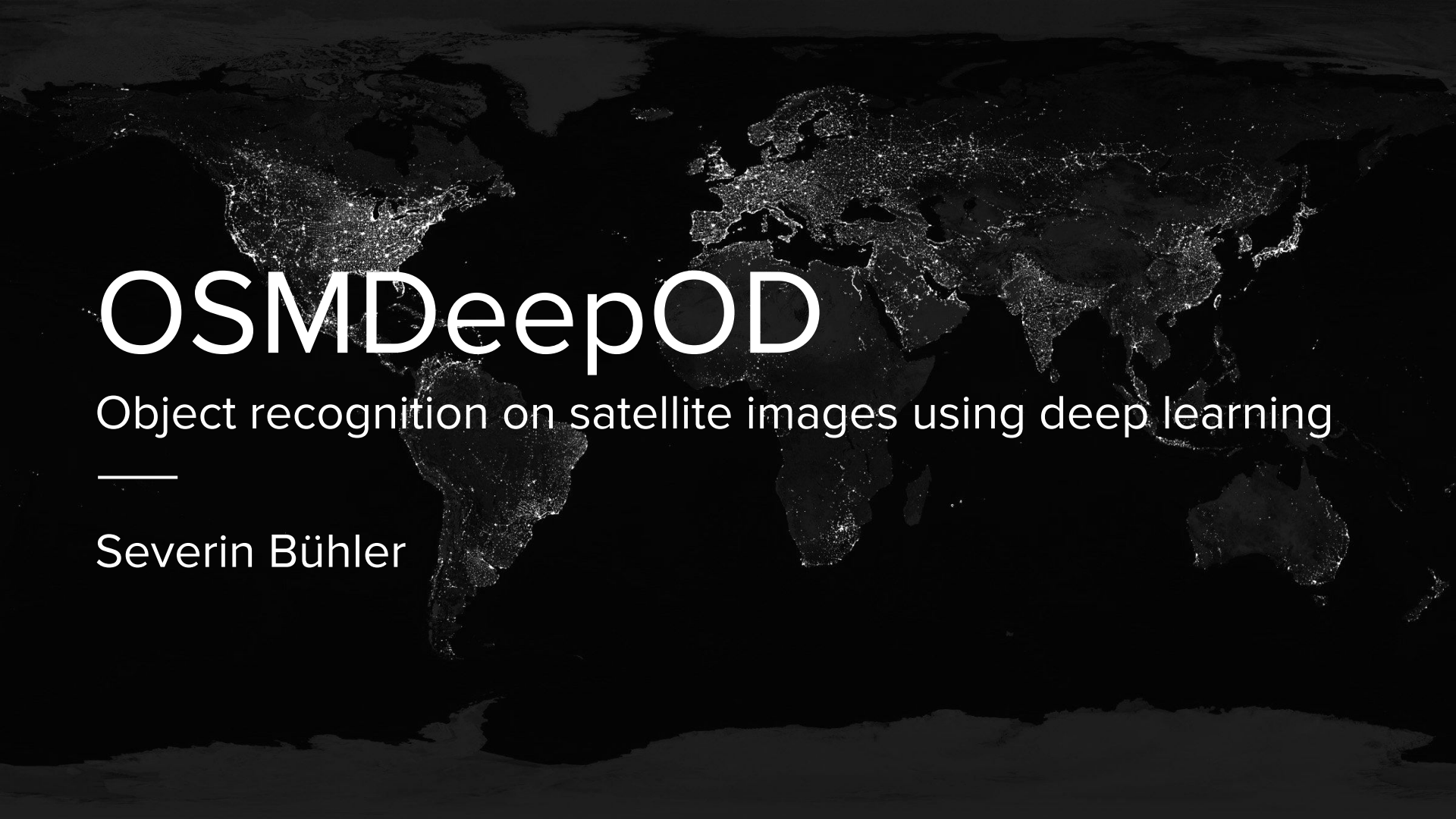


OSMDeepOD

Object recognition on satellite images using deep learning

Severin Bühler

Beginning

- Samuel Kurath & Severin Bühler
- Computer science at the university of applied science Rapperswil
- Origin aim: Recognize crosswalks on satellite images
  - Improve pedestrian navigation
- Start: Summer 2015

Agenda

- Where do we get the training data?
- How do we recognize objects?
- Big amount of data
- Pushing data back to the crowd

First, who knows
OpenStreepMap?

OpenStreetMap

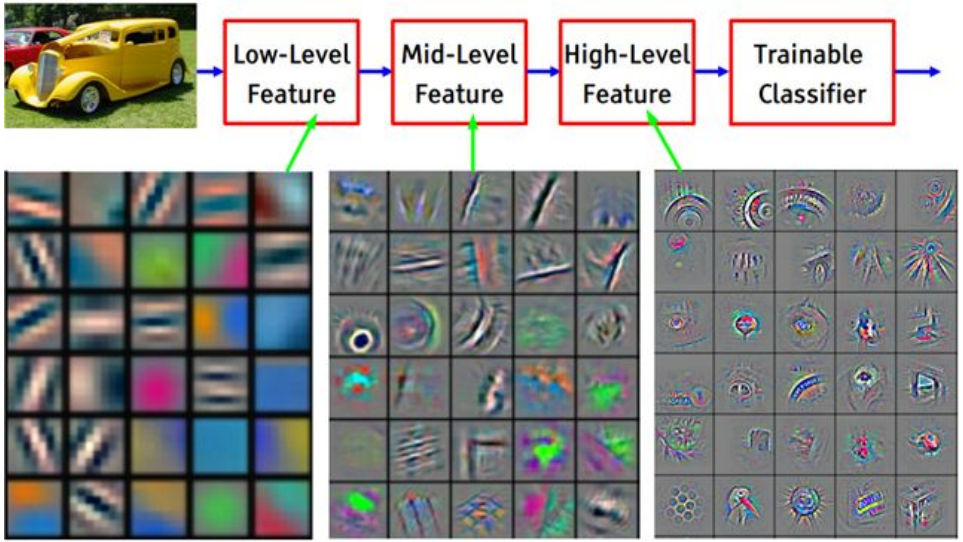
- A collaborative project to create a free map of the world. “The wikipedia for maps“
- Largest open geospatial vector database of the world
- For maps visualizations (base maps), analysis, POIs, routing, geocoding...
- Provides massive data
- Possibility to generate datasets automatically

Crosswalks

Non-crosswalks

Image recognition

- Convolutional Neural Network
- Pretrained InceptionV3
- Fine-tuned on our own data (40’000 images)
- Tensorflow
- 90% true positive, 5% false positive

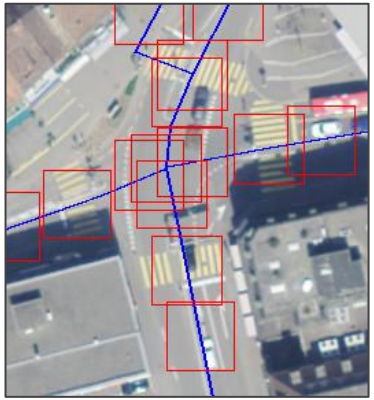


Convolutional Neural Network

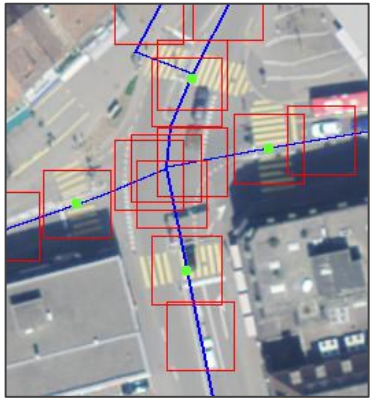
Core detection process (for crosswalks)

1. Get orthophotos

2. Load OSM streets



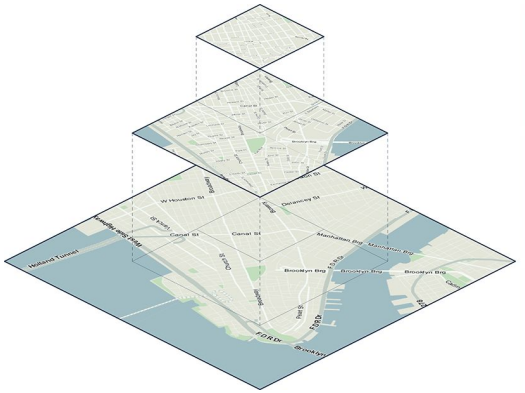
3. Walk along the streets



4. Detect the objects

BIG data

Example for Switzerland	➜ 41'285 km^2
Zoom level 19	➜ 1px equals 0.3m
50x50px image	➜ 225m^2
Total	➜ 183’488’889 images
Process time	➜ Over 4 days (Titan X)



Conclusion:

- Build to be parallelized on a unlimited amount of machines
- Reduce computational cost with intelligent data selection (streets only)

MapRoulette

http://www.maproulette.org/

Current status

- 15’000 newly detected crosswalks
- Detect other objects
  - Roundabouts
  - Sidewalks
  - Swimming pools
  - Photovoltaic
  - Football fields
  - Tennis courts
  - ...

Roundabout detection

Questions?

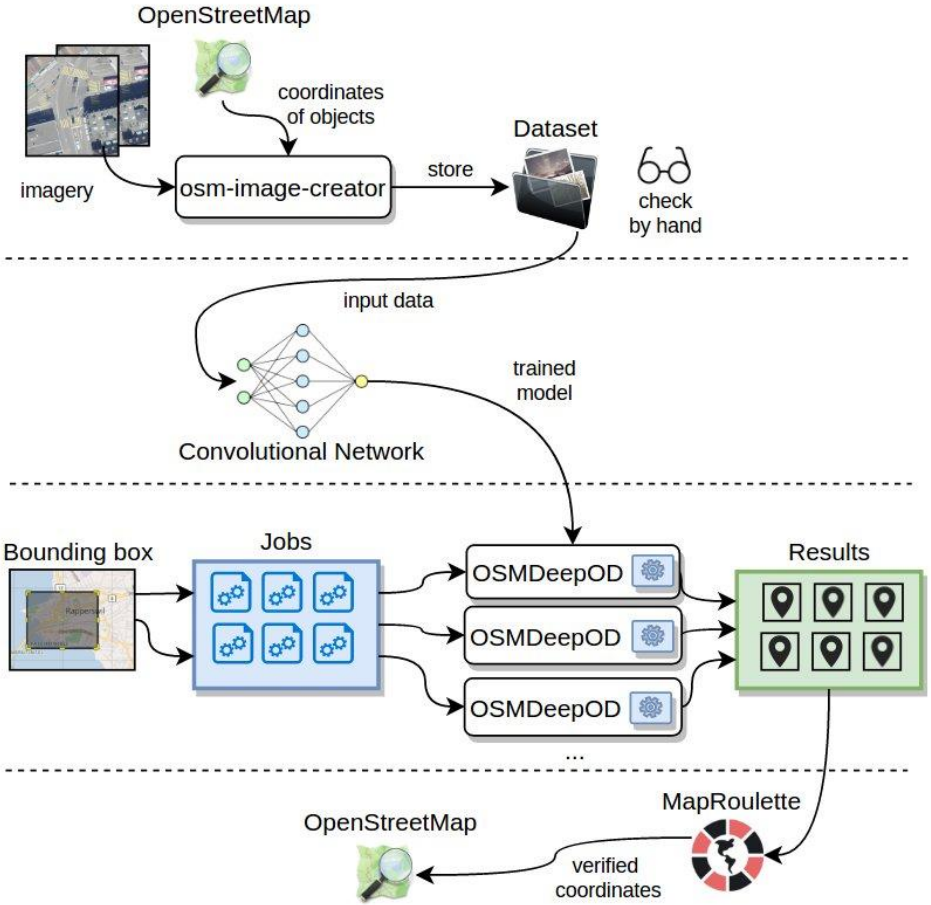
Resources

OSMDeepOD on Github
https://github.com/geometalab/OSMDeepOD
OSMDeepOD-Visualize on Github
https://github.com/geometalab/OSMDeepOD-Visualize
OpenStreetMap - Geodata provider
https://www.openstreetmap.org
MapRoulette - Gamified data insertion in OSM
http://www.maproulette.org
Zebrastreifen Safari - Overview of all crosswalks in OSM
http://zebrastreifen-safari.osm.ch

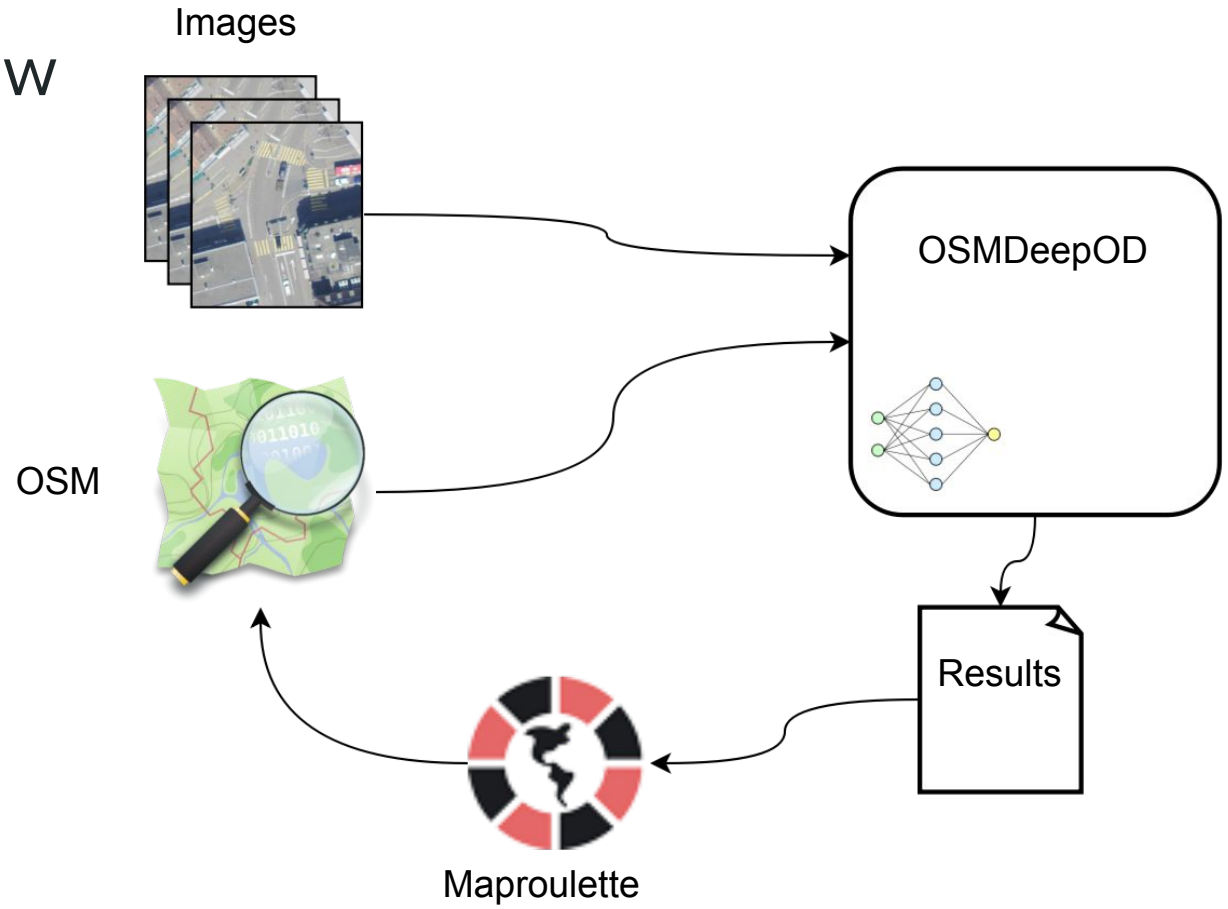
Severin Bühler on Twitter
https://twitter.com/SeverinBuhler
Samuel Kurath on Twitter
https://twitter.com/murthy_10

Convolutional Neural Network course
http://cs231n.github.io

Process


OpenStreetMap
coordinates of objects
imagery
osm-image-creator
store
Dataset
check by hand
input data
trained model
Convolutional Network
Bounding box
Jobs
OSMDeepOD
OSMDeepOD
OSMDeepOD
...
Results
MapRoulette
OpenStreetMap
verified coordinates

Dataflow



Streets