

Hierarchical Scene Annotation

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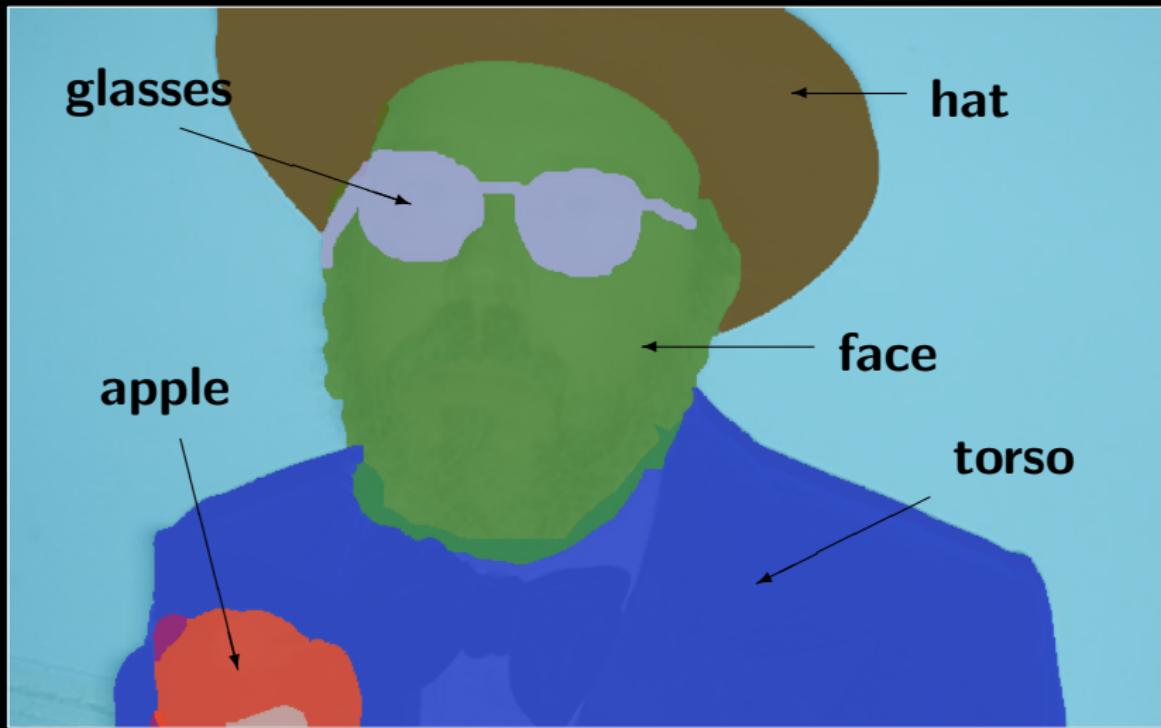
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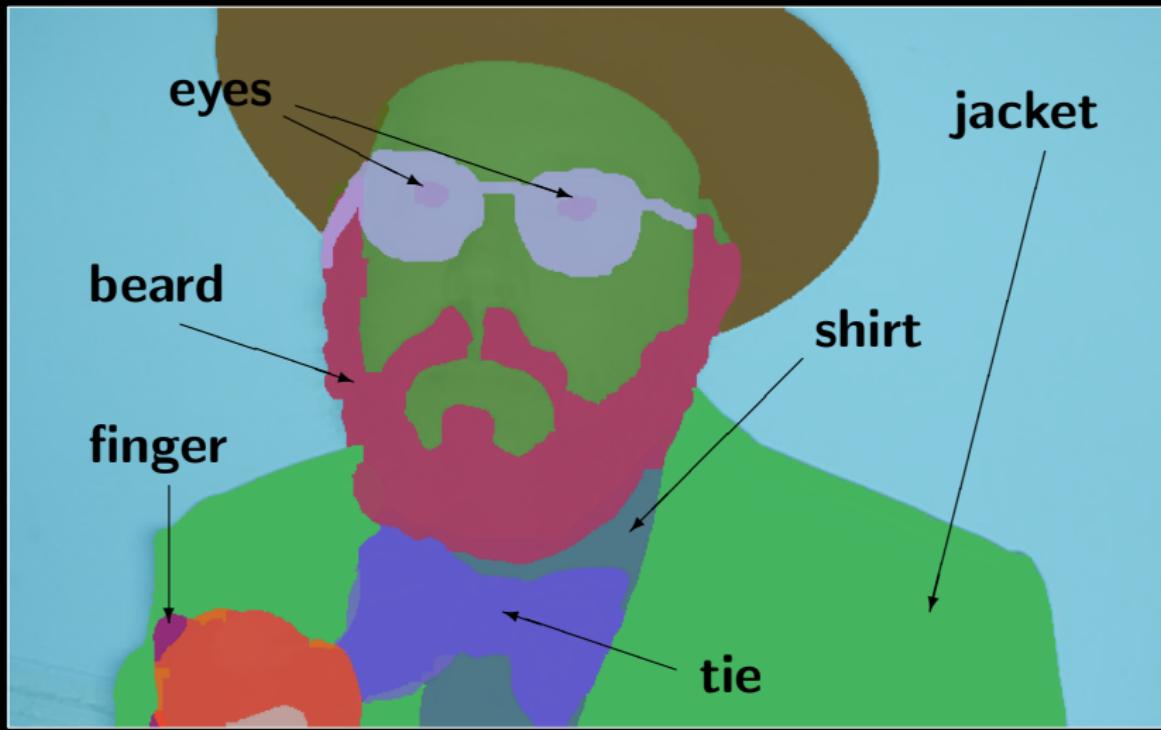
What to Annotate?



Objects/Parts



Subparts



Figure/Ground



Rich Annotation

Rich Annotation

- ▶ Multiple modalities:
 - ▶ Objects, parts, subparts
 - ▶ Object-part containment
 - ▶ Segmentation
 - ▶ Occlusion (figure/ground)
 - ▶ Attributes

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BMVC
2013

extension

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- ▶ Unifying abstraction: region trees

BMVC
2013

extension

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 - ▶ Occlusion (figure/ground)
 - ▶ Attributes
- ▶ Unifying abstraction: region trees
- ▶ Web-based annotation tool
 - ▶ Computer-assisted segmentation
 - ▶ Model invariant enforcement
 - ▶ Visual feedback
 - ▶ “LabelMe on steroids”

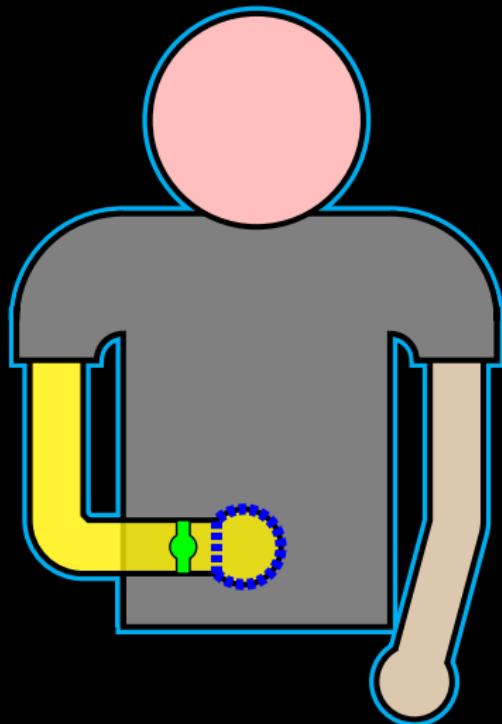
Rich Annotation

BMVC
2013

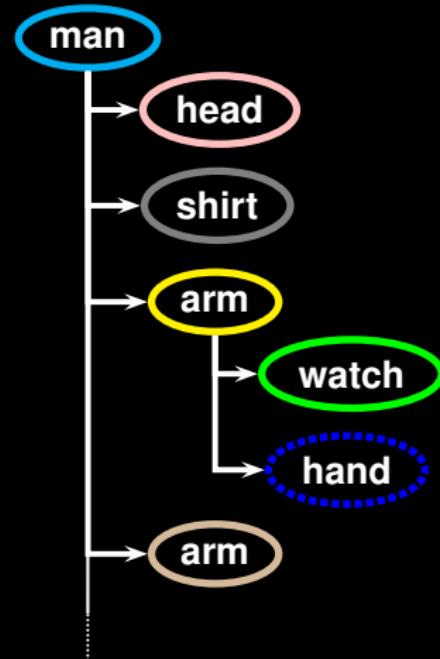
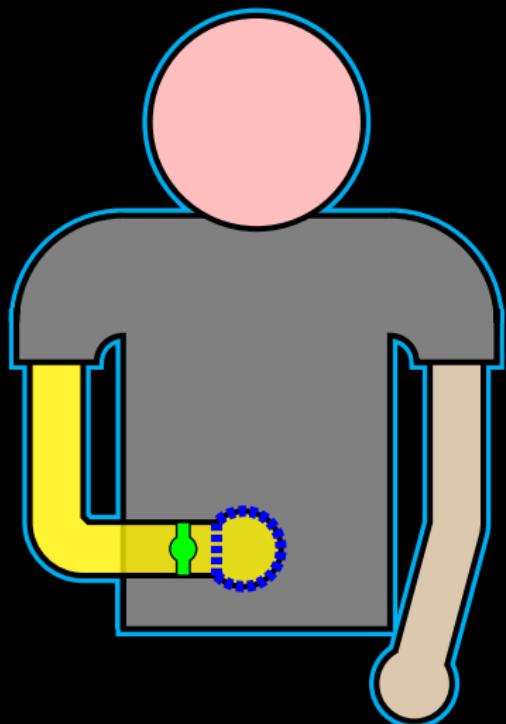
extension

- ▶ Multiple modalities:
 - ▶ Objects, parts, subparts
 - ▶ Object-part containment
 - ▶ Segmentation
 - ▶ Occlusion (figure/ground)
 - ▶ Attributes
- ▶ Unifying abstraction: region trees
- ▶ Web-based annotation tool
 - ▶ Computer-assisted segmentation
 - ▶ Model invariant enforcement
 - ▶ Visual feedback
 - ▶ “LabelMe on steroids”
- ▶ Object segmentation dataset + benchmark

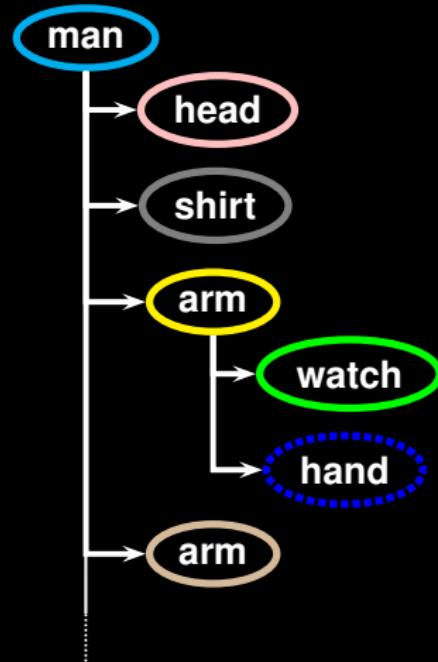
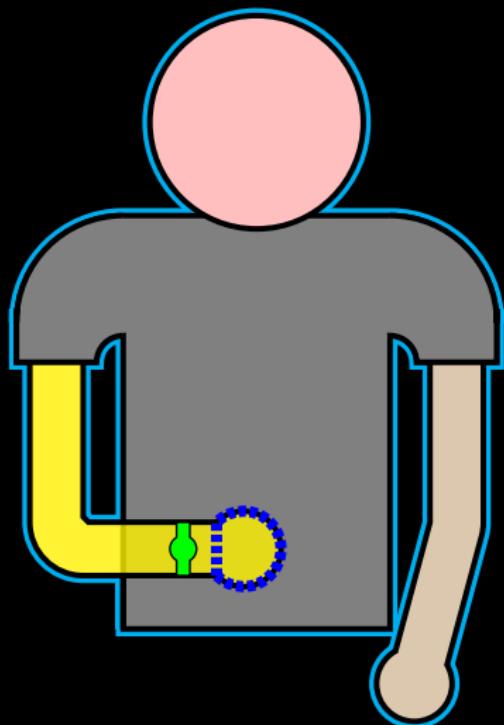
Object Model: Region Tree



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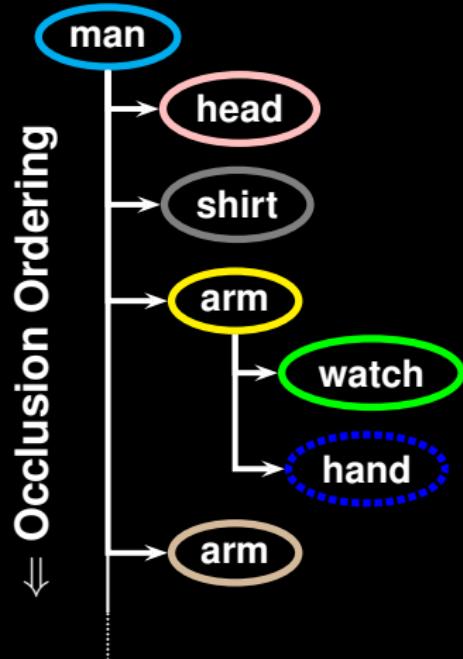
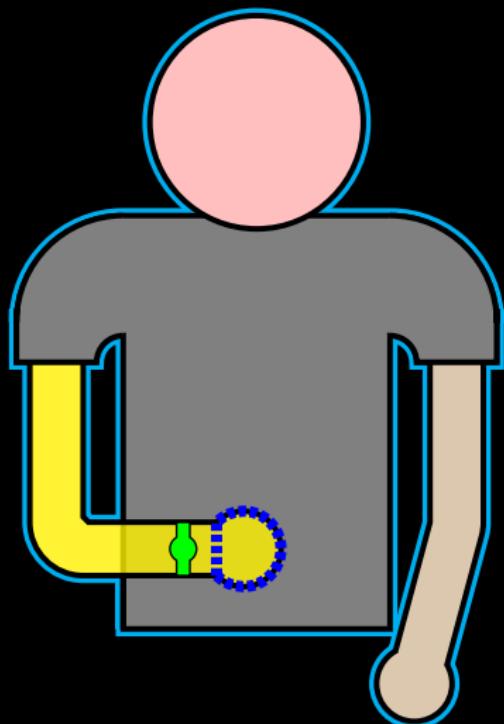


Object Model: Region Tree



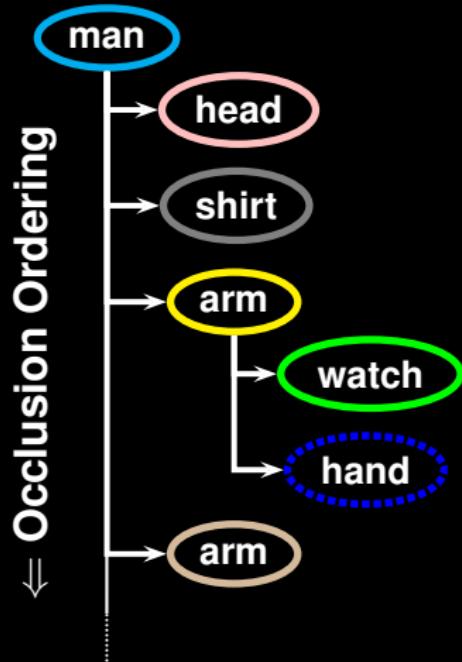
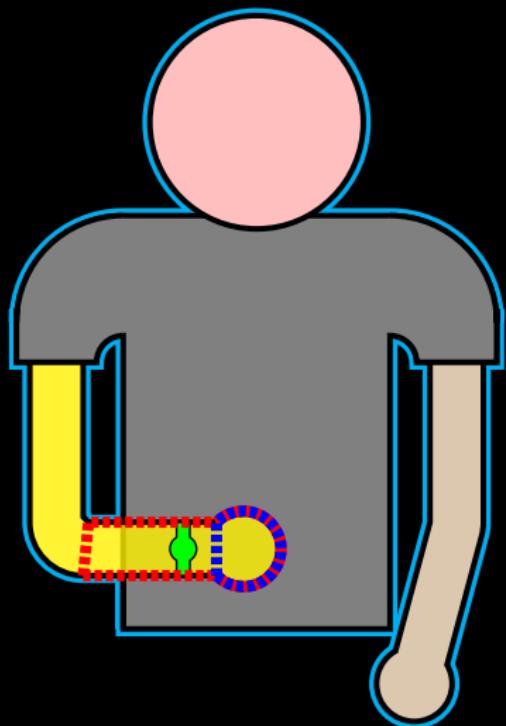
Object-Part ⇒

Object Model: Region Tree



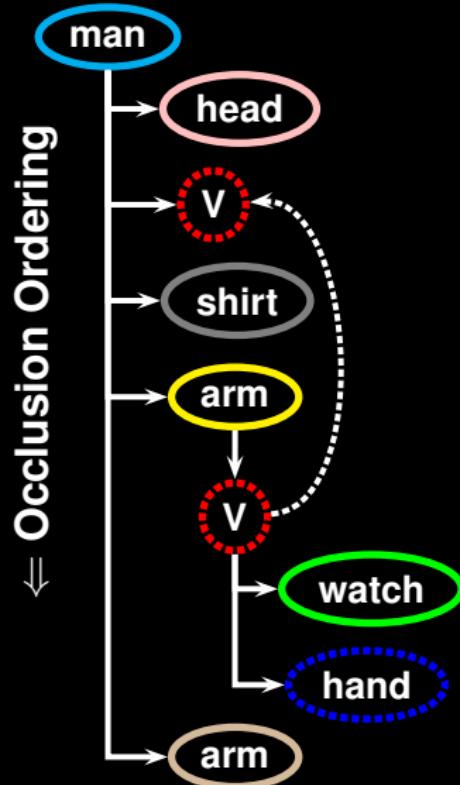
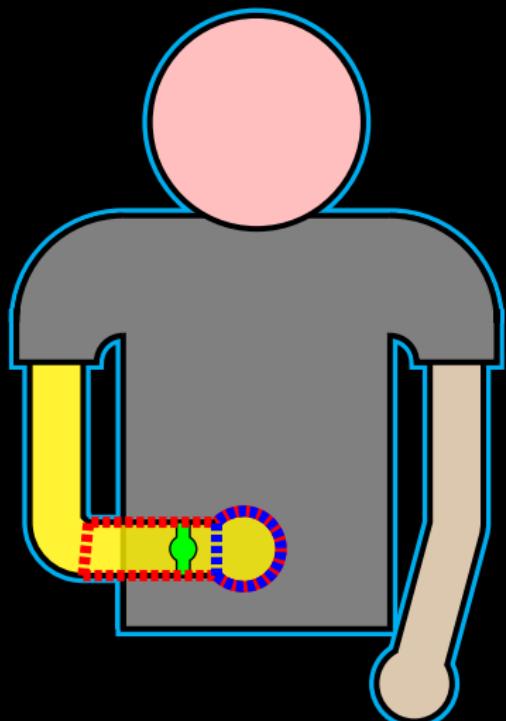
Object-Part ⇒

Object Model: Self Occlusion

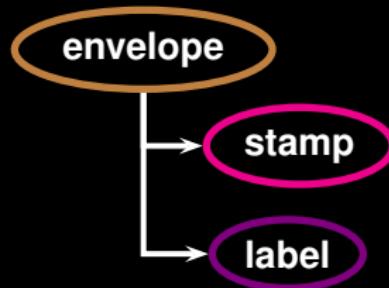
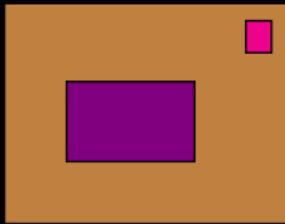


Object-Part ⇒

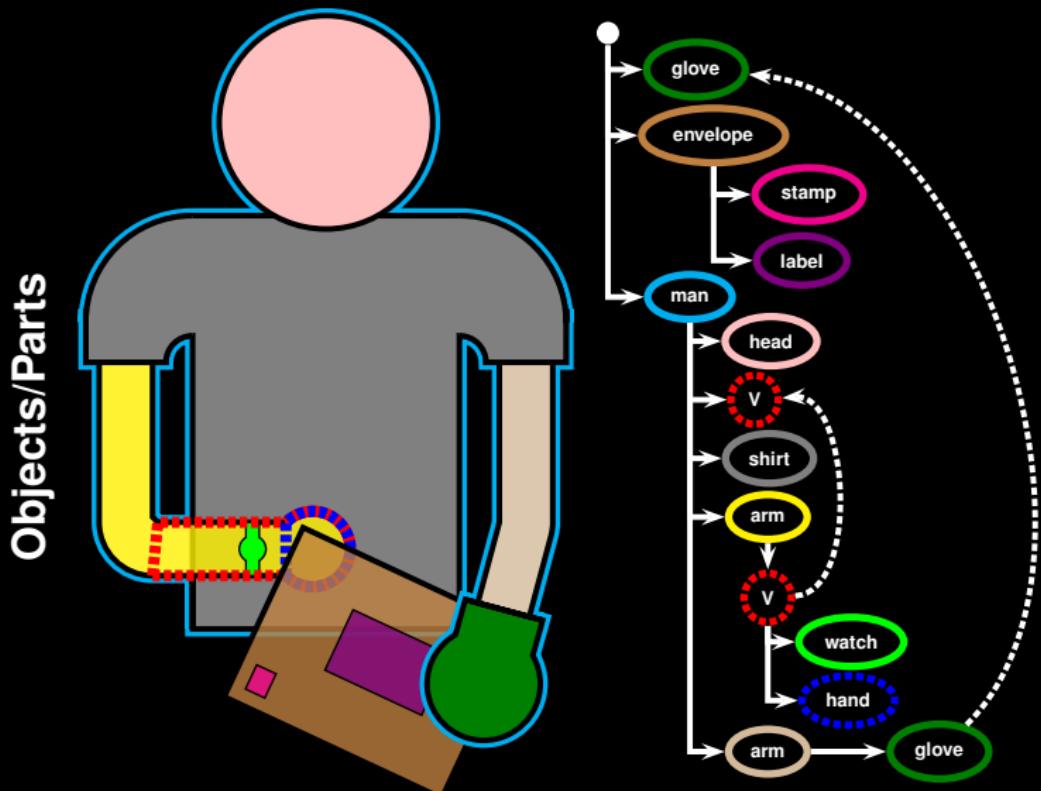
Object Model: Virtual Link



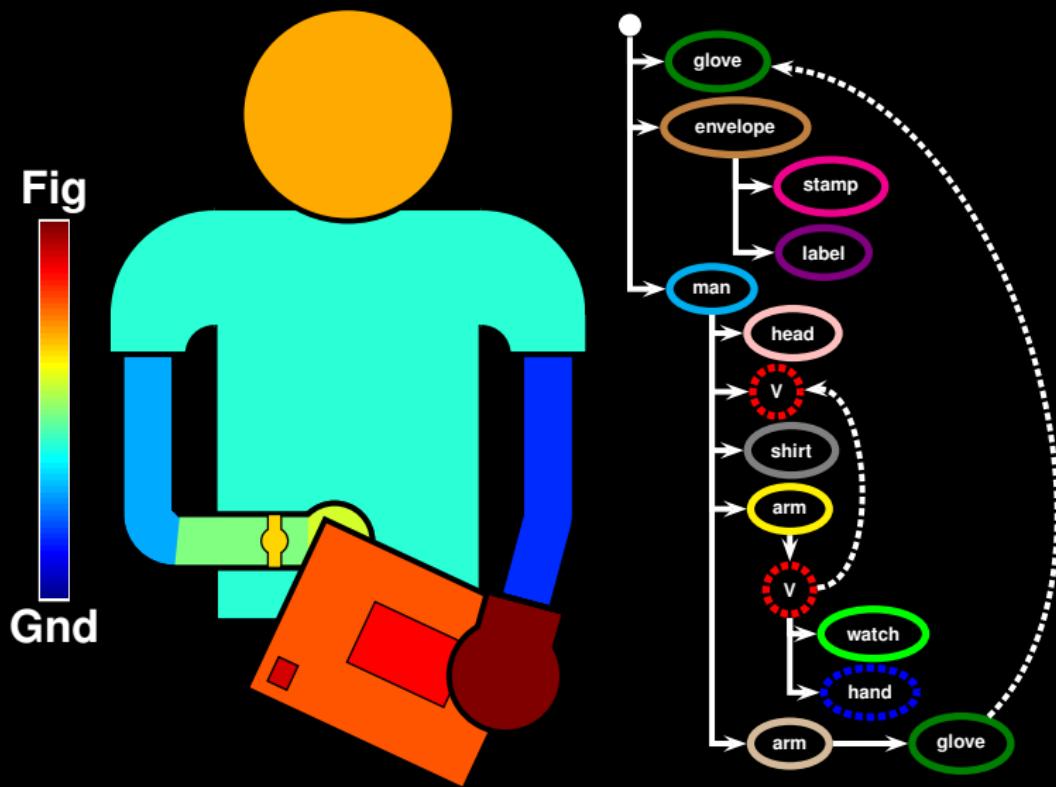
Additional Object Models



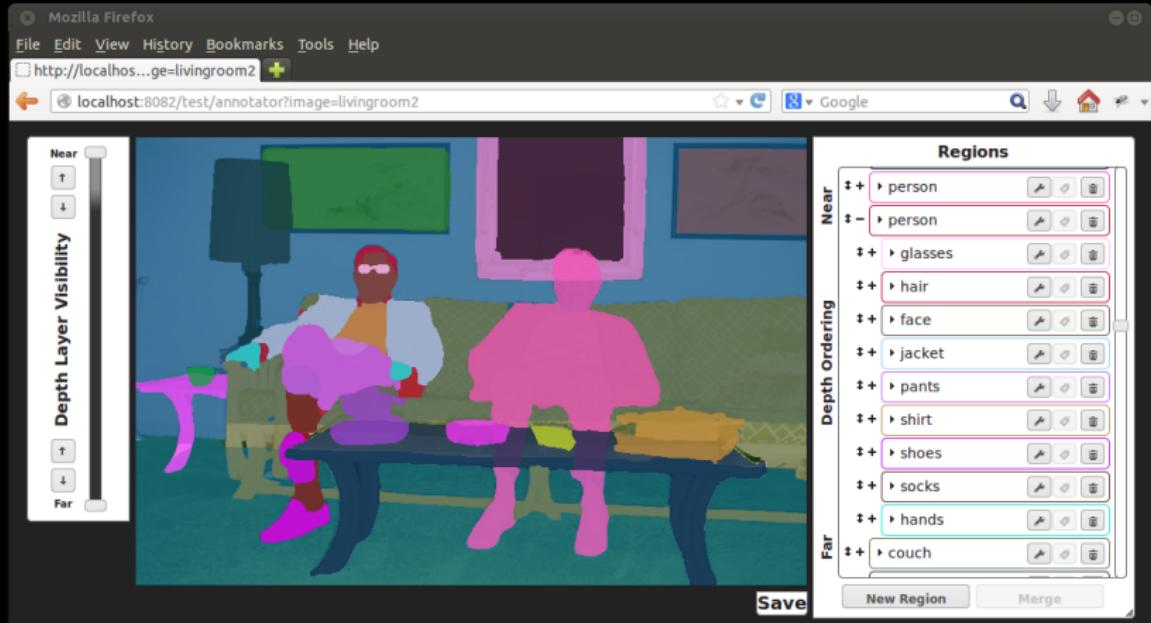
Scene Model: Region Tree



Tree Traversal Recovers Figure/Ground



Annotation Software



Region Tree Navigation

The image shows a 3D scene with various objects highlighted by colored regions: a pink region covers a person in the foreground, a green region covers a person's head, a blue region covers a car, and a cyan region covers a building facade. To the right, a 'Regions' interface displays a hierarchical tree of detected objects:

Depth Ordering	Region Type	Object Name	Operations
Near	Region	man	[Edit, Delete]
		Expand Subregions	[Edit, Delete]
		car	[Edit, Delete]
		person	[Edit, Delete]
		people	[Edit, Delete]
		canopy	[Edit, Delete]
		canopy	[Edit, Delete]
		street	[Edit, Delete]
		traffic light	[Edit, Delete]
		umbrella	[Edit, Delete]
Far	Region	canopy	[Edit, Delete]

Buttons at the bottom of the interface include 'New Region' and 'Merge'.

Region Tree Navigation



Containment Constraints



Regions

Depth Ordering	Region
Near	\$ - > man
	\$ + > jacket
	\$ + > shirt
	\$ + > hair
	\$ - > head
	\$ + > glasses
	\$ + > mouth
Far	\$ - > man
	\$ + > jacket
	\$ + > shirt
	\$ + > head

New Region Merge

Containment Constraints



Regions

Depth Ordering	Region
Near	\$ - > man
	\$ + > jacket
	\$ + > shirt
	\$ + > hair
	\$ - > head
	\$ + > glasses
	\$ + > mouth
Far	\$ - > man
	\$ + > jacket
	\$ + > shirt
	\$ + > head

New Region Merge

Interactive Segmentation



Image



Oversegmentation



Click

Interactive Segmentation



Image



Oversegmentation



Drag

Interactive Segmentation



Image



Oversegmentation



Release

Interactive Segmentation



Image

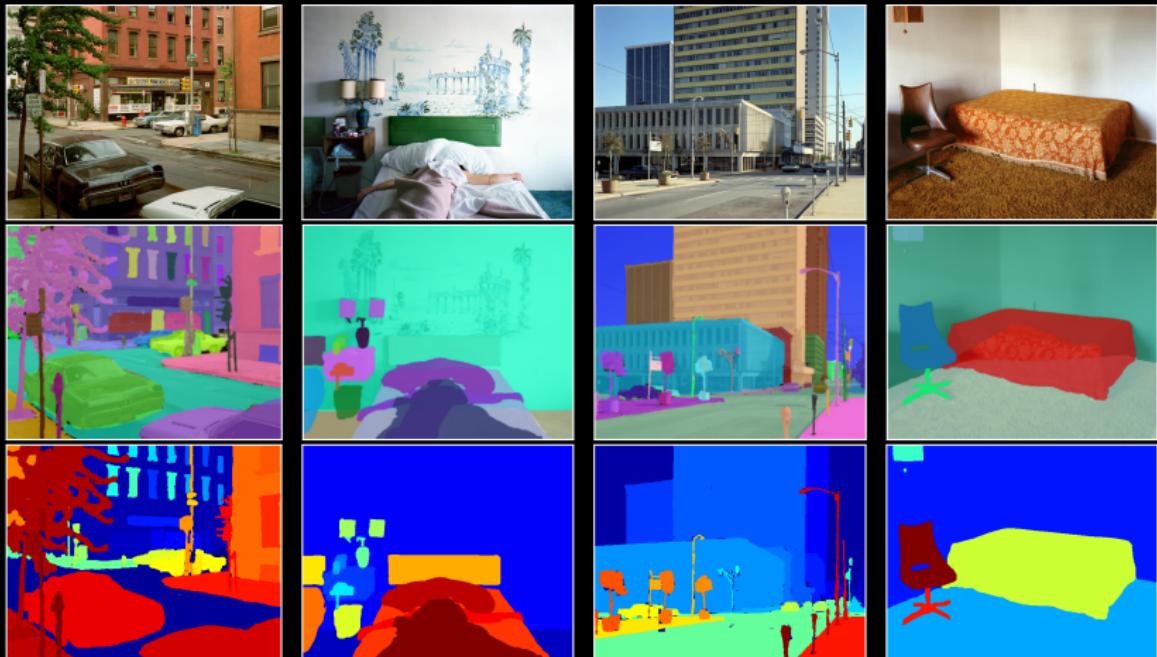


Oversegmentation

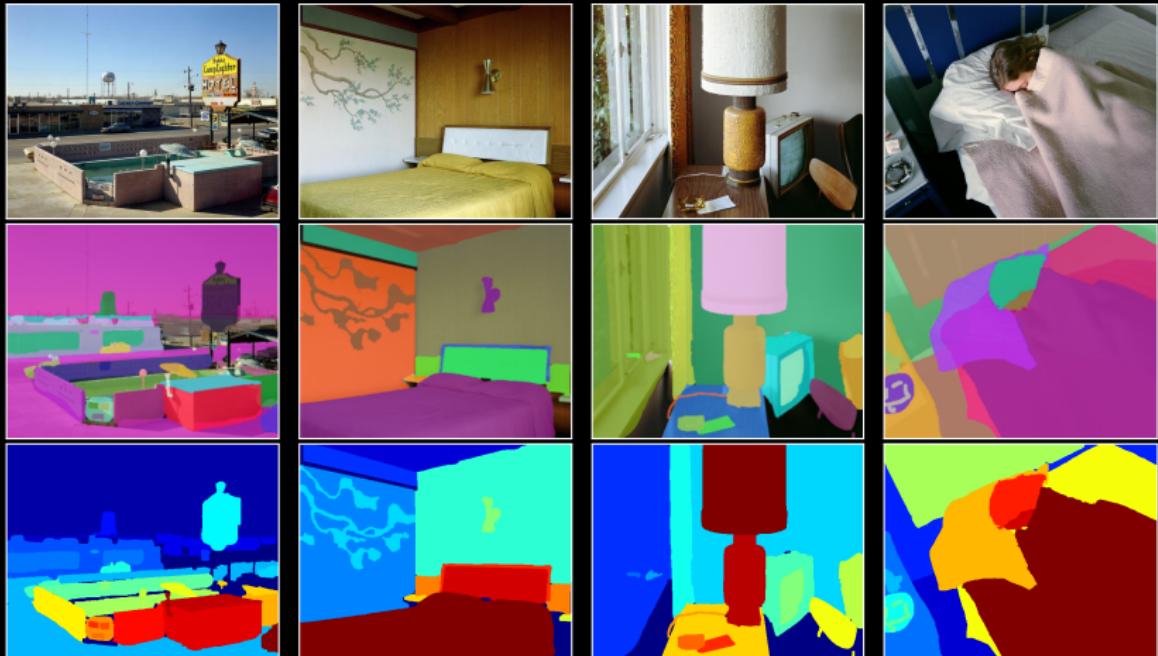


Touch-up

Annotated Scene Dataset



Annotated Scene Dataset



Example Object-Part Hierarchies



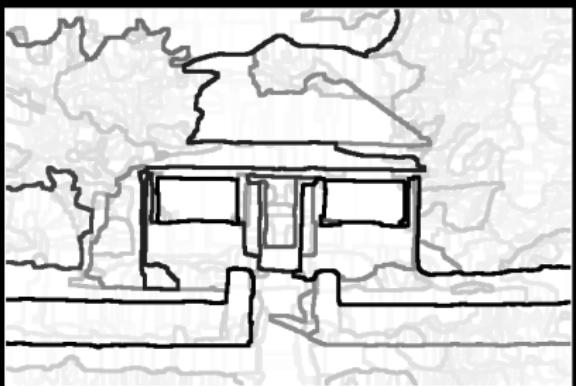
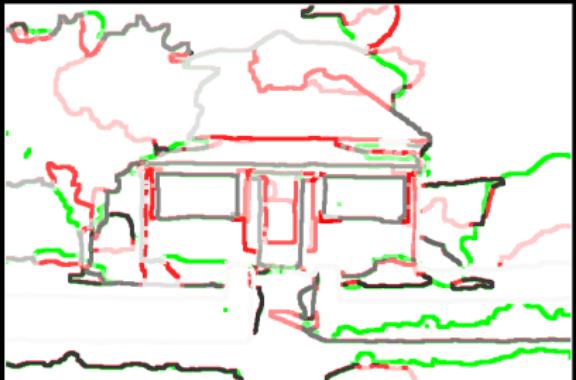
Groundtruth UCM vs gPb-UCM



Groundtruth UCM vs gPb-UCM



Groundtruth UCM vs gPb-UCM



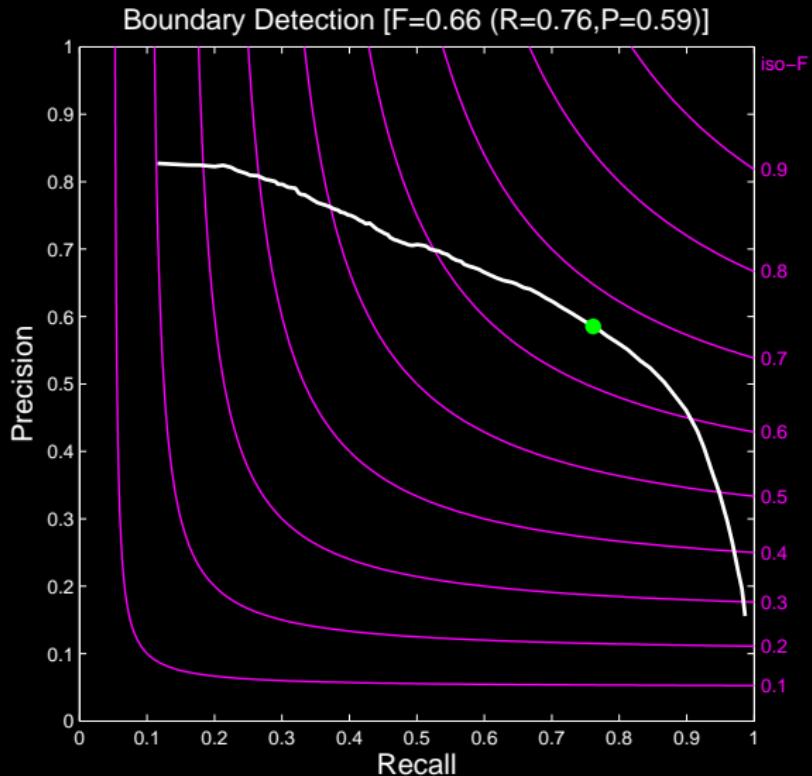
Groundtruth UCM vs gPb-UCM



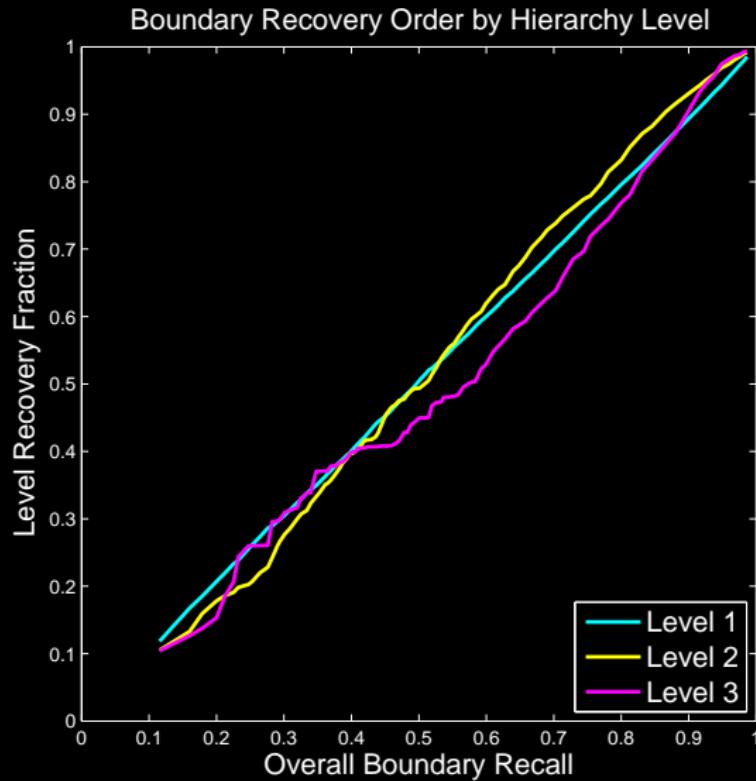
Groundtruth UCM vs gPb-UCM



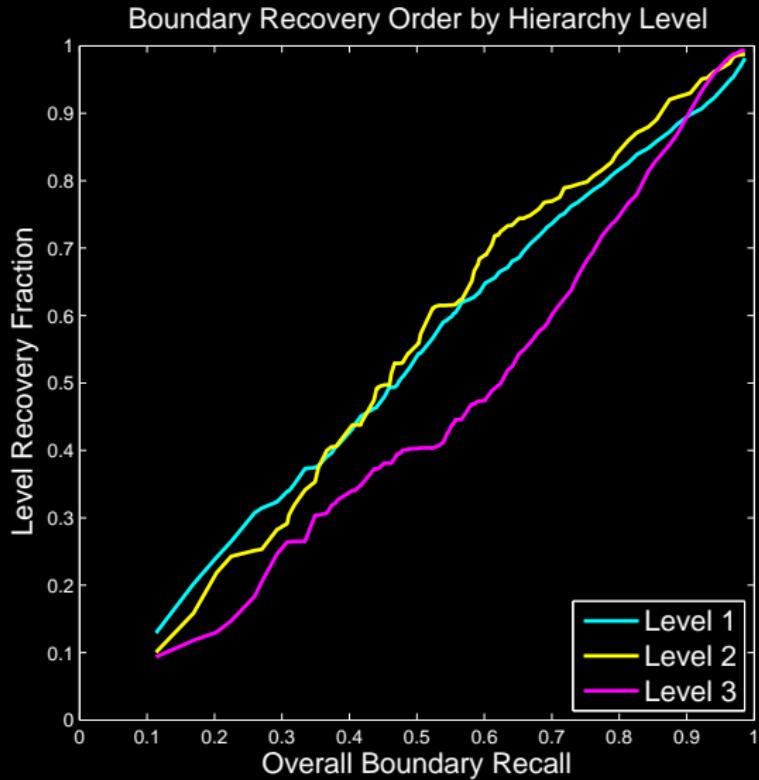
Boundary Benchmark



Hierarchical Boundary Benchmark



Hierarchical Boundary Benchmark - Portraits



Thank You