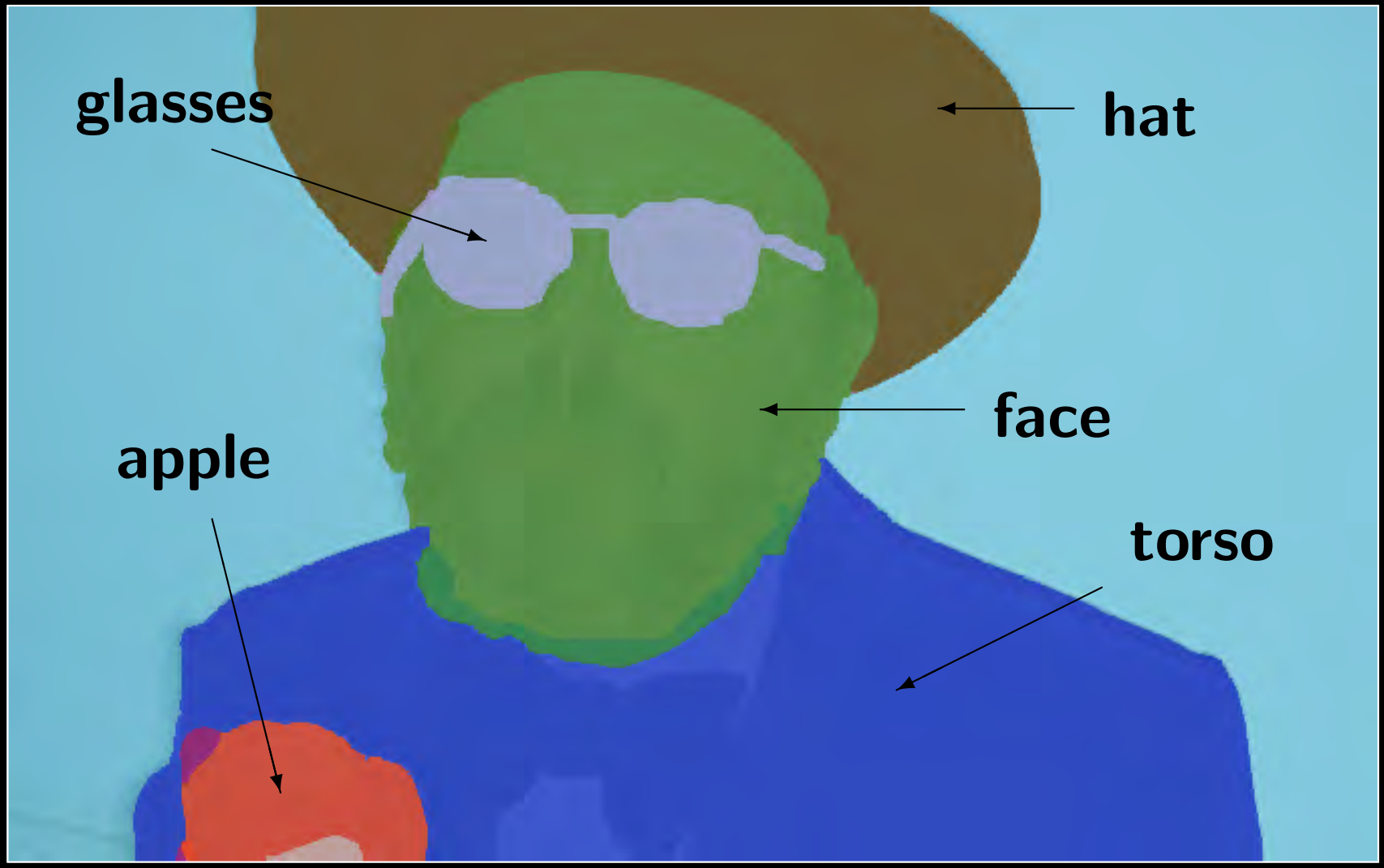
Hierarchical Scene Annotation

Michael Maire[1], Stella X. Yu[2], Pietro Perona[1]

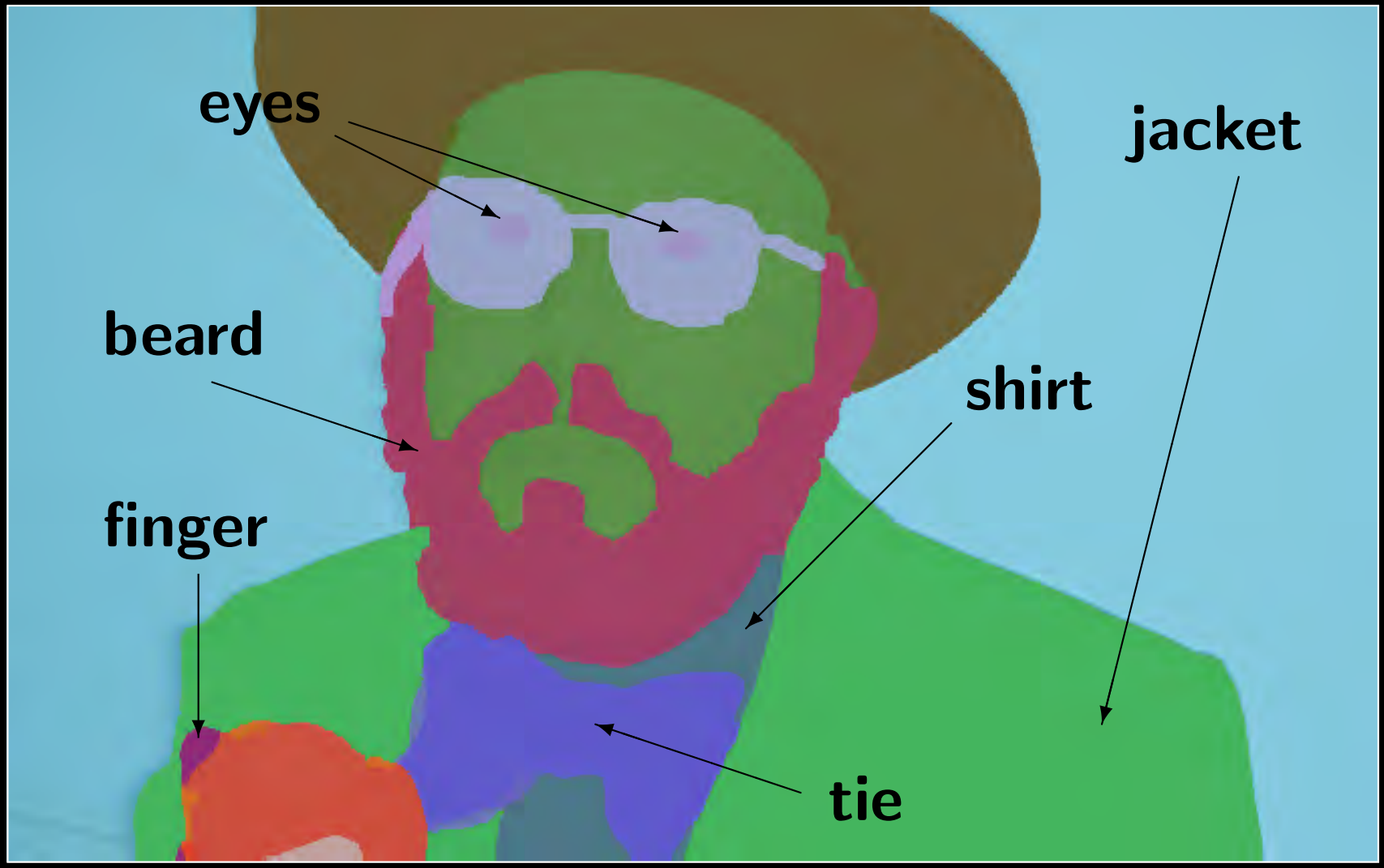
[1]California Institute of Technology - Pasadena, CA
[2]University of California at Berkeley / ICSI - Berkeley, CA

What to Annotate?

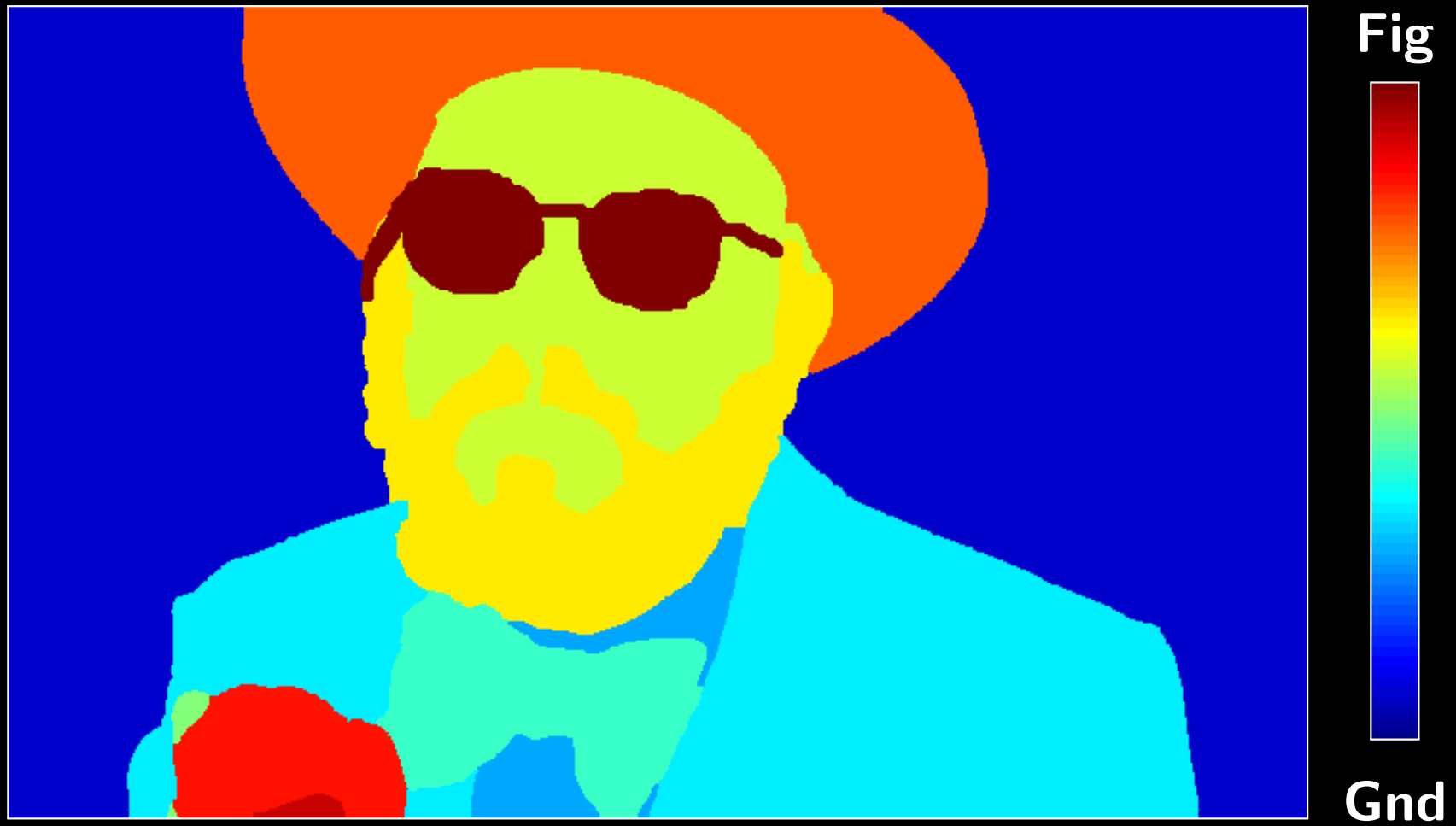
Objects/Parts



Subparts



Figure/Ground



Rich Annotation

Rich Annotation

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

Rich Annotation

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

BMVC 2013

extension

Rich Annotation

- Multiple modalities:
  - Objects, parts, subparts
  - Object-part containment
  - Segmentation
  - Occlusion (figure/ground)
  - Attributes
- Unifying abstraction: region trees

BMVC 2013

extension

Rich Annotation

- 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"

BMVC 2013

extension

Rich Annotation

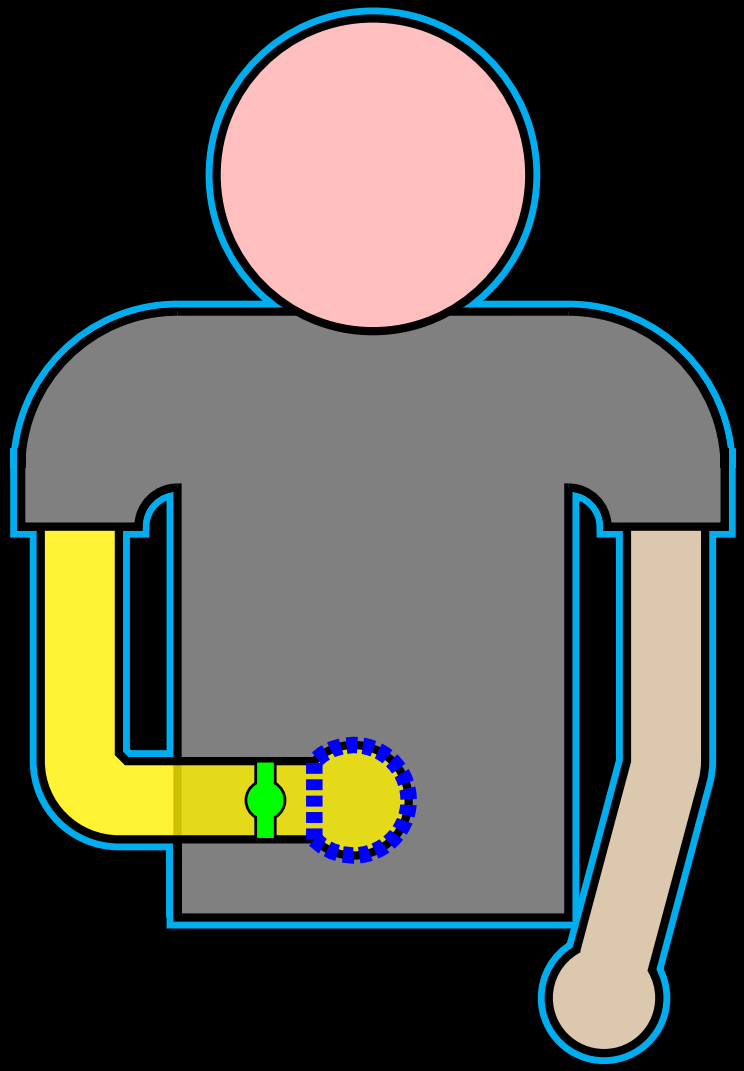
- Multiple modalities:
  - Objects, parts, subparts
  - Object-part containment
  - Segmentation
  - Occlusion (figure/ground)
  - Attributes

BMVC 2013

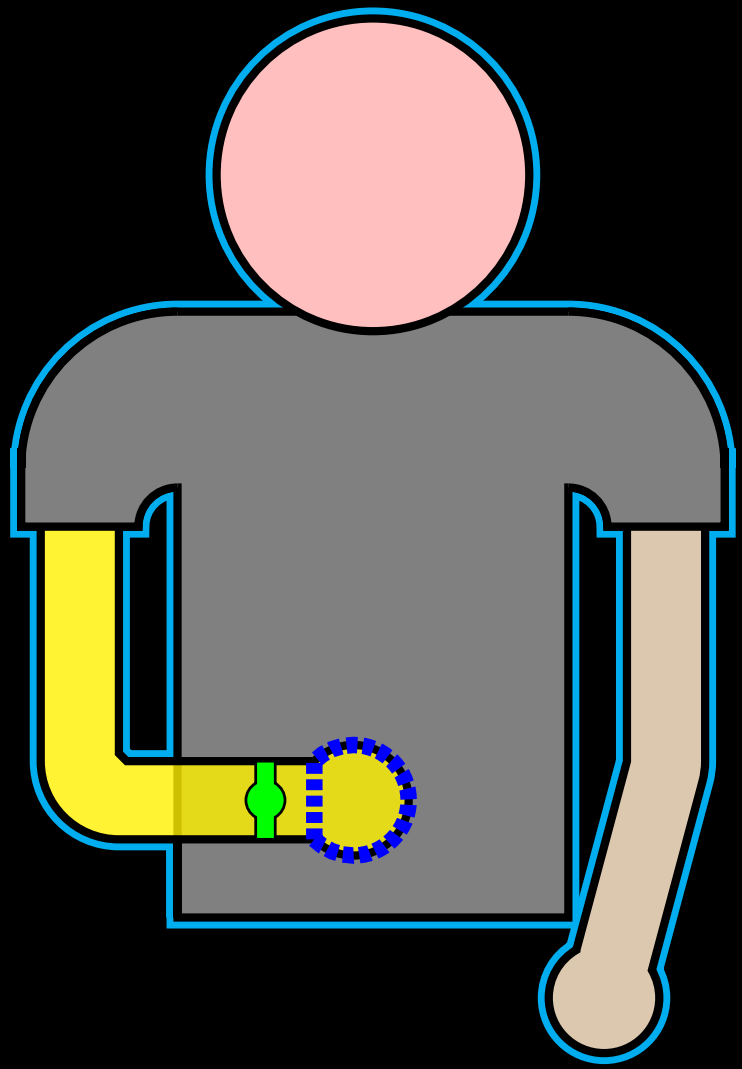
extension

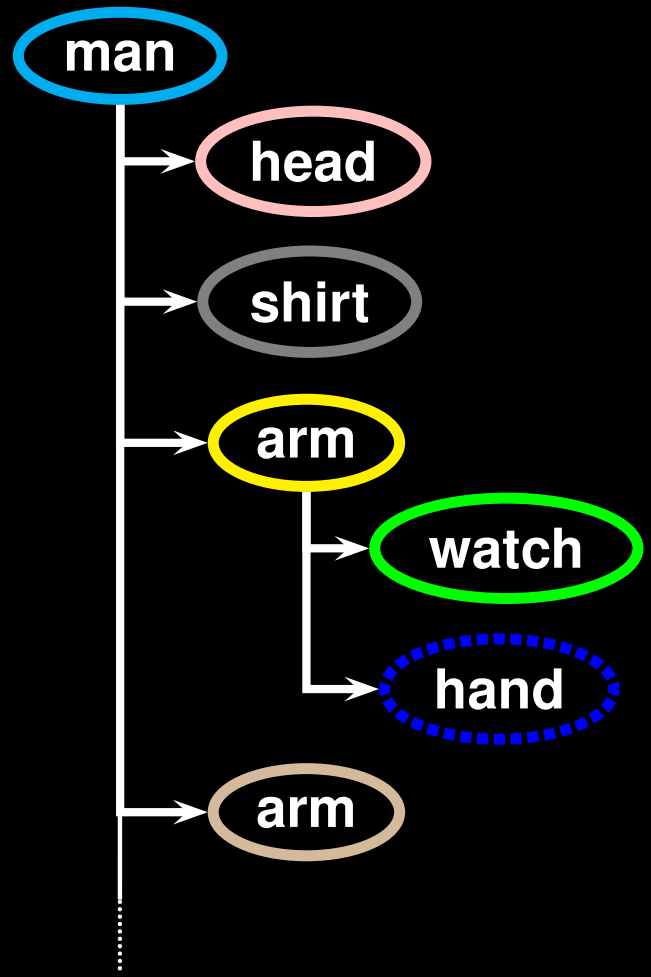
- Unifying abstraction: region trees
- Web-based annotation tool
  - Computer-assisted segmentation
  - Model invariant enforcement
  - Visual feedback
  - "LabelMe on steroids"
- Object segmentation dataset + benchmark

Object Model: Region Tree

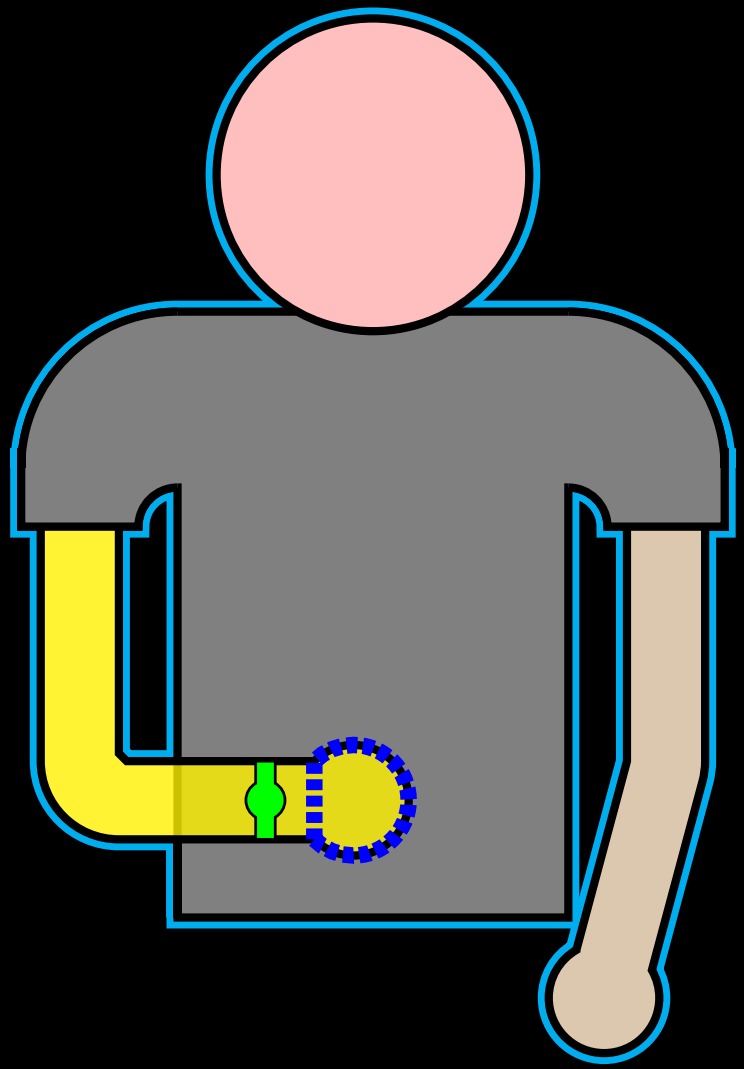


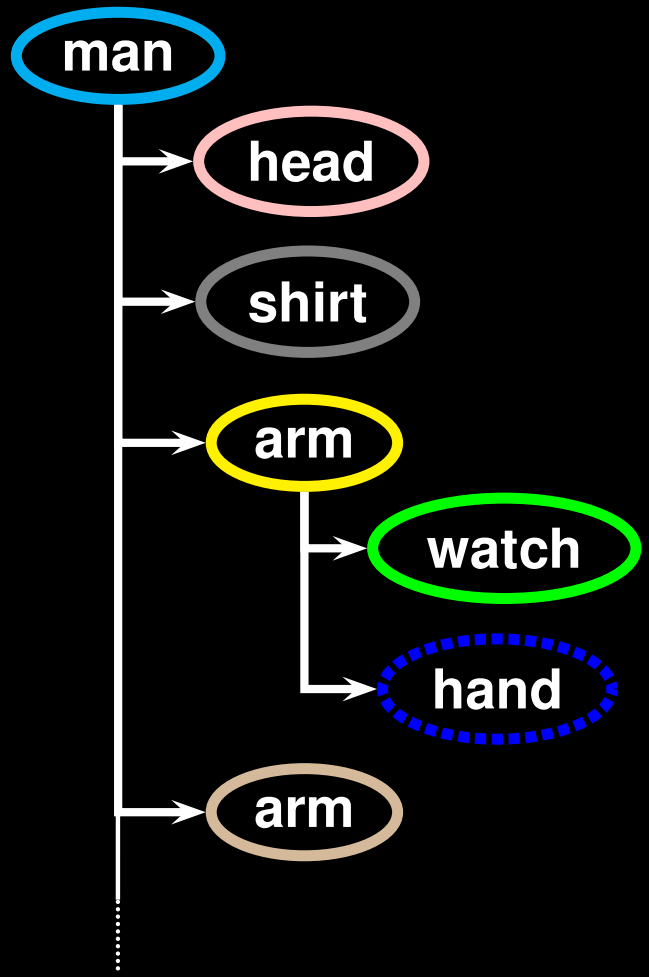
Object Model: Region Tree





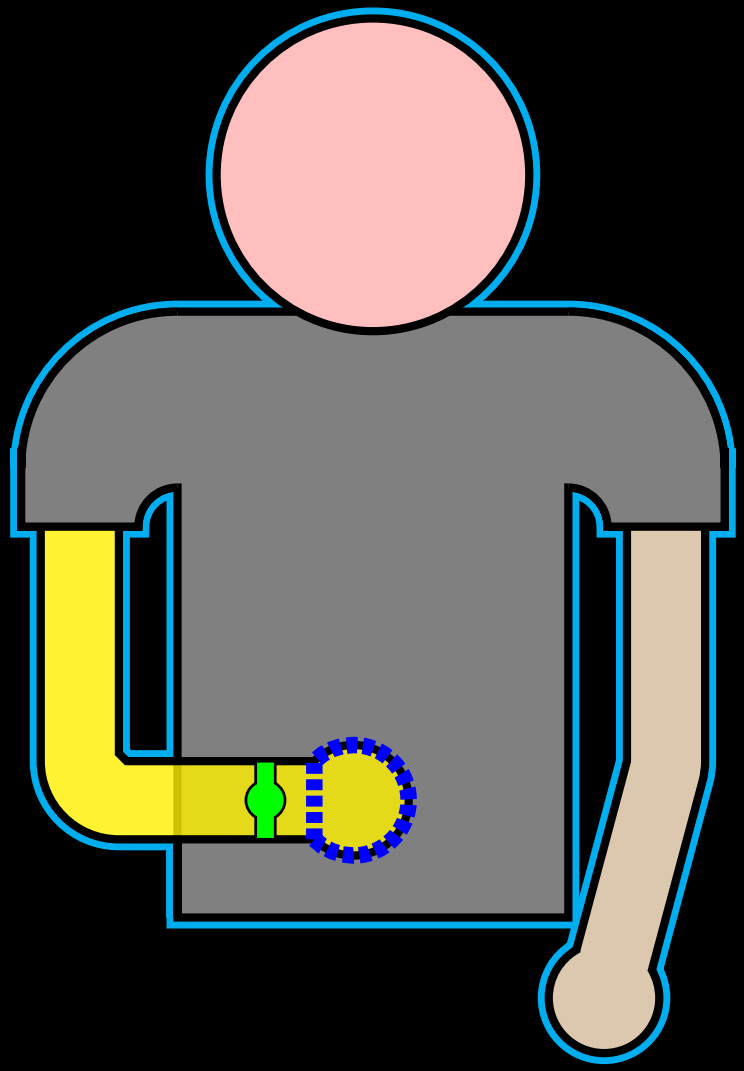
Object Model: Region Tree

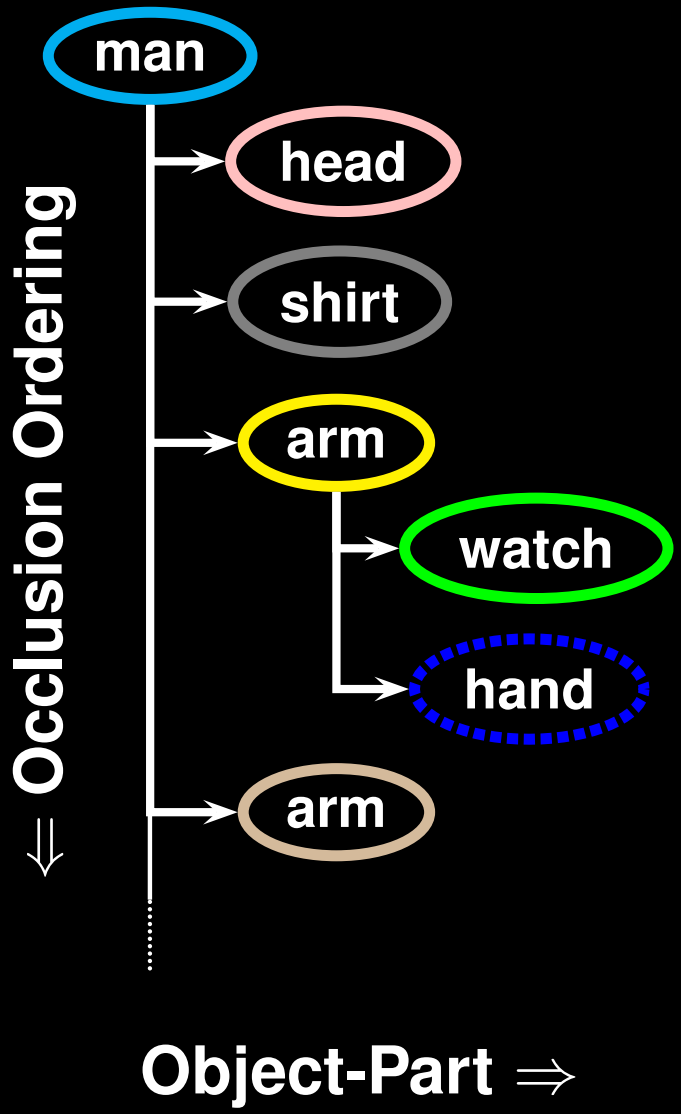




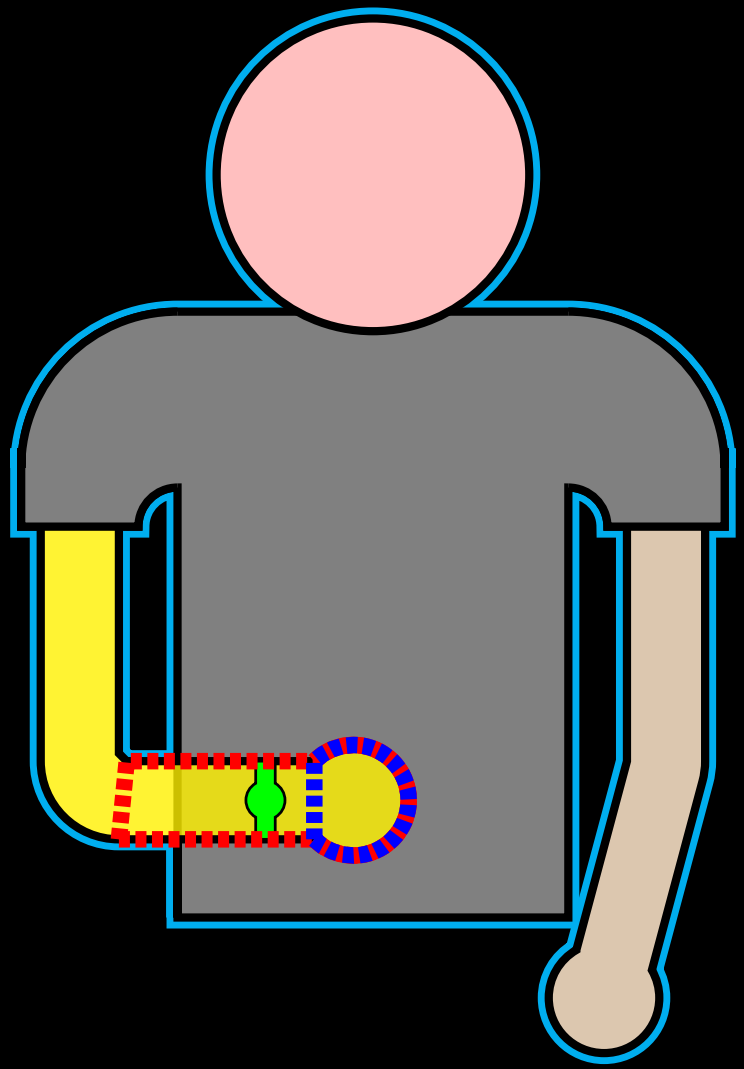
Object-Part $\Rightarrow$

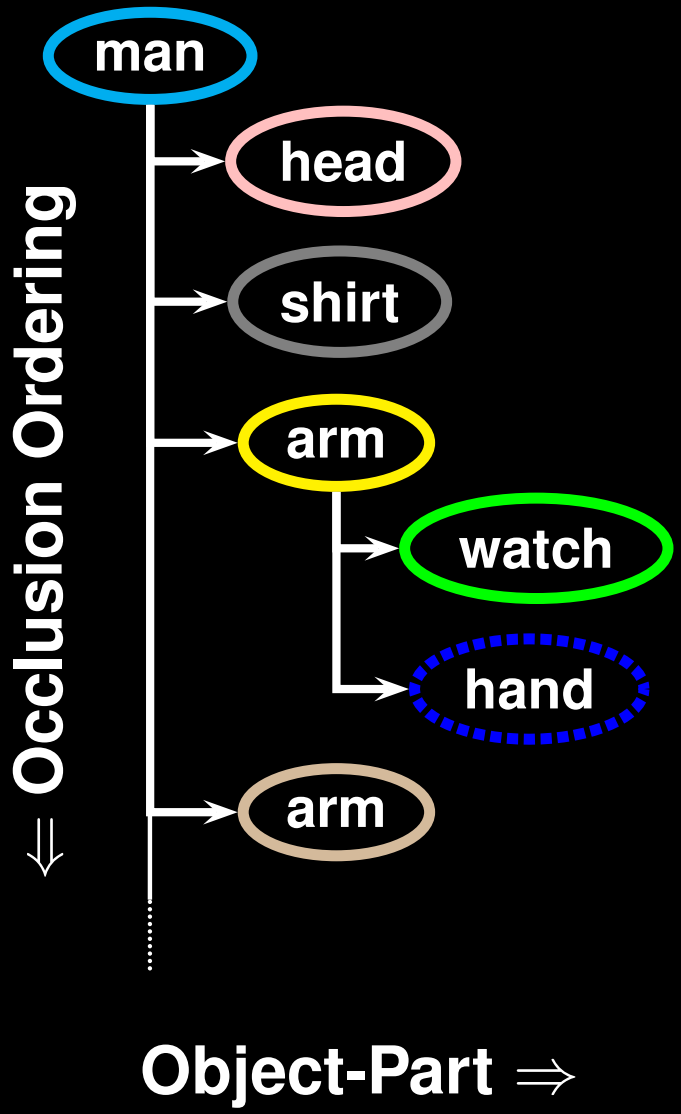
Object Model: Region Tree



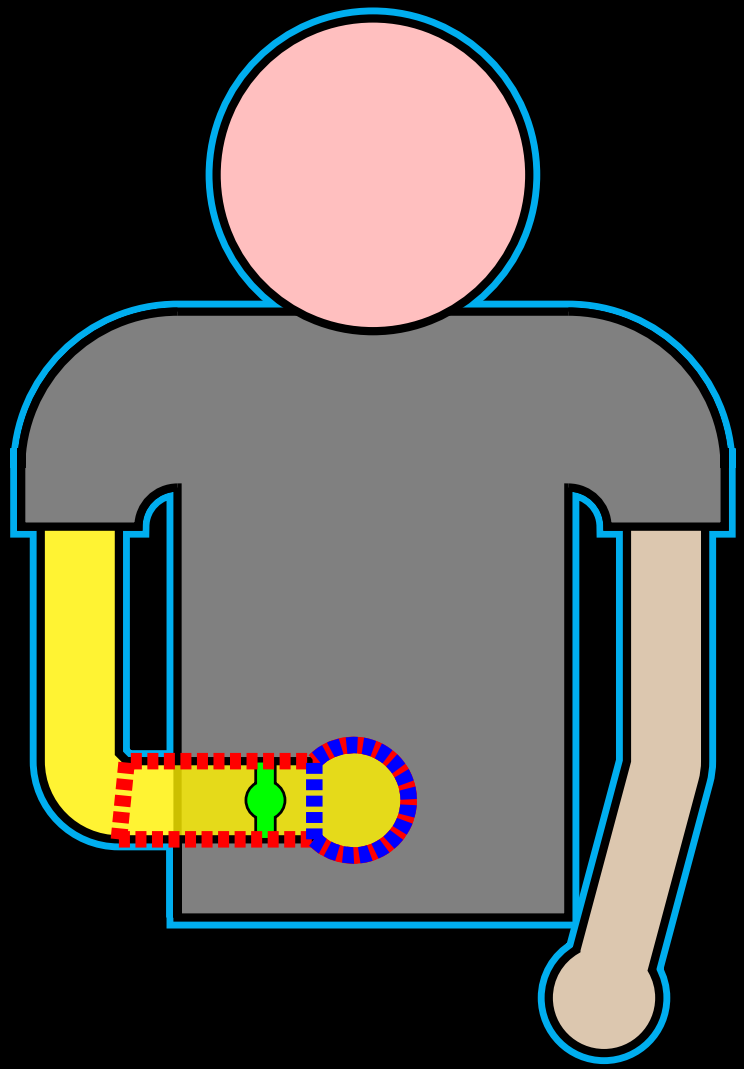


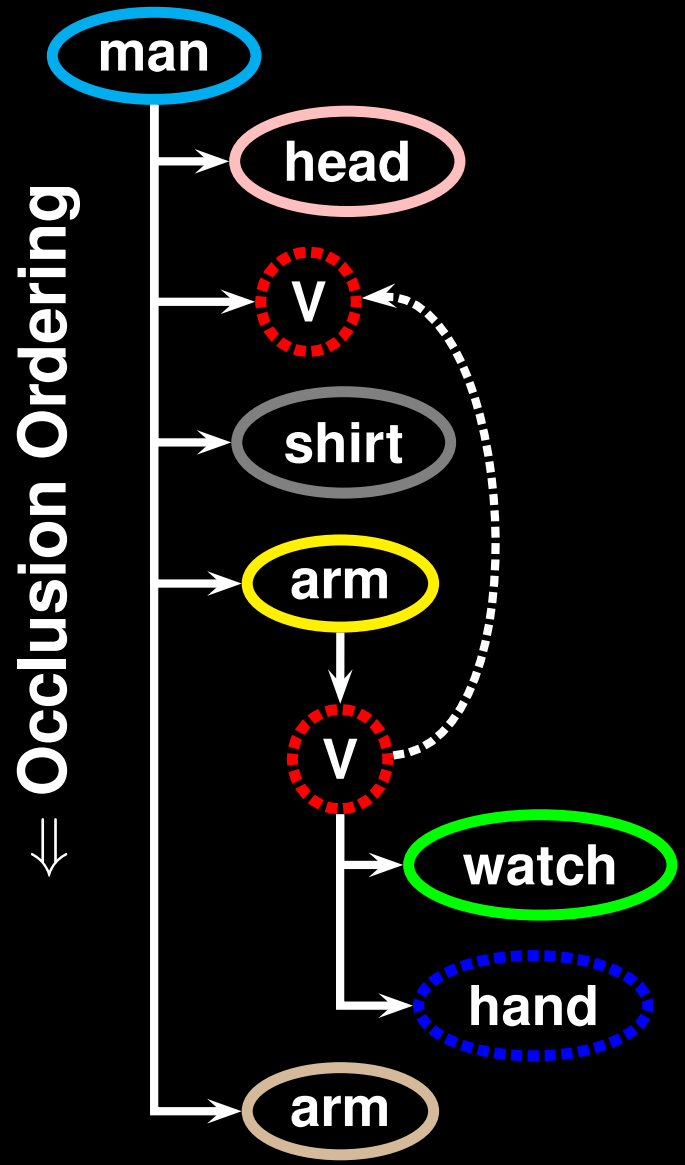
Object Model: Self Occlusion



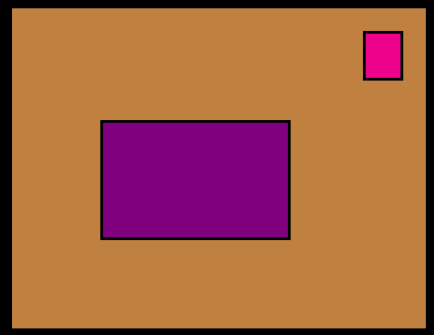


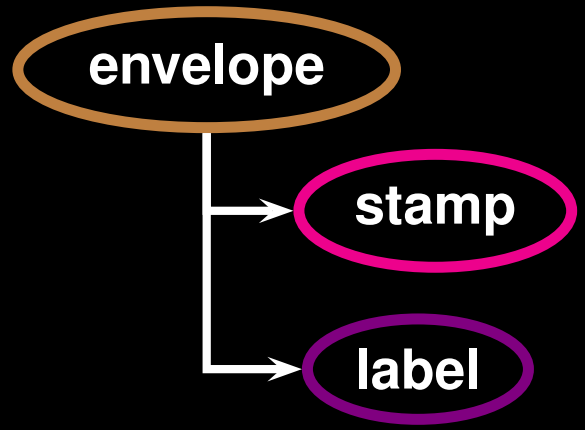
Object Model: Virtual Link

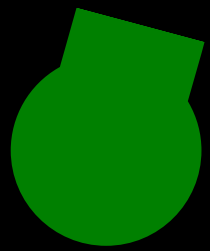




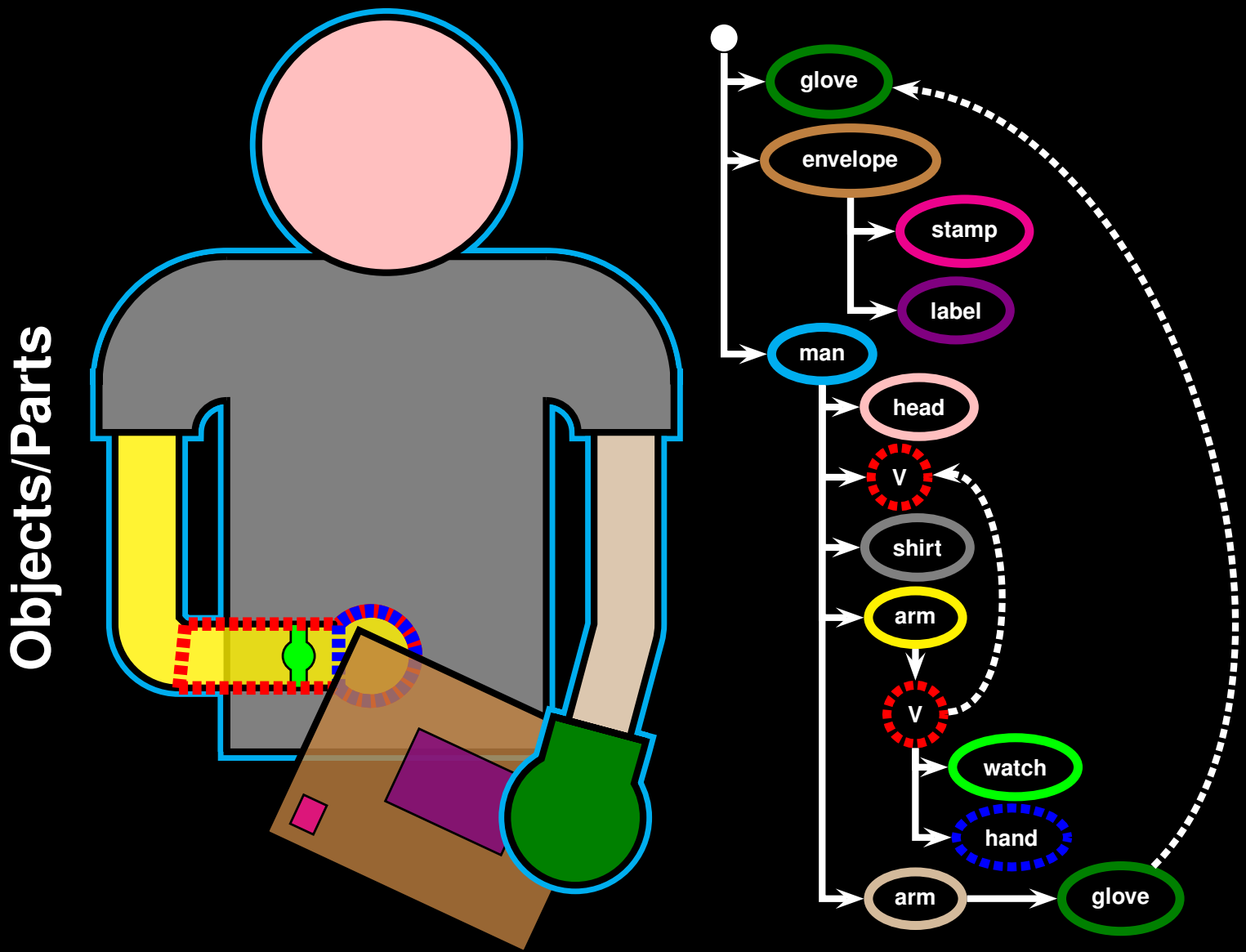
Additional Object Models



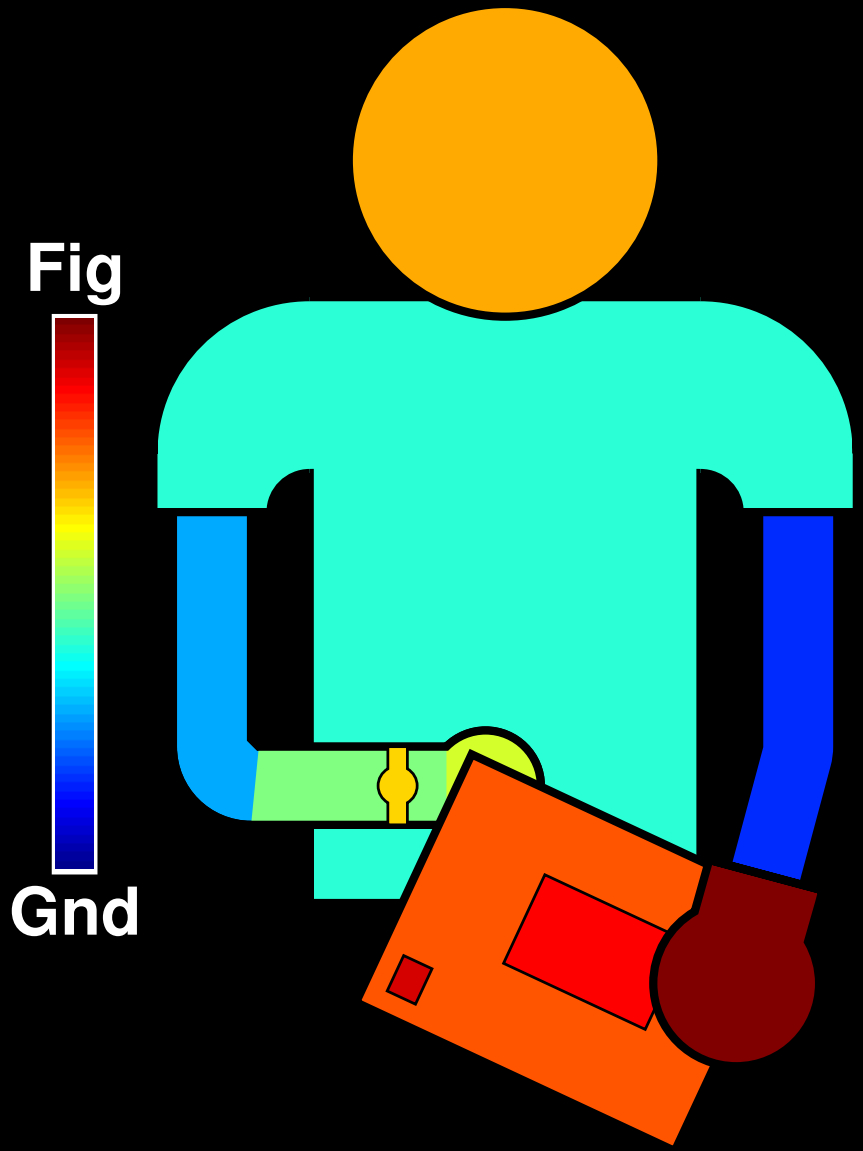


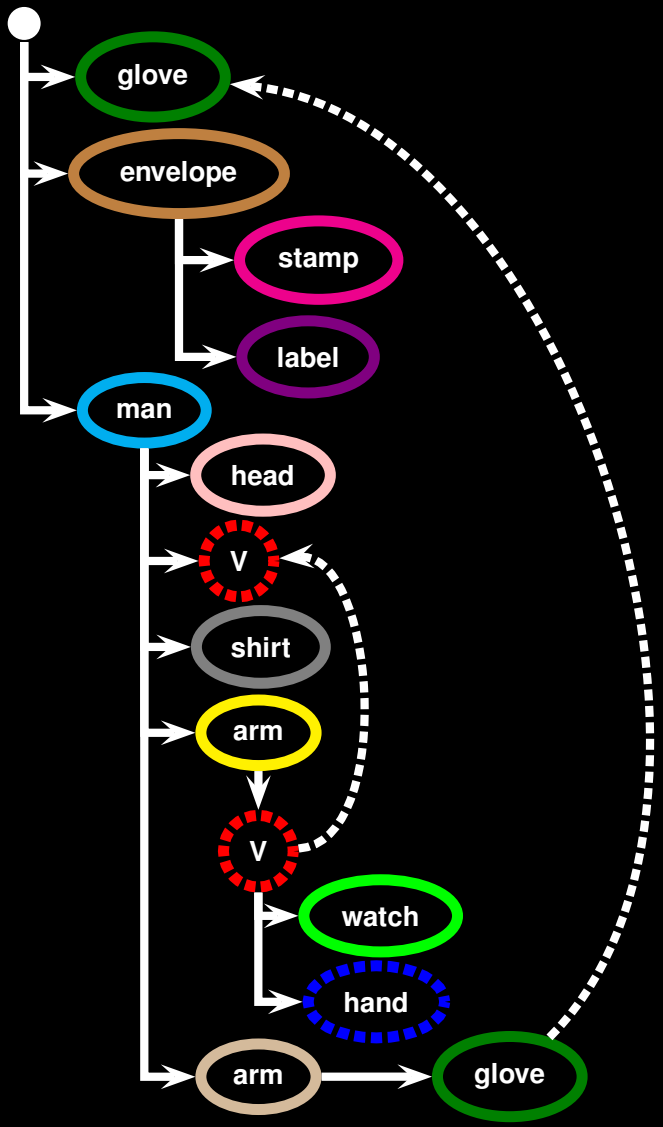


Scene Model: Region Tree

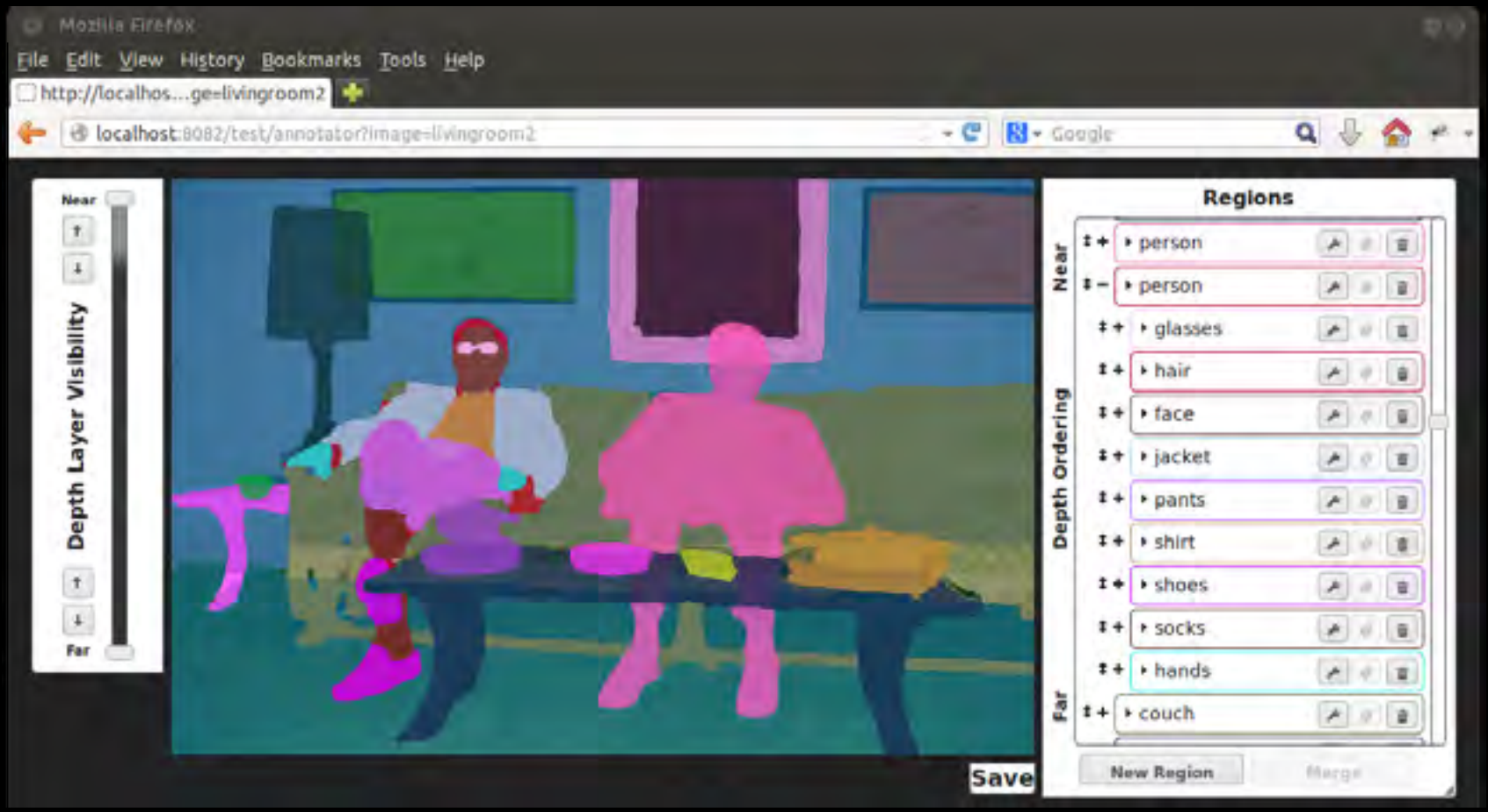


Tree Traversal Recovers Figure/Ground





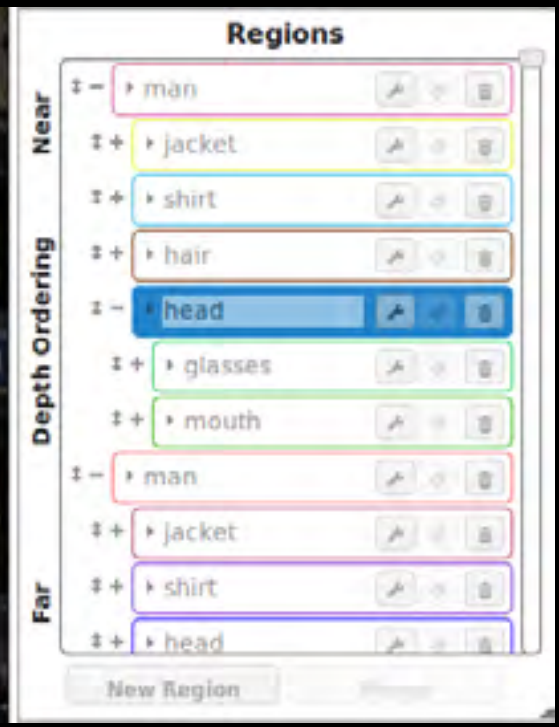
Annotation Software



Region Tree Navigation

Region Tree Navigation

Containment Constraints



Containment Constraints

Interactive Segmentation

Image

Oversegmentation

Click

Interactive Segmentation

Image

Oversegmentation

Drag

Interactive Segmentation

Image

Oversegmentation

Release

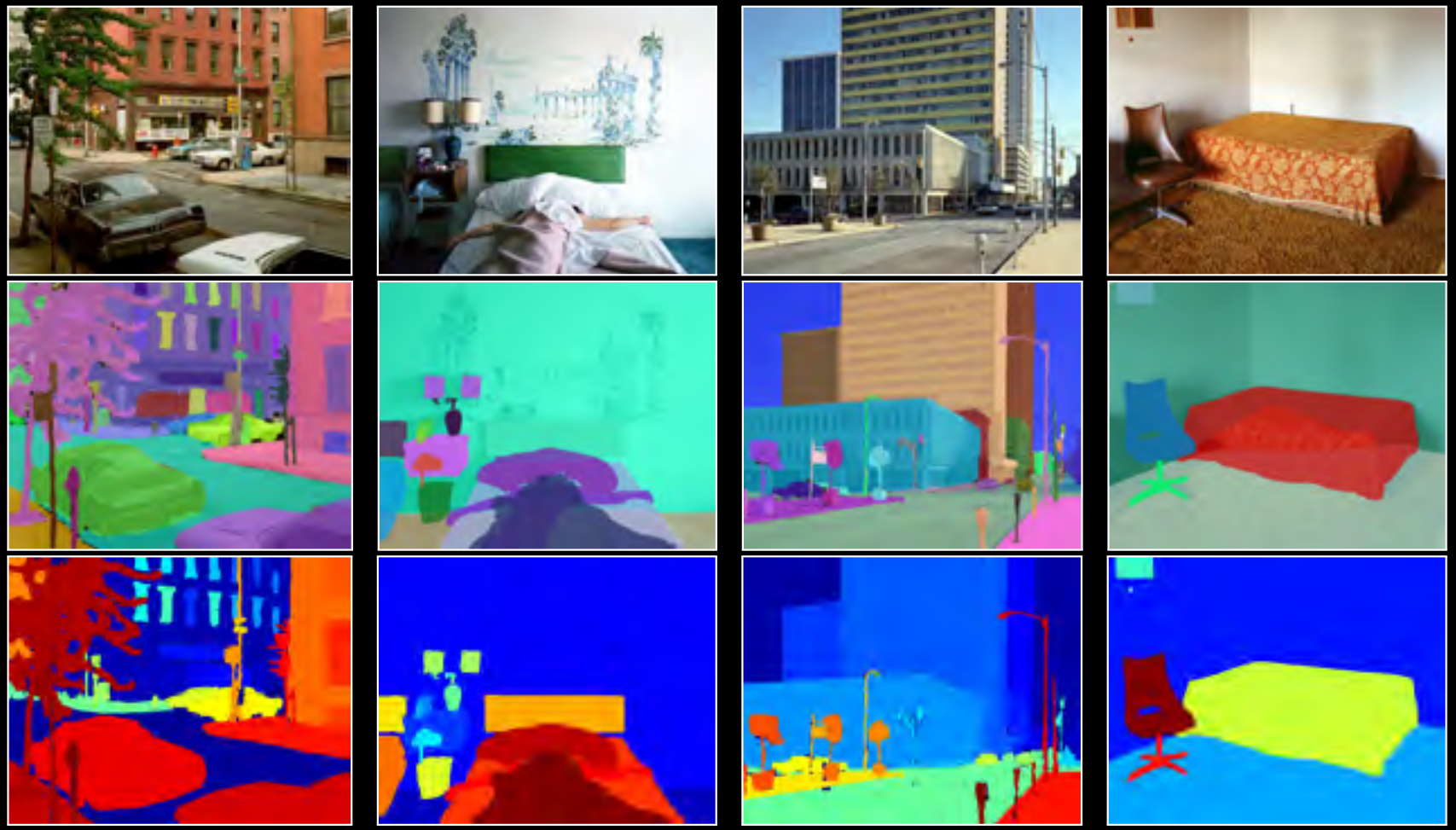
Interactive Segmentation

Image

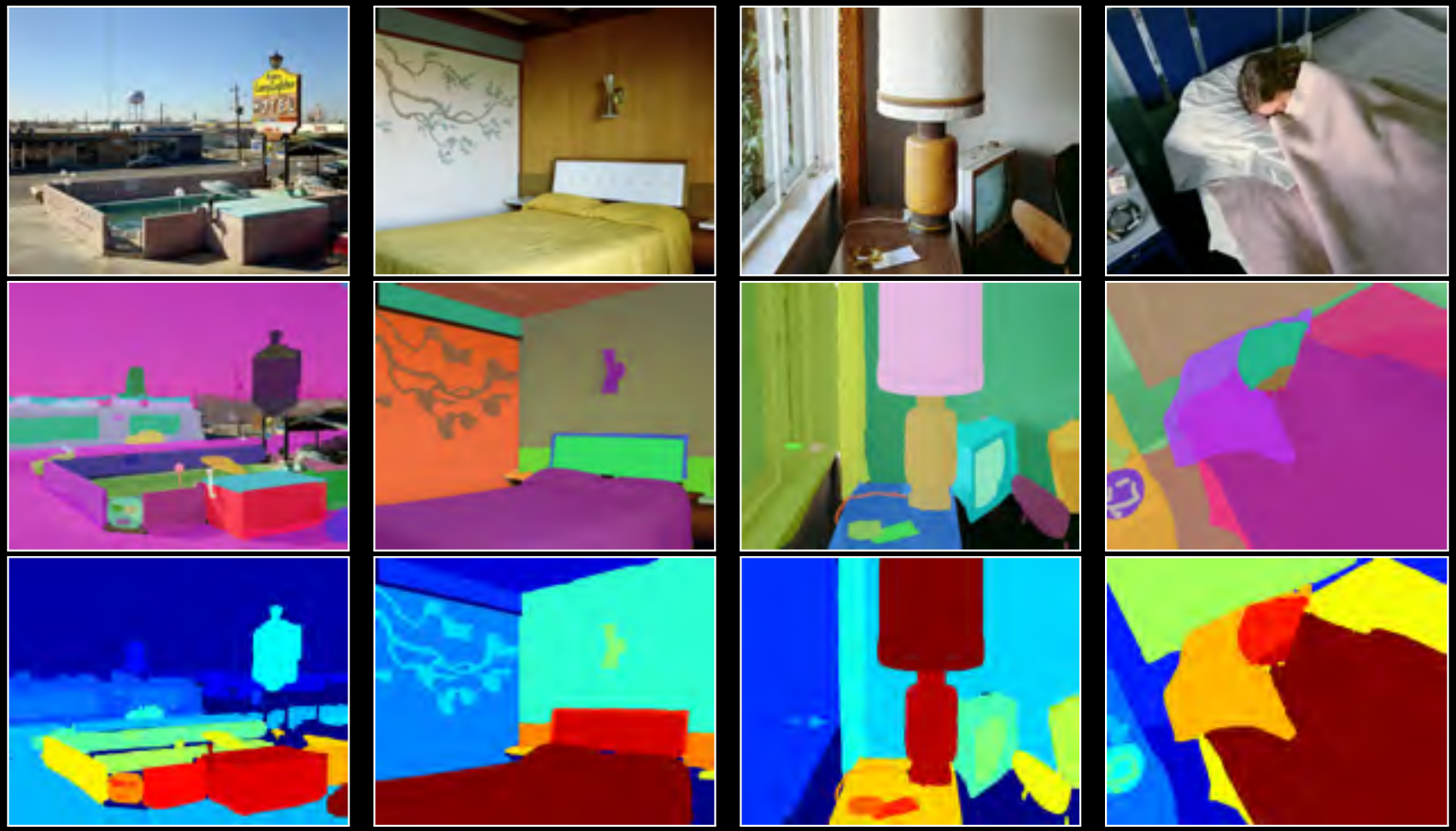
Oversegmentation

Touch-up

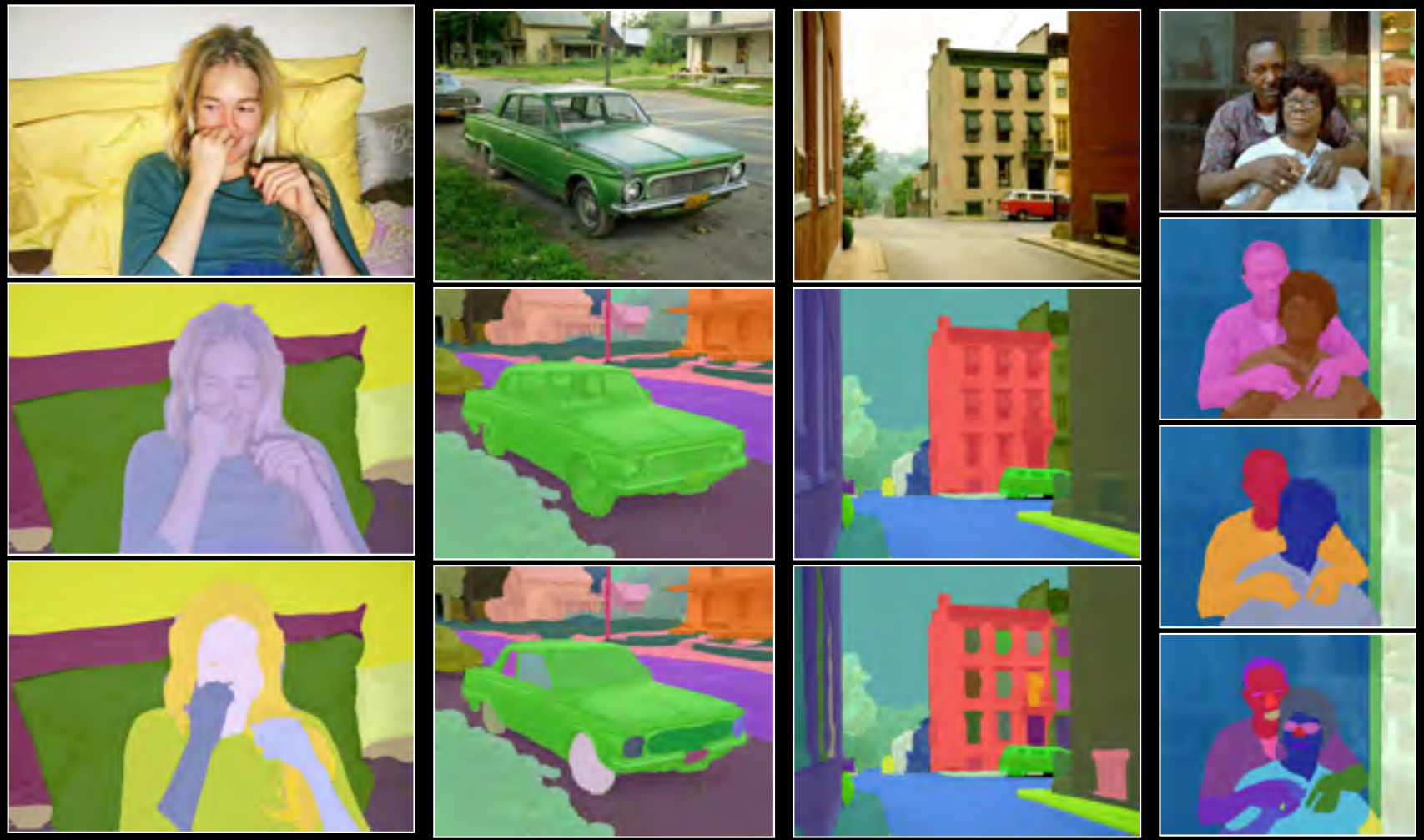
Annotated Scene Dataset



Annotated Scene Dataset

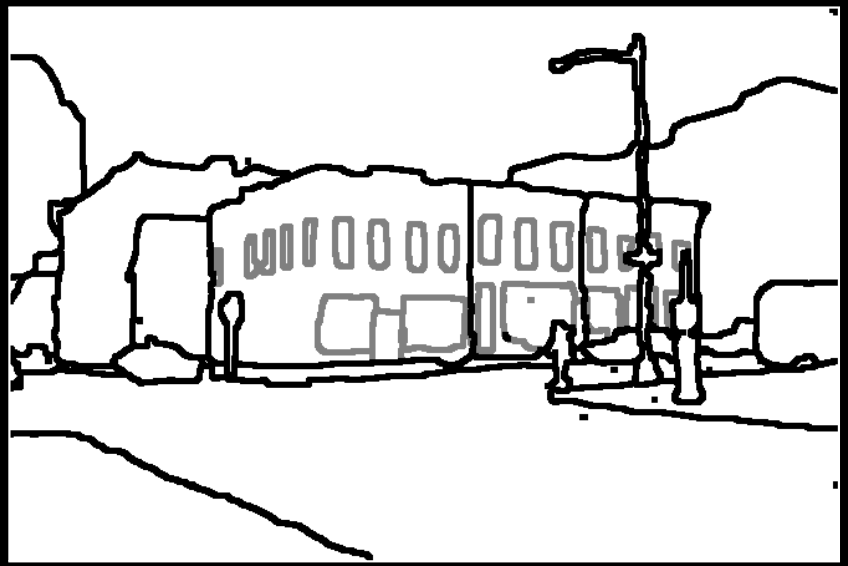


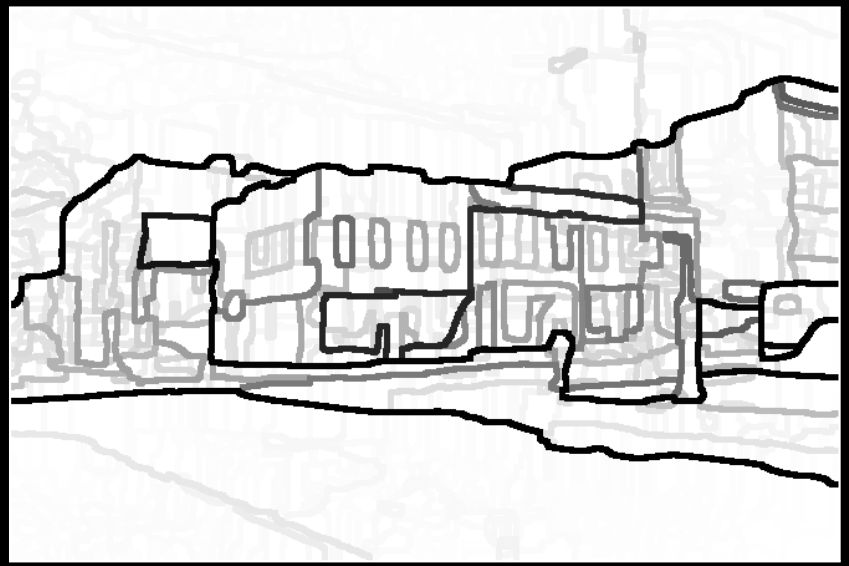
Example Object-Part Hierarchies



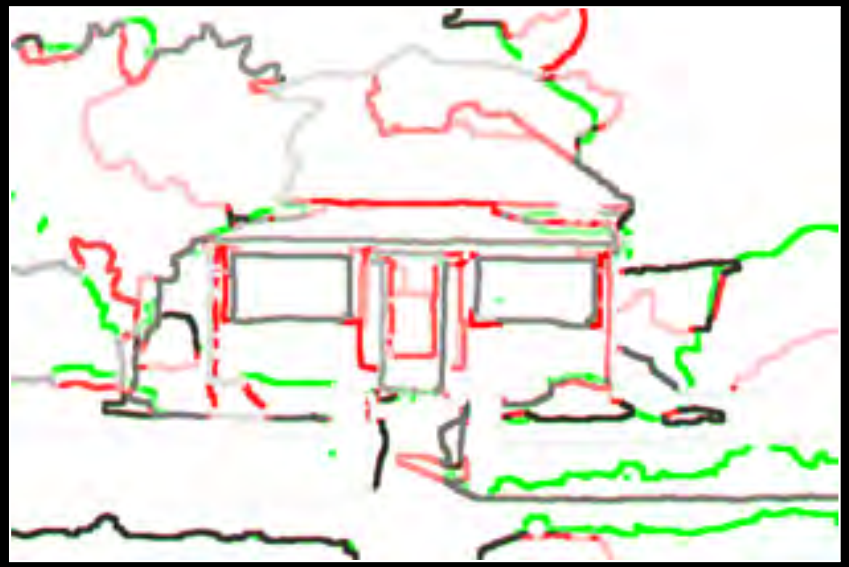
Groundtruth UCM vs gPb-UCM

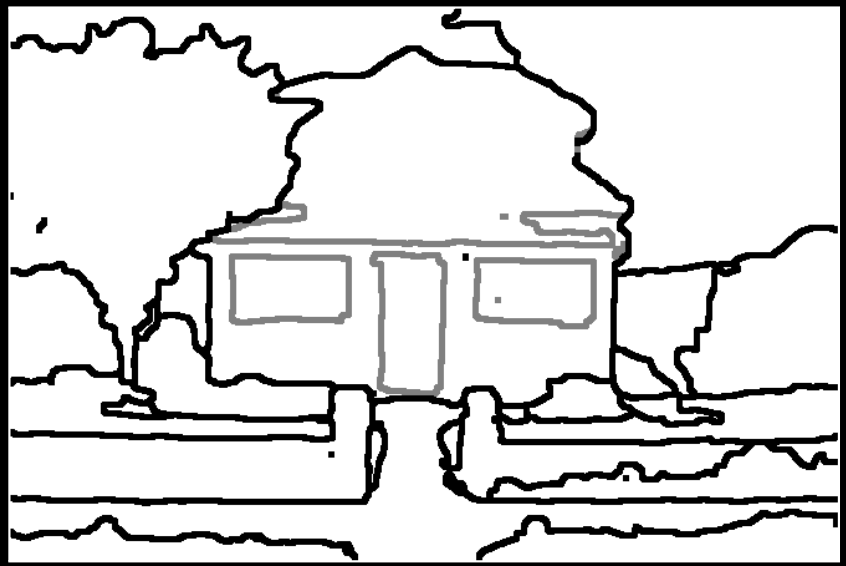
Groundtruth UCM vs gPb-UCM





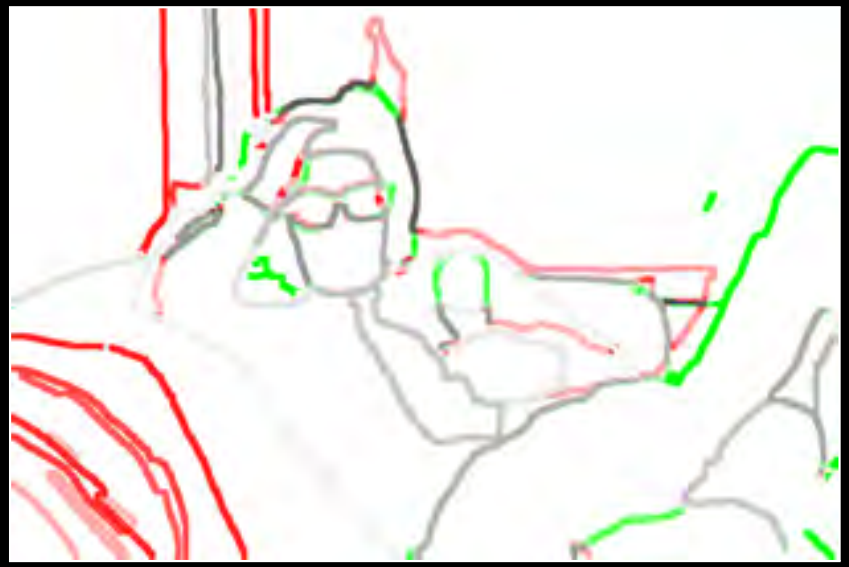
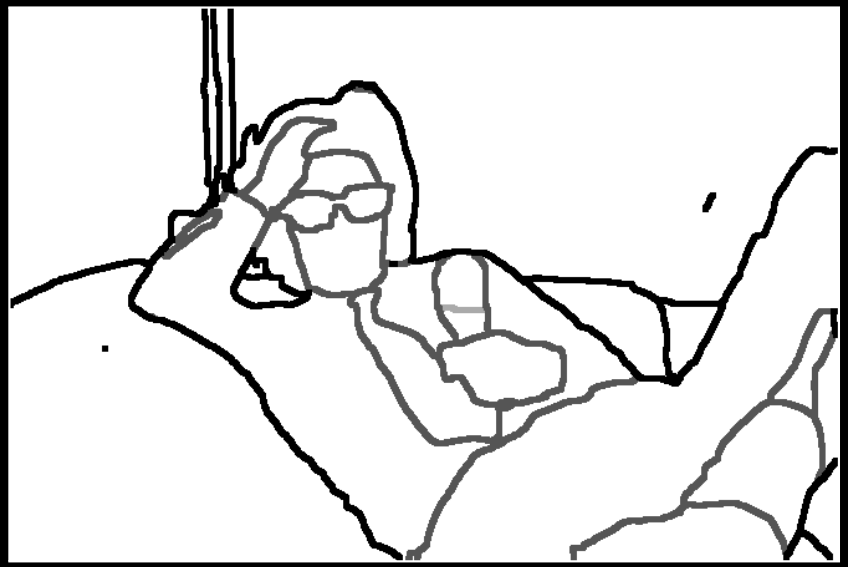
Groundtruth UCM vs gPb-UCM



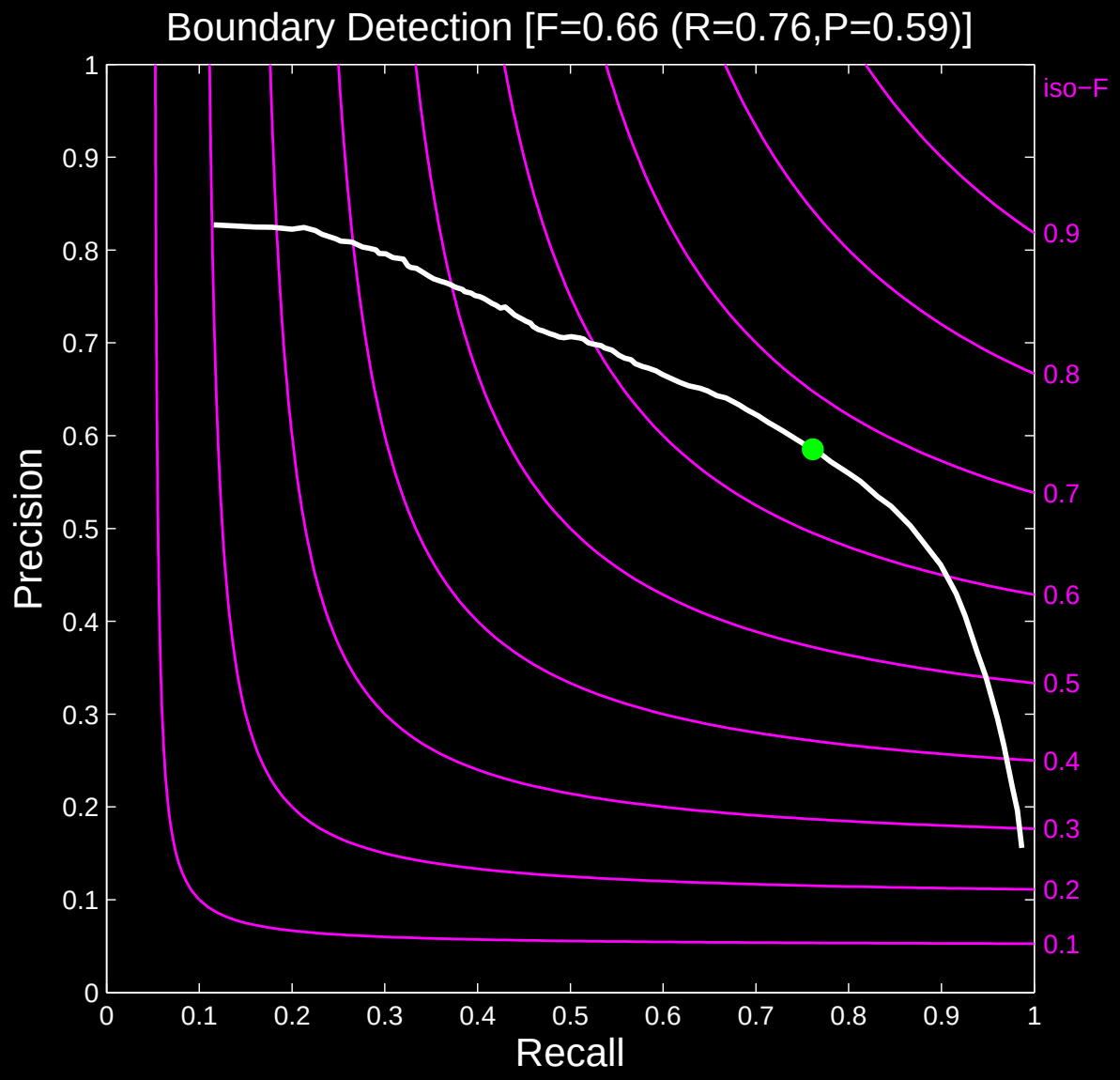


Groundtruth UCM vs gPb-UCM

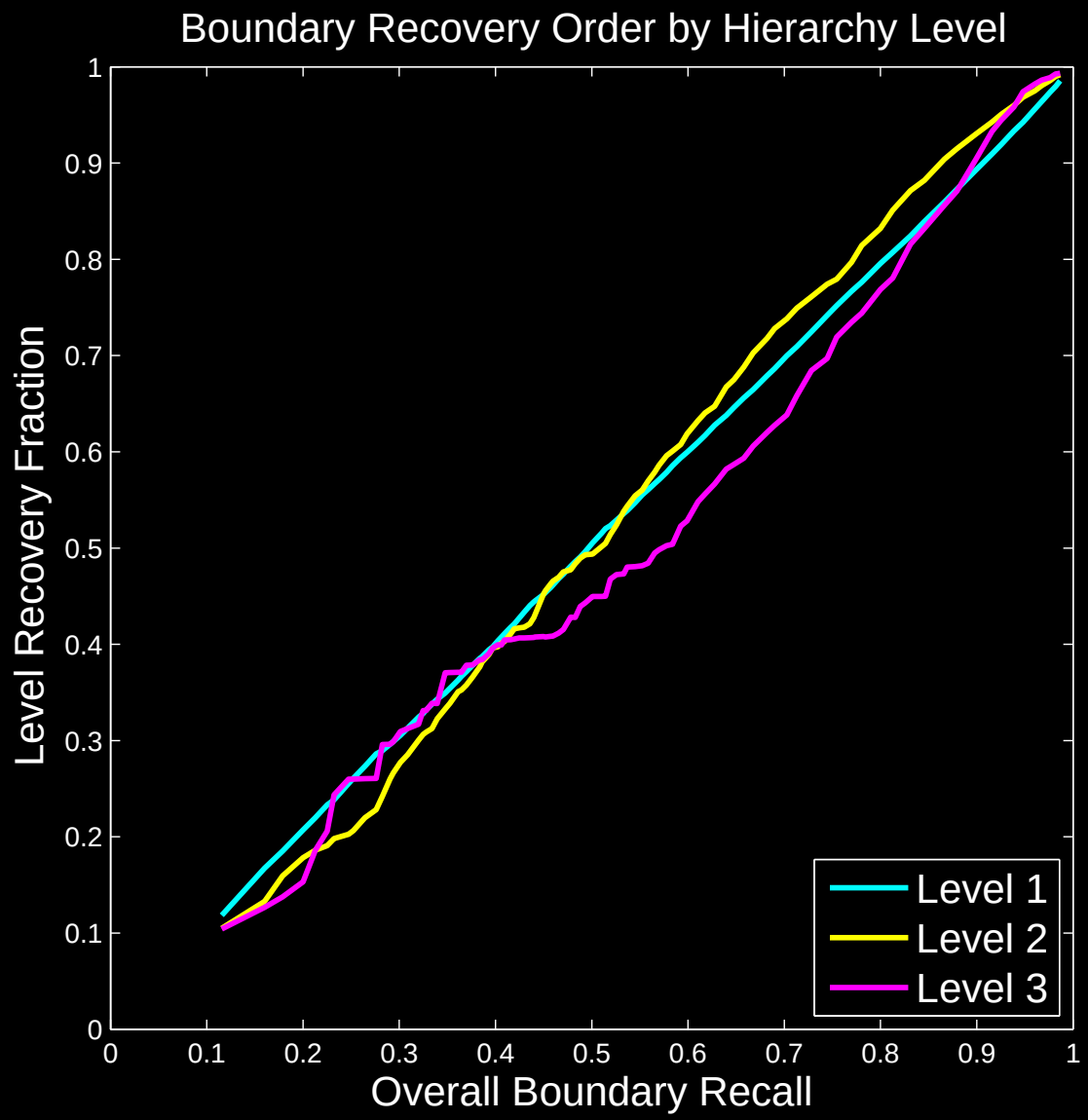
Groundtruth UCM vs gPb-UCM


Boundary Benchmark



Hierarchical Boundary Benchmark



Hierarchical Boundary Benchmark - Portraits