



Rapid Damage Assessment from Satellite Images

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Damage assessment after violent natural events, such as wildfires and floods, is a crucial activity for estimating losses and providing a prompt and efficient restoration plan in cultural and natural heritage areas. **Assessments over large areas are challenging and time consuming**, as they require EO-based information and a thorough inspection by domain experts.

We automate these tasks exploiting a machine learning pipeline able to process heterogeneous satellite data to provide delineations or severity estimations, given a specific area of interest (AoI) and time interval as input.

Sentinel-1 and Sentinel-2 satellite imagery from ESA's Copernicus Programme has been exploited to train and validate **flood and burned areas delineation models**. Both approaches, based on state-of-the-art segmentation networks, can map a given AoI in a completely automated fashion and within minutes.

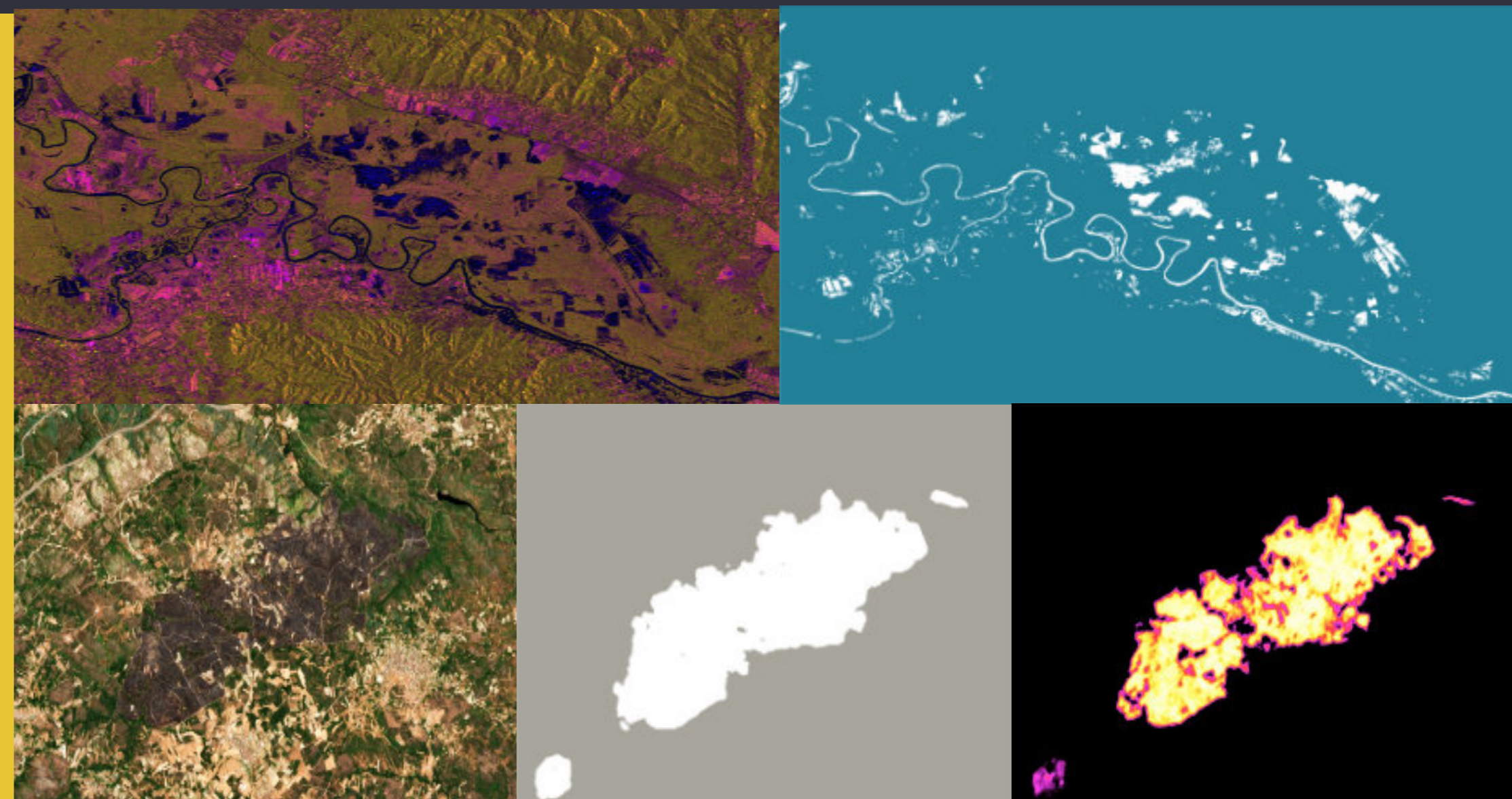
How

Flooded area delineation.

Given an area of interest, estimate the extent of the flooded areas through binary segmentation (U-Net).

Burnt area delineation and severity estimation.

Given a similar AoI, delineate the affected area, and estimate the burn severity through regression (Double-Step U-Net).



Results

Validating flooded areas.

We test our model against manually validated Copernicus EMS flood activations, focusing on the Sava river basin.

Validating burnt areas and burn severities.

We test against historical EMS wildfires (F1 Score) and we compute dNBR outputs from Galician wildfires for severity estimation.

Functionality

Capabilities and connections.

The service can map large areas on demand, providing fast and accurate delineations and severity estimations thanks to deep learning solutions.

The service is independent and async: it communicates with external clients through the SHELTER message bus only.

Task	Method	Metric	Score
Flood delineation	Thresholding	F1	0.7515
Flood delineation	U-Net (Ours)	F1	0.8601
Burned area del.	Single U-Net	F1	0.8231
Burned area del.	Double-step U-Net (Ours)	F1	0.8812
Severity estimation	dNBR	RMSE	0.9180
Severity estimation	Double-step U-Net (Ours)	RMSE	0.8760

