Transfer learning with ADAF:
extending archaeological detection beyond its training grounds

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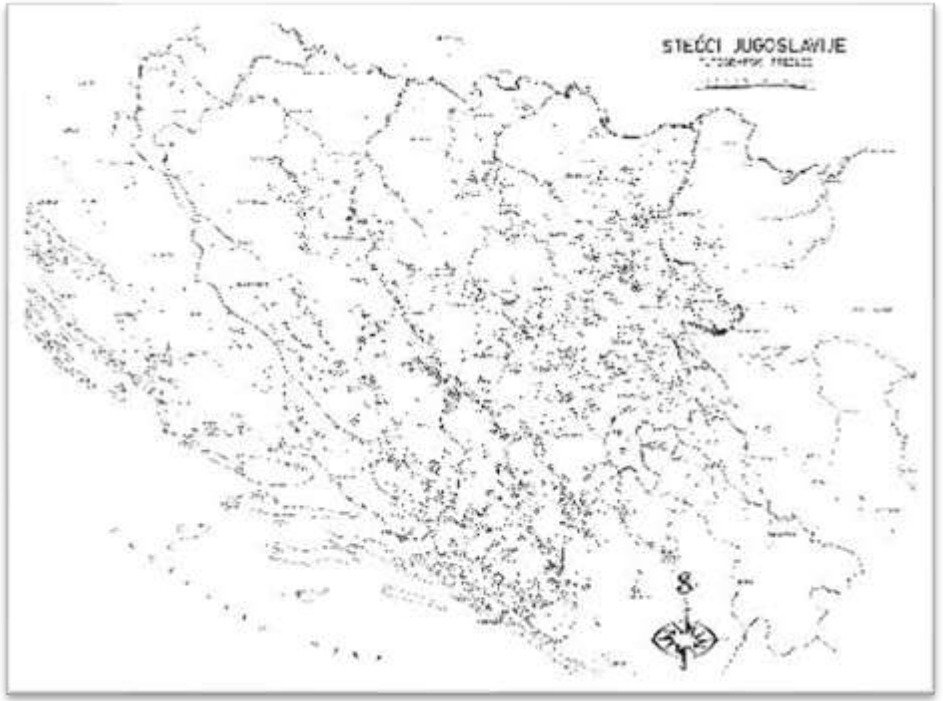
Project STONE



Project STONE

Is it possible to use ***remote sensing*** data to ***reliably detect*** prehistoric ***burial mounds*** and hillforts to reconstruct the prehistoric funerary landscape?

Challanges of mapping burial mounds in eastern Herzegovina

Project STONE

ADAF / background

- **Early identification** of previously unknown or potentialy significant monuments at **large scale**

ELSEVIER

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Automatic detection of archaeological features from airborne laser scanning data using deep learning: Development and evaluation of the ADAF tool

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Bonneagar Iompair Éireann
Transport Infrastructure Ireland

The Discovery Programme
Centre for Archaeology and Innovation Ireland

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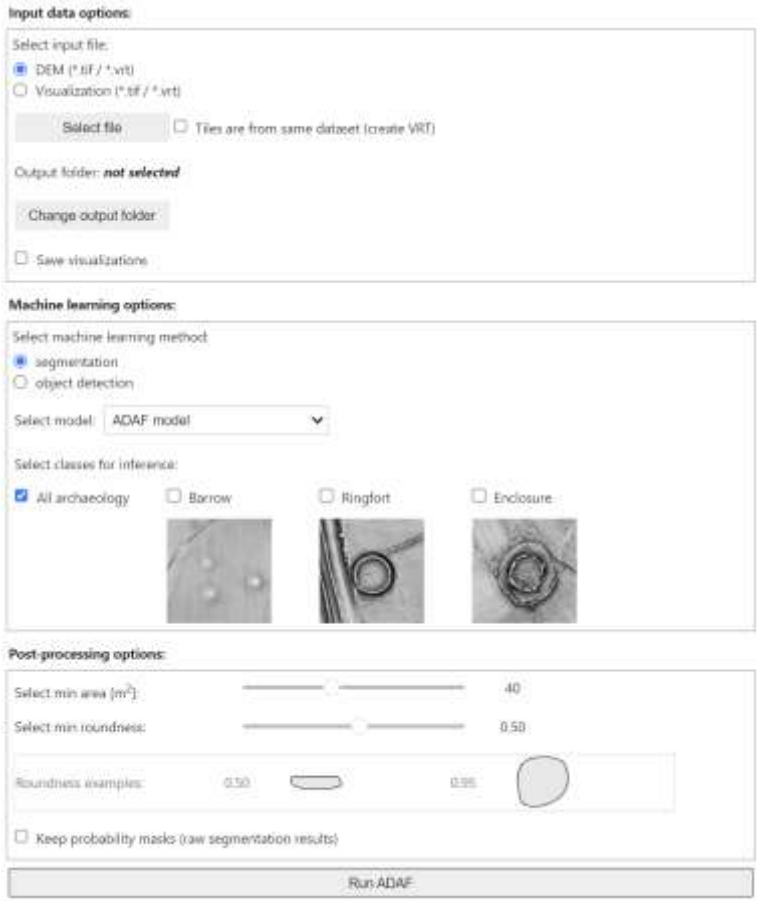
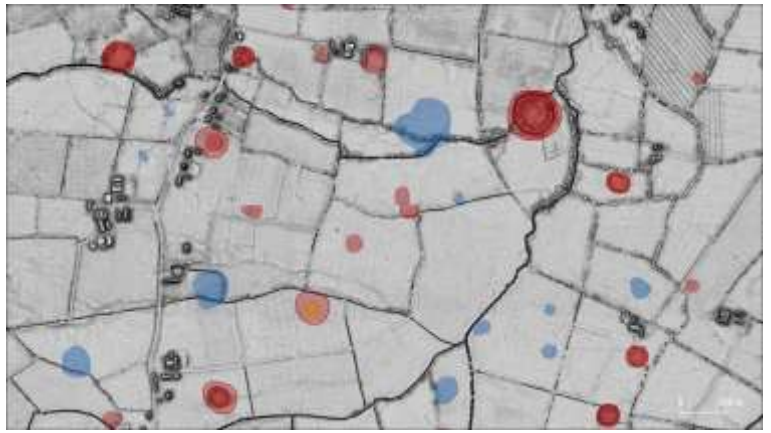
Bias Variance Labs

ADAF / software

DEM

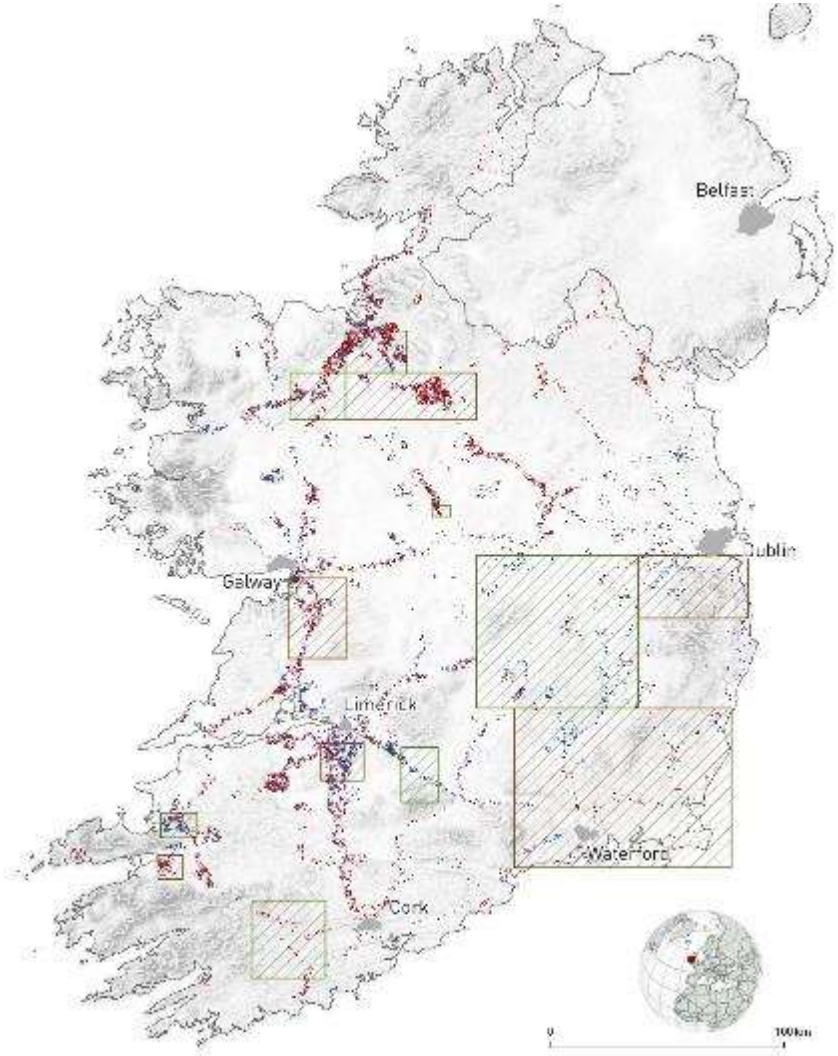




Polygons

EarthObservation/adaf

ADAF / ML model



- HRNet
- SLRM
- Expertly labelled data
- From >200 datasets
- Train : Validation : Test = 60% : 20% : 20%

training class	count
barrow	*2,461
enclosure	2,324
ringfort	5,933
total	**10,718**

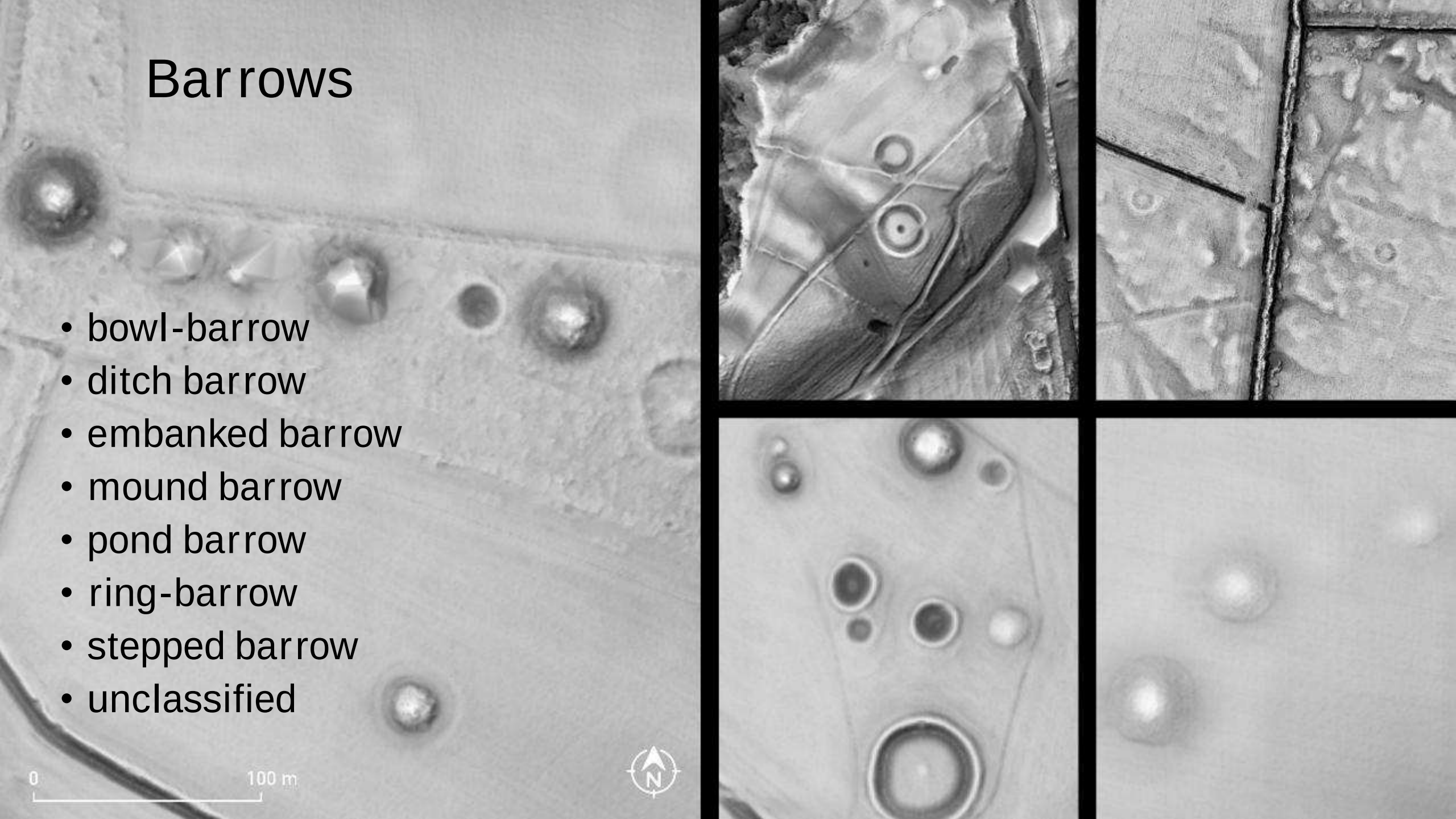
Barrows

Photo: Aristodemo De Cesaris

Barrows

Barrows

- bowl-barrow
- ditch barrow
- embanked barrow
- mound barrow
- pond barrow
- ring-barrow
- stepped barrow
- unclassified



Domain adaptation

ADAF detected around half of the known burial mounds.

What can we do to make it better?

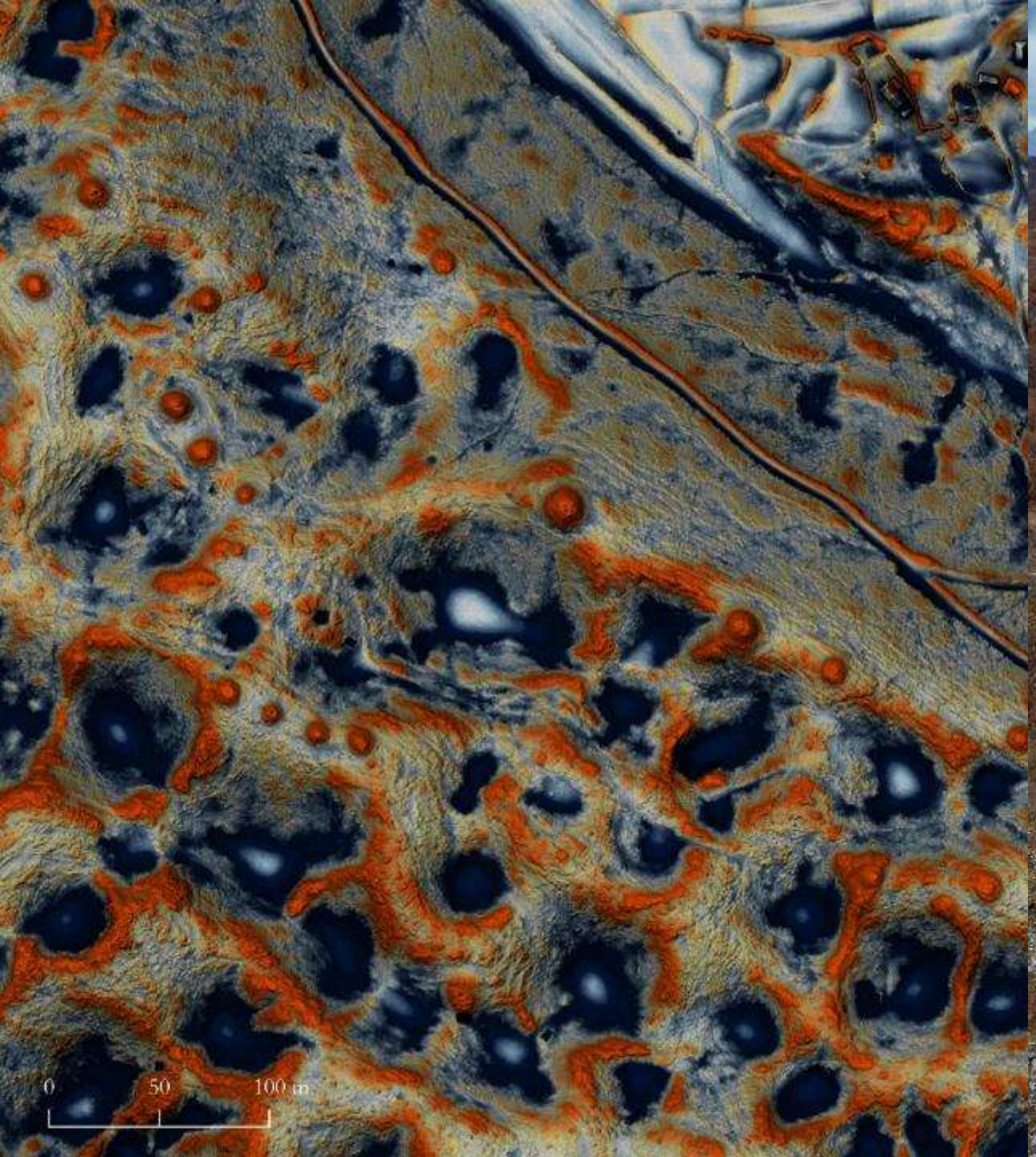

0
50
100 m


Photo: Luka Škerjanec


Photo: Žiga Kokalj


Photo: Žiga Kokalj


Photos: Luka Škerjanec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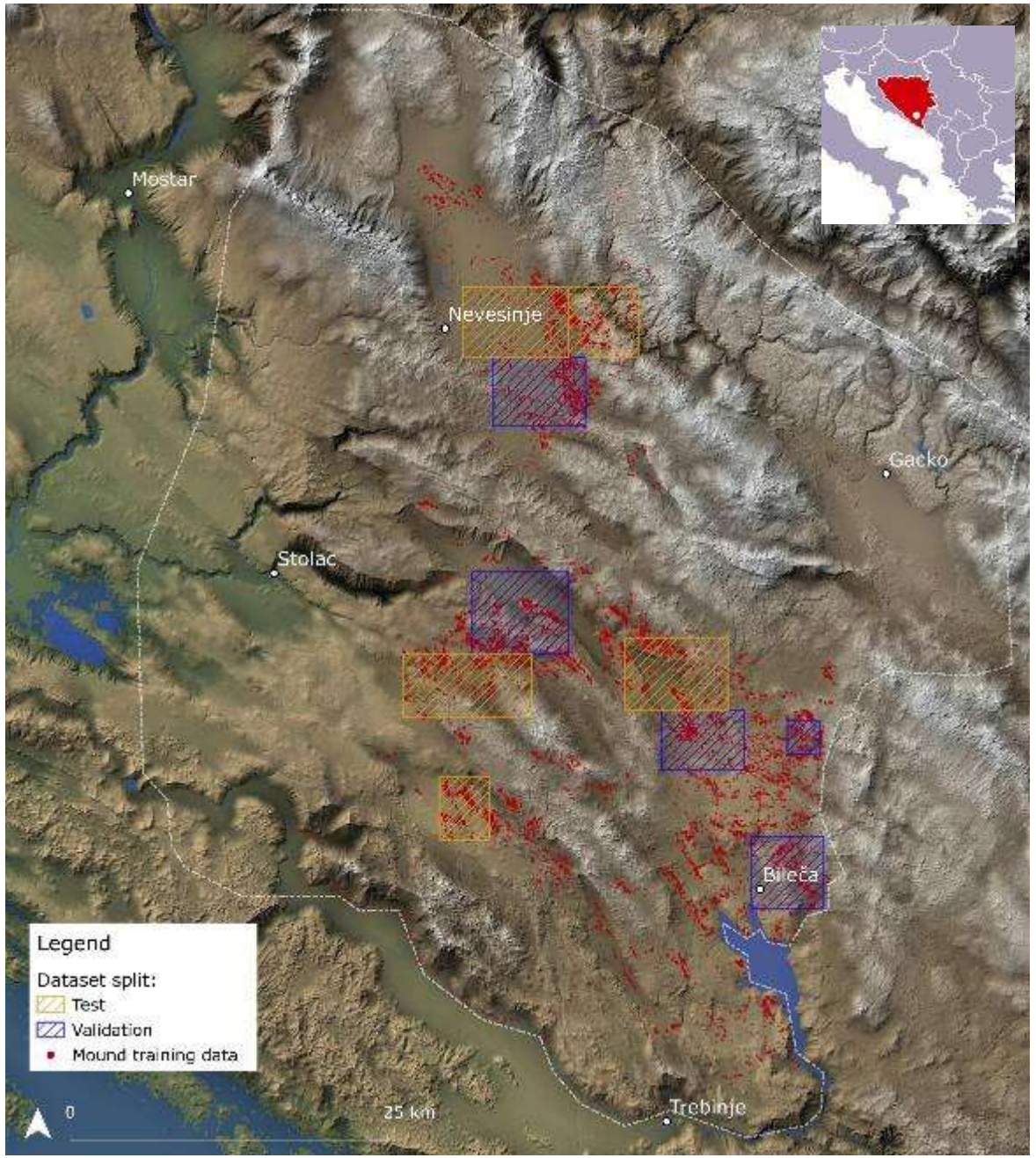


Retraining

Training data:

- study area 3400 km^2
- 8616 samples
- data split = 60/20/20

ML models:

name	domain	tile size
adaf	Ireland	512px
adaf-retrained	Ireland + BIH	512px & 256 px
stone	BIH	512px & 256 px

Results

ANALYSIS ON TEST AREA

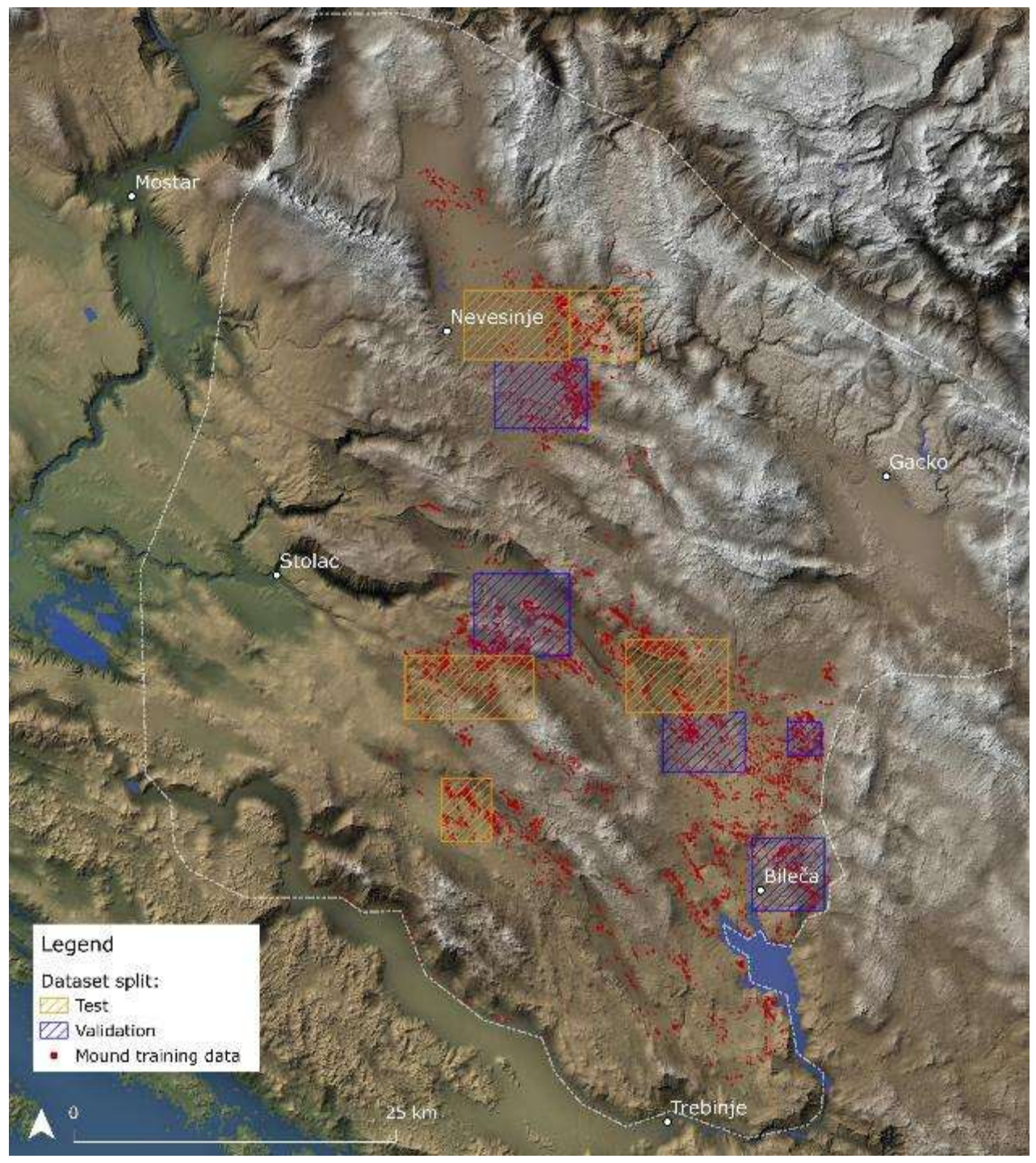
No. of instances in reference data (RD) = 1917

experiment	tile size	detections	TP	FP	FN	% of detections TP	% of detections FP	% of RD FN	f1	Iou
adaf	512 px	891	742	149	1175	83%	17%	61%	0.528	0.280
adaf-retrained	512 px	1930	**1508**	422	**409**	78%	22%	**21%**	0.784	**0.591**
stone	512 px	1819	1474	**345**	443	**81%**	**19%**	23%	**0.789**	0.562
adaf-retrained	256 px	1958	1364	594	553	70%	30%	29%	0.704	0.500
stone	256 px	2060	1466	594	451	71%	29%	24%	0.737	0.507

Results

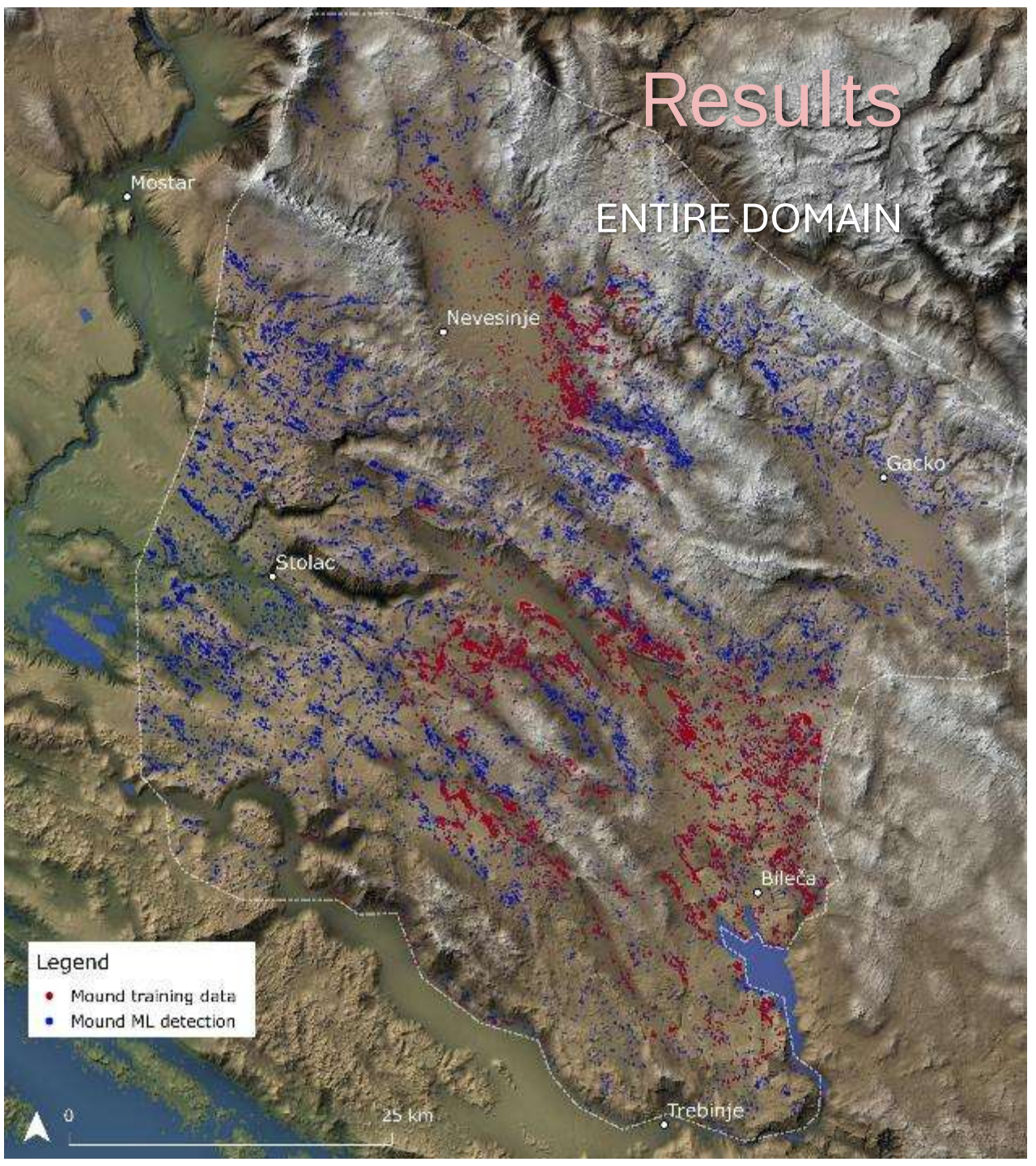
ANALYSIS ON TEST AREA

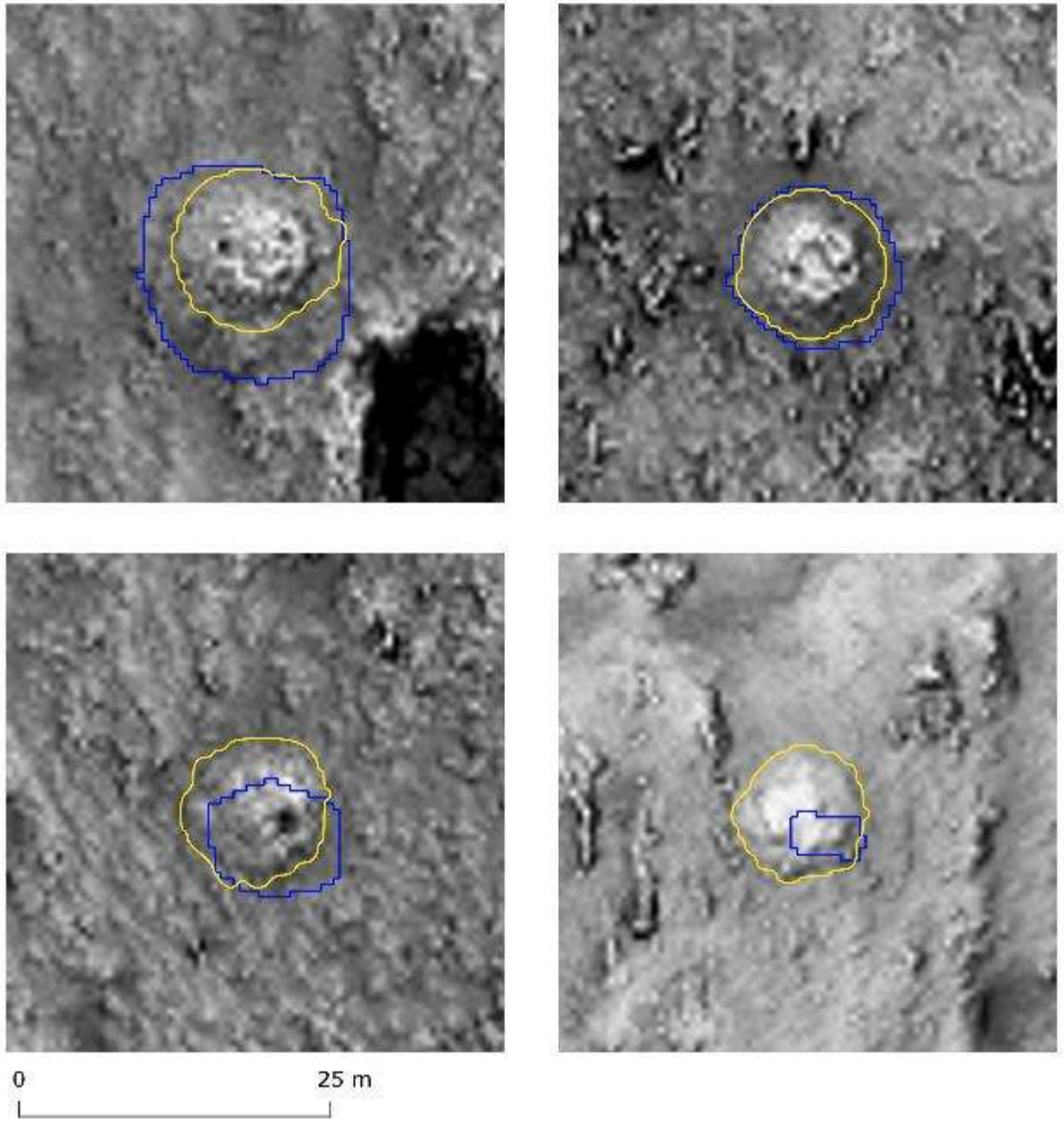
	correctly identified	F1-score
Ireland	39%	0.53
Ireland + STONE	79%	0.78
STONE	77%	0.79



Results

ENTIRE DOMAIN





Results

SITE SCALE

Results are polygons BUT – what can we do with them?

- Luka needs better segmentation to do his analysis

- ADAF used to **localise only** – use a different method for accurate segmentation

Challanges / Discussion

What next?

Strugled to detect burial mounds on sloped terrain
- Limitation of using SLRM; a different visualisation could improve this

What about other regions?
- Slovenia, Croatia, ...
- Switzerland
- A long path ahead to a generalised model

Thank you for your attention!

Čož et al., 2026

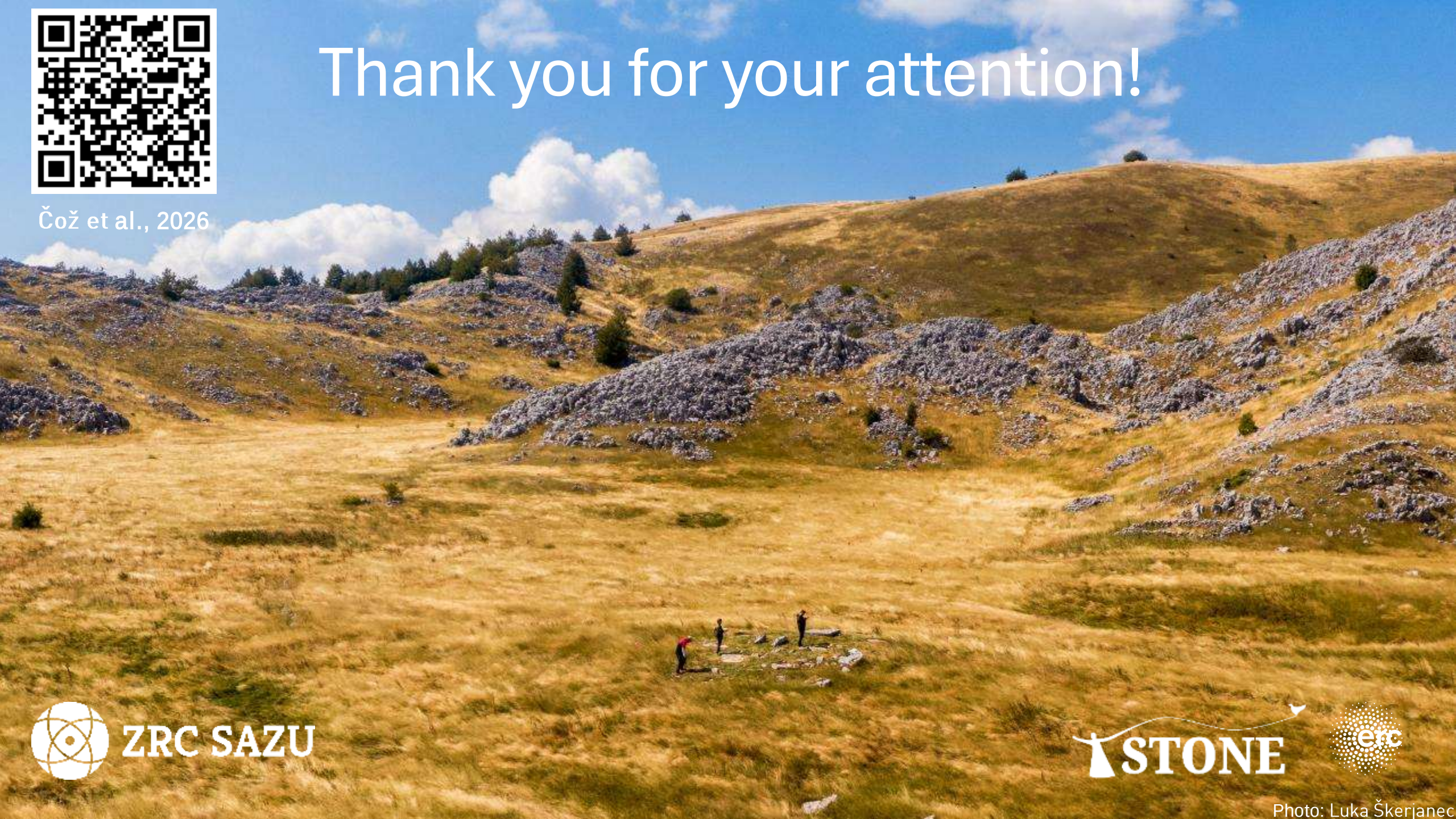


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Photo: Luka Škerjanec