Model Name PV Segmentation

PURPOSE	This model segments photovoltaic (PV) installations on Swiss rooftops using high-resolution aerial imagery. It serves as the foundational component of the PV capacity and production estimation on a building level. Its output enables the identification of *unregistered* PV systems and the correction of incomplete public records.
TRAINING DATA	Pretrained backbone on COCO subset (DeepLabV3_ResNet101_Weights.COCO_WITH_VOC_LABELS_V1, 20 Pascal VOC categories) Finetuned on: • 750 labelled 100×100 m Swisstopo aerial images • 1500 labelled 80×80 m Swisstopo aerial images (10 cm resolution)
MODEL INFORMATION	• Architecture: DeepLabv3 with ResNet101 backbone + linear layer • Loss: Dice + Binary Cross-Entropy • Training: minor brightness/contrast augmentation, early stopping
INPUTS AND OUTPUTS	**Input:** High-resolution aerial image tile (RGB, 10 cm resolution) **Output:** Probabilistic PV segmentation mask and extracted PV polygon outlines
VALIDATION PROCEDURE	A random 80%/10%/10% train/validation/test split was used.
TEST DATA	Besides the test data from the random split we inferred installed capacity from the detected area and compared it on a building level with registered installations from Pronovo.
PERFORMANCE METRICS	F1-score: 90% Intersection-over-union: 85% Mean Absolute error on inferred installed capacity on building level: 25% Mean Absolute error on inferred installed capacity on district level: 7%
ROBUSTNESS	No explicit adversarial or perturbation robustness tests performed
OPTIMAL CONDITIONS	Regions with recent Swisstopo aerial imagery (in one thirds of Switzerland is updated yearly)
POOR CONDITIONS	Regions with outdated imagery may miss PV segments
INTENDED USES & LIMITATIONS	**Intended uses:** • Estimation of building-level PV capacity • Identification of unregistered PV systems • Input for national PV production and forecasting models **Limitations:** • Performance dependent on imagery recency and quality • For outdated images correction factors need to be used to account for the growth • May misclassify visually similar rooftop objects
CONTACT INFORMATION	Any queries related to the operation of the model can be addressed to lucas.tochtermann@bfe.admin.ch.