Harvesting historical spy imagery by evaluating deep learning models for state-wide mapping of land cover changes between 1965-1978

Lucas Kugler, Christopher Marrs, Eric Kosczor, Matthias Forkel
Technische Universität Dresden

_ summary

- land cover analysis and land cover change analysis plays a fundamental role in climate change understanding
- in 1995, the Central Intelligence Agency of the United States of America released previously classified spy imagery taken from 1960 onwards with near-global coverage
- here, we aim to analyse the past land cover from CORONA imagery for a state-wide mapping of past land cover changes between 1965 and 1978 by training, testing and validating various deep learning models

Georeferencing 157 CORONA image strips

↓

Selection Example Dataset

↓

Applying different filters on example data + Data Augmentation

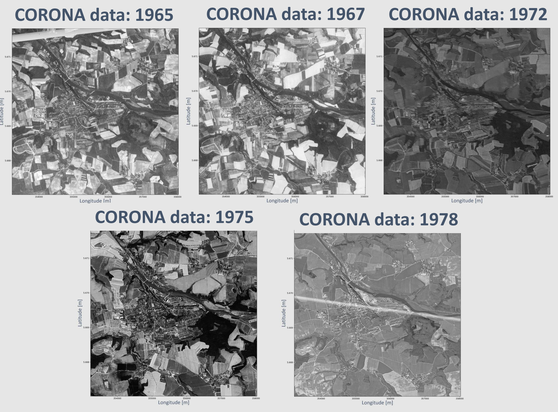
↓

Training and Evaluation of different U-shaped architectures

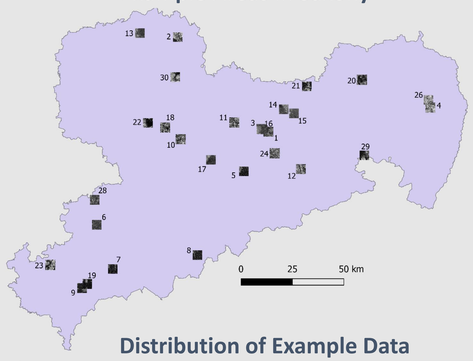
↓

Inference on CORONA imagery of Saxony

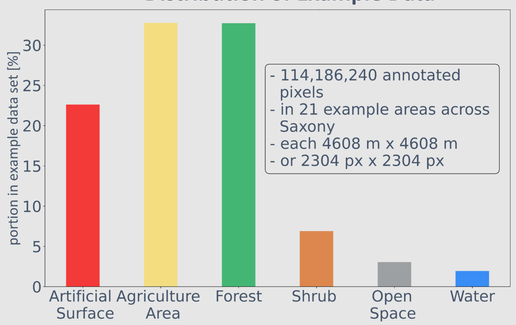
_ data



Example Areas in Saxony

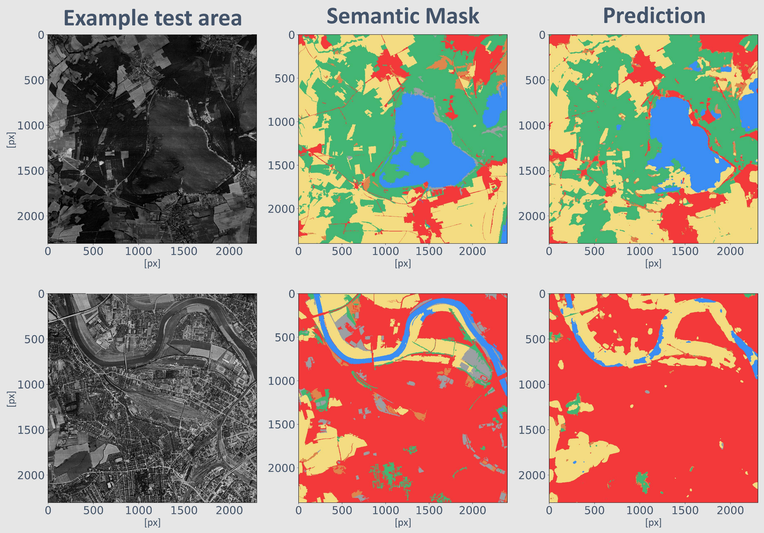


Distribution of Example Data



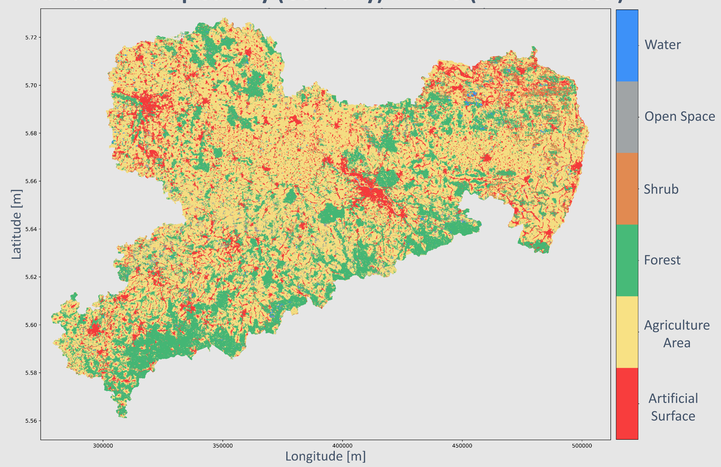
_ training & evaluation

	Artificial Surface	Agriculture Area	Forest	Shrub	Open Space	Water	Ø IoU
U-Net	57,07 %	63,47 %	73,10 %	0,00 %	0,00 %	0,00 %	32,22 %
ResNet50 U-Net	53,54 %	62,07 %	75,31 %	3,86 %	10,45 %	39,37 %	40,77 %
ResNet101 U-Net	57,05 %	63,02 %	74,42 %	12,74 %	6,63 %	34,98 %	41,13 %
InceptionV3 U-Net	59,14 %	67,82 %	78,47 %	3,11 %	0,68 %	53,81 %	43,84 %
InceptionResNet V2 U-Net	60,97 %	70,26 %	84,27 %	17,27 %	12,13 %	61,83 %	51,12 %
U-Net2+	61,25 %	70,21 %	82,76 %	14,27 %	9,26 %	50,02 %	47,95 %
U-Net3+	61,58 %	71,99 %	82,22 %	14,82 %	7,67 %	57,89 %	49,36 %
Attention U-Net	53,24 %	62,85 %	75,38 %	3,32%	19,94 %	39,25 %	42,33 %
Trans U-Net	68,83 %	74,21 %	83,29 %	21,82 %	22,97 %	66,49 %	56,26 %
Swin U-Net	62,91 %	71,27 %	84,67 %	14, 54 %	16,41 %	52,78 %	52,10 %

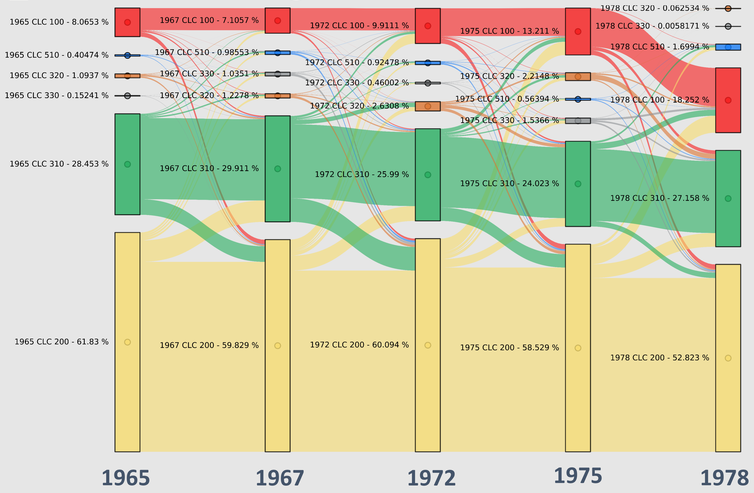


_ application

Land cover map Saxony (Germany) in 1975 (2m resolution)



_ land cover change 1965 – 1978 in Saxony



Questions or interested in future discussion?

lucas.kugler@tu-dresden.de https://tu-dresden.de/geo/envrs

Application project and development was financed by the Saxon State Office for Environment, Agriculture and Geology (LfULG).