UNIVERSITY OF TWENTE.

COMBINING VGI WITH VIEWSHEDS FOR PHOTO TAG SUGGESTION

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OVERVIEW

COMBINING VGI WITH VIEWSHEDS FOR PHOTO TAG SUGGESTION

- Introduction
- **Methodology:**
  - determine theoretical field of view
  - use DSM to calculate realistic field of view
  - determine objects visible in the view
  - clustering VGI data and ranking
- Experiment:
  - Implementation in ArcGIS
  - Implementation as a webservice
- Conclusion

INTRODUCTION

an improved method for tagging of digital photos

- making tagging process simpler and more accurate for users
- increasing the quality of the tag data as a whole

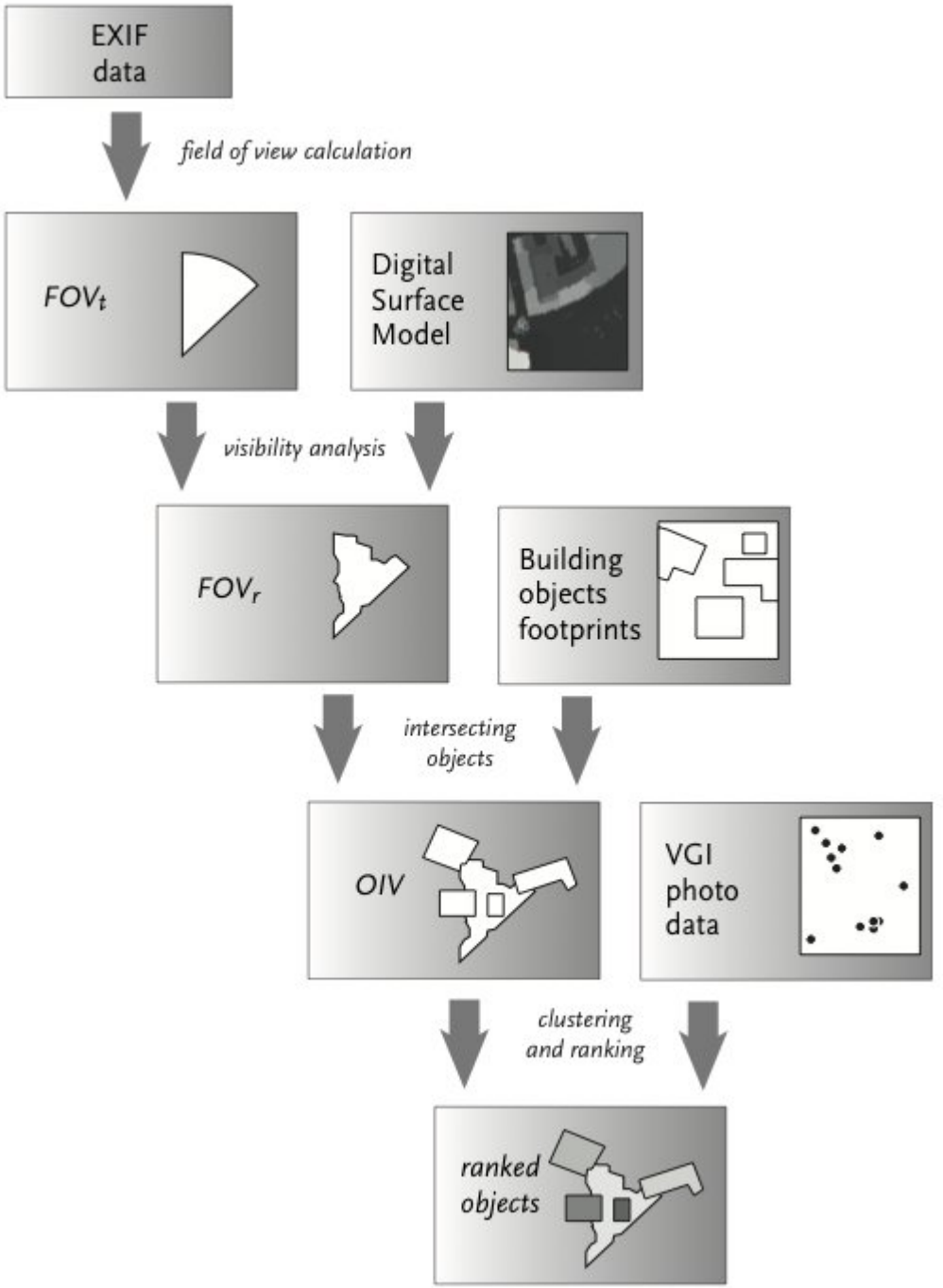
Scenario:

- you have taken a digital photo, and want to tag it
- system takes into account
  - objects that are in the photo's field of view
  - existing tags for those objects (ranked)
- to suggest suitable tags for you photo

main problem: *how to identify objects that might be visible in a given spatially referenced photograph ?*

METHODOLOGY

- use EXIF data to calculate theoretical field of view *FOVt*
- use DSM and visibility analysis to calculate realistic field of view *FOVr*
- use object footprints to determine objects visible in the view *OIV*
- clustering of VGI data within *OIV* to rank objects



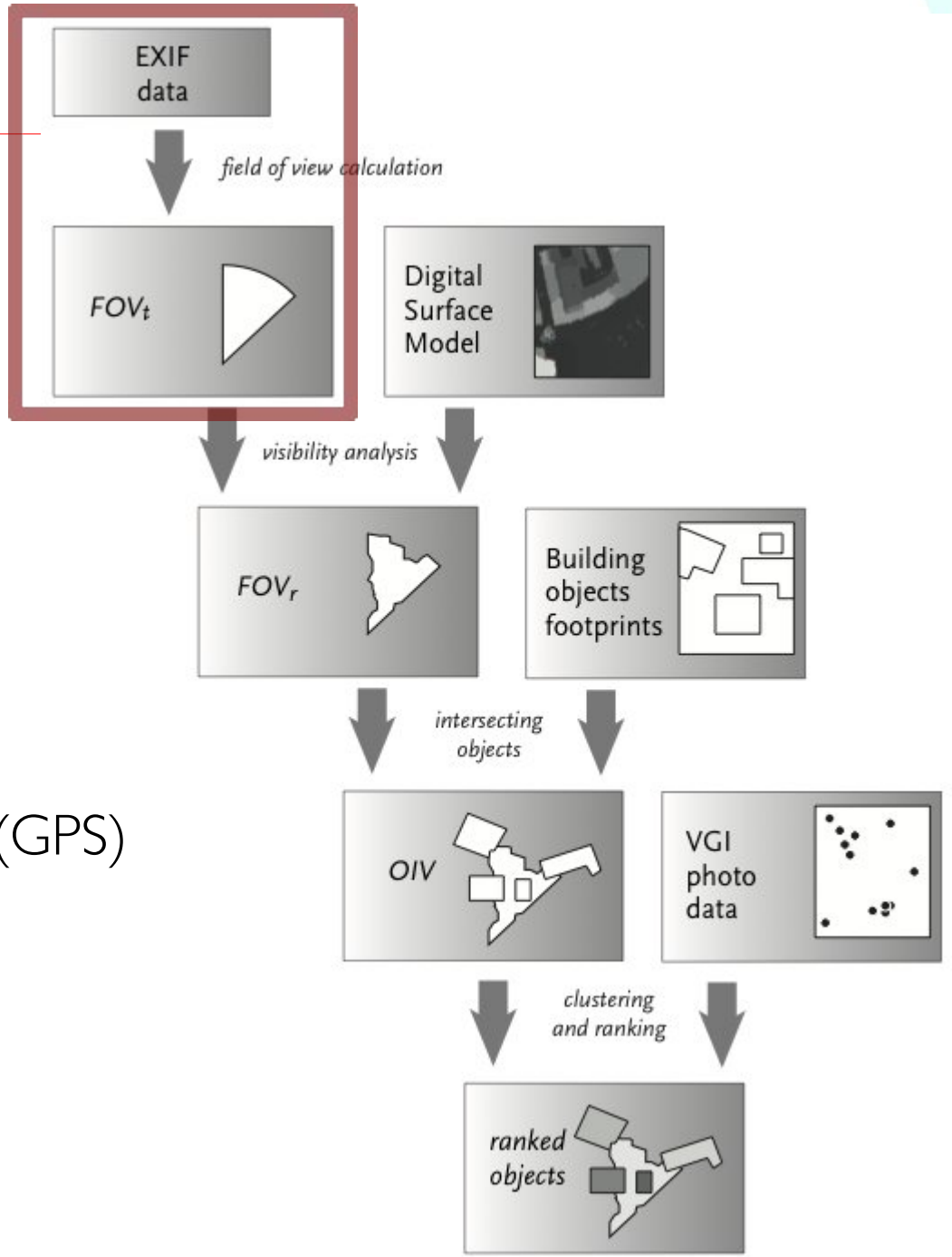
METHODOLOGY

- use EXIF data to calculate theoretical field of view *FOVt*
  - calculate the view angle:

$$\theta = 2 \arctan\left(\frac{l_d}{2\, l_f}\right)$$

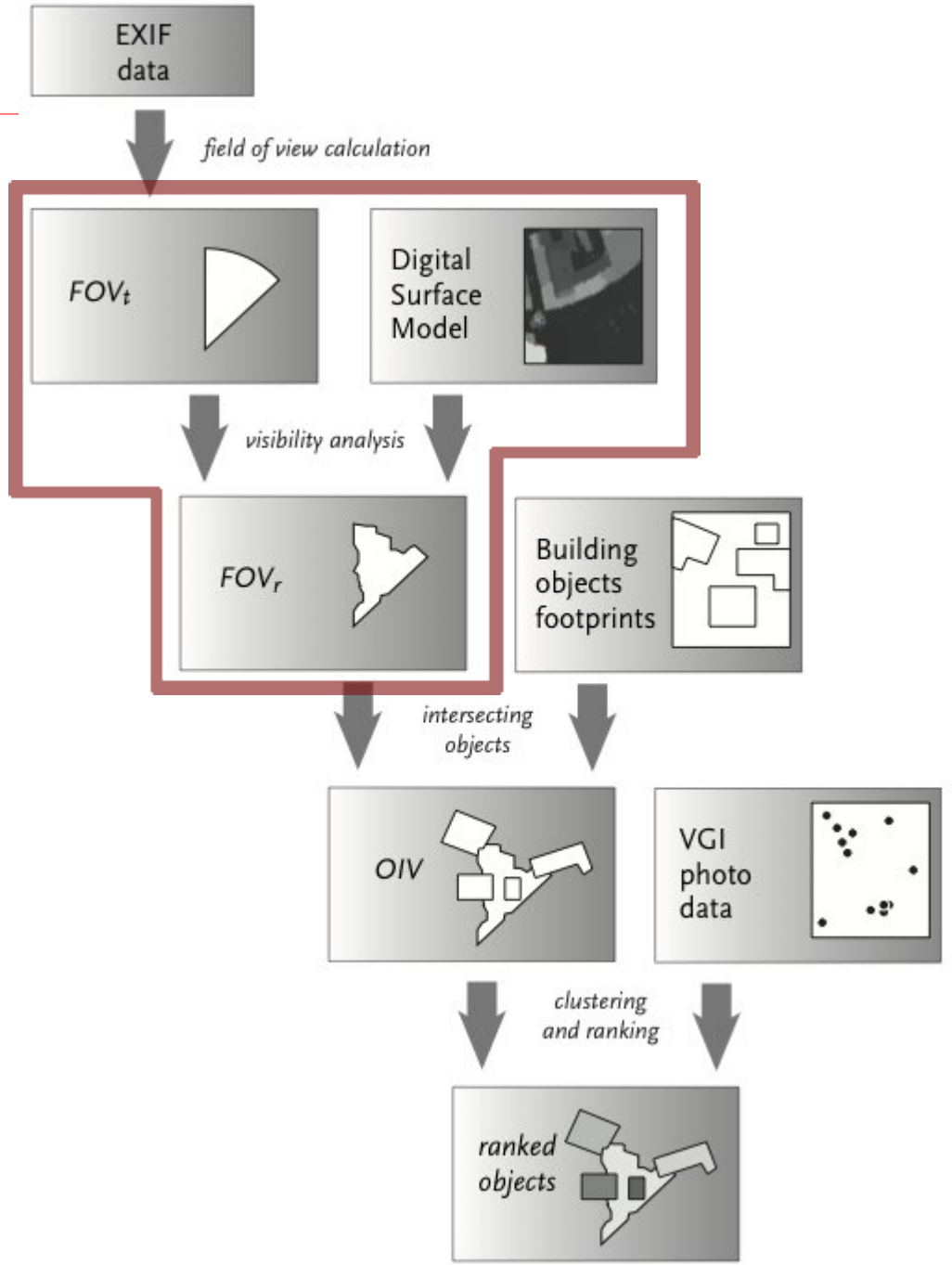
θ = view angle
l_d is CCD size (image dimension)
l_f is the focal length

  - combine with camera position (GPS) and direction (compass)



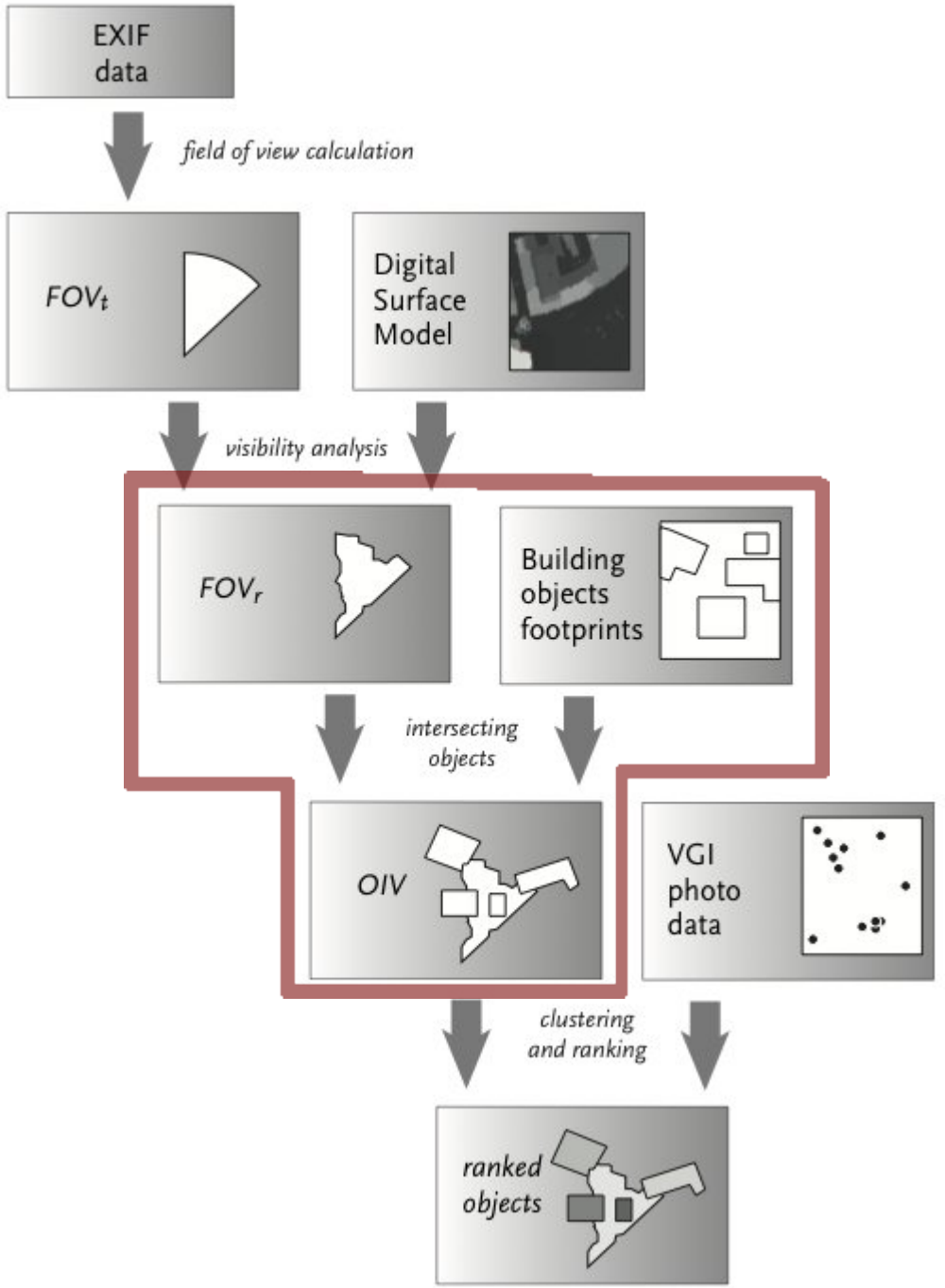
METHODOLOGY

- use EXIF data to calculate theoretical field of view *FOVt*
- use DSM and visibility analysis to calculate realistic field of view:
  - *FOVt* + DSM + observer height used in **viewshed** analysis
  - *FOVr* is subset of *FOVt*



METHODOLOGY

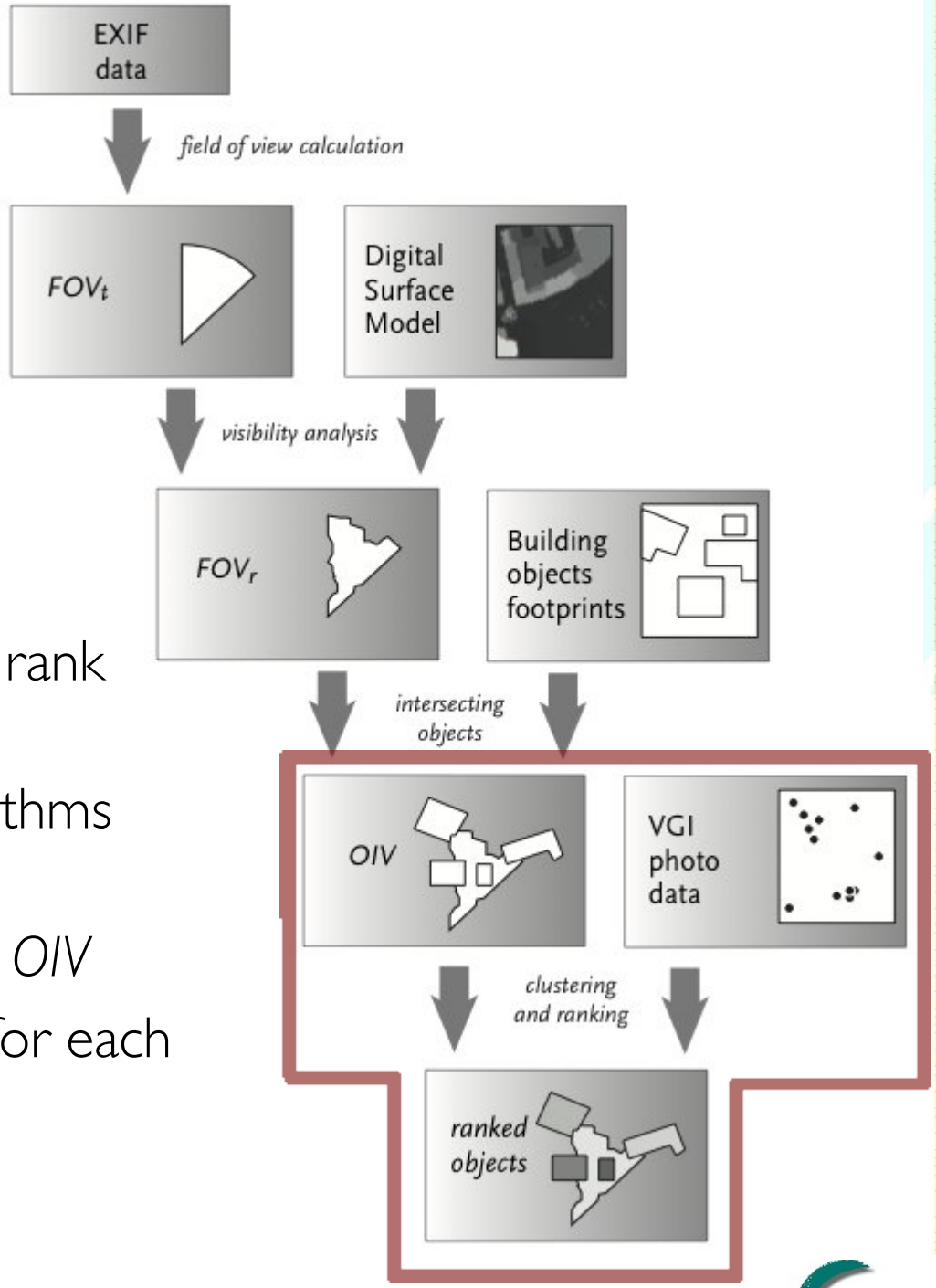
- use EXIF data to calculate theoretical field of view *FOVt*
- use DSM and visibility analysis to calculate realistic field of view *FOVr*
- use object footprints to determine objects visible in the view *OIV:*
  - add objects that **intersect** or **touch** *FOVr*
  - *OIV* is more than *FOVr*



METHODOLOGY

- use EXIF data to calculate theoretical field of view *FOVt*
- use DSM and visibility analysis to calculate realistic field of view *FOVr*
- use object footprints to determine objects visible in the view *OIV*
- clustering of VGI data within *OIV* to rank objects:
  - experimented with several algorithms
  - finally simple frequency: count of occurrences of VGI points within *OIV*
  - absolute frequencies to relative: for each object percentage *p*: $p = \frac{n}{N}100$

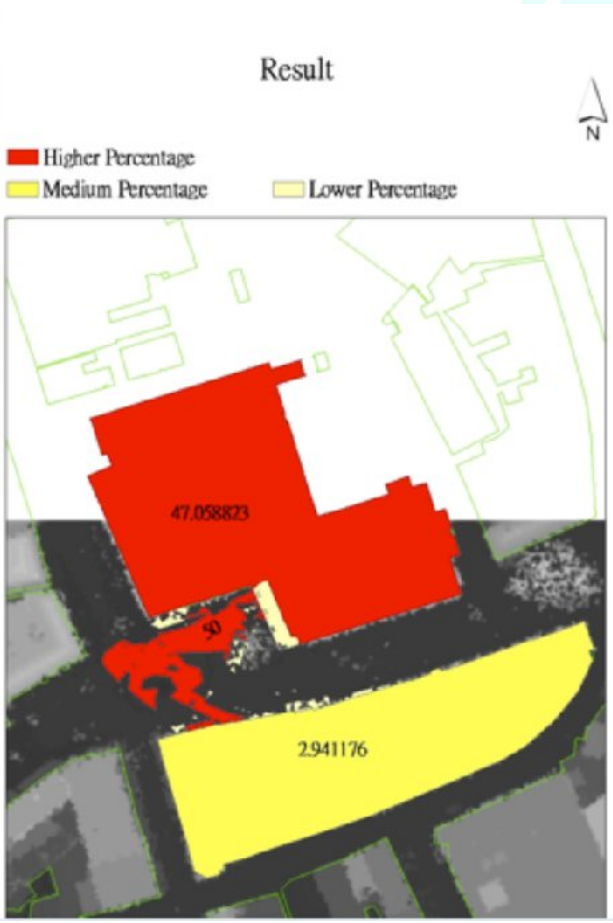
n = number of tags within object
N = total number of tags within *OIV*



EXPERIMENT: Implementation in desktop GIS

"proof–of–concept": pragmatic and practical

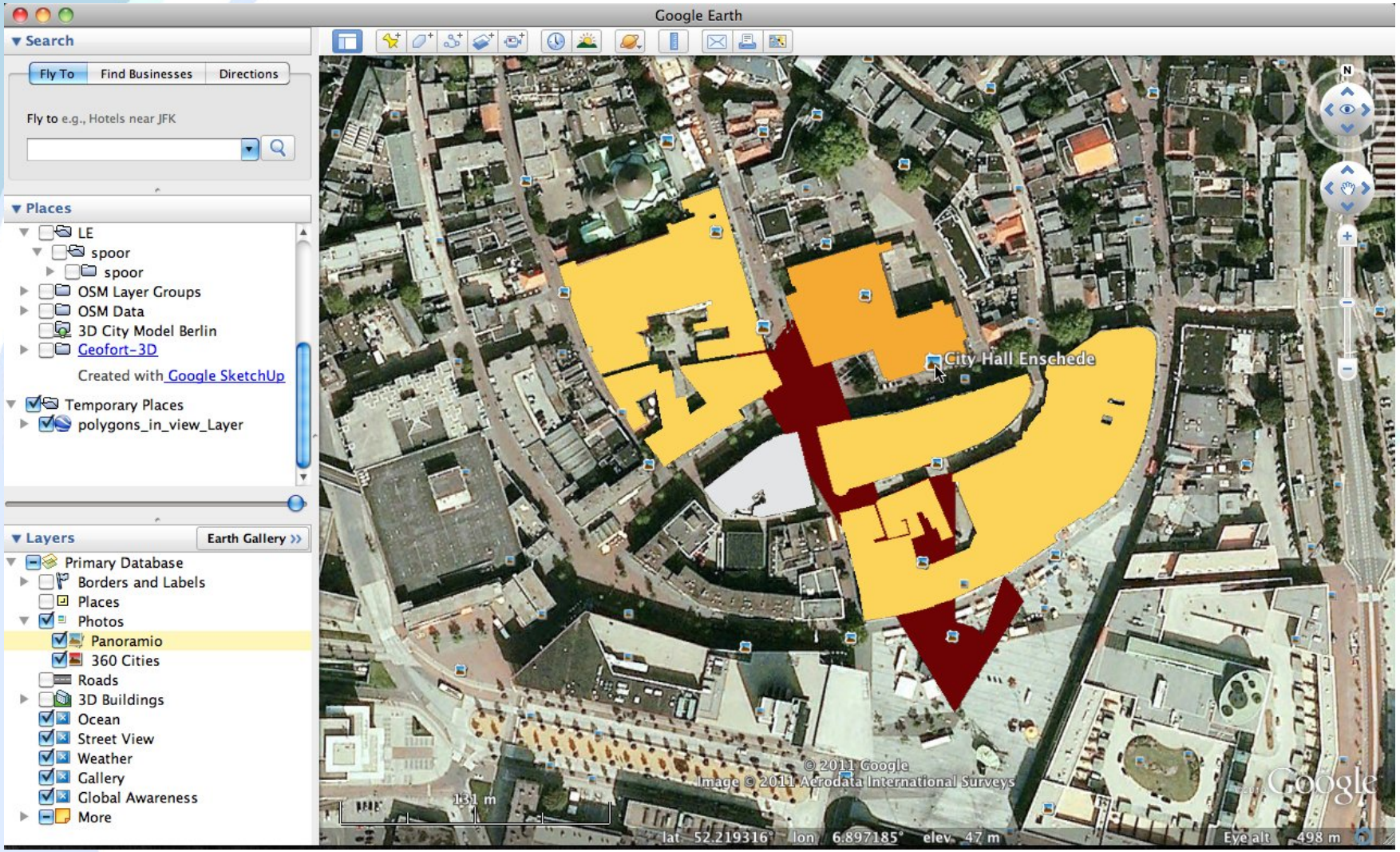
- Apple iPhone4 and Fujifilm F200 EXR + eTrex GPS/compass
- available data (Enschede city centre):
  - DSM: airborne laser altimetry (20 points/m^2)
  - building footprints: Top10NL topographic data of Kadaster NL
  - geo-tagged photos: Flickr + Panoramio
- Commercial Off-The-Shelf Software (ESRI ArcGIS 10):
  - various toolboxes



EXPERIMENT: Implementation as a webservice

ArcGIS no good for intended users ➔ implemented as webservice:

- server–side Python using ESRIs *arcpy* to run the ArcGIS models
- output to KML format



CONCLUSION

Method works well and seems to offer effective way to make tagging both easier and more accurate,
ultimately increasing the quality of the VGI data as a whole.

- implementation problems:
  - limited accuracy of iPhone GPS and eTrek compass
  - building layer:
    - relatively dated: not always matched DSM and actual situation
    - building block outlines only, no individual shops / houses
    - no other environmental objects (statues, street objects)
  - dependency on building and DSM data:
    - system as it now stands not suitable for real–world use, mainly because of very limited spatial extent
    - availability is fast changing (OpenStreetMap / GlobalOrtho)
- future work:
  - better tag suggestion system (using text mining and semantics)

THANK YOU FOR YOUR ATTENTION !

(more details in paper in Springer book)

QUESTIONS....?

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