Contextual Description of Superpixels for Aerial Urban Scenes Classification

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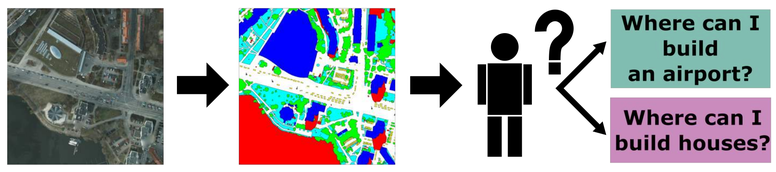
HONORABLE MENTION

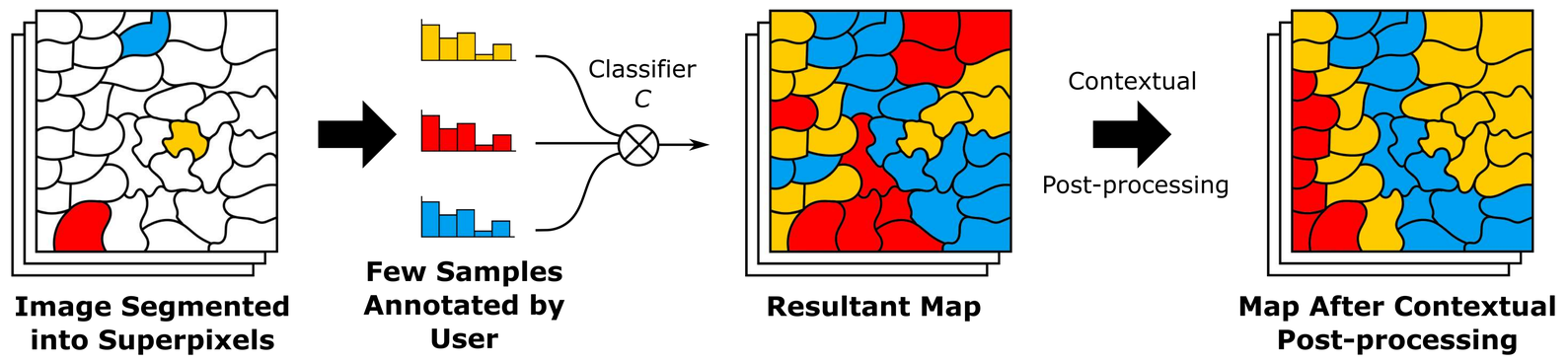
1. Motivation

Thematic maps play a fundamental role in the decision-making in several areas such as urban planning, environmental monitoring and economic activities.



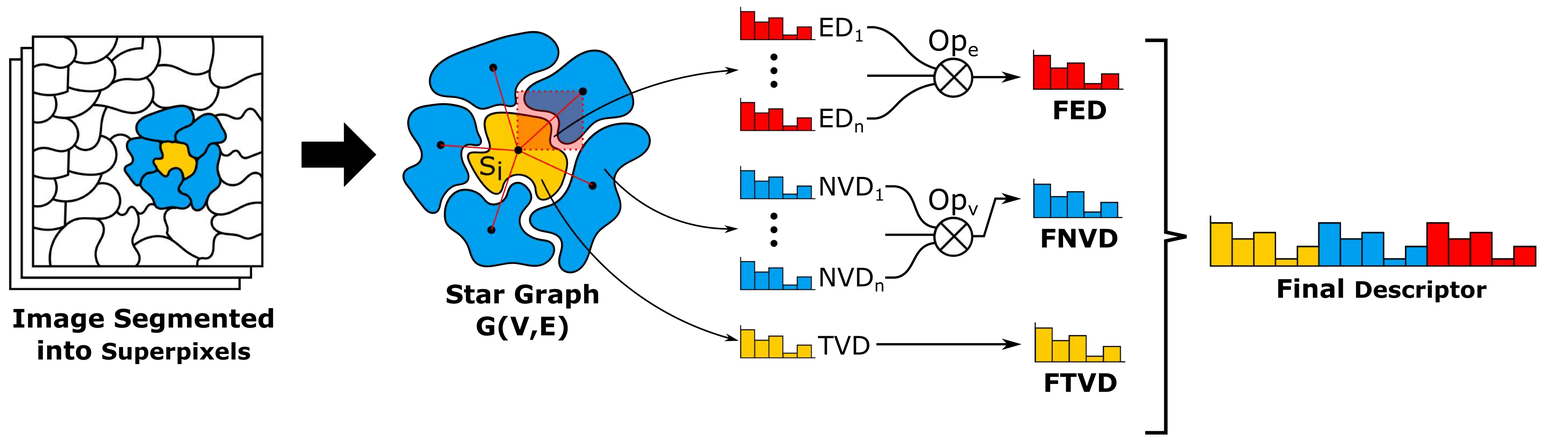
2. Problem

It is widely recognized that context improves classification results. However, traditional methods require lots of labeled data to impose contextual constraints over the results. That is not suitable for automatic thematic maps creation.



Is there a way to encode context in the description of image elements without labeling them?

3. Star Descriptor



4. Datasets

- **grss_dfc_2014**: 7 classes, 3769x4386 Very High Resolution (VHR) image, spatial resolution of 20 cm, taken over Québec, Canada, provides particular subset for training

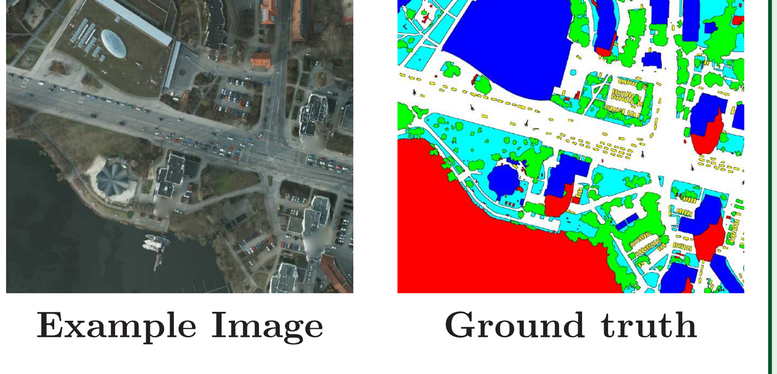
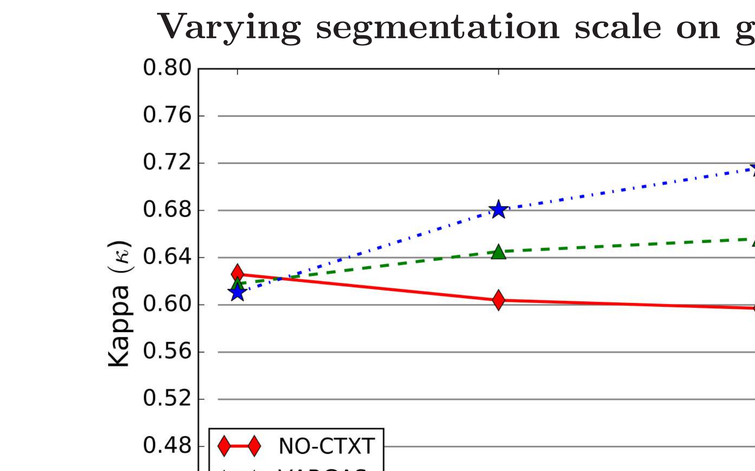


Image | Ground truth

- **ISPRS Postdam**: 6 classes, 38 6000x6000 VHR image patches, spatial resolution of 5 cm, taken over Postdam, Germany. We selected 5 from the 38 images, once ground truth for test images is not provided



Example Image | **Ground truth**

5. Experimental Setup

Segmentation: Simple Linear Iterative Clustering (SLIC)
Region Descriptors: three color (BIC, CCV, GCH) and one texture descriptor (Unser)
Edge Descriptors: two texture descriptors (LBP and Unser)
Summarization operations: sum, average and max pooling
Classifier: SVM with RBF kernel
grss_dfc_2014 protocol: specific training/test subsets
ISPRS Postdam: 5-fold Cross-validation
Baselines: low-level descriptors without context (NO-CTXT) and Vargas' descriptor (VARGAS)

7. Conclusions

- It is possible to aggregate context to automatically generate thematic maps without using lots of labeled data
- Borders might be important in urban scenarios
- Accuracy of the generated map is strongly dependent on the combination of low-level descriptors and summarization operations chosen

Acknowledgments

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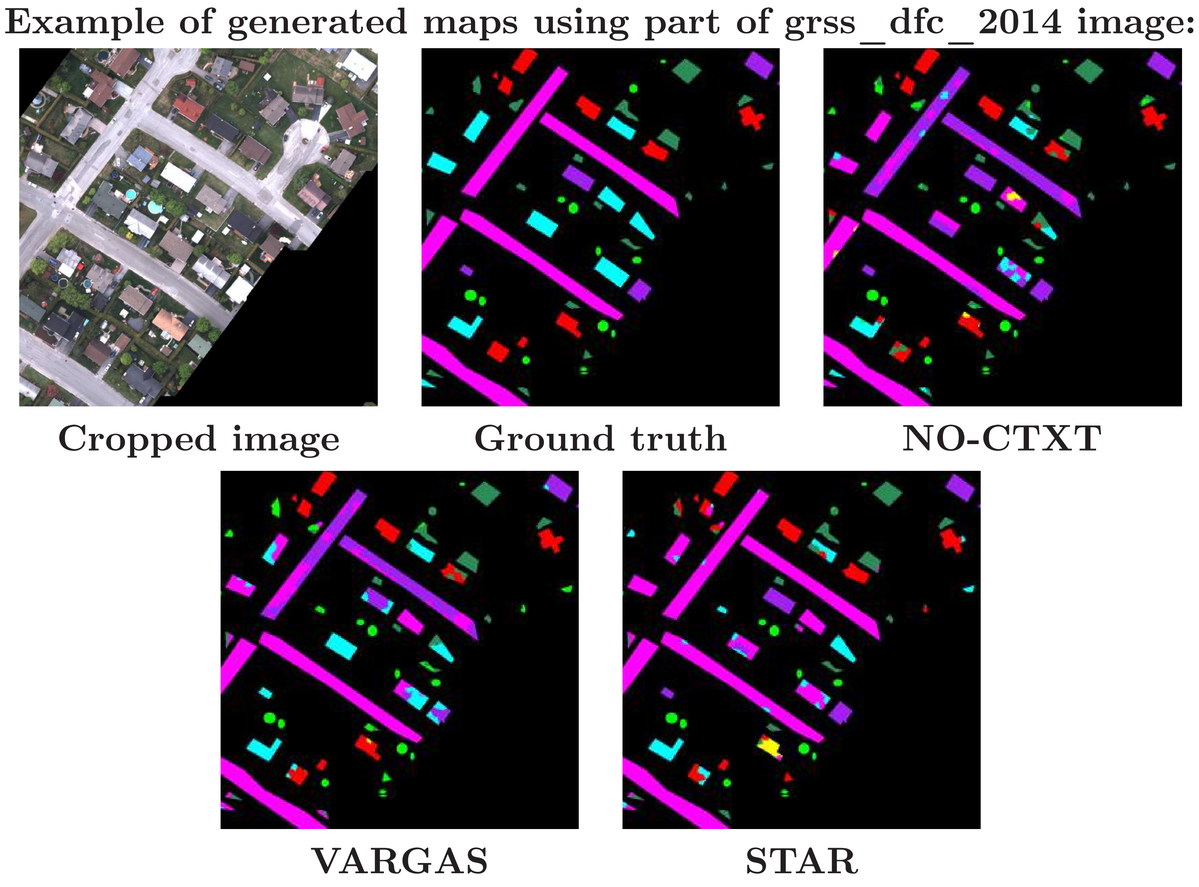
6. Results

Kappa index and overall accuracy on both datasets:

	grss_dfc_2014		ISPRS	
Descriptors	κ	Ovr.	κ	Ovr.
NO-CTXT	0.619	0.724	0.230±0.040	0.474±0.065
VARGAS	0.651	0.751	**0.275±0.053**	**0.501±0.058**
STAR	**0.735**	**0.822**	0.181±0.049	0.421±0.064

Varying segmentation scale on grss_dfc_2014:

Example of generated maps using part of grss_dfc_2014 image:



Cropped image | Ground truth | NO-CTXT

VARGAS | STAR