Object Cosegmentation

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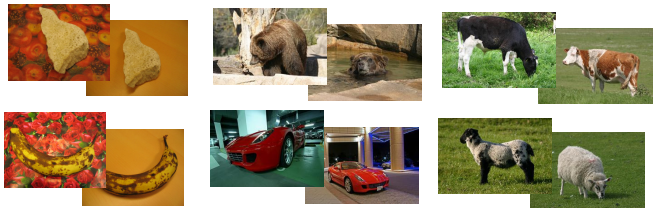
Cosegmentation

Goal of cosegmentation: extract the common region in multiple images.

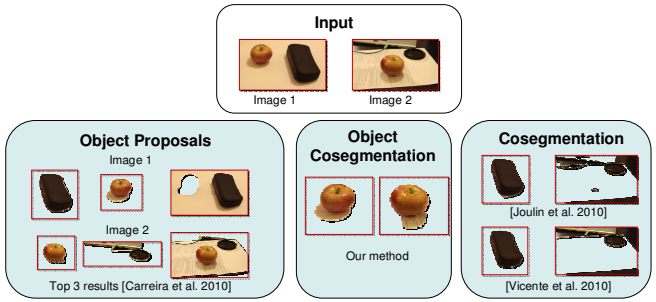


In many applications, the region of interest is an **object**.

Our goal: object cosegmentation

Object-like segmentations:

- Rely on object proposal methods to obtain good object-like segmentations.

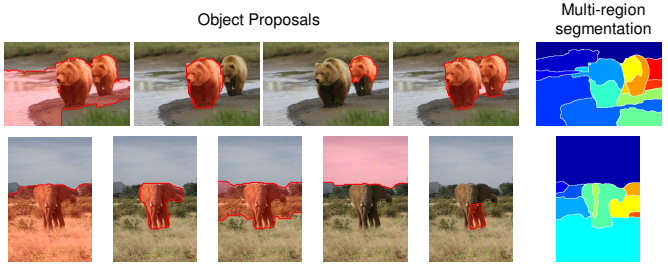


Learn to adapt to datasets with different intra-class variability:

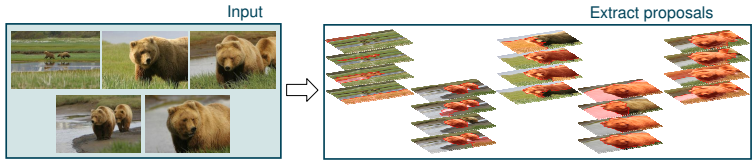
- Use training data to learn a similarity measure between proposals.

Preprocessing: object proposal method [Carreira et al. 2010]

- Obtain **multiple binary segmentations** using parametric maxflow with different seeds and foreground biases.
- **Rank** the segmentations based on **object properties**, e.g. alignment with image edges, convexity, intra and inter-region similarity.



Overview of our method



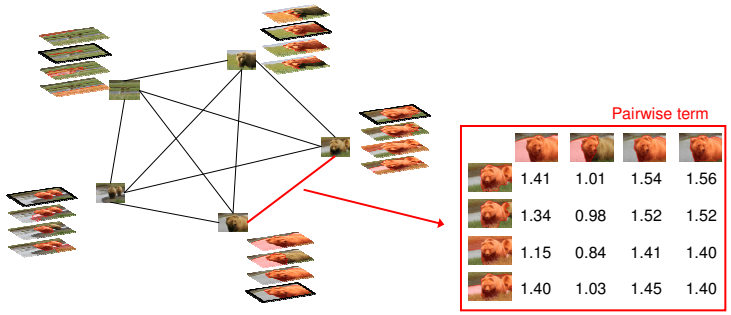
Cosegmentation task is converted into a **graph labeling problem** in a complete graph:

- Nodes = images
- Labels = proposals

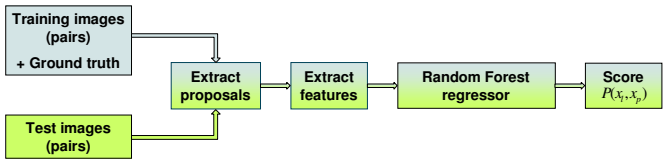
Goal: find labeling that maximizes scoring function $E(x)=\sum P(x_i,x_p)$.

The pairwise term $P(x_i,x_p)$ is learned using a Random Forest regressor and encodes how similar and how close to the ground truth the two proposals are.

Inference: exact A*-search algorithm [Bergtholdt et al 2010].



Learning the pairwise term between proposals



Features including both images and proposals

Foreground histogram similarity (color, textons and SIFT).

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Proposals similarity: curvature, boundary orientation, overlap.

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Features based on one image

Foreground and background histogram similarity (color, textons, SIFT).

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Alignment with image edges.

Proposal properties, e.g. location, extent, convexity, area.

Experimental results

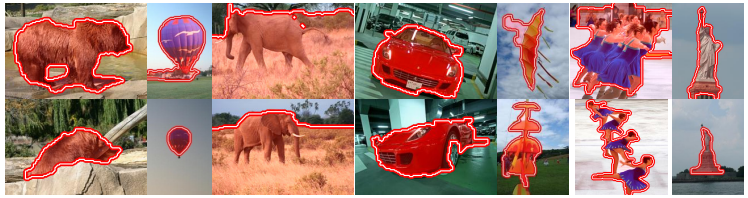
Cosegmentation Dataset

20 image pairs - Training: Leave one out cross validation

iCoseg Dataset [Batra et al. 2010]

Training set: Cosegmentation dataset

	Our Method		Competitors			Baselines	
	1 image	All images	1 image [Carreira et al. 2010]	Pairs [Vicente et al. 2010]	All images [Joulin et al. 2010]	Upper bound	Uniform
Alaskan bear (9)	79.0	90.0	60.4	58.2	74.8	96.4	79.0
Balloon (8)	79.5	90.1	97.5	89.3	85.2	99.3	86.8
Baseball (8)	84.5	90.9	74.6	69.9	73.0	96.5	88.8
Bear (5)	78.2	95.3	83.5	87.3	74.0	97.5	68.4
Elephant (7)	75.4	43.1	74.3	62.3	70.1	96.5	82.9
Ferrari (11)	84.8	89.9	71.8	77.7	85.0	97.1	73.9
Gymnastics (6)	82.1	91.7	72.2	83.4	90.9	96.4	83.4
Kite (8)	89.3	90.3	81.5	87.0	87.0	96.7	83.5
Kite panda (7)	80.2	90.2	87.7	70.7	73.2	97.8	68.7
Liverpool (9)	87.4	87.5	83.2	70.6	76.4	92.7	76.0
Panda (8)	87.8	92.7	79.5	80.0	84.0	96.3	62.0
Skating (7)	78.4	77.5	73.4	69.9	82.1	85.8	62.7
Statue (10)	92.9	93.8	91.5	89.3	90.6	97.8	73.7
Stonehenge (5)	84.2	63.3	83.3	61.1	56.6	96.1	78.2
Stonehenge 2 (9)	88.9	88.8	79.7	66.9	86.0	93.8	64.4
Taj Mahal (5)	80.7	91.1	82.2	79.6	73.7	96.5	82.2



MSRC Dataset – unsupervised class segmentation

Training: Leave one out cross validation on classes

	Our Method		Competitors		
	1 image	All images	1 image [Carreira et al. 2010]	Pairs [Vicente et al. 2010]	All images [Joulin et al. 2010]
Bird	90.8	95.3	90.7	88.0	62.2
Car	80.2	79.6	72.3	64.9	78.6
Cat	91.9	92.3	87.8	77.5	80.8
Cow	93.9	94.2	92.9	91.9	80.8
Dog	92.9	93.0	88.7	86.7	75.6
Plane	82.7	83.0	78.2	65.7	80.3
Sheep	94.6	94.0	94.3	89.8	92.5