EE 569 Lecture on Image Segmentation

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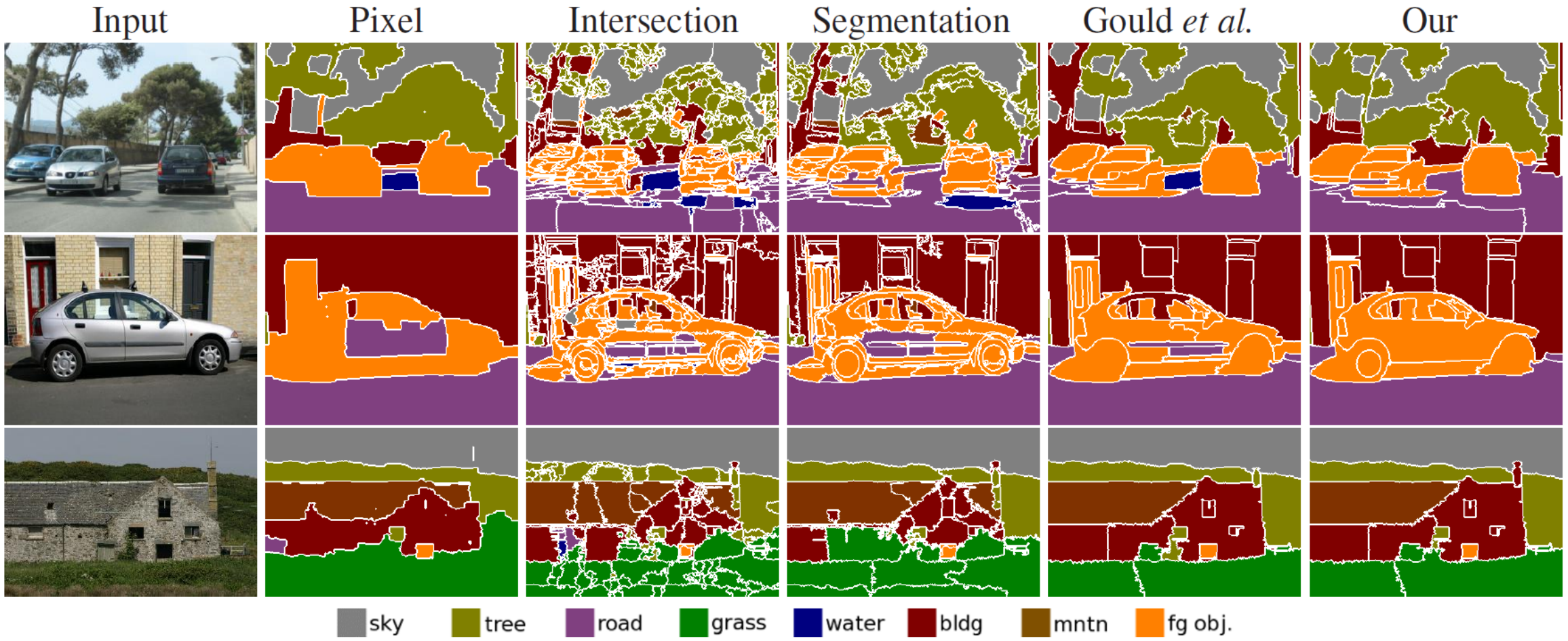
4 Tightly Coupled Problems

Image Segmentation, Object Detection, Visual Saliency and 3D Scene Layout

Why Image Segmentation Is Difficult?

- What is a good number of segments?
  - What is the purpose of the segmentation?
    - Visual-saliency-based segmentation may be more meaningful
    - Object-recognition-based segmentation may be more relevant
- Human uses 3D information to segment (e.g. occlusion) while computers have only 2D image information
- Human uses semantics to group pixels while computers are very weak in semantic understanding

The segmentation results in the right 5 columns do not take the 3D scene lay out into account. Thus, it does not provide much valuable information. It is desired to have the following “distance order” information because of “segmentation task” (from the closest to the farthest)
Top: 1) road 2) car,s 3) tree and 4) sky
Middle: 1) road, 2) car and 3) building
Bottom: 1) grass, 3) house, 3) mountain and 4) sky



Simplest Cases

- Blue Screen Technology


BoscoTech

Image Segmentation Types

- Interactive segmentation (with human assistance)

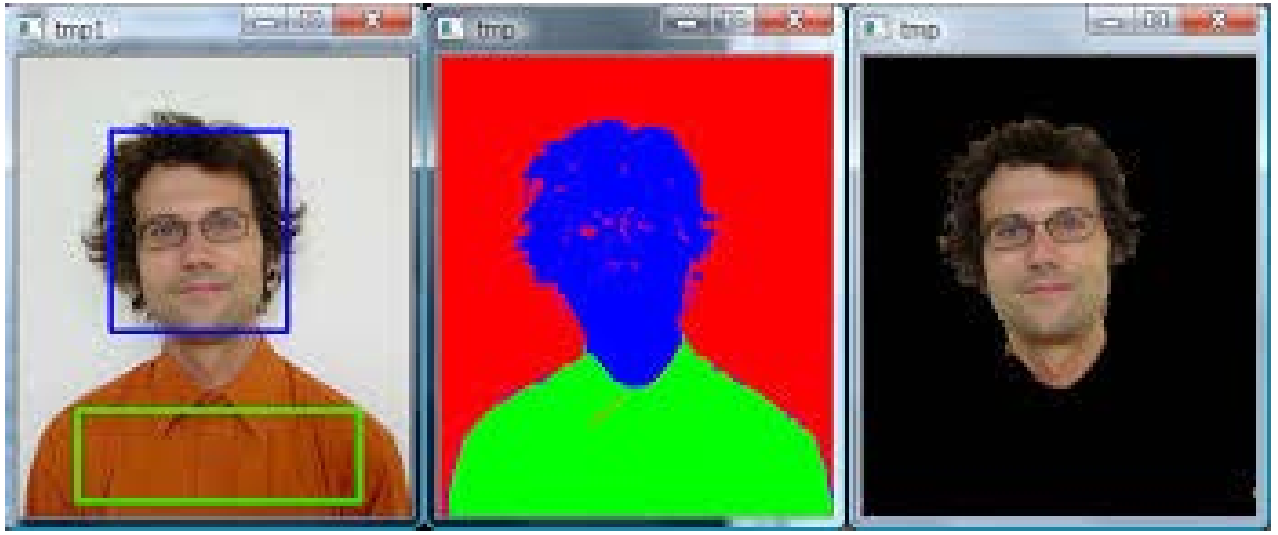
https://www.youtube.com/watch?v=aOqOwM-Qbtg

- Automatic segmentation

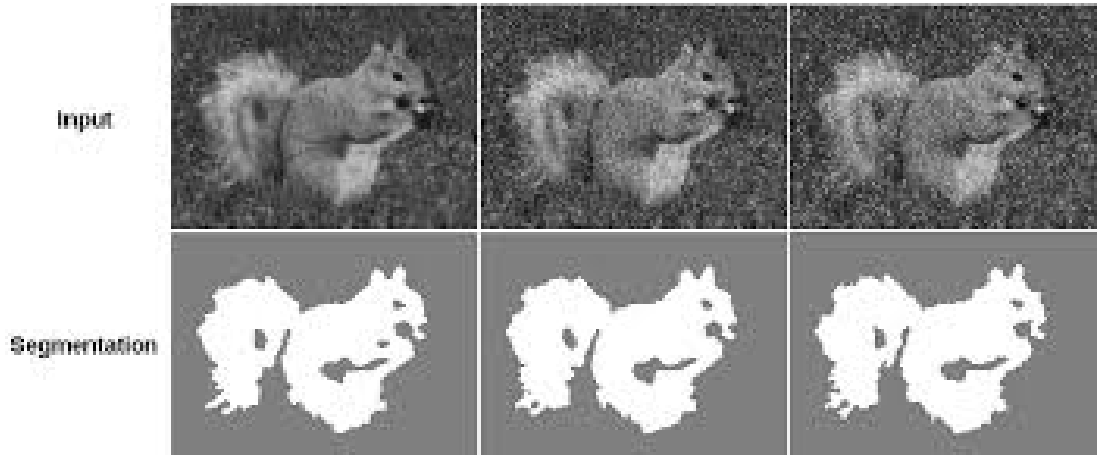
Without human assistance

Image Segmentation Tasks

- From Two Groups (Foreground and Background) to Multiple Groups



- From Gray-Scale Images to Color Images



Basic Ideas

- Contour detection (contour serves as a separator)
  - Active contour
- Region growing
  - Watershed
- Graph-based
  - Pixels are nodes, their similarity is defined by an edge value
    - Very similar -> small edge value
    - Very different -> large edge value
    - How to define similarities? mostly related to color (could be others)