Detection of urban trees in multiple-source aerial data (optical, infrared, DSM)

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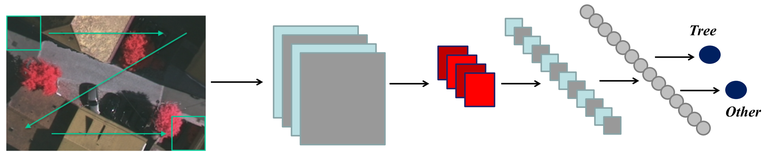
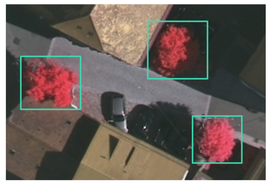
Introduction

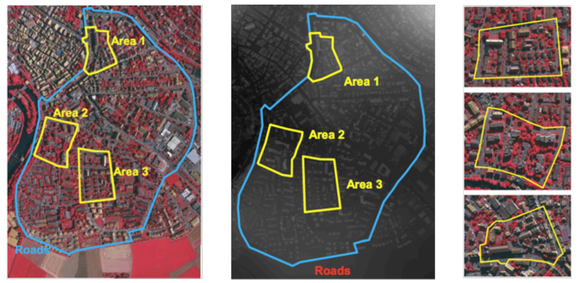
- Deep Learning [1] methodology for localization of urban trees in multiple-source aerial data,
- Evaluation of Convolutional Neural Networks (CNNs) on this task,
- Comparison to standard machine learning methods that exploit hand-crafted descriptors.





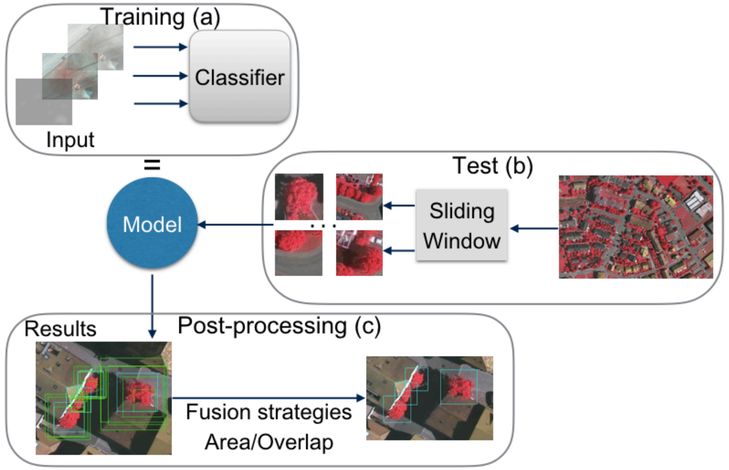
Vaihingen database[1]

- Channels Red, Green, Near-infrared and DSM
- 1,600 trees annotated on 19 images
- Use of data augmentation to get about 6,000 images “tree” and 40,000 images “other”



[1] The Vaihingen data set was provided by the German Society for Photogrammetry, Remote Sensing and Geoinformation (DGPF) [2].

Method

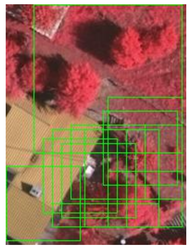


Results

	AlexNet [3]	GoogleNet [4]	HOG [5]+SVM [6]	HOG+RF [7]
Area Strategy				
Recall	41.56%	**46.99%**	26.66%	38.67%
Precision	24.28%	**29.24%**	0.95%	7.77%
F-Measure	30.41%	**35.68%**	1.83%	10.91%
Overlap Strategy				
Recall	**49.28%**	48.96%	21%	33.47%
Precision	22.57%	**25.71%**	1.83%	10.91%
F-Measure	30.63%	**33.32%**	2.88%	13.78%

Ground truth

AlexNet



HOG+SVM

Conclusions

- HOG descriptor is not sufficient to this task,
- Deep Learning approach gives better results than the standard approach,
- A simple way to deal with multi-source aerial data,
- Two different strategies used for the fusion of bounding boxes,
- For the future:
  - Integration of the localization/detection step directly in the Deep Learning methods,
  - Have better management of multi-source data.

Bibliography

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