

**M U N I  
S C I**

# **Využití umělé inteligence v kartografické generalizaci**

Aneta Ryglová

# Osnova

- Úvod
- Současný stav výzkumu v oblasti využití umělé inteligence v kartografické generalizaci
- Technologie umožňující využití umělé inteligence v kartografii
- Grafová databáze a její možnosti využití v rámci umělé inteligence
- Závěr

# Úvod

- Využití AI v kartografii - analýza satelitních snímků, rozhodování o cestovním plánování nebo při detekci změn v krajině
- Algoritmy strojového učení mohou být použity k identifikaci klíčových prvků na mapě -> rozhodování o tom, které prvky generalizovat

# Současný stav výzkumu v oblasti využití umělé inteligence v kartografické generalizaci

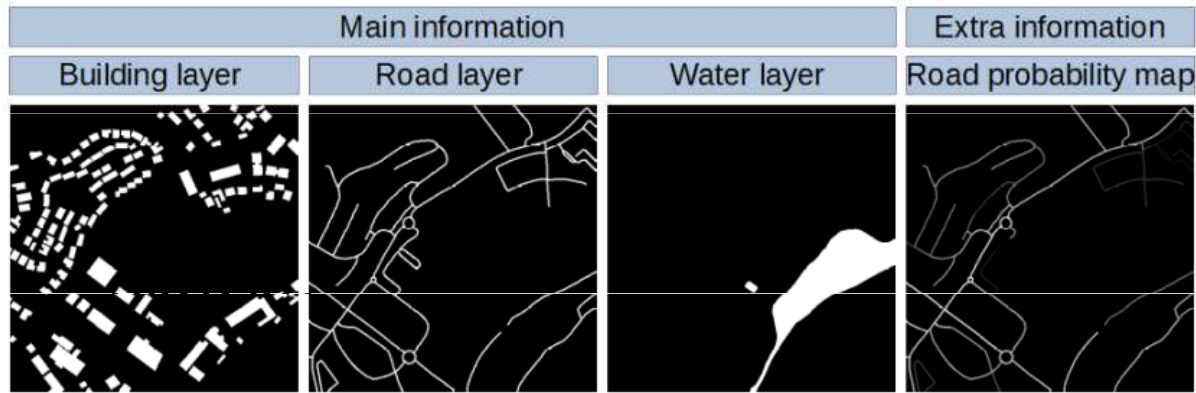
## Representing Vector Geographic Information As a Tensor for Deep Learning Based Map Generalisation

Azelle Courtial<sup>1</sup>, Guillaume Touya<sup>1</sup>, and Xiang Zhang<sup>2</sup>

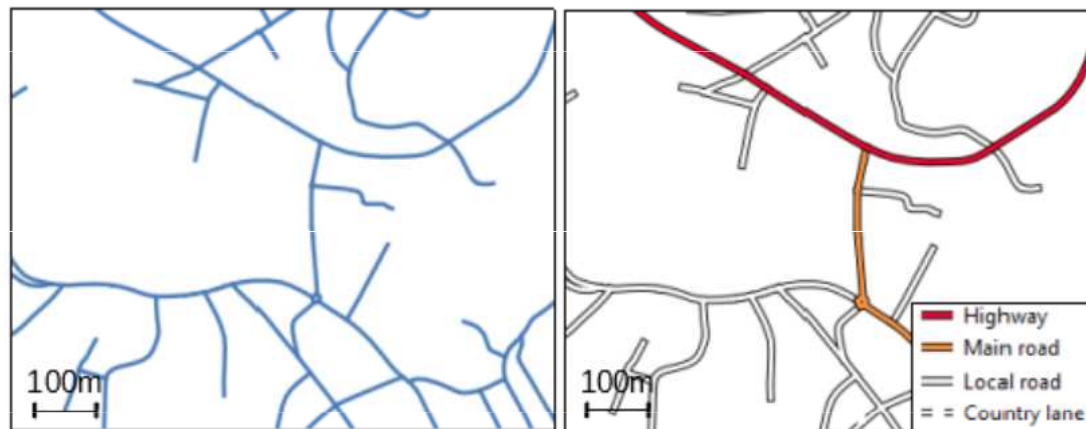
<sup>1</sup>LASTIG, Univ Gustave Eiffel, ENSG, IGN, F-94160 Saint-Mande, France

<sup>2</sup>School of Geospatial Engineering and Sciences, Sun Yat-Sen University, Guangzhou 510275, China

Correspondence: Azelle Courtial ([azelle.courtial@ign.fr](mailto:azelle.courtial@ign.fr))



**Figure 10.** Illustration of the representation of road context as an additional information.



**Figure 4.** Illustration of the interest of semantic information

*Article*

# Make It Simple: Effective Road Selection for Small-Scale Map Design Using Decision-Tree-Based Models

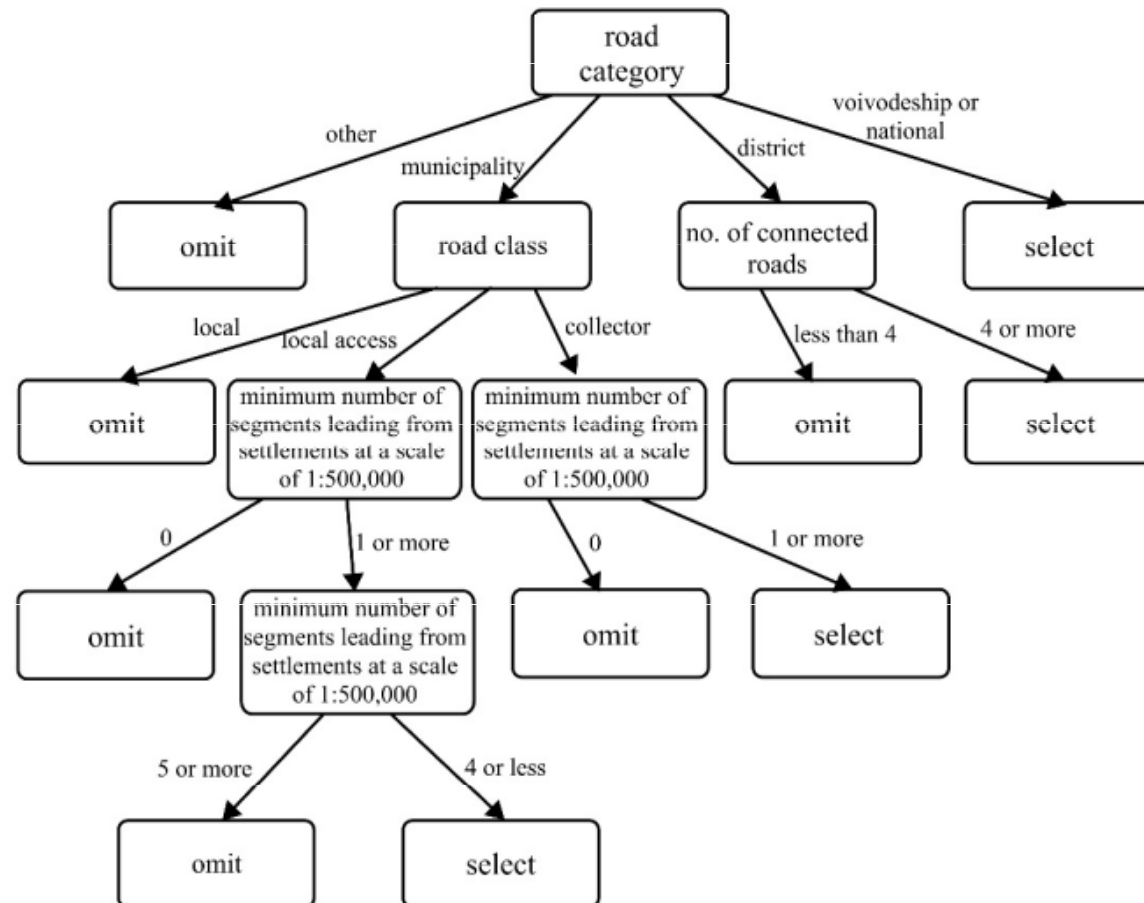
Izabela Karsznia <sup>1,\*</sup>, Karolina Wereszczyńska <sup>1</sup> and Robert Weibel <sup>2</sup>

<sup>1</sup> Department of Geoinformatics, Cartography and Remote Sensing, Faculty of Geography and Regional Studies, University of Warsaw, Krakowskie Przedmiescie 30, 00-927 Warsaw, Poland

<sup>2</sup> Department of Geography, University of Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland

\* Correspondence: [i.karsznia@uw.edu.pl](mailto:i.karsznia@uw.edu.pl)

# Decision tree



Source data (GGOD)



Atlas map 1:500,000



roads

- national
- voivodeship
- district
- community
- other

settlement

- city
- village with municipality seat
- village

Basic approach

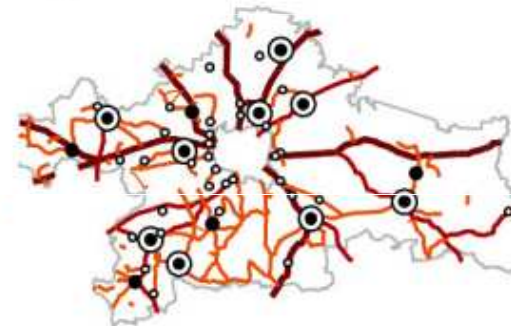


0 40 km

DT- GA



RF





*AutoCarto 2022, Nov 2-4, 2022. Redlands, CA, USA*

## **May AI Help You? Automatic Settlement Selection for Small-Scale Maps Using Selected Machine Learning Models**

**I. Karsznia\*<sup>a</sup>, R. Weibel<sup>b</sup> and S. Leyk<sup>c</sup>**

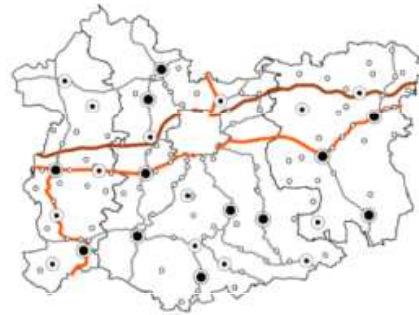
<sup>a</sup> Department of Geoinformatics, Cartography and Remote Sensing, University Of Warsaw, Warsaw, Poland

<sup>b</sup> Department of Geography, University of Zurich, Zurich, Switzerland

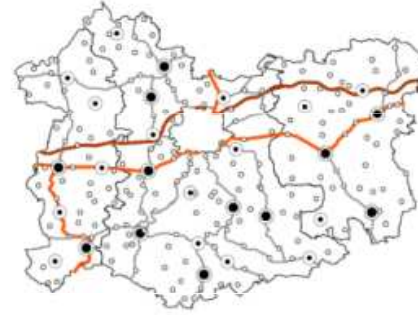
<sup>c</sup> Department of Geography, University of Colorado Boulder, Boulder, USA

\* [i.karsznia@uw.edu.pl](mailto:i.karsznia@uw.edu.pl)

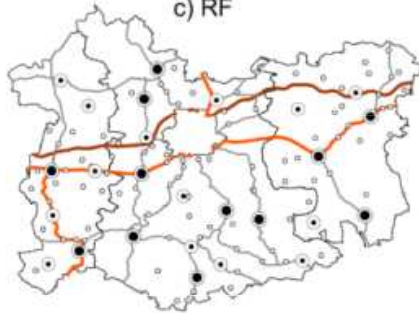
a) Source data (GGOD)



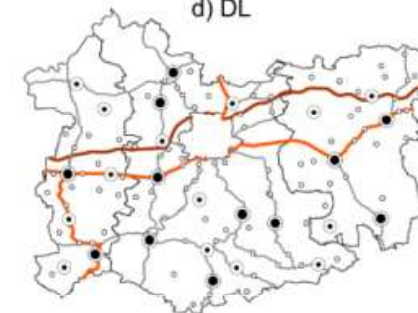
b) Atlas map (reference)



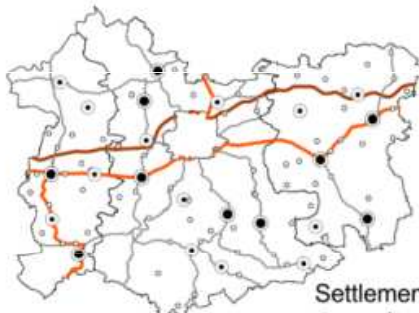
c) RF



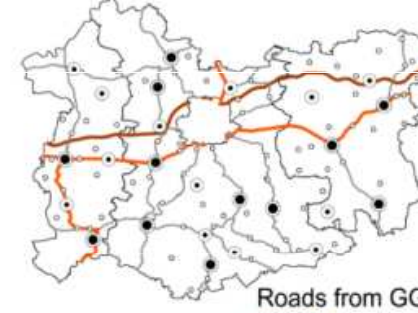
d) DL



e) DT-GA



f) DT



Settlement  
 ● city  
 ○ village with municipality seat  
 ◦ village

Roads from GGOD  
 — main road  
 — secondary road  
 — local road

0 25 km

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# THE ETHICS OF AI-GENERATED MAPS: A STUDY OF DALL·E 2 AND IMPLICATIONS FOR CARTOGRAPHY

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**Yuhao Kang**

GISense Lab, Department of Geography, University of South Carolina  
GeoDS Lab, Department of Geography, University of Wisconsin-Madison  
yuhaokang@sc.edu

**Qianheng Zhang**

HGIS Lab, Department of Geography, University of Washington  
qianhz2@uw.edu

**Robert Roth**

Cartography Lab, Department of Geography, University of Wisconsin-Madison  
reroth@wisc.edu

# Technologie umožňující využití umělé inteligence v kartografii

- Tensorflow
- Pytorch
- Keras
- (ArcGIS)

# ArcGIS Pro - pre-trained deep learning models



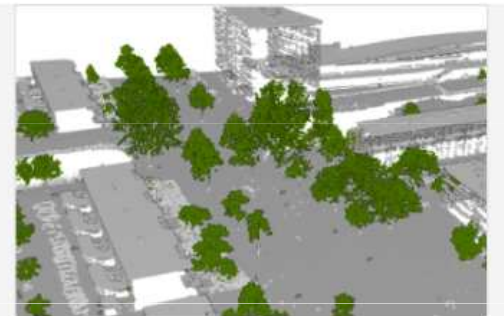
Building Footprint Extraction - Africa



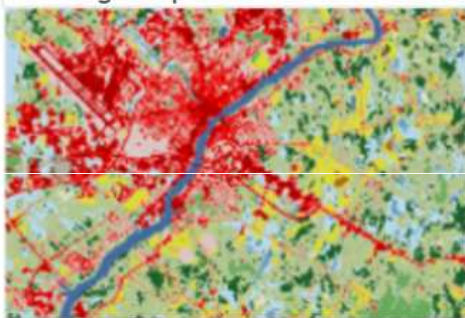
Car Detection - USA



Building Footprint Extraction - USA



Tree Point Classification

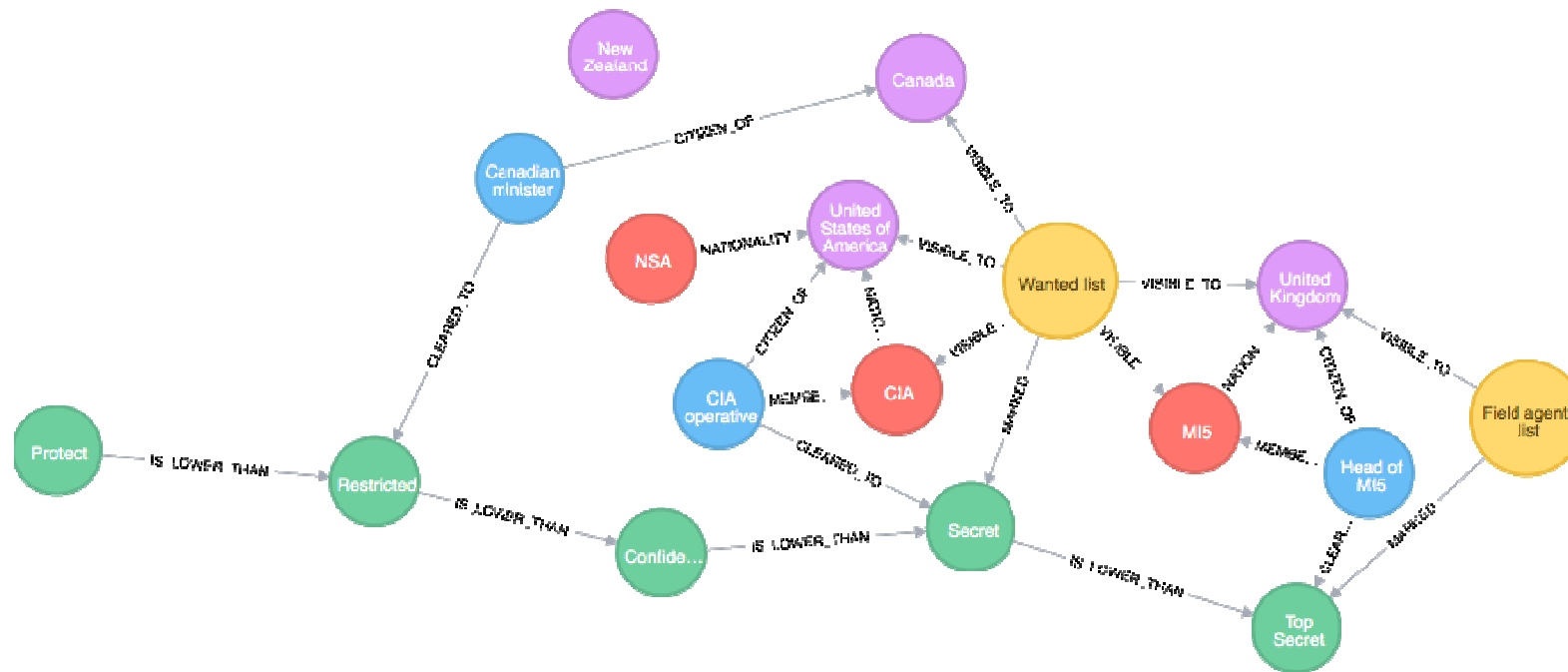


Land Cover Classification (Landsat 8)



Road Extraction - North America

# Grafová databáze a její možnosti využití v rámci umělé inteligence



# An automated generalization of the settlements based on graph neural networks

- Explore the method of transforming the spatial layout of a settlement into a graph
- Breaking down the process into a series of transformations that define the layers of a neural network
- Compare this approach with the traditional, deterministic model of generalizing built-up areas in historical urban centres
- Neo4j and Pytorch

# Závěr

- Využití umělé inteligence v kartografické generalizaci má velký potenciál a nabízí řadu nových přístupů k tvorbě map
- Vyžaduje další výzkum a experimentování
- Modely strojového učení jsou založeny na trénovacích datech a mohou být ovlivněny kvalitou a dostupností těchto dat
- Etika



# Reference

- 1) Courtial, A., Touya, G., Zhang, X. (2022). Representing Vector Geographic Information As a Tensor for Deep Learning Based Map Generalisation.
- 2) Karsznia, I., Wereszczynska, K. M., & Weibel, R. (2022). Make It Simple: Effective Road Selection for Small-Scale Map Design Using Decision-Tree-Based Models
- 3) Karsznia, I., Weibel, R., & Leyk, S. (2022). May AI Help You? Automatic Settlement Selection for Small-Scale Maps Using Selected Machine Learning Models
- 4) Courtial, A., El Ayedi, A., Touya, G., & Zhang, X. (2020). Exploring the Potential of Deep Learning Segmentation for Mountain Roads Generalisation
- 5) Chen, Y., Huang, Q., Li, X., & Zhang, Y. (2018). Graph database for modeling road network in urban area.
- 6) Lee, J., Jang, H., Yang, J., & Yu, K. (2017). Machine learning classification of buildings for map generalization
- 7) Kang, Y., Zhang, Q., & Roth, R. (2023). The Ethics of AI-Generated Maps: A Study of DALLE 2 and Implications for Cartography.