

# Hierarchical Scene Annotation

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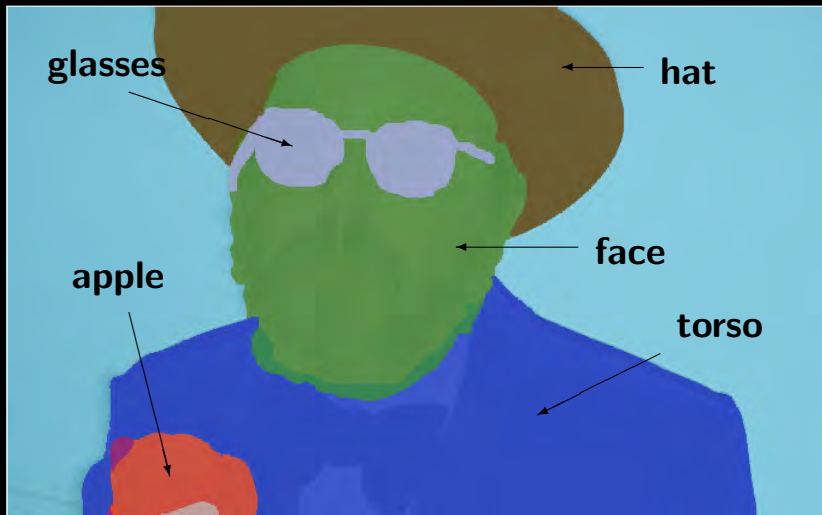
<sup>1</sup>California Institute of Technology - Pasadena, CA

<sup>2</sup>University of California at Berkeley / ICSI - Berkeley, CA

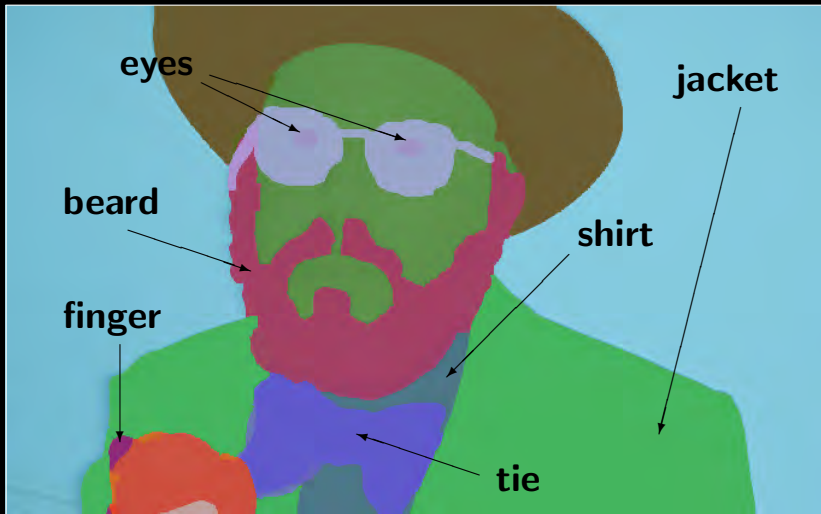
# What to Annotate?



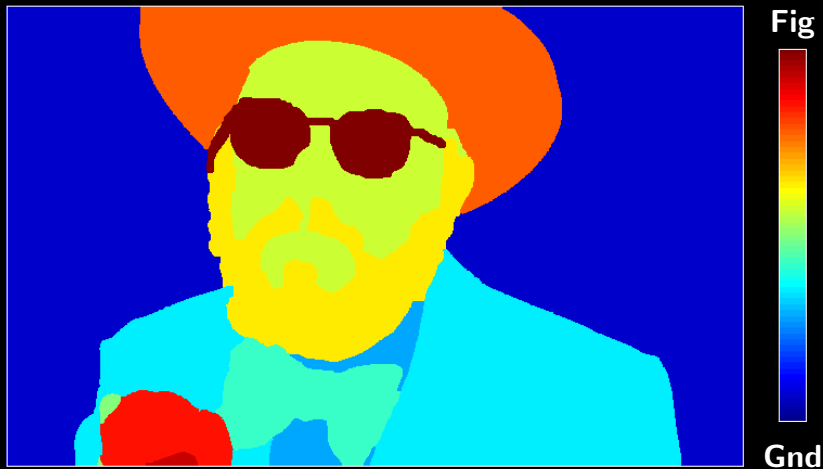
# Objects/Parts



# Subparts



# Figure/Ground



# Rich Annotation

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

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BMVC  
2013

extension



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BMVC  
2013

extension

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- ▶ Unifying abstraction: **region trees**
- ▶ Web-based annotation tool
  - ▶ Computer-assisted segmentation
  - ▶ Model invariant enforcement
  - ▶ Visual feedback
  - ▶ “LabelMe on steroids”

BMVC  
2013

extension

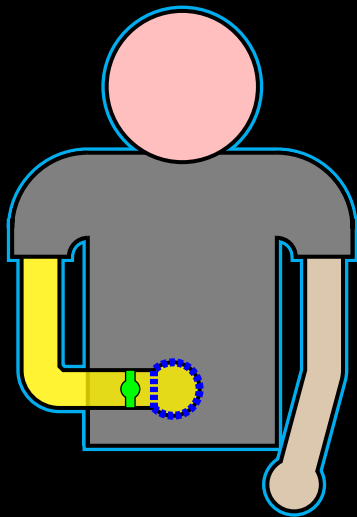
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- ▶ Unifying abstraction: **region trees**
- ▶ Web-based annotation tool
  - ▶ Computer-assisted segmentation
  - ▶ Model invariant enforcement
  - ▶ Visual feedback
  - ▶ “LabelMe on steroids”
- ▶ Object segmentation dataset + benchmark

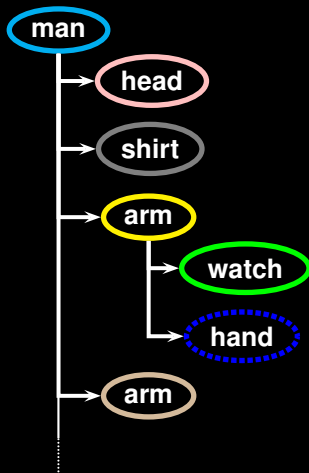
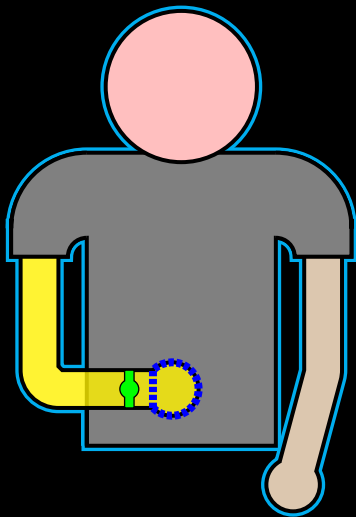
BMVC  
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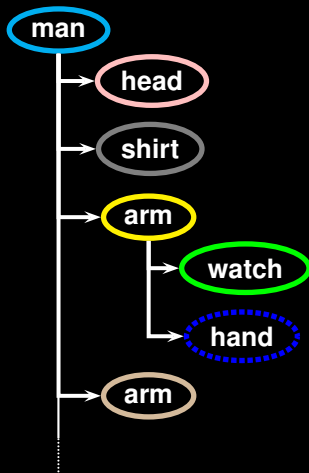
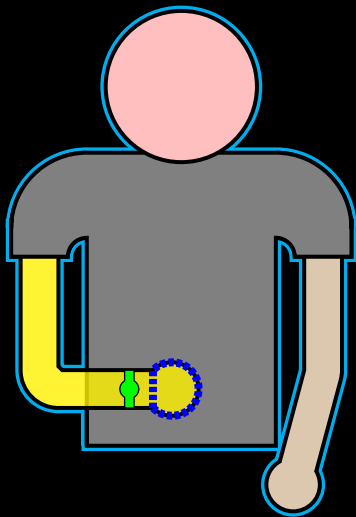
# Object Model: Region Tree



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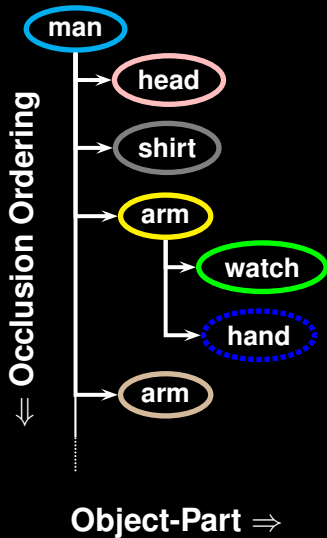
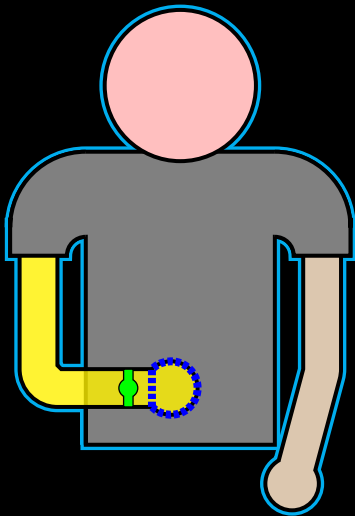


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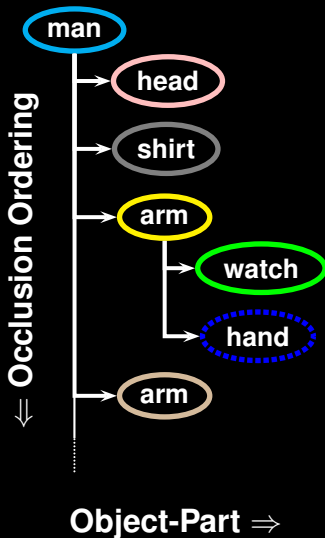
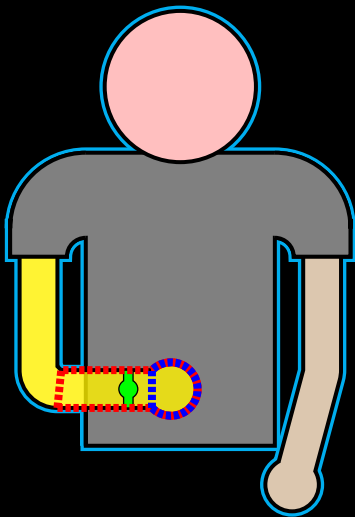


Object-Part ⇒

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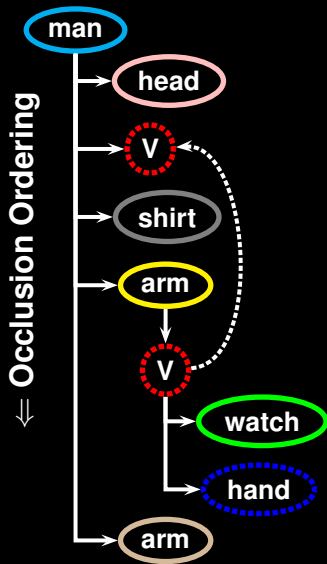
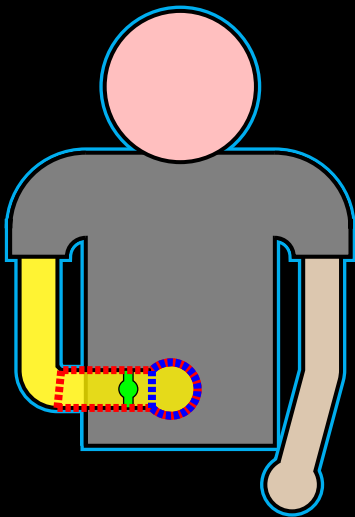


# Object Model: Self Occlusion

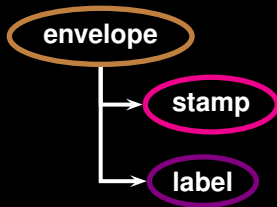
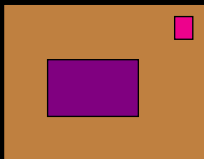




# Object Model: Virtual Link

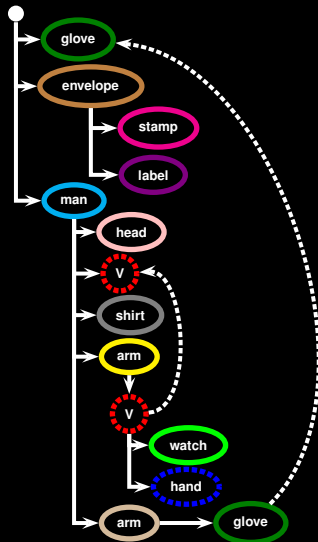
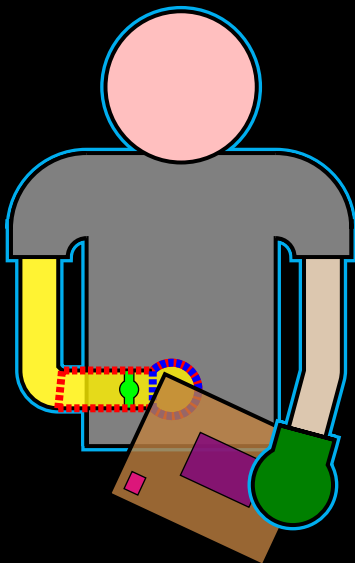


# Additional Object Models

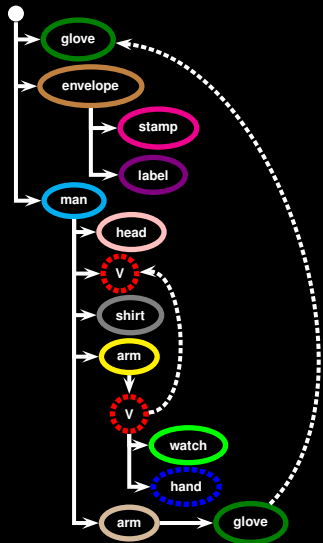
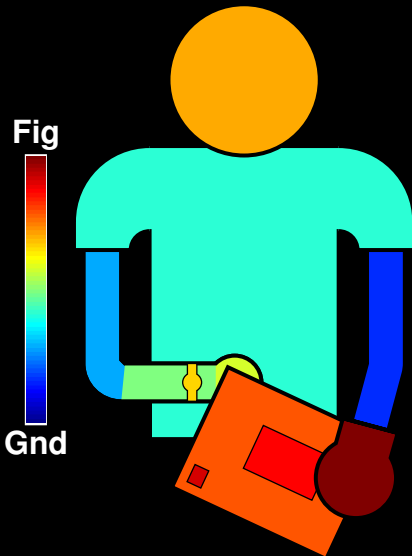


# Scene Model: Region Tree

Objects/Parts



# Tree Traversal Recovers Figure/Ground



# Annotation Software

Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost:8082/test/annotator?image=livingroom2

localhost:8082/test/annotator?image=livingroom2

Depth Layer Visibility

Near

Far

Regions

- 1+ person
- 2+ person
- 3+ glasses
- 4+ hair
- 5+ face
- 6+ jacket
- 7+ pants
- 8+ shirt
- 9+ shoes
- 10+ socks
- 11+ hands
- 12+ couch

New Region Merge

Save

# Region Tree Navigation

**Regions**

Depth Ordering

- man
- Expand Subregions
- car
- person
- people
- canopy
- canopy
- street
- traffic light
- umbrella
- canopy

New Region Merge

# Region Tree Navigation

**Regions**

Depth Ordering

Near

- man
- Collapse Subregions
- shirt
- hair
- head
- glasses
- mouth

Far

- man
- jacket
- shirt
- head

New Region Merge

# Containment Constraints



**Regions**

Depth Ordering

Near

- 1- man
- 1+ jacket
- 1+ shirt
- 1+ hair
- 1- head
- 1+ glasses
- 1+ mouth

Far

- 1- man
- 1+ jacket
- 1+ shirt
- 1+ head

New Region

The interface shows a list of regions for depth ordering. The 'Near' section contains seven regions: 'man', 'jacket', 'shirt', 'hair', 'head', 'glasses', and 'mouth'. The 'Far' section contains four regions: 'man', 'jacket', 'shirt', and 'head'. Each region has a depth ordering indicator (e.g., '1-' or '1+') and a set of control icons. The 'head' region in the 'Near' section is currently selected, highlighted in blue.



# Containment Constraints



# Interactive Segmentation



Image



Oversegmentation



Click

# Interactive Segmentation



Image



Oversegmentation



Drag

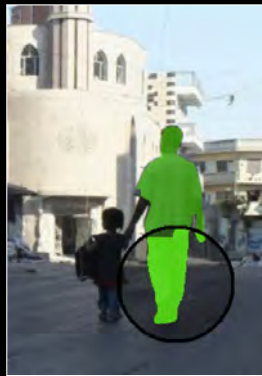
# Interactive Segmentation



Image



Oversegmentation



Release

# Interactive Segmentation



Image

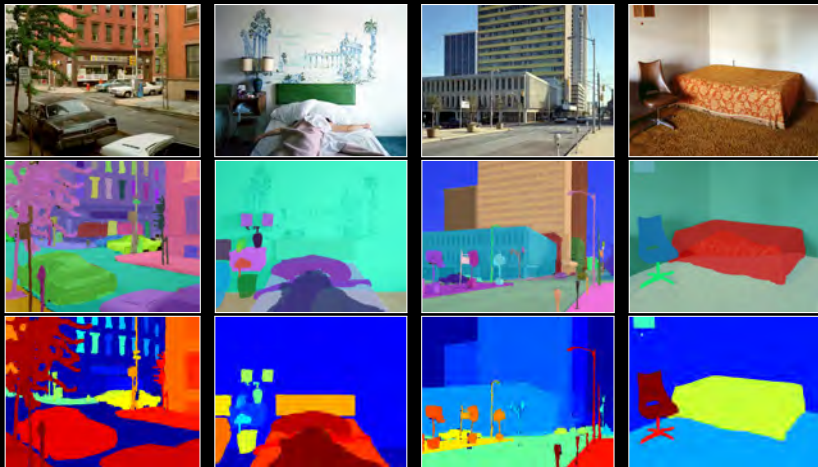


Oversegmentation

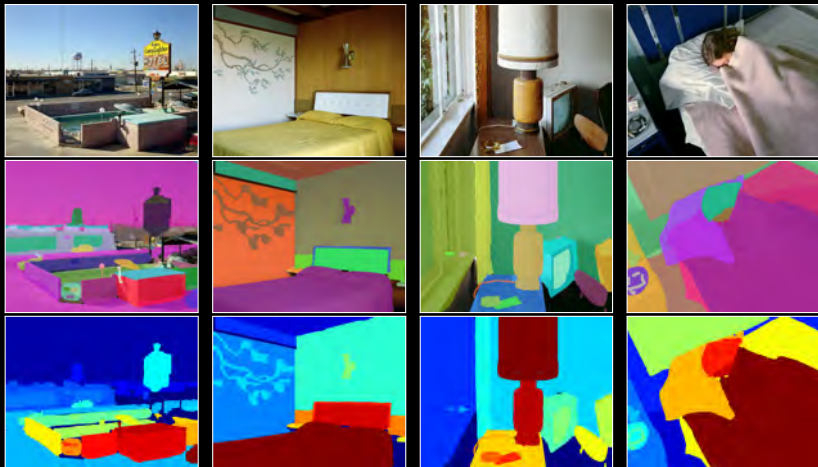


Touch-up

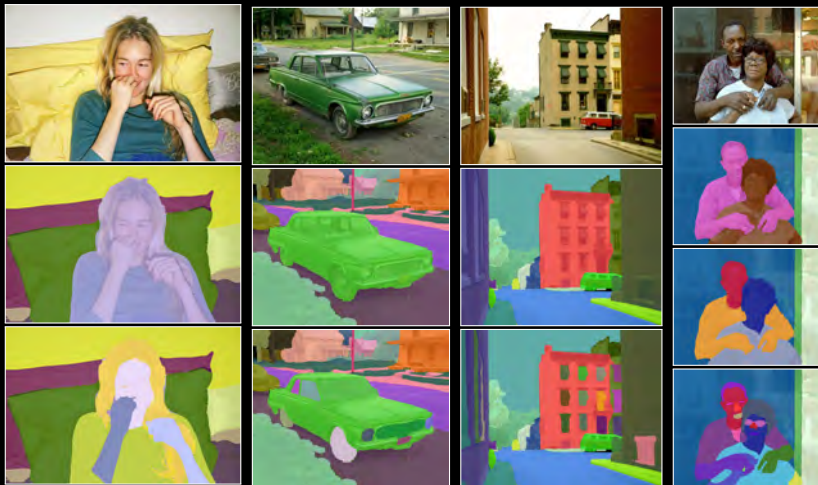
# Annotated Scene Dataset



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# Example Object-Part Hierarchies





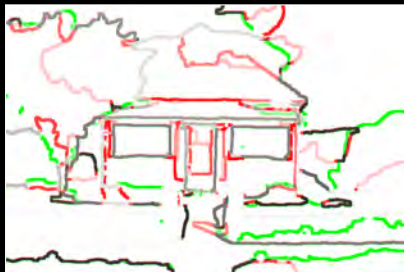
# Groundtruth UCM vs gPb-UCM



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# Groundtruth UCM vs gPb-UCM



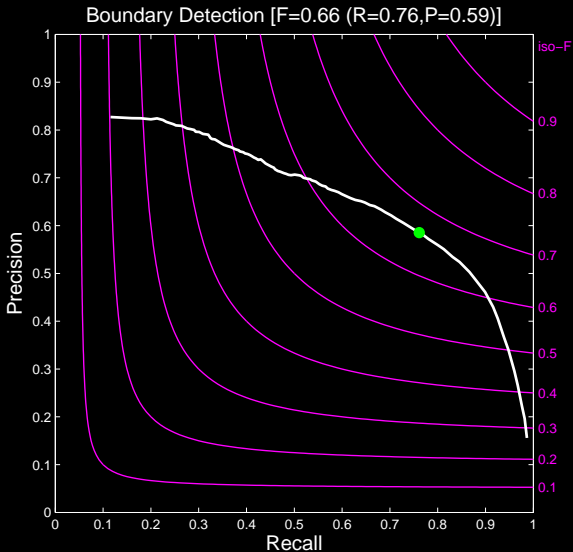
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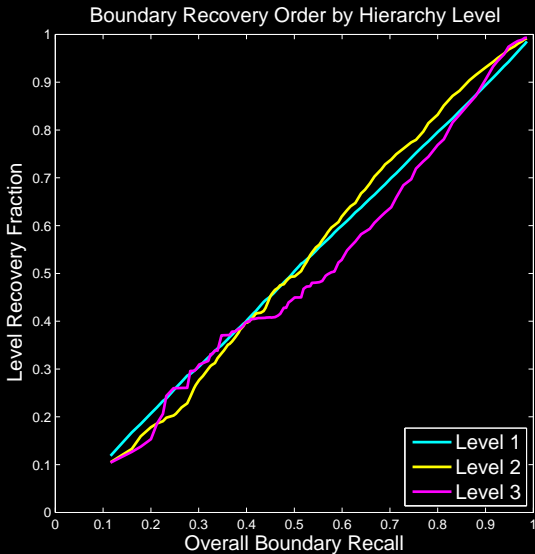
# Groundtruth UCM vs gPb-UCM



# Boundary Benchmark



# Hierarchical Boundary Benchmark



# Hierarchical Boundary Benchmark - Portraits

