Beyond PASCAL: A Benchmark for 3D Object Detection in the Wild

Yu Xiang[1,2], Roozbeh Mottaghi[2] and Silvio Savarese[2]
[1]University of Michigan, [2]Stanford University
yuxiang@umich.edu, roozbeh@cs.stanford.edu, ssilvio@stanford.edu

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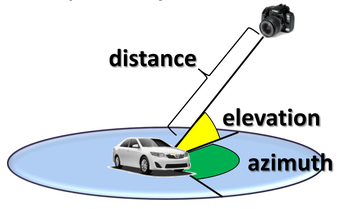
Introduction

Goal

Build a large scale dataset for 3D object detection.

3D Object Detection

Understand the 3D properties of objects from a single image, such as the 3D pose and the 3D shape of object.



3D Object Detection Datasets

3DObject, Savarese & Fei-Fei, ICCV'07

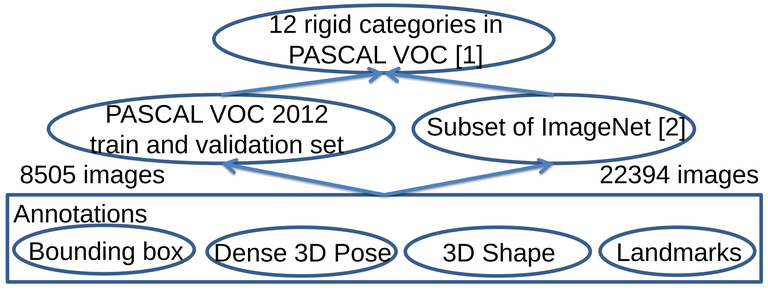
EPFL Car, Ozuysal et al., CVPR'09

ImageNet, Xiang & Savarese , CVPR'12

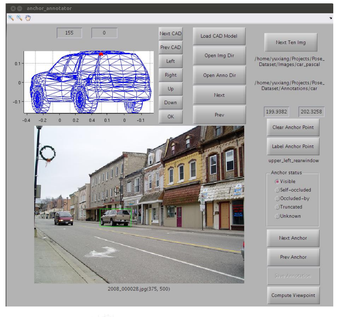
Limitations

- Small number of categories
- Small number of instances
- Clean background
- Centered objects
- No occlusion or truncation
- Sparse viewpoint annotations

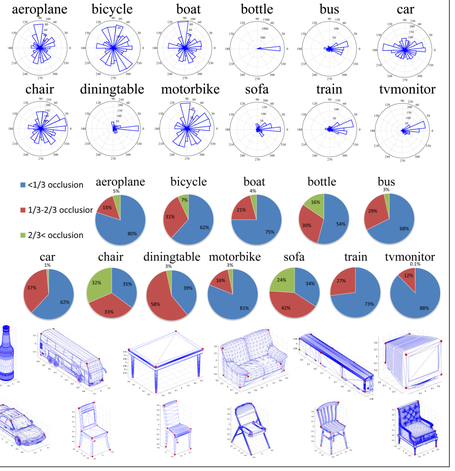
Our Contribution: PASCAL3D+



3D Annotation



Statistics



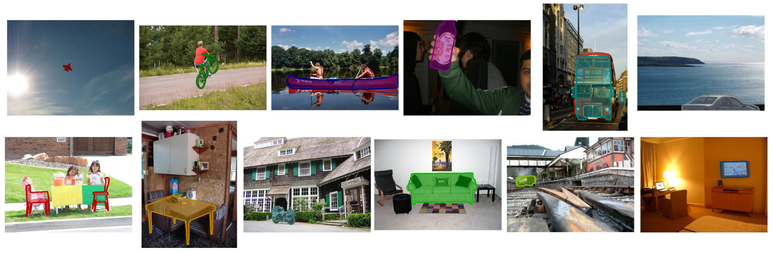
Experiments

1. Object Detection and Pose Estimation

AP/AVP	DPM	VDPM 8 View	VDPM 16 View	VDPM 24 View	[3] 8 View	[3] 16 View	[3] 24 View
aeroplane	42.2/--	39.8/23.4	43.6/15.4	42.2/8.00	40.5/28.6	38.0/15.9	36.0/9.70
boat	6.0/--	5.8/1.0	6.2/0.5	6.0/0.3	0.5/0.2	0.7/0.3	5.3/2.2
car	38.3/--	37.3/23.5	36.6/18.1	36.3/13.7	47.6/36.6	46.0/29.6	42.1/24.6
chair	15.0/--	11.4/5.8	12.8/6.0	12.6/4.4	11.3/9.4	10.2/6.1	8.0/4.2
diningtable	9.0/--	10.2/3.6	7.6/2.2	11.1/3.6	5.3/2.6	6.2/2.3	5.4/2.1
Average of 12	29.6/--	29.9/18.7	30.0/15.6	29.5/12.1	28.3/21.5	28.3/17.3	27.1/13.6

2. Segmentation

	GT CAD	Random CAD	VDPM 8 View	VDPM 16 View	VDPM 24 View
aeroplane	48.3	32.8±0.3	24.1	24.7	24.5
boat	43.0	28.7±1.1	23.5	23.5	20.5
car	67.3	61.8±0.5	51.2	51.9	50.9
chair	41.8	35.8±0.8	27.6	26.5	27.2
Average of 12	52.4	45.2	33.3	34.1	33.5



Conclusion

- PASCAL3D+: a large scale 3D object detection dataset
- Benchmark both 2D and 3D object detection methods
- Benefit research in 3D object detection and pose estimation

Acknowledgements
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References

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[2] J. Deng, W. Dong, R. Socher, L. Li, K. Li, and L. Fei-Fei. Imagenet: A large-scale hierarchical image database. In CVPR, 2009.
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