Geodesic Object Proposals

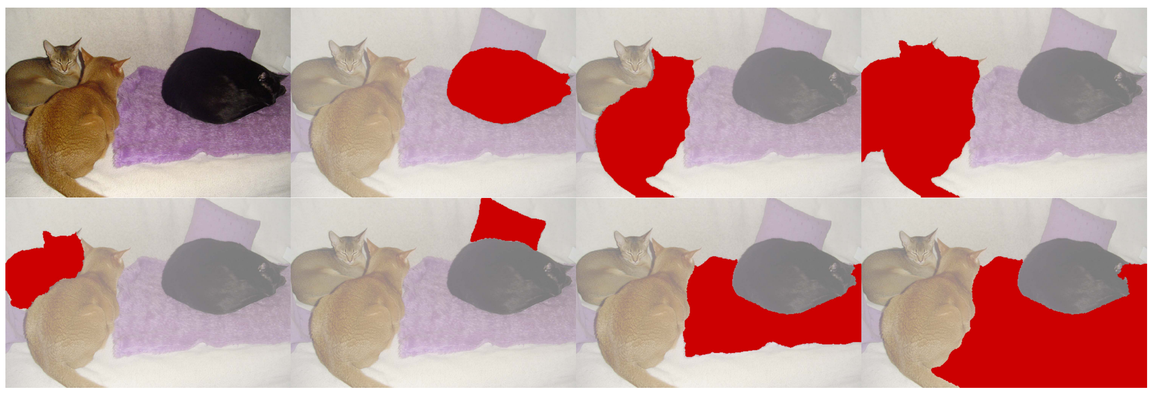
Philipp Krähenbühl Vladlen Koltun

Stanford University Adobe Research

http://www.philkr.net/home/gop

Object Proposals

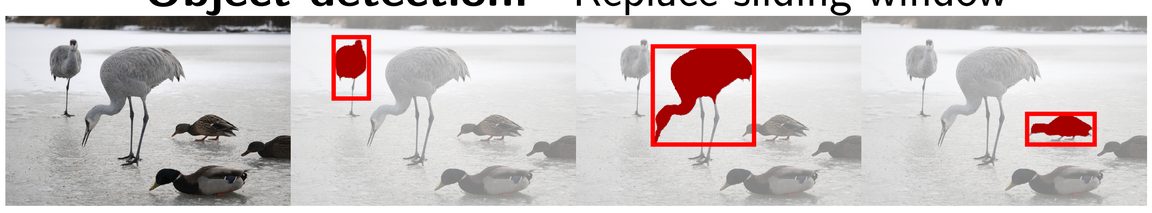
Find a small set of segment proposals that includes all objects in the scene.



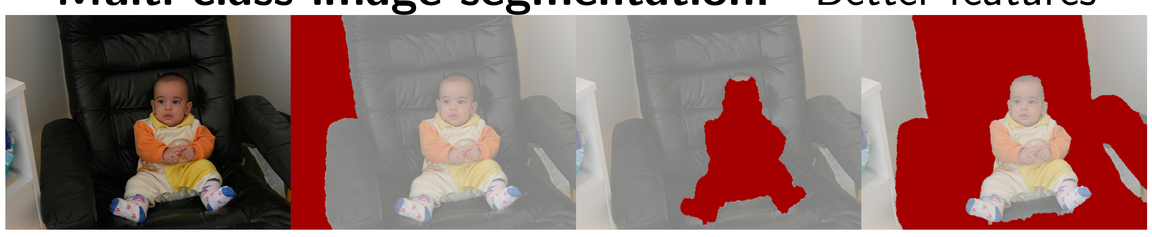
Wrong proposals are allowed.

Uses of Object Proposals

Object detection: Replace sliding window



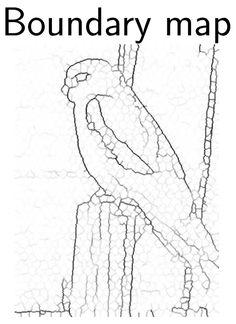
Multi-class image segmentation: Better features



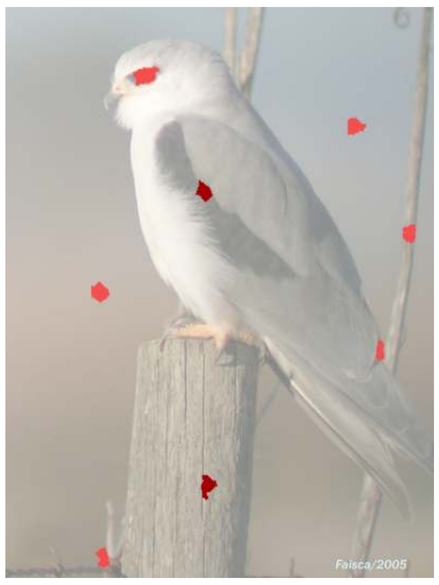
Geodesic Object Proposals

Input

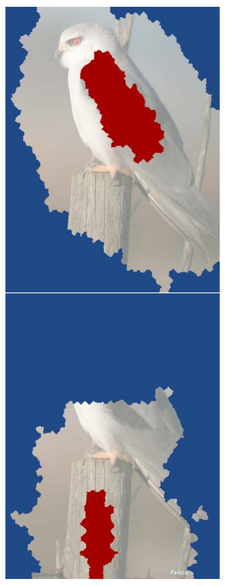
Superpixels, Boundary map



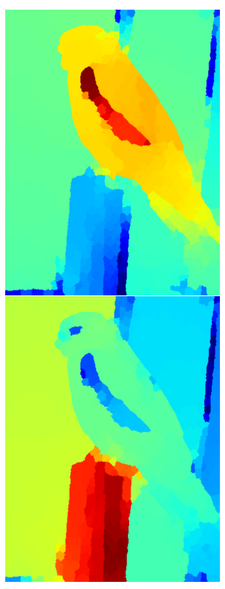
Seeds



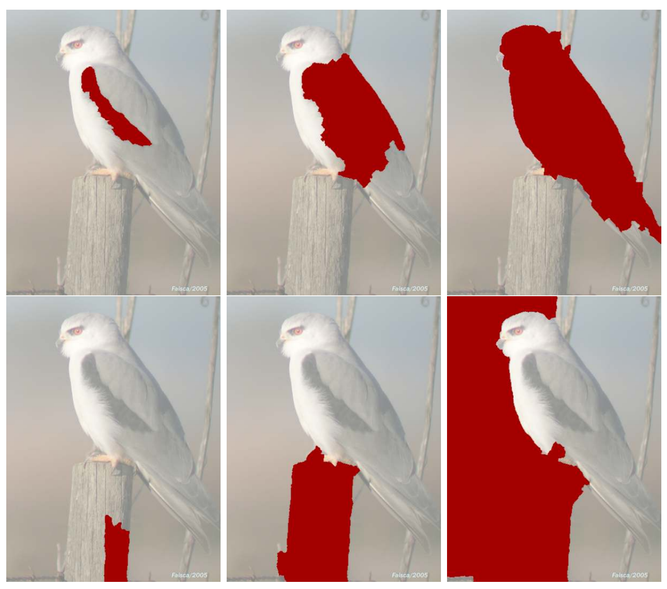
Foreground and background masks



Signed Geodesic Distance Transform



Multiple Proposals



Evaluation Metric

Overlap between two segments A and B

$$\mathcal{J}(A,B) = \frac{|A \cap B|}{|A \cup B|}$$

Best overlap of ground truth segment O_k

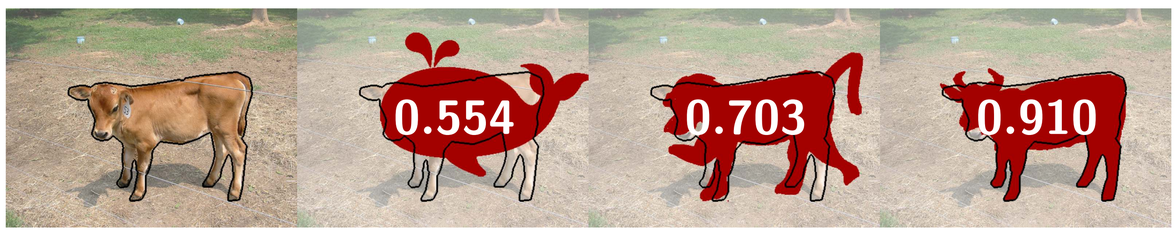
$$b(O_k) = \max_P \mathcal{J}(O_k, P)$$

Average Best Overlap (ABO)

$$\frac{1}{N}\sum_k b(O_k)$$

α-recall

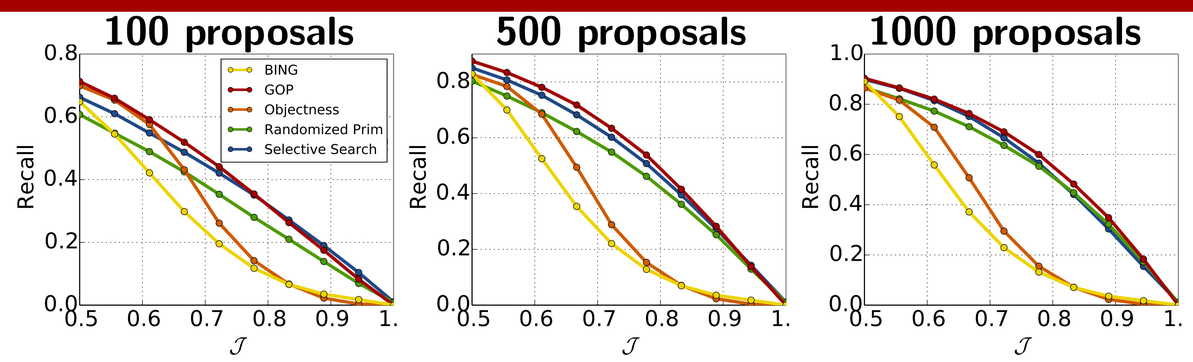
$$\frac{1}{N}\sum_k [b(O_k) > \alpha]$$



VOC 2012 Segment Results

Method	# prop.	ABO	50%-recall	70%-recall	Time
CPMC [2]	646	0.703	0.784	0.609	252s
Baseline GOP	653	0.712	0.833	0.622	**0.6s**
Learned GOP	652	0.720	0.844	0.632	**1.0s**
Cat-Ind OP [4]	1536	0.718	0.820	0.624	119s
Baseline GOP	1090	0.727	0.847	0.644	**0.65s**
Learned GOP	1199	0.741	0.865	0.673	**1.1s**
Sel Search [6]	4374	0.735	0.891	0.597	2.6s
Baseline GOP	2089	0.744	0.867	**0.673**	0.9s
Learned GOP	2286	0.756	0.877	**0.699**	1.4s
Baseline GOP	3958	0.756	0.881	**0.699**	1.2s
Learned GOP	4186	0.766	0.889	**0.715**	1.7s

VOC 2012 Bounding Box Results



Volume under Surface (VUS) Score [5]

Method	Linear	Log	Time
Objectness [1]	0.323	0.225	2.2s
BING [3]	0.278	0.189	0.003s
Randomized Prim [5]	0.511	0.274	1.1s
Selective search [6]	0.528	0.301	2.6s
GOP	0.546	0.310	0.9s

References

[1] Bogdan Alexe, Thomas Deselaers, and Vittorio Ferrari. Measuring the objectness of image windows. *PAMI*, 34(11), 2012.

[2] João Carreira and Cristian Sminchisescu. CPMC: Automatic object segmentation using constrained parametric min-cuts. *PAMI*, 34(7), 2012.

[3] Ming-Ming Cheng, Ziming Zhang, Wen-Yan Lin, and Philip Torr. Bing: Binarized normed gradients for objectness estimation at 300fps. In *IEEE CVPR*, 2014.

[4] Ian Endres and Derek Hoiem. Category-independent object proposals with diverse ranking. *PAMI*, 36(2), 2014.

[5] Santiago Manén, Matthieu Guillaumin, and Luc Van Gool. Prime object proposals with randomized Prim's algorithm. In *ICCV*, 2013.

[6] Jasper R. R. Uijlings, Koen E. A. van de Sande, Theo Gevers, and Arnold W. M. Smeulders. Selective search for object recognition. *IJCV*, 104(2), 2013.