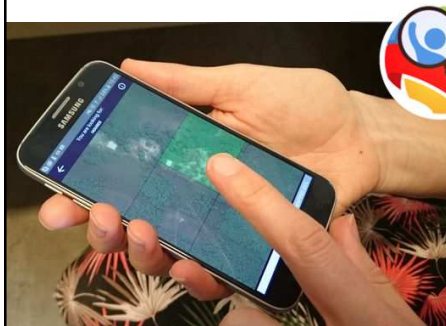
ohsome.org
OSM-HISTORY PLATFORM



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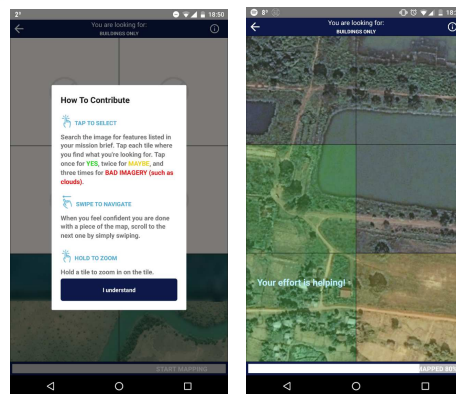


MapSwipe.org - Mobile Mikrotasking



MapSwipe

- since July 2016
>26.000 contributors
- > 560 contributors per project
- > 500.000 km²

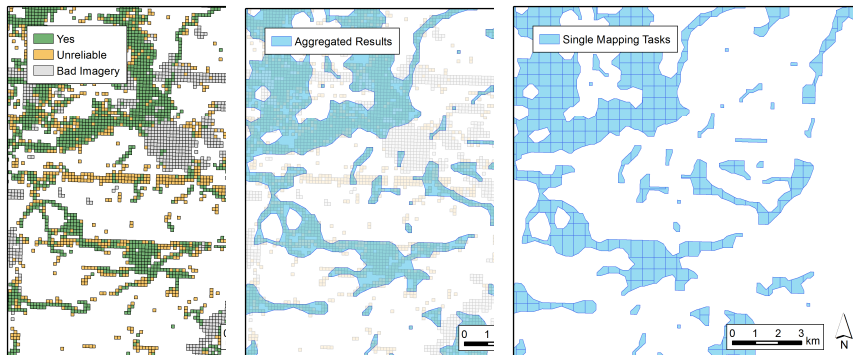


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Priorizing Disaster Mapping in OSM

- MapSwipe to HOT Tasking Manager



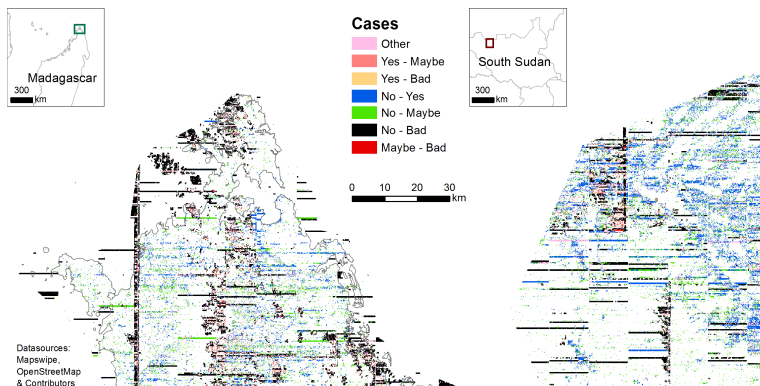
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Mapswipe Analytics

mapswipe.heigit.org

- Different agreement cases
- ML for calculation of agreement between users



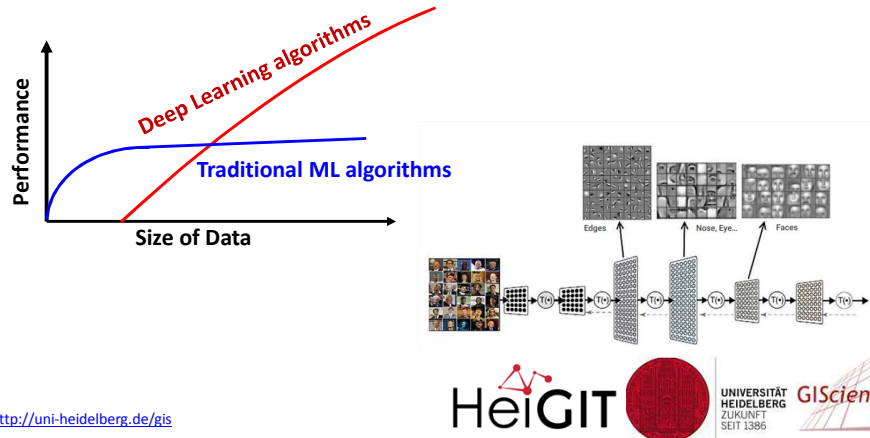
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(Deep) Machine Learning

Machines learn from given examples
 – needs labelled training set

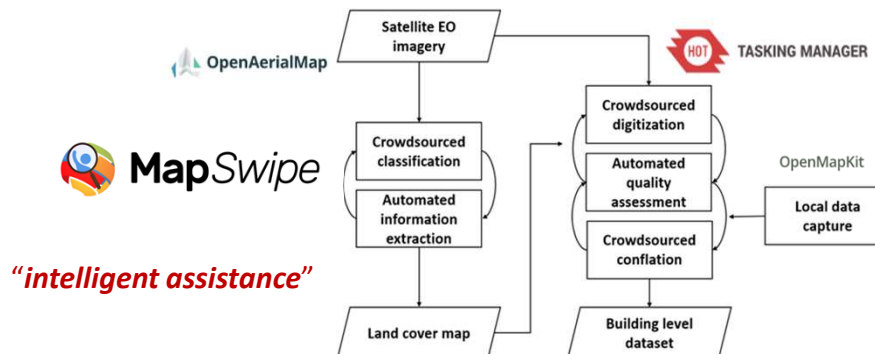
- **crowd generates training data labels**



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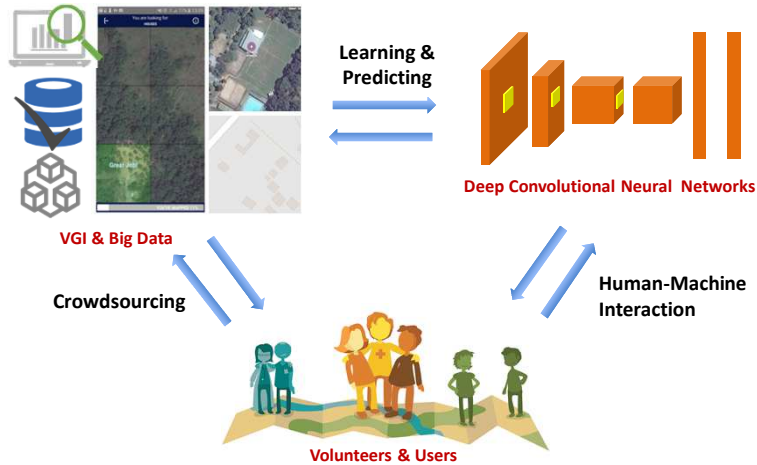
“Smarter” MapSwipe workflow using ML

- Automation during **information extraction & quality assessment**
- Mappers are essential in all steps of the workflow



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DeepVGI Concept

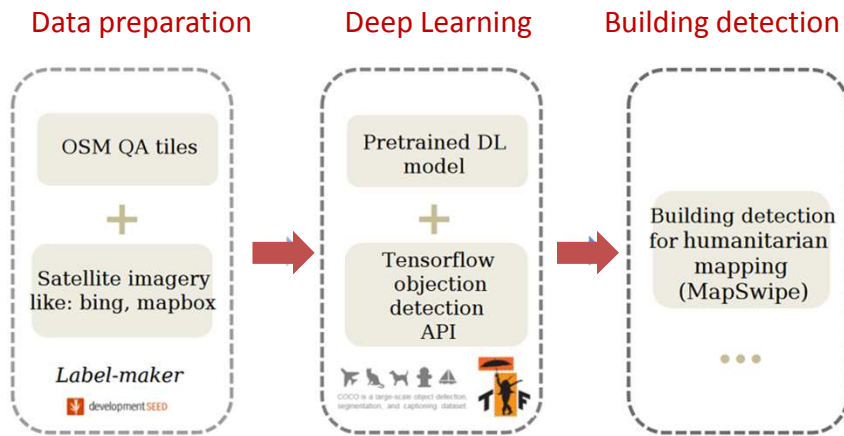


Chen, J., Zipf, A. (2017): Deep Learning with Satellite Images & Volunteered Geographic Information. In: Karimi, H. A. & Karimi, B. (eds.): Geospatial Data Science Techniques & Applications. CRC Press.

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DeepVGI - Building Detection

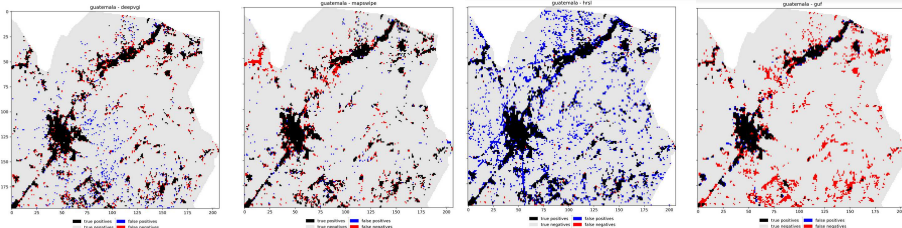


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Evaluation with other data sets

true positives
 true negatives
 false positives
 false negatives



Deep VGI

MapSwipe

Global Urban Footprint

High Resolution Settlement Layer

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1. Synopsis

Goals

- Improve data quality (sensitivity & precision)
- Increase mapping speed or map larger areas
- Rely on human skills when needed
- Rely on automation when possible

Potential for Machine Learning

- Pre processing e.g. filtering cloudy areas or waterbodies etc.
- Image analysis & object detection
- Intrinsic data quality analysis

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Landuse data from OSM: OSMLanduse.org

OSMLanduse.org Mimic CORINE classification

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Info & Contact

search place...

52.1%

19.6%

Area in current viewport

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OSMLanduse fusion with Sentinel-2 satellite data

Generate Landuse map from OSM & Satellite Imagery via Machine Learning

10 m resolution // validation

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GIScience

Vision: Machine Learning Assisted Mapping

Extending – not replacing state of the art approaches

Machine

- Machine learning assists volunteers while mapping
- Detecting mapping errors
- Instant feedback to users



Crowd

- Crowdsourcing OSM data as training samples
- Volunteers validate the automatically generated features

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Thank you very much!


Questions?



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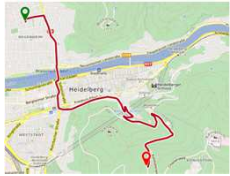
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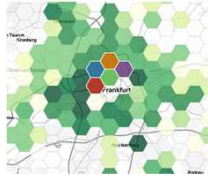
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Smart Mobility
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**VGI for
Humanitarian Aid**




**Big Spatial Data
Analytics**

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OSM Research Overview

Jokar Arsanjani, J., Zipf, A., Mooney, P., Helbich, M., (eds) (2015):
OpenStreetMap in GIScience: experiences, research, applications.
373p. Springer Science. Heidelberg, Berlin.
ISBN 978-3-319-14279-1



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