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Object-Based Augmentation for Building Semantic Segmentation: Ventura and Santa Rosa Case Study

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Object-based augmentation for satellite data

General domain

Simple Copy-Paste is a Strong Data Augmentation Method for Instance Segmentation, Google Research, Brain Team, 2020

Remote sensing domain

???

Challenges:

- small datasets
- different environmental conditions
- rare target objects
- geo-spatial satellite data specificity (objects distribution, image size, shadows, etc)

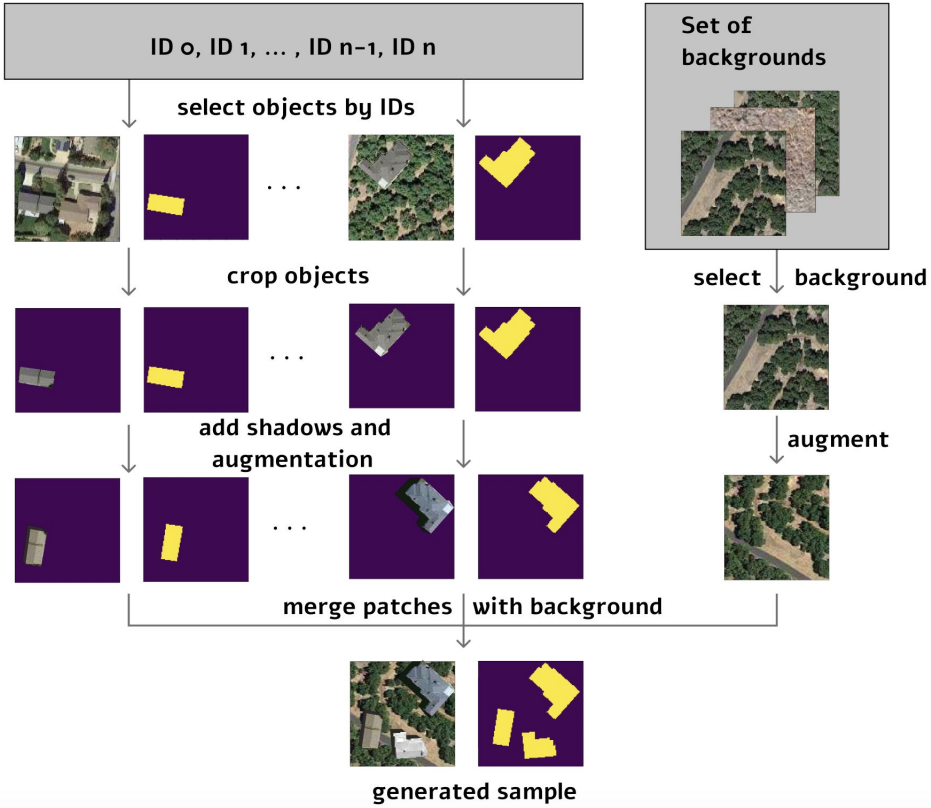
The goal:

to achieve higher performance with less data requirements in the remote sensing domain

Proposed approach

Building segmentation case study

- georeferenced images and markup
- set of backgrounds



Original samples

Generated samples

Training area

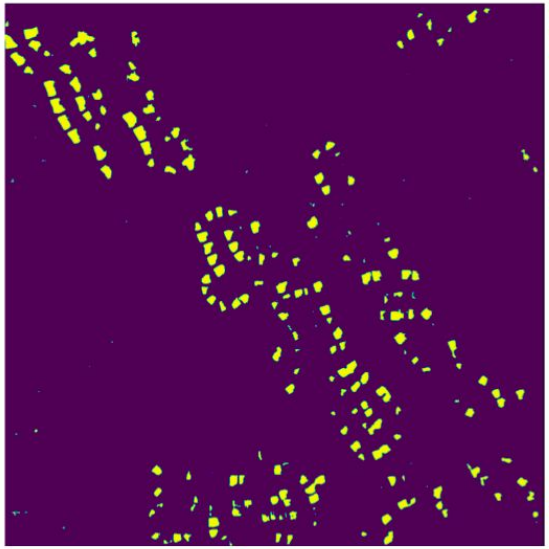
Ground truth mask

4.000 * 4.000 pixels

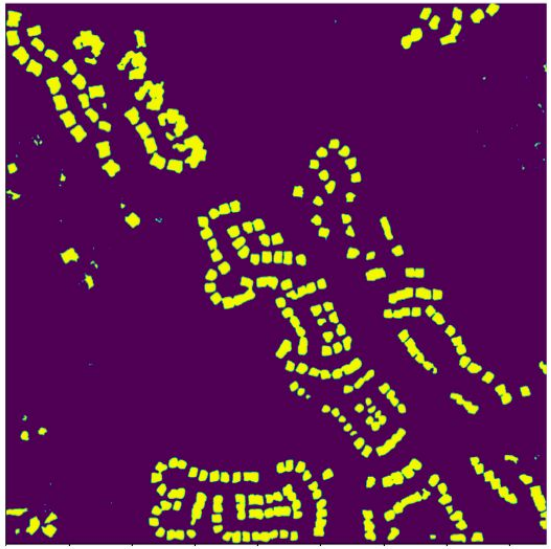
Study area:
Santa Rosa, Ventura (California)

	Train	Validation	Test
Objects number	955	226	282
Area in hectars	390	100	93
Extra background area in hectars	2000	500	500

Image and ground truth mask



Without augmentation



Object-based augmentation

	Base augm.	Shadow	Extra background
Baseline_no_augm	✗	✗	✗
Baseline	✓	✗	✗
OBA_no_augm	✗	✓	✓
OBA_no_shadow	✓	✗	✓
OBA_no_background	✓	✓	✗
OBA	✓	✓	✓

Standard augmentation	Augmentation	F1-score
No	*Baseline_no_augm*	0.45
	OBA_no_augm	0.66 (+21%)
Yes	*Baseline*	0.788
	OBA_no_shadow	0.811 (+2.3%)
	OBA_no_background	0.81 (+2.2%)
	OBA	0.829 (+4.1%)
	OBA + optimization	0.835 (+4.7%)

Conclusions

- We proposed augmentation for building segmentation
- We tested different augmentation configurations
- The proposed object-based augmentation improves the performance of remote sensing task
- We provided the code