Analysis of georeferenced landscape pictures extracted from public picture collections

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Landscape pictures
Smartphone: georeferencing

EXIF-Tags (automatically stored); e.g.

- GPS coordinates
- Azimuth
- Type of camera
- Crop factor

Uploaded to public picture collections (Flickr, Panoramio, etc)

→ Extractable using API’s
Public picture collections
Identification of visible areas

DEM (Digital Elevation Model)

1. Viewshed algorithm

2. Cut viewsheds using calculated angular aperture

→ Obtain visible areas on a DEM for each picture
Usability of the azimuth angle

Ground truth: 29 photos taken from Zermatt showing the Matterhorn
→ 70% of the photos had matching azimuth angles
→ Newer models: increasing accuracy
Case study - data

5’131 images for the Swiss Canton of Vaud downloaded from FlickR

Pictures taken outside of OSM building footprint:

3’483 potential landscape images

Result: map with accumulated fields of view

→ Pictures taken from points that are easily accessible
→ Waterbodies very visible
→ Rural areas less prominent

→ accessibility and population density can induce a bias
Only 2.4% of the pictures have been taken more than 10 meters away from a path/road/railroad (based on OSM data).

→ Accessibility induces a bias
Case study – accessibility bias

2 datasets:

1 million random points on roads / railroads / paths

→ viewsheds for each point (based on a 20 meter DEM)

20 K random points on roads / railroads / paths

→ viewsheds for each point (based on a 10 meter DEM)
Case study – accessibility bias

Result:

1 million random points on roads / railroads / paths

Viewsheds for each point on:
→ DEM France (01, 25, 74)
→ DEM swissALTI3D outside canton Vaud
→ DSM inside canton Vaud

More than 1 month parallel computation on a 50 cores + 256 GB RAM machine.
Case study – accessibility bias

Delta view indicator:

Ratio between the pixels that have been photographed and the total number of photos divided by the number of pixels that can be photographed divided by the number of points:

\[ \delta v = \left( \frac{V_{px}}{V_{tot}} \frac{T_{px}}{T_{tot}} - 1 \right) \times 100\% \]
Conclusions & Perspectives

High potential for spatial planning decision support

e.g.
- finding spots for the construction of windmills
- tourism: find scenic routes
- find beautiful spots to build houses (do the very frequently covered places correlate with landmarks?)
- define protected areas
- …

Perspectives:

- Population bias
- Seasonal changes
- Machine learning for the automated characterization of the photos
Questions?

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