



AUTOMATIC APPROACHES FOR ANALYZING THE OVERLAP OF LAND COVER AND CADASTRAL BOUNDARIES BASED ON UAV IMAGERY

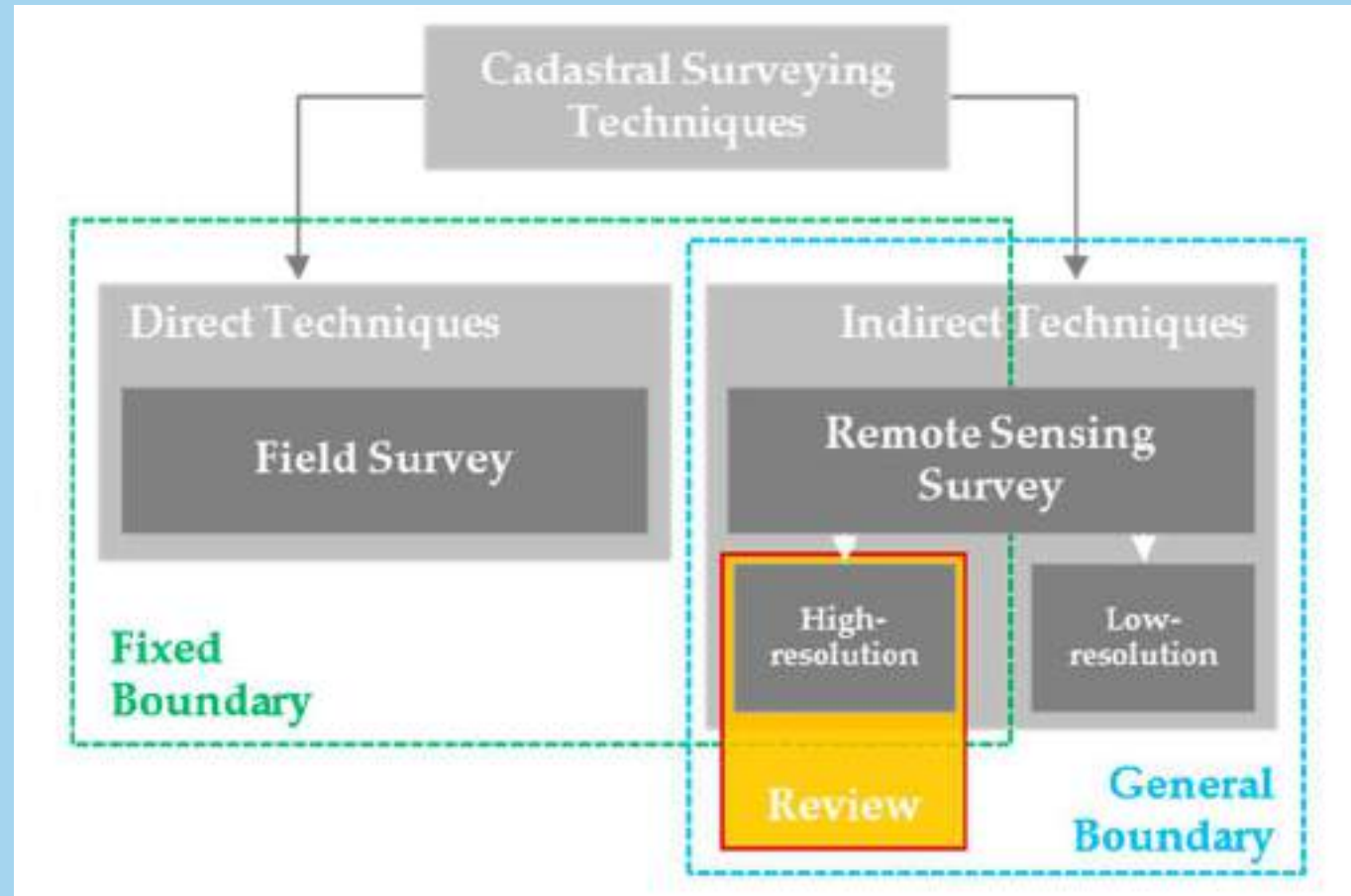
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BACKGROUND

Different countries different cadastral principles...

- Compulsory vs Optional registration of land rights
- Title vs Deed registration
- **Fixed vs General boundaries**
- **Measurement-based vs Coordinate-based**
- Public vs Private cadastral services

CADASTRAL SURVEYING TECHNIQUES



(Crommelinck et al., 2016)

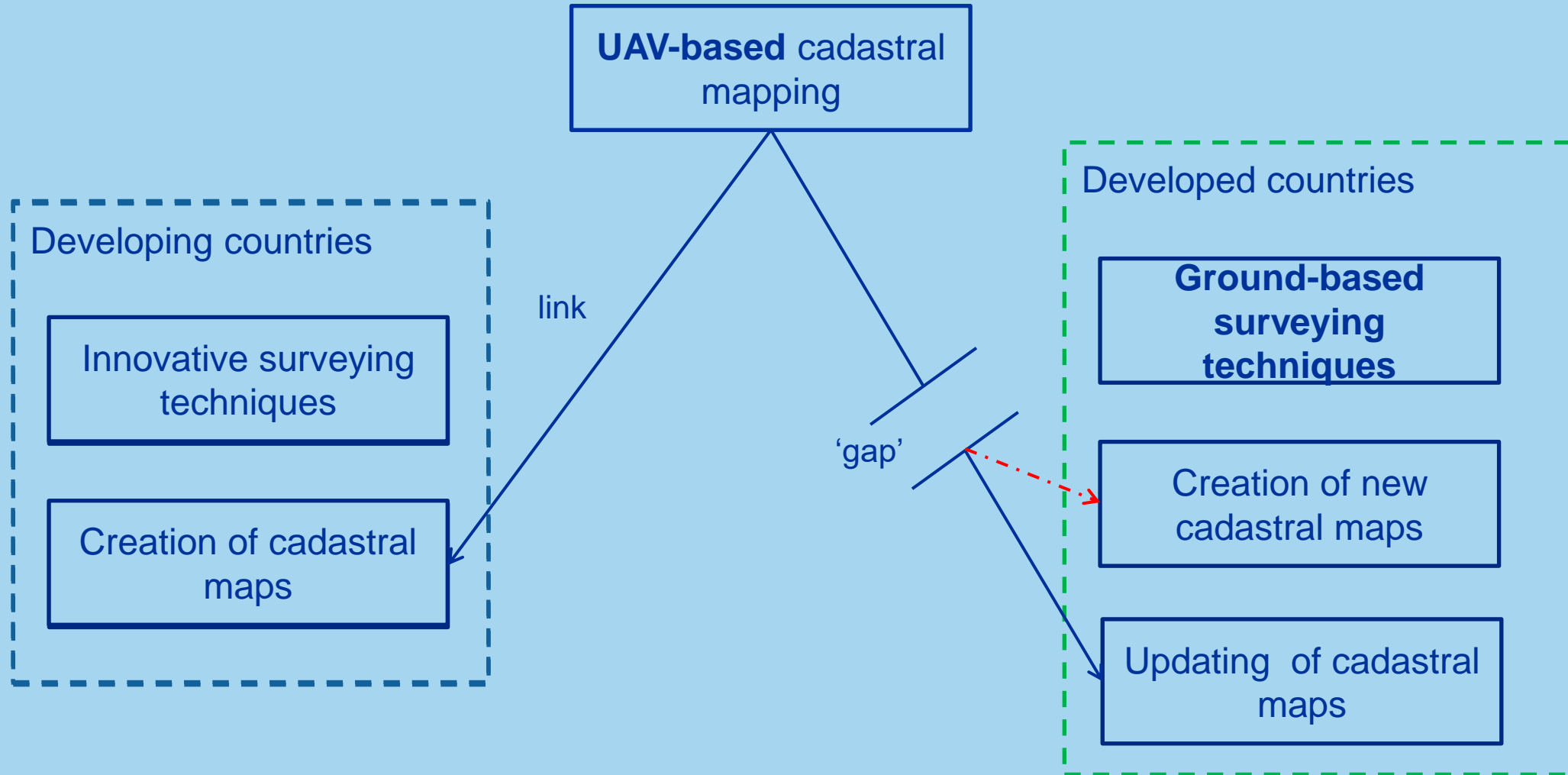
CURRENT CHALLENGE...

Speed-up cadastral mapping to complete the registration of land rights – countries with LOW cadastral coverage

Up-to-date land data – countries with FULL cadastral coverage

However, innovative cadastral surveying techniques are mostly applied in developing countries rather in developed ones.

FOR INSTANCE



BOUNDARY MAPPING APPROACH

Usually, **manual delineations** of cadastral boundaries from remote sensing imagery

Visible boundaries such as hedges, land cover, building walls coincide with cadastral boundaries

Automatic extraction of visible cadastral boundaries

Recently, **deep learning** is becoming highly prominent



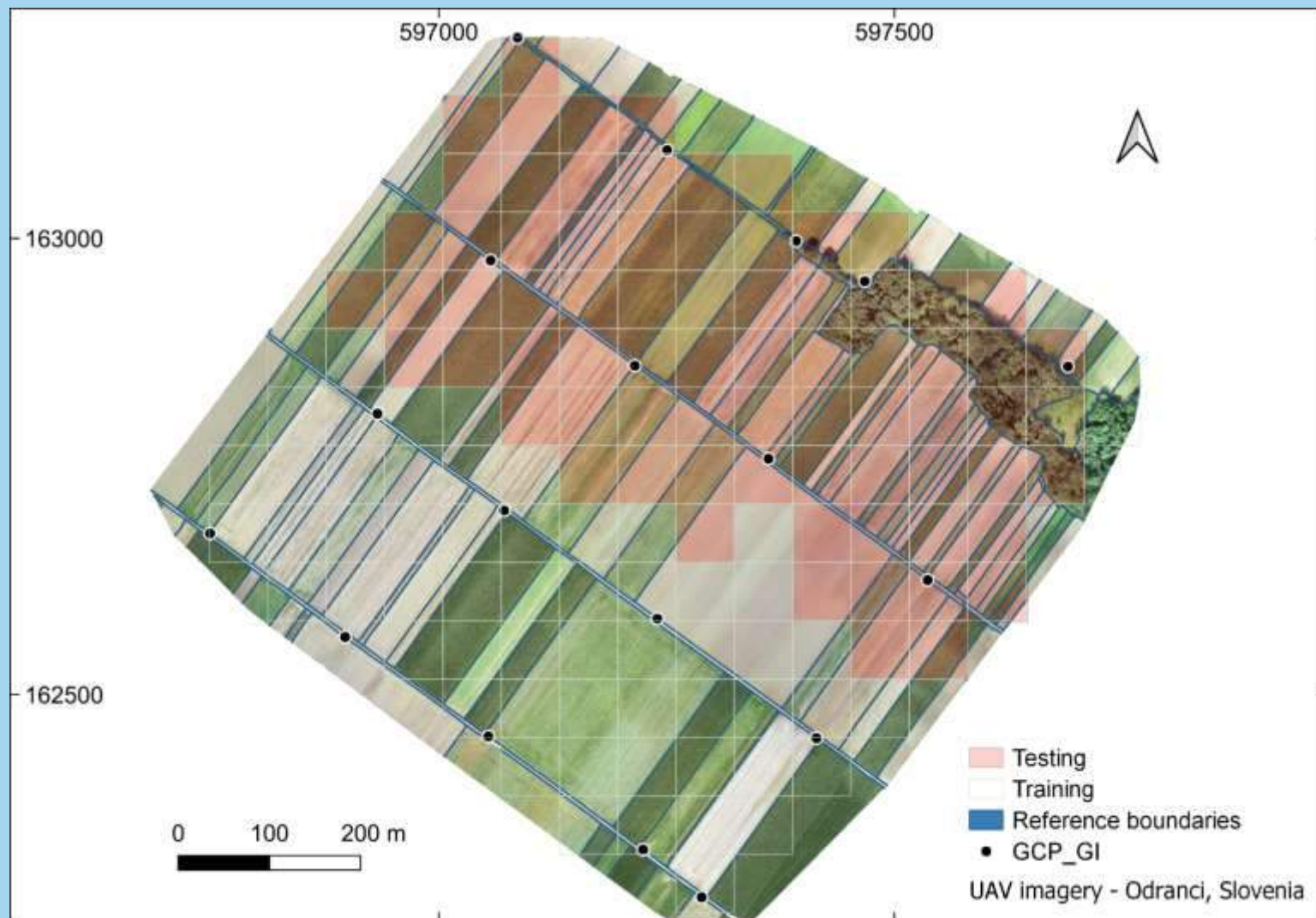
OBJECTIVE OF THE STUDY

To automate the extraction of visible land boundaries through deep learning and analyse their overlap with cadastral boundaries.

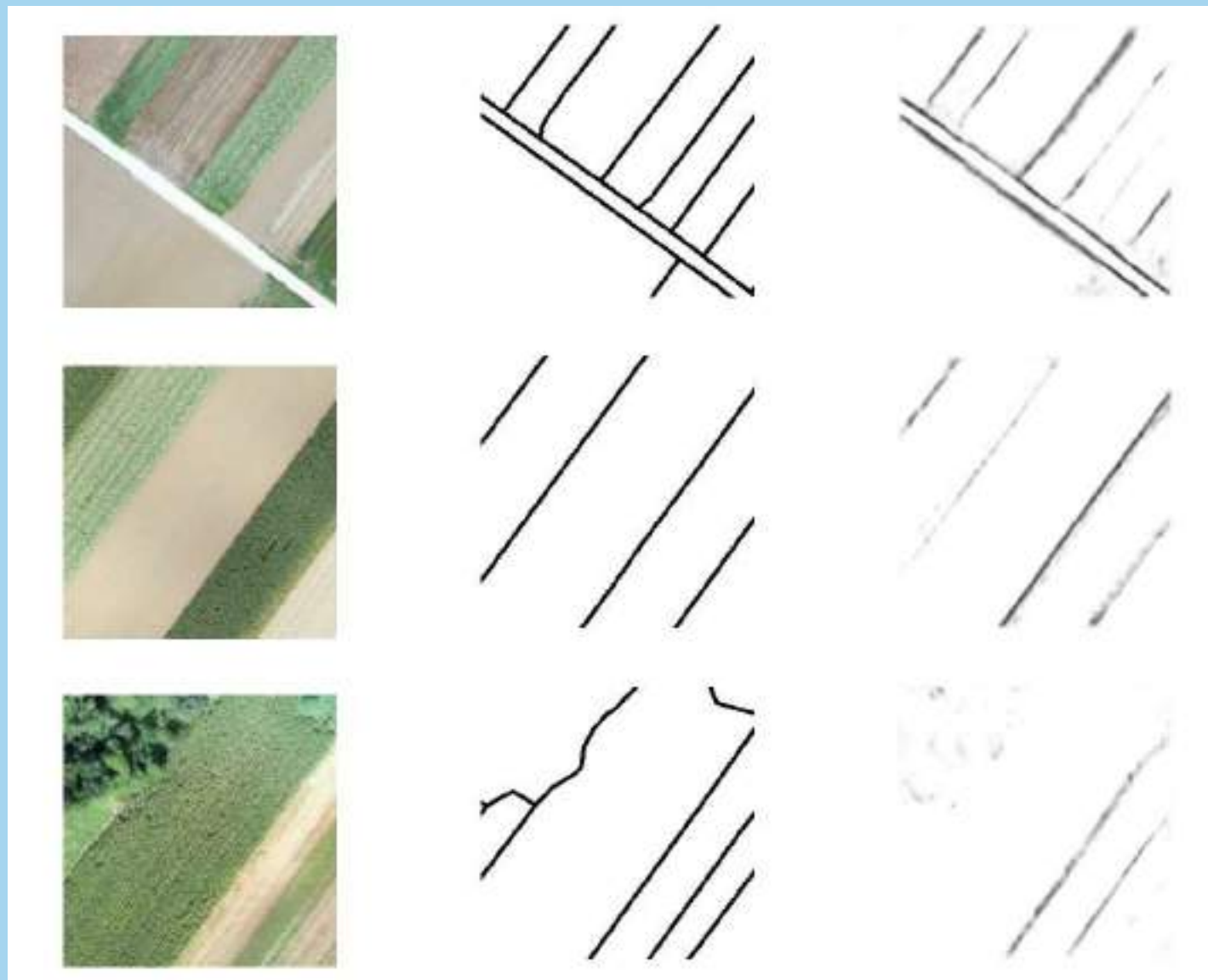
CASE STUDY

- Odranci, Slovenia
- Area 63.9 ha
- Flight altitude 90 m
- GSD 2.35 cm

- Training and testing tiles 256 x 256 pixels
- For training additional UAV dataset have been used



DATA PREPARATION



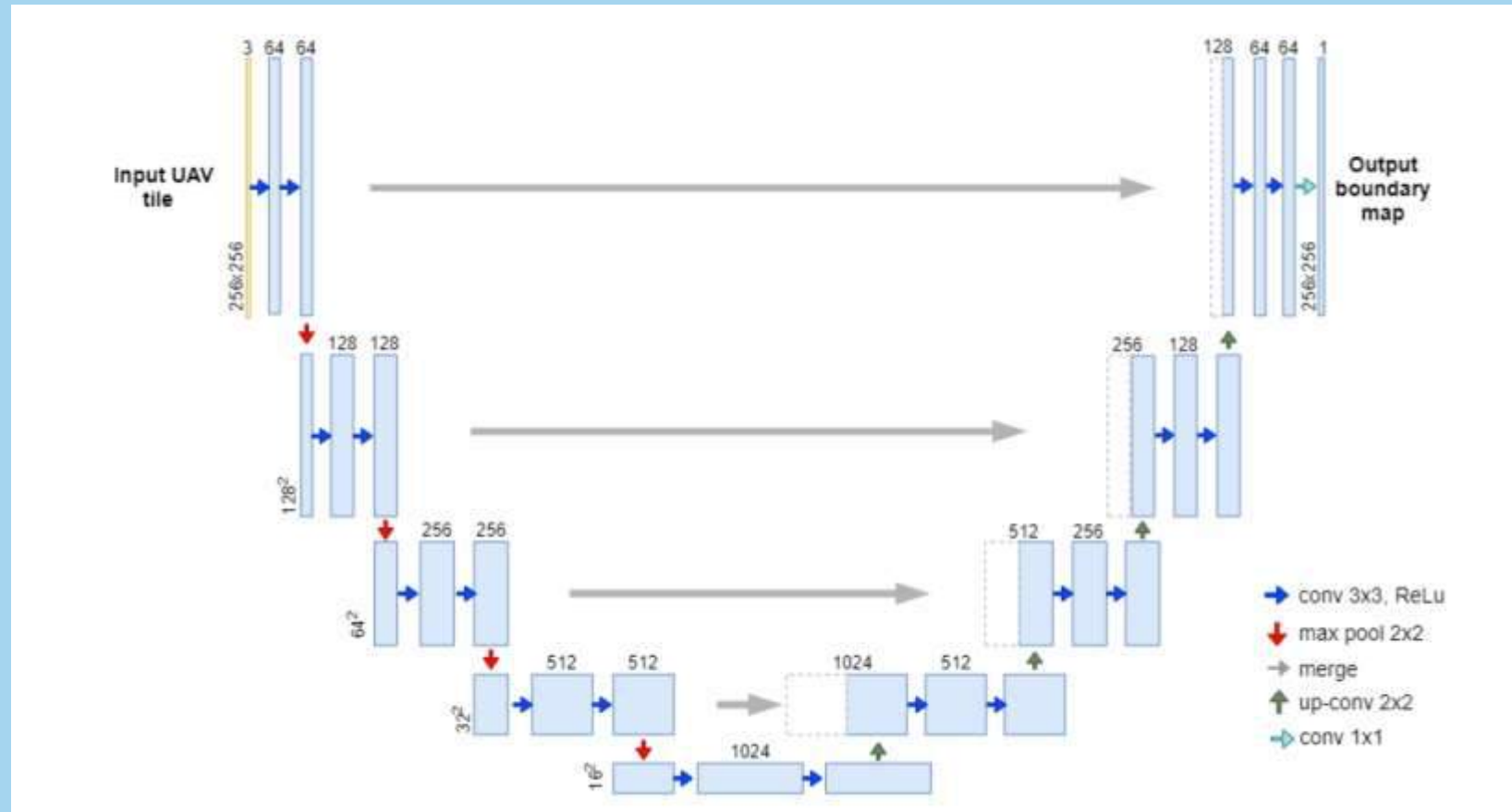
Image

Label

Prediction

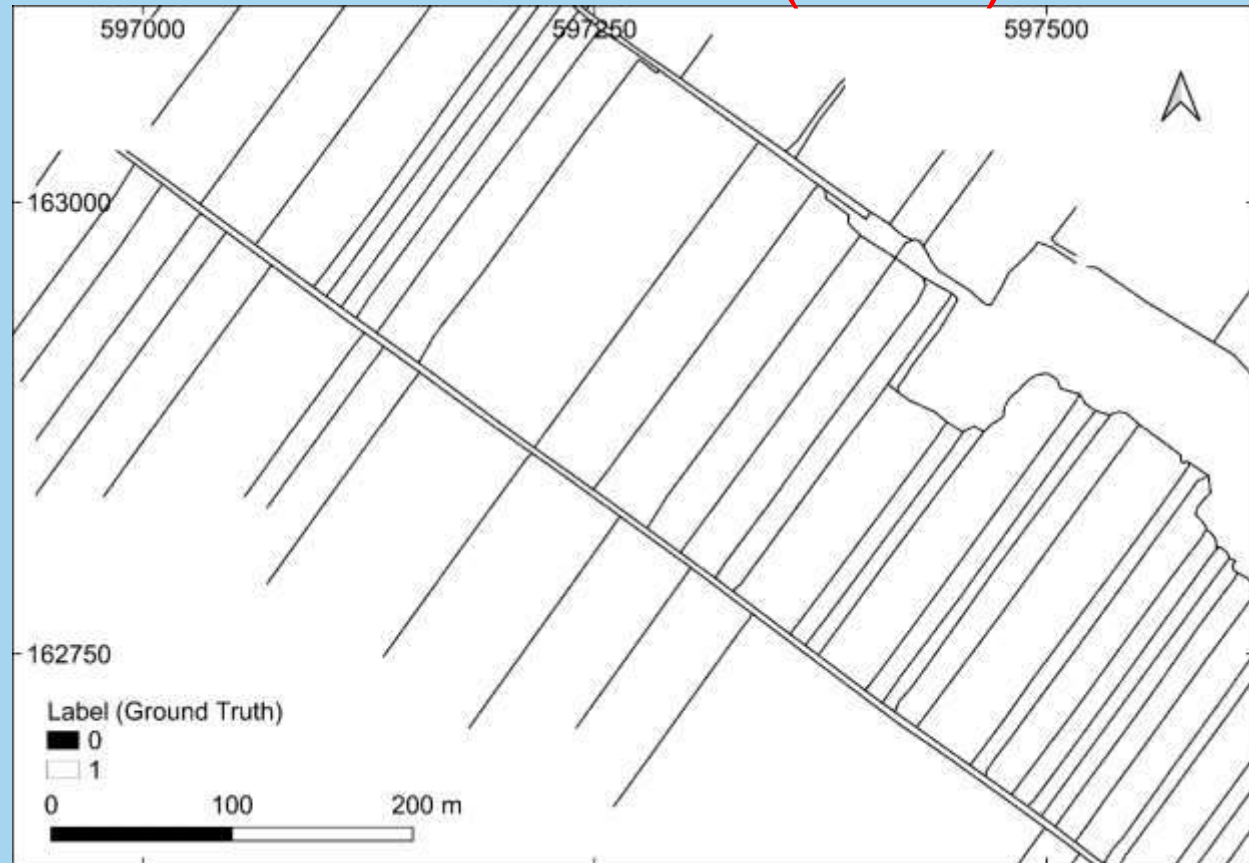
U-NET

- Implemented in API Keras, on top of Tensorflow
- Written in Python
- Training performed in Google Colab
 - 100 epochs ~ 4 hours
- Best model saved with overall accuracy 0.97 (imbalanced classes)



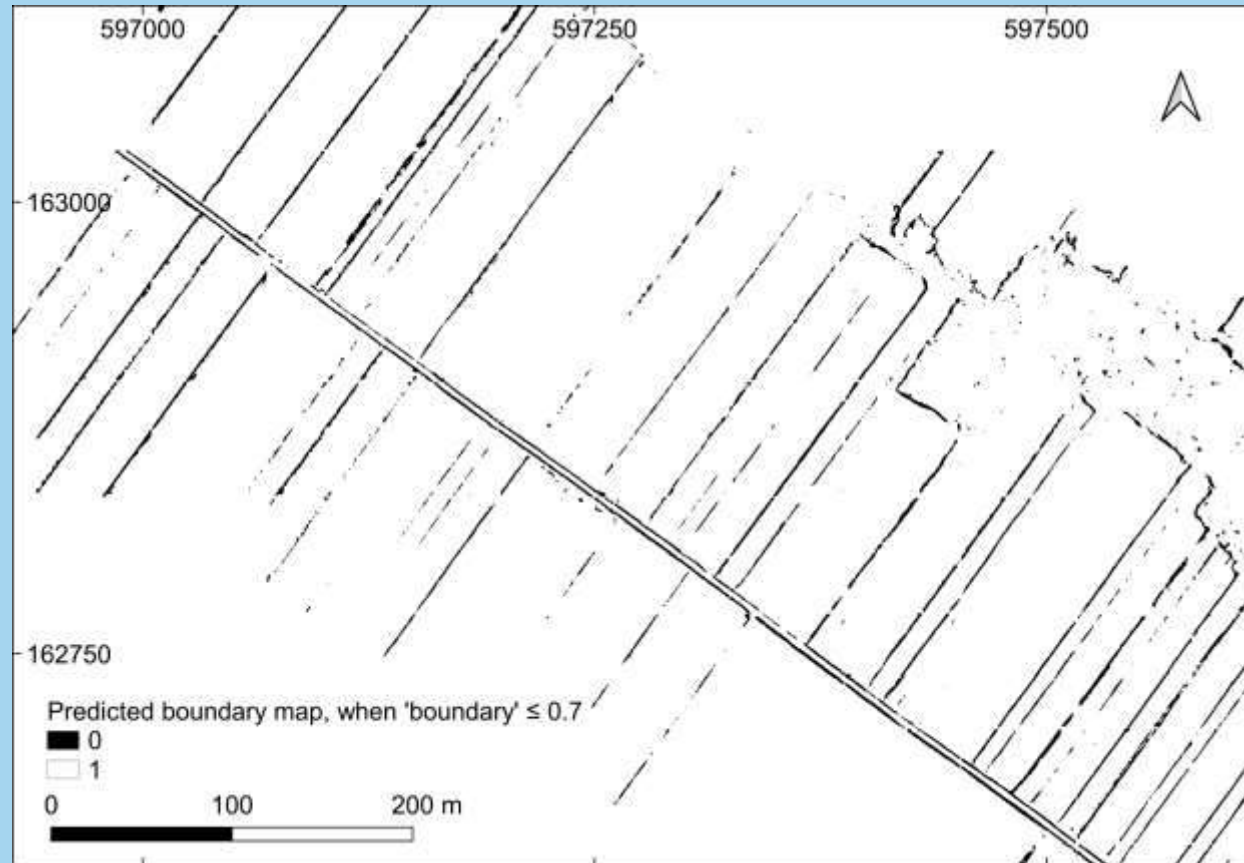
RESULTS

Ground Truth (Label)



RESULTS

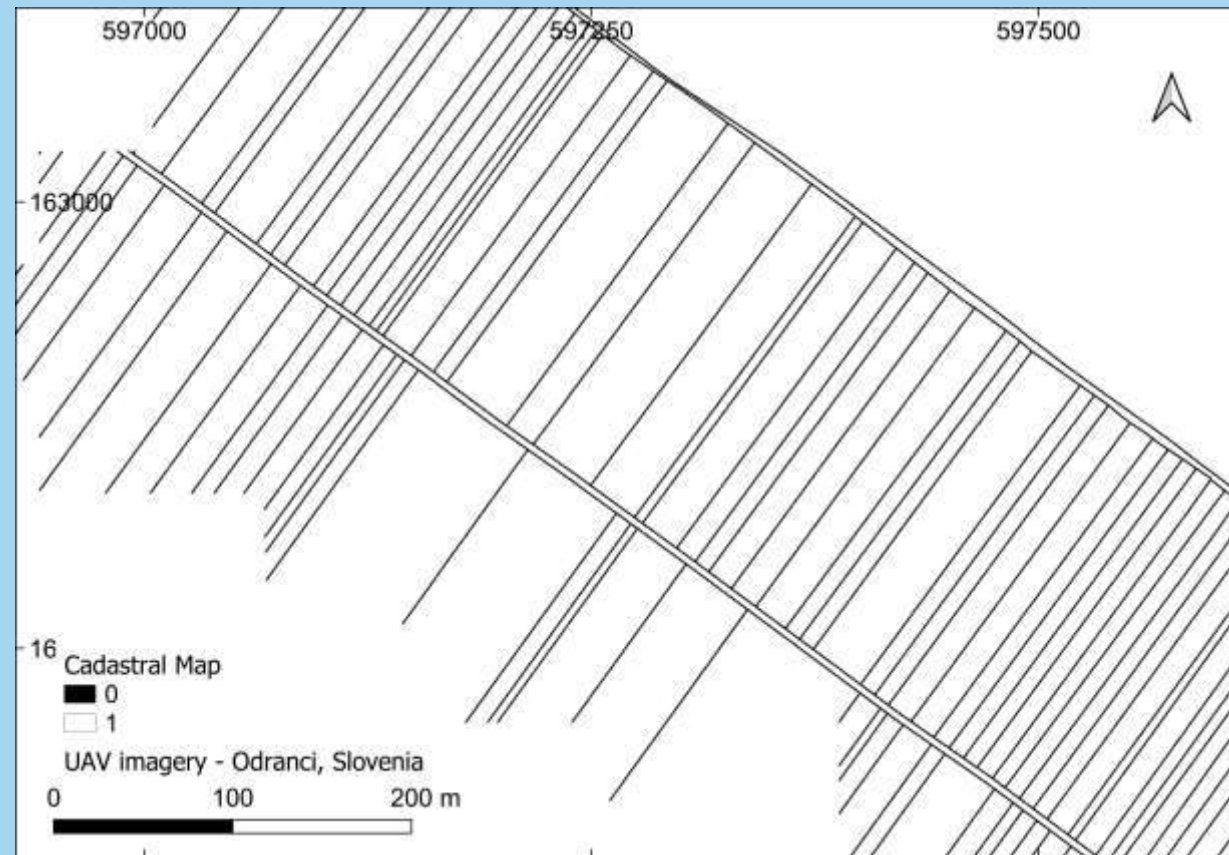
Prediction



Precision = 0.68; Recall: 0.35; F1 = 0.46

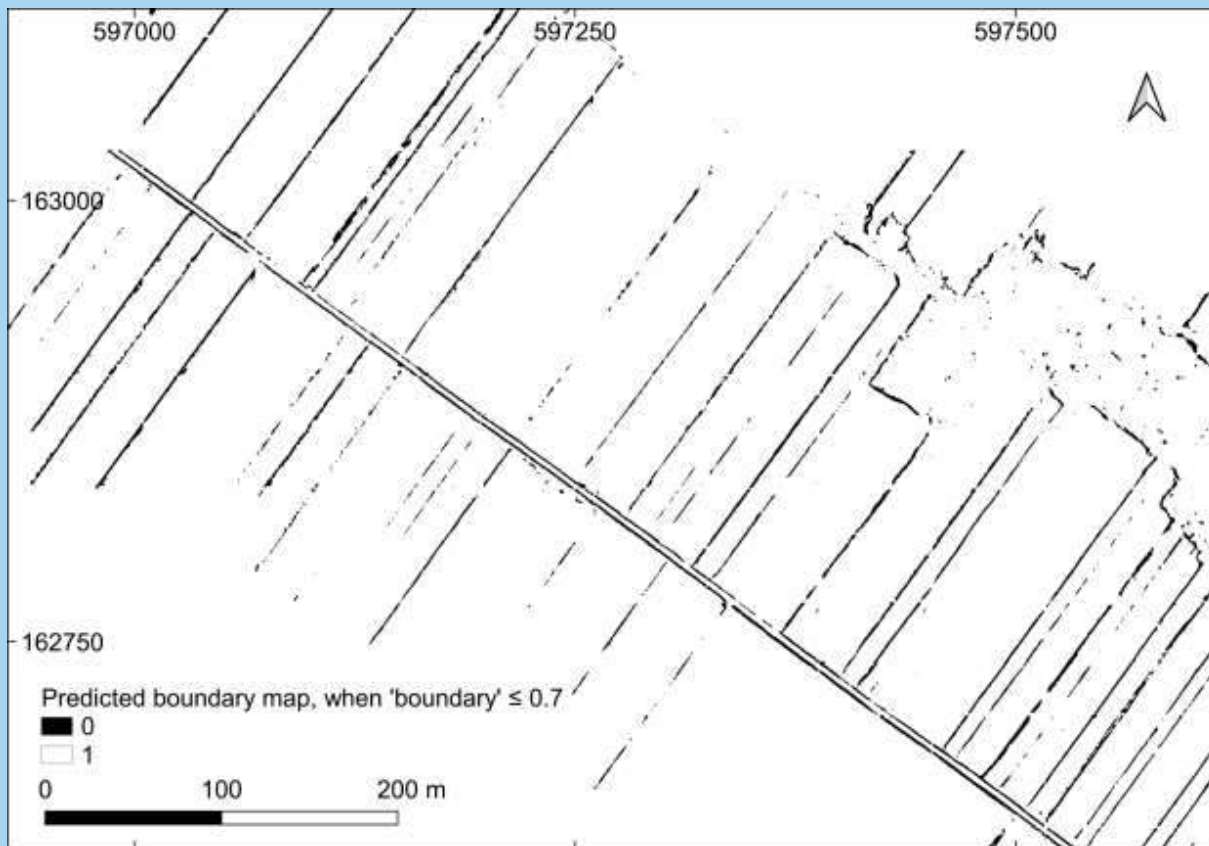
RESULTS

Cadastral Map

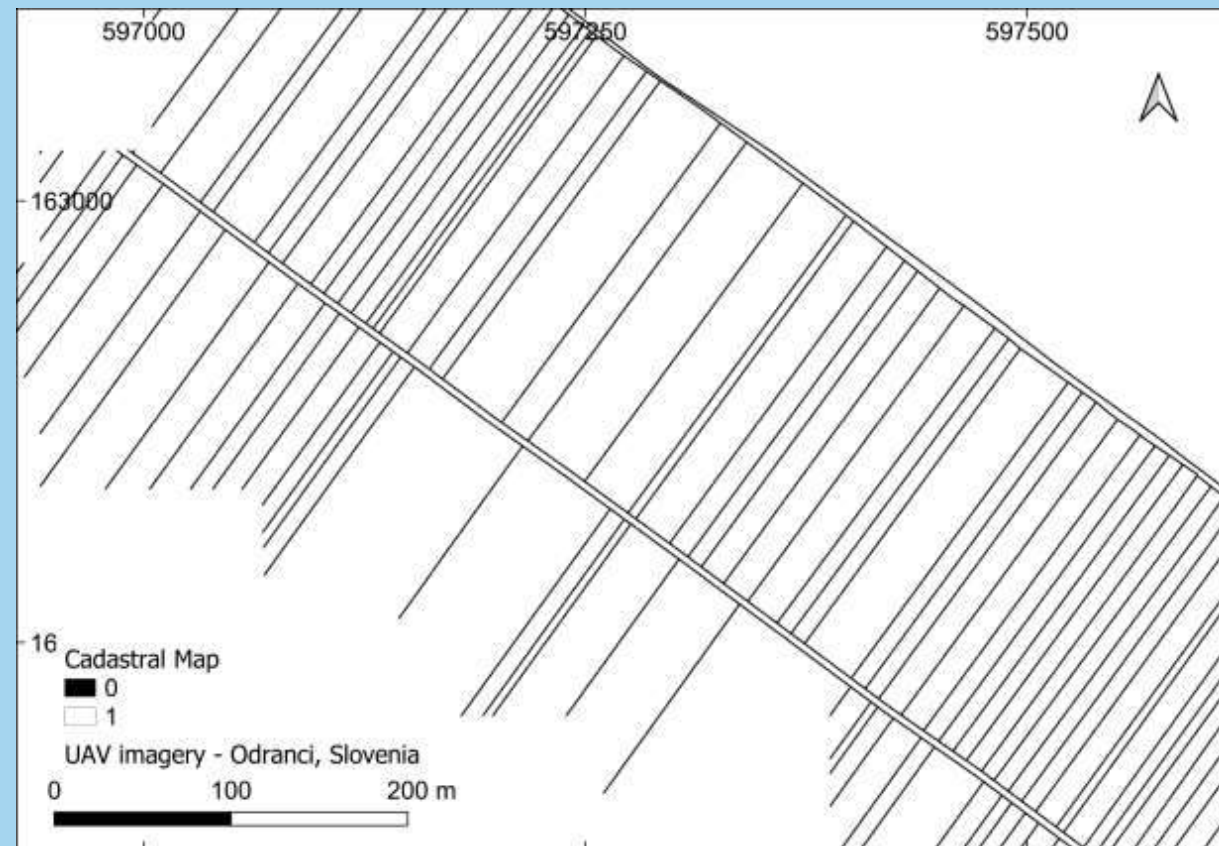


RESULTS

Prediction



Cadastral Map



Precision = 0.52; Recall: 0.19; F1 = 0.27

CONCLUSIONS

- Automating the extraction visible land boundaries is still under investigation phase, especially for cadastral purposes.
- Image-based cadastral mapping, namely UAV imagery, should be further investigated especially for determination of fixed cadastral boundaries in developed contexts.
- The extracted visible boundaries, at this phase, may be used as preliminary boundaries to automatically identify areas where updates are needed.
- This approach is more applicable for rural areas where the degree of visible boundaries is higher - compared to complex urban areas.

MAIN LITERATURE

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3. Koeva, M.; Muneza, M.; Gevaert, C.; Gerke, M.; Nex, F. Using UAVs for map creation and updating. A case study in Rwanda. *Surv. Rev.* **2018**, *50*, 312–325, doi:10.1080/00396265.2016.1268756.
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VPRAŠANJA / QUESTIONS