Human Mapping with Machine Data

Mapillary

STATE OF THE MAP
Bridging the Map
Heidelberg 2019

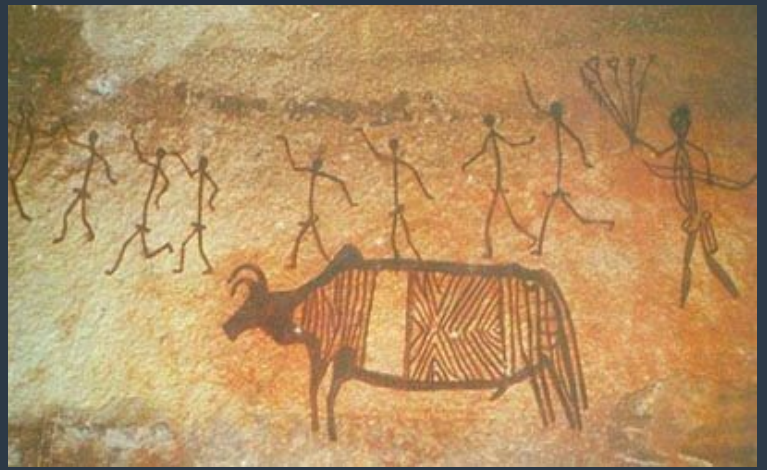
Edoardo Neerhut & Christopher Beddow

Human Mapping

- Mapping is:
  - Cartography, Data collection, Design, Data management, more…
  - Symbols to make sense of the world
- By **humans**, for **humans**
- Maps == tools
- Humans…

  build/design/test/break/invent/imagine

  tools
- Humans do the same with **maps**



Sources

- Maps are tools built from **data**
- **Raw, uninterpreted data** is a source of information
- **Imagery** is not a map: it becomes a map
- OSM changesets cite the source (imagery)
- Sources interpreted by human
- Human is bridge between data & information

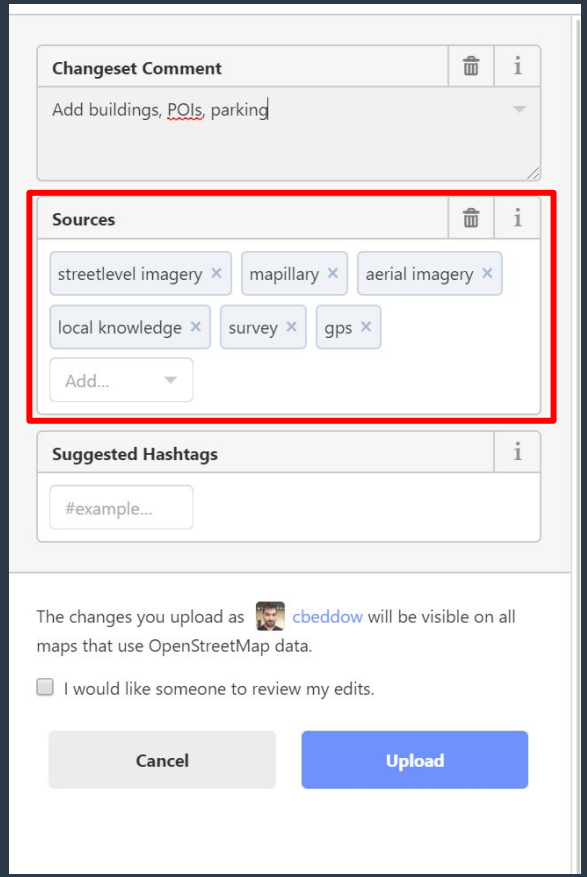
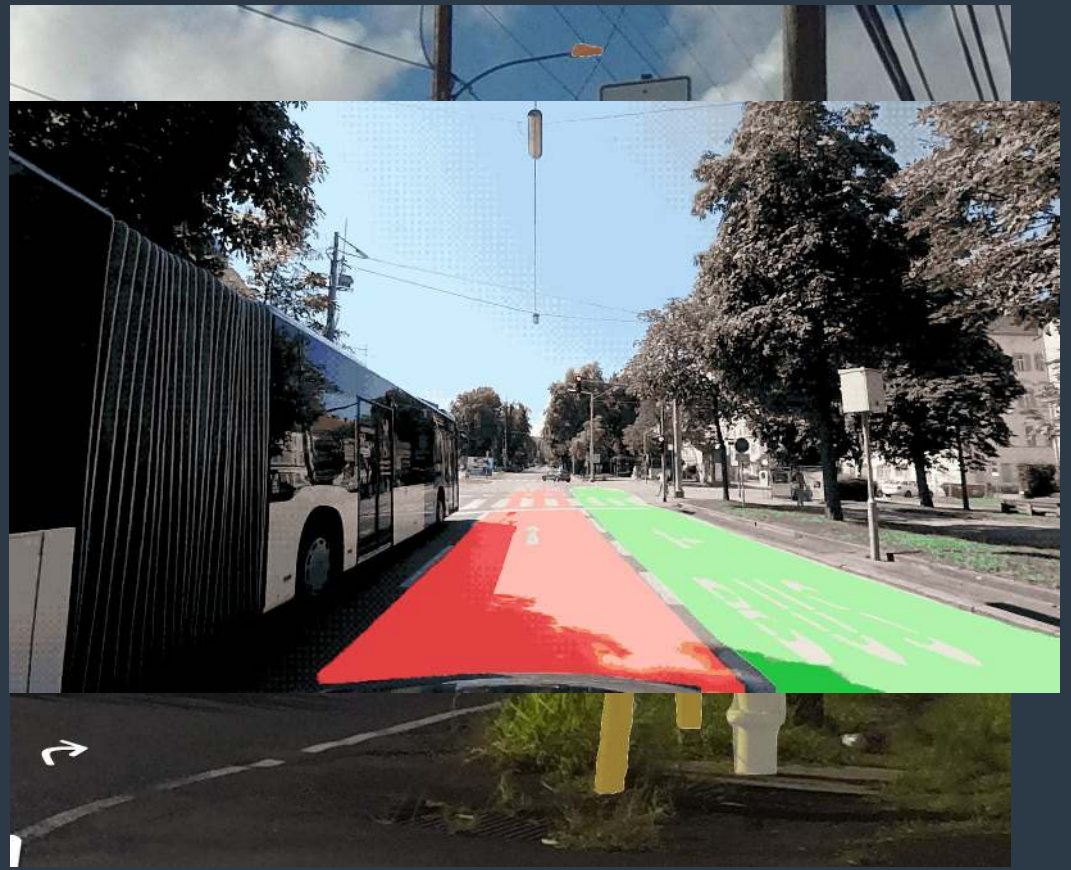


Photo mapping

- Image capture at dense interval gives snapshot of ground level
- How to use images for mapping?
  - Geotag, timestamp
- Upload to Mapillary => view in OSM
- Fast data collection (10-120 km/h?)
- Less field time, more desktop time
- Well suited for temporal studies

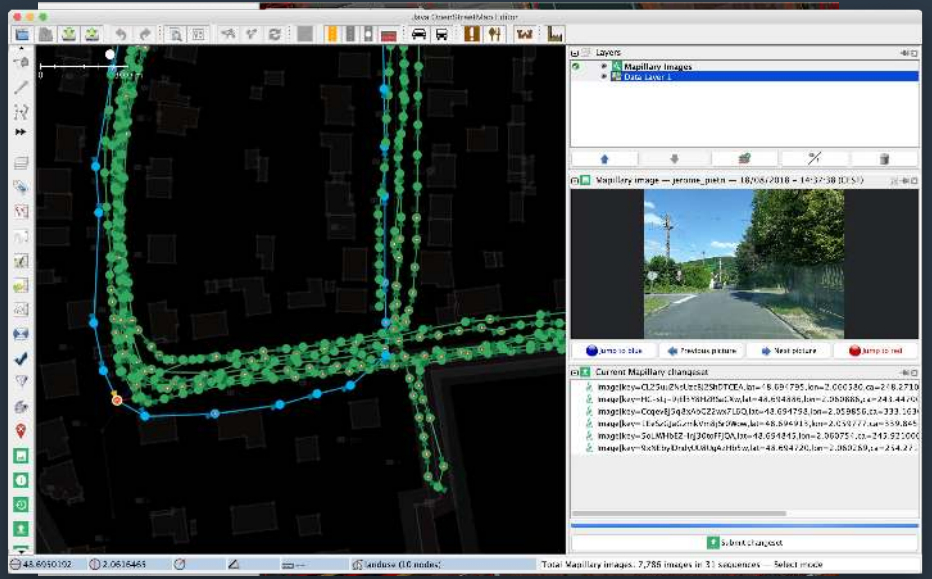
Computer Vision

- Algorithms to interpret images
  - Training data
  - Scalable
- Analyze immense amounts of imagery, in a short time
- Classify images, 3d scene construction
- Get the data back to the map



Mapillary ❤ OSM - A brief history

- Traffic sign layer for iD Editor available since early 2016
- Traffic sign layer for JOSM available since mid 2016
- Little visibility into how this data is used to make edits in OSM
- Willingness from community to improve quality of derived data



mapillary2osm

- Experiment in 5 cities to better understand how derived map data is useful in OpenStreetMap
- 5 locations were selected
- 25km^2 area of interest
- 3 map features provided

Mapillary

mapillary2osm

16 April - 16 May, 2019

Read more

User	Location	post_box	bicycle_parking	bench	Total
velmyshanovnyi	kyiv	0	0	242	242
Approksimator	kyiv	0	0	228	228
trueVadila	kyiv	1	0	100	101
Sergey82K	kyiv	2	1	45	48
enoerhut	melbourne	0	0	6	6
roamingbuffalonian	austin	0	0	2	2
mds08011	austin	0	0	1	1
AE35	ballerup	0	0	2	2
tmdq	austin	0	1	0	1

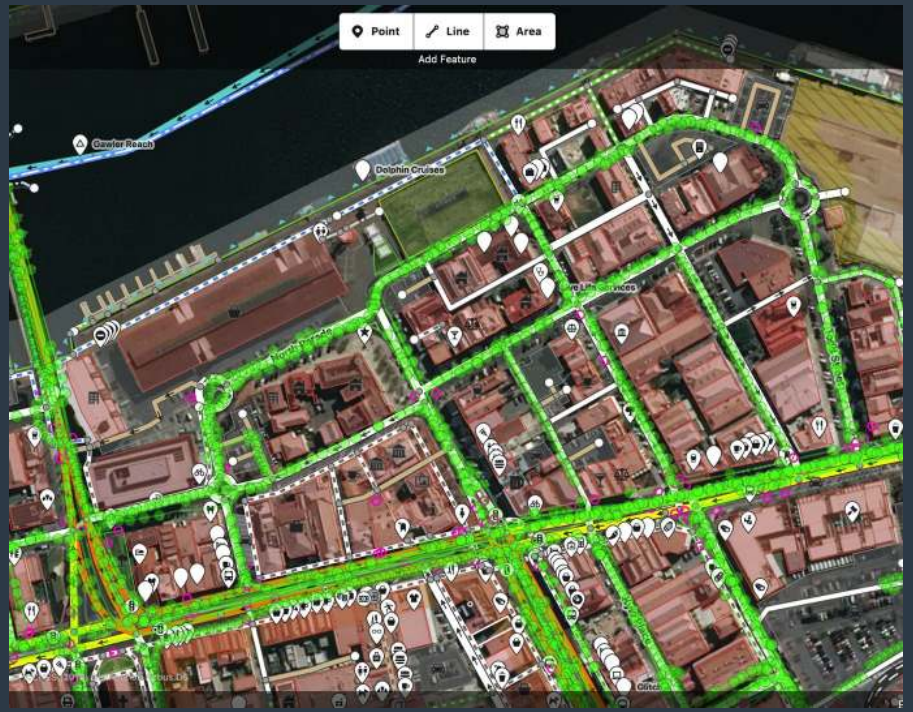
Location	Participants	Nodes
kyiv	4	619
melbourne	1	6
austin	3	4
ballerup	1	2





mapillary2osm

- Map features loaded directly in iD editor using GeoJSON file
- GeoJSON file does not sure image in which map feature was detected
- Accuracy dependent on GPS of capture device



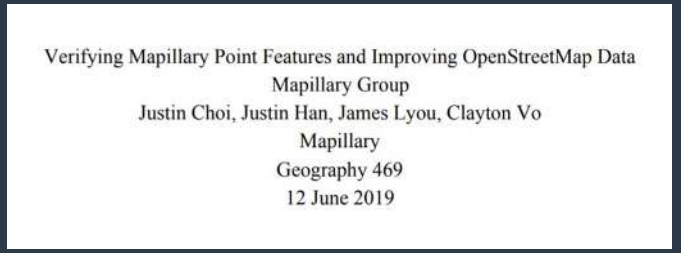
Data feedback

- Not all the icons are intuitive
- The lat/lon of identified features varies considerably in line with the accuracy of the the camera GPS positions
- Object classes for humanitarian purposes are limited

False bench detection in Austin

Student Project

- Analyze area with dense Mapillary data
  - Pearl District in Portland, Oregon
- Evaluate data quality by comparing to OSM
  - Fire hydrants
  - trash bins
  - Crosswalks
  - Benches
  - Bicycle racks
- Second item
- Fourth item



Verifying Mapillary Point Features and Improving OpenStreetMap Data
Mapillary Group
Justin Choi, Justin Han, James Lyou, Clayton Vo
Mapillary
Geography 469
12 June 2019

2,098

Total Points

1193 Points Visible | **904** Points Non-Visible

59% Accuracy

452

Points Added to OSM

Student Project

False Positives

Benches	Guard Rails, Bus Stops, Chairs, Tables
Waste Baskets	Parking Machines, Newspaper Vending Machines, Mailboxes
Bicycle Racks	Handrails
Crosswalks	Bright splotches of white light

False Positives, Duplicates, Poor image quality

	Visible	Non-Visible	Detection Rate	Total
Bench	288	460	38%	748
Bicycle Racks	241	50	83%	291
Fire Hydrants	400	92	81%	492
Waste Baskets	85	214	28%	299
Crosswalks	179	89	67%	265
Total	1,193	905	57%	2,098

Drawbacks

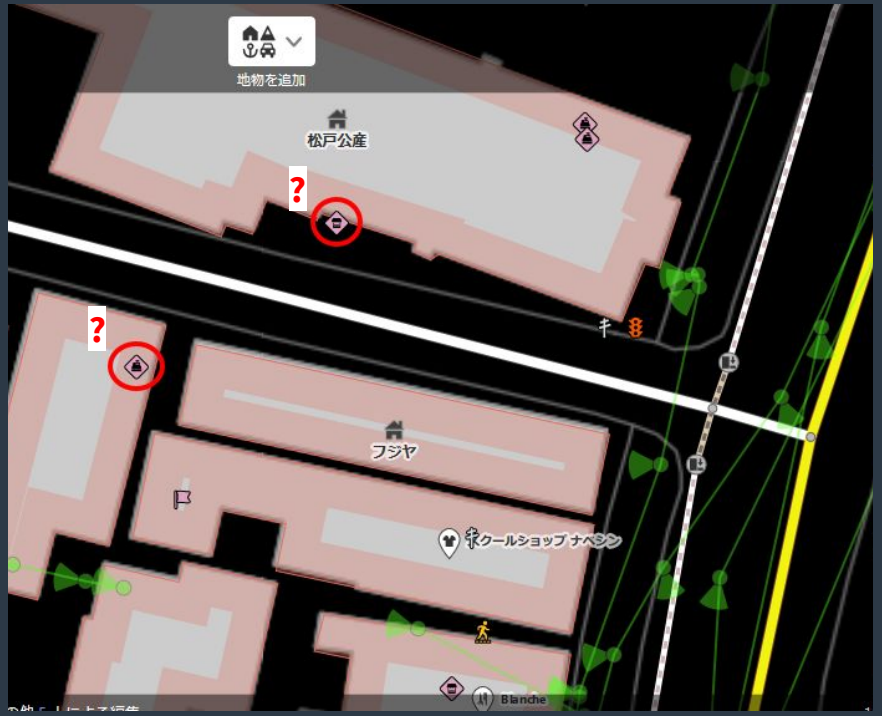
- Data not easy to interpret
- API not easily imported to OSM
- Irrelevant data classes
- Variable accuracy and precision
- Data needs verification, validation
- No established workflow
- **How to properly ingest this type of data into OSM?**

Data Overlay

- **New experiment**: tile the map features from API
- Use Mapillary sprites, overlay on OSM iD
- Click icon to show images
- Add the data to OSM if correct
- Map features must appear in >3 images

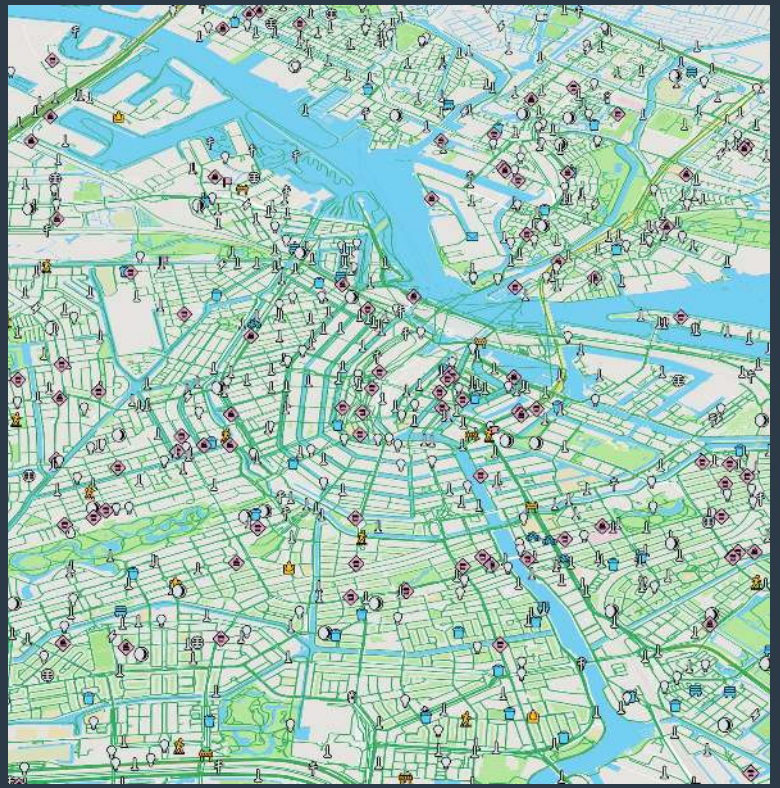
Drawbacks

- Icons not all intuitive
- Bad image GPS == bad data position
- Unverified data == false positives, false negatives
- Unclear what data is available, and what is not



Available data

- Bench
- Bike rack
- Fire hydrant
- Mailbox
- Phone booth
- Street light
- Utility pole
- Traffic light
- Trash can
- Crosswalk
- CCTV Camera
- Banner
- Catch basin
- Manhole
- Advertisement
- Information sign
- Shop sign

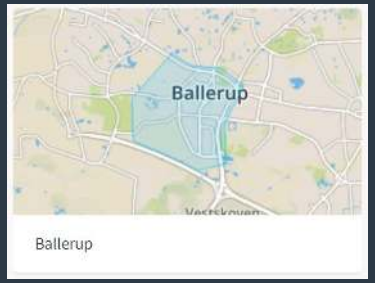


Test Regions

- Test areas available on request
- **User requests:** Freising, Tokyo, Ballerup
- **Mapillary tests:** Madeira, Galapagos, Zanzibar

Madeira

Heidelberg



Ballerup

Zanzibar

Galapagos

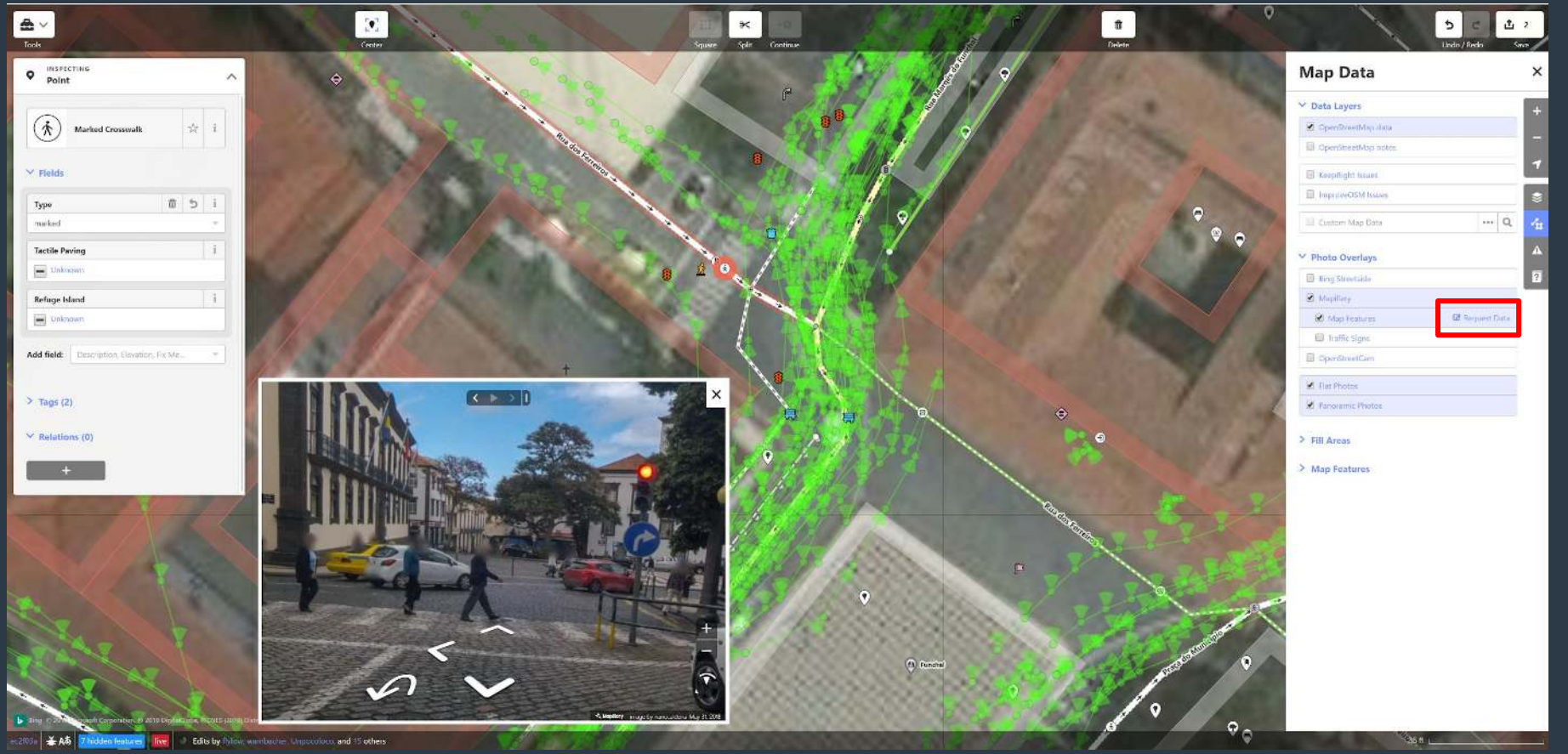
Trento

Tokyo-Matsudo area - username higa4

Freising - LukFunk

Test it out

http://tiny.cc/mapillarytest



Request Test

Mapillary

OpenStreetMap Data Request

Please tell us about yourself and your project. This will help us confirm that you are meeting our requirements for open data.

Mapillary map features are not visible on OSM unless the community requests it. Draw an area of interest using the draw tool at bottom right of the map. Please request a reasonable area you want to help map, and not something large like an entire country. It is suggested to start with towns and neighborhoods.

On submitting the form you will be able to agree to Mapillary license terms for OSM, and when we approve the data request you'll be notified. The data will automatically be visible on OSM iD in the area you requested.

First name:

Last name:

Email:

Website (optional):

Organization (optional):

OSM username:

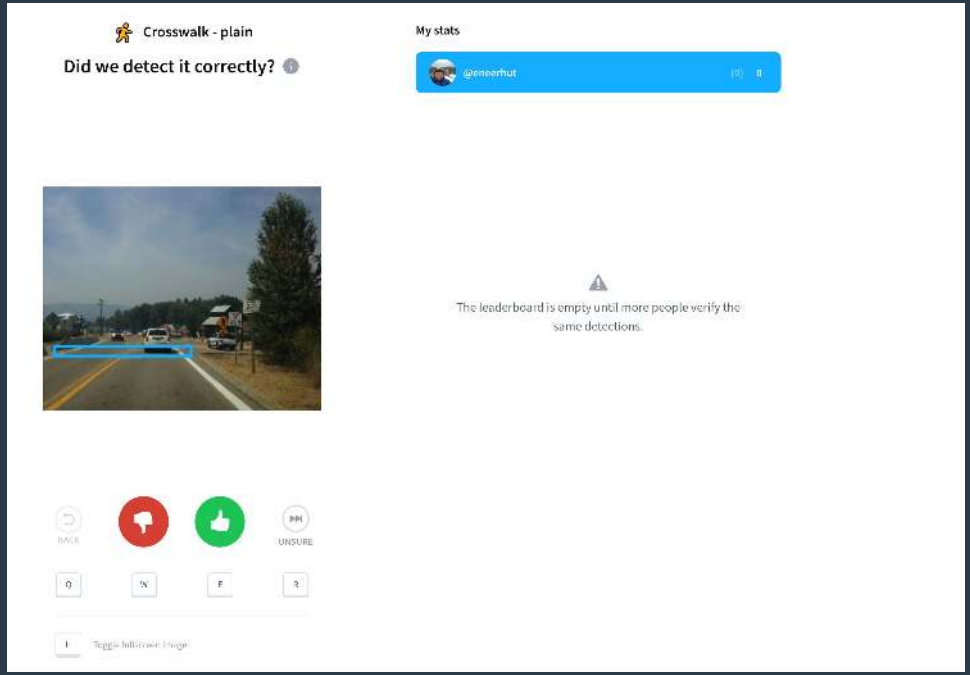
Mapillary username:

Please describe your project in detail...

Request data

Verification projects

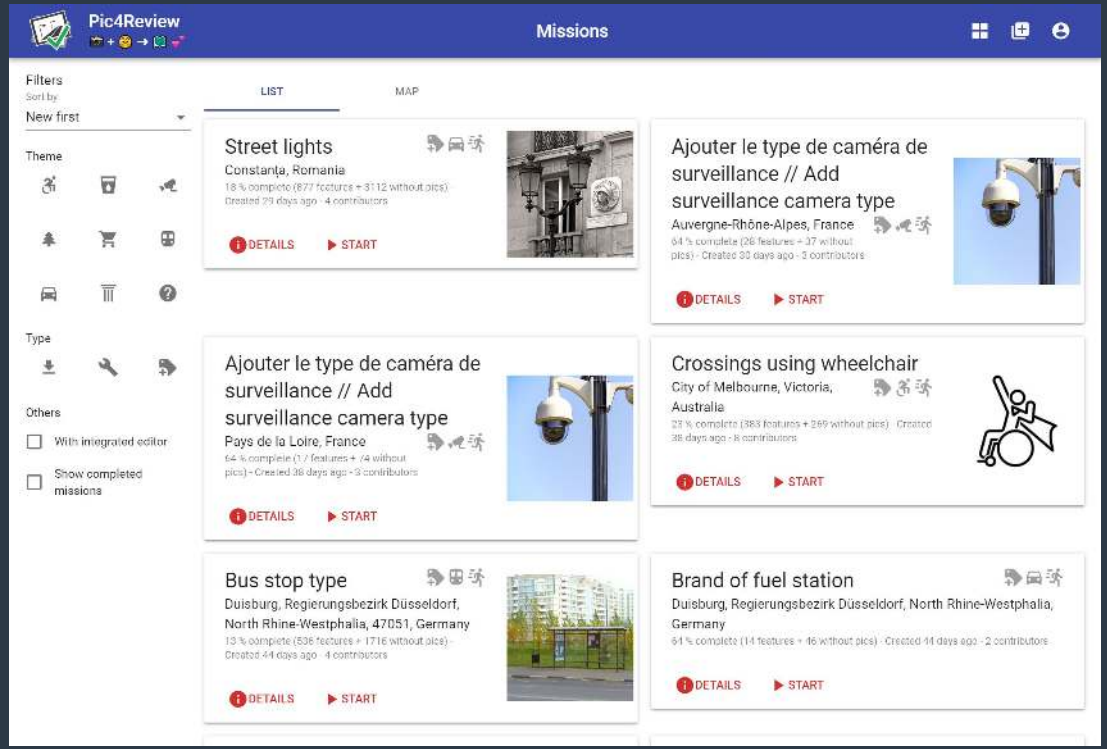
- Aiming for 1,000,000 verifications
- 40 object classes
- Prizes for the top 3
  - GoPro Hero 7 Black
  - Blackvue DR900S 1-CH Dashcam
  - Ticket to the State of the Map of your choice
- Targeted deadline of October 6th



1. Remove false positives
2. Improve recall for the object class

Other tools

- Pic4Review
- Osmose
- MapRoulette
- Deriviste
- Contact us for help developing any new tools
- **mapillary.com/developer**



What is next?

- Global verification project - **1 milion**!
- More emphasis on dense capture and community use of capture tools
- More accurate tracking of Mapillary as a source in OSM
- Huge amount of data available from each image, but what is relevant?

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