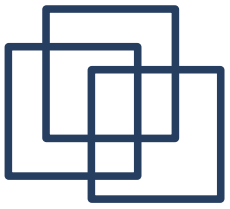


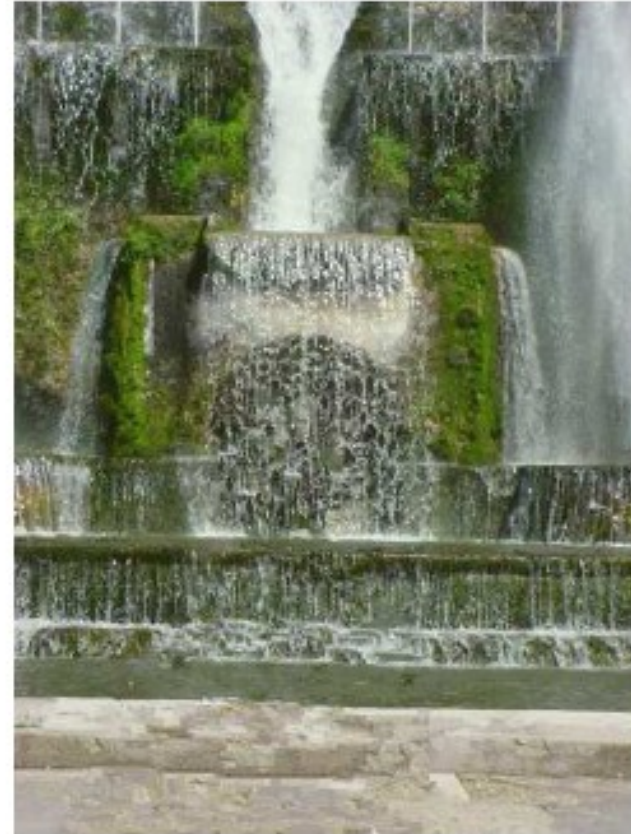
CS294-69 Image Manipulation and Computational Photography

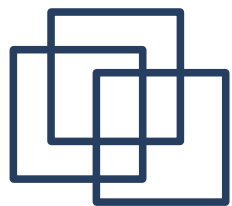
- Region-Filling and Object Removal by Exemplar-Based Inpainting. Criminisi, Pérez, and Toyama. CVPR 2004
- Image Completion with Structure Propagation. Sun, Yuan, Jia and Shum SIGGRAPH 2005



Problem

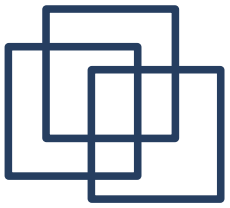
- Region filling, object removal, image completion, ...





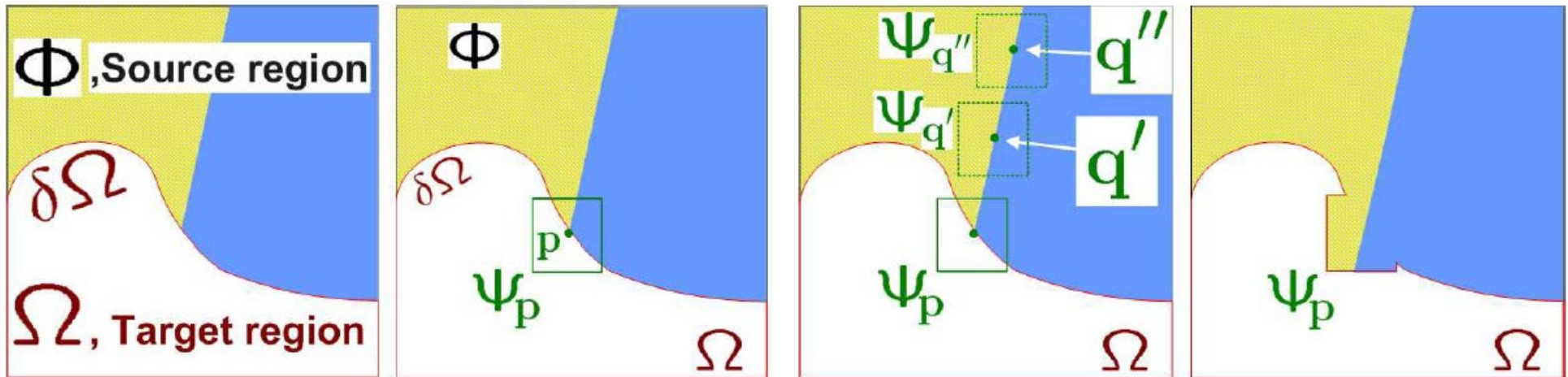
Another Example





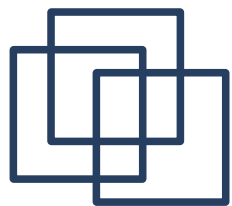
Key ideas (1)

- Exemplar-based synthesis



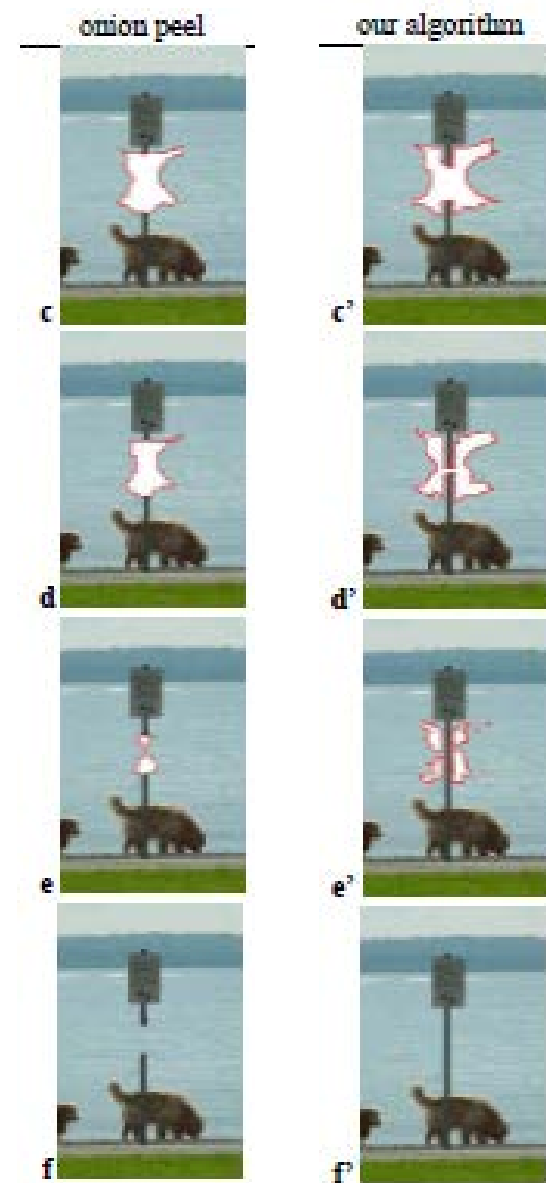
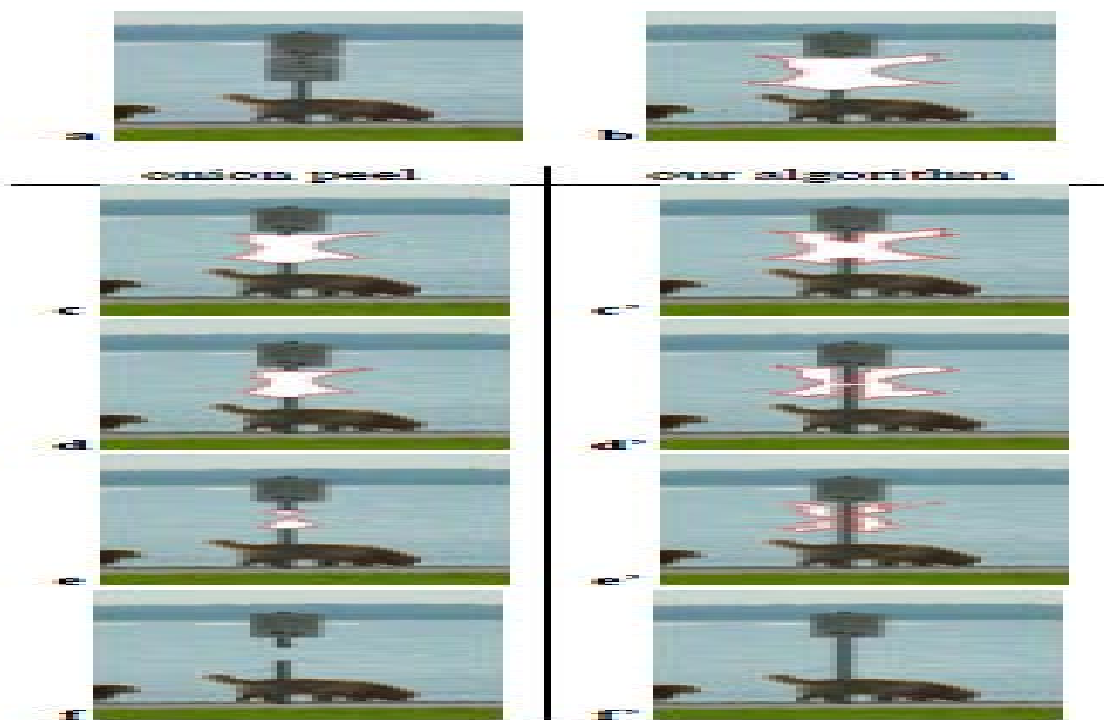
+ execution speed

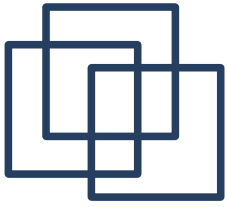
+ accuracy of propagated structures



Key ideas (2)

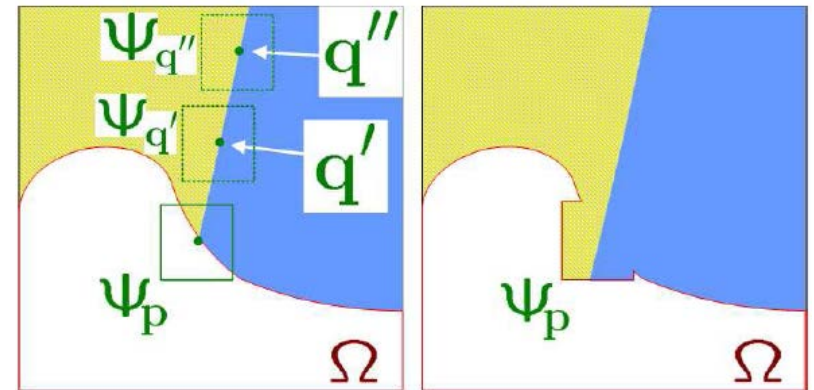
- Filling order is critical

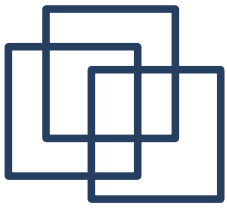




Algorithm

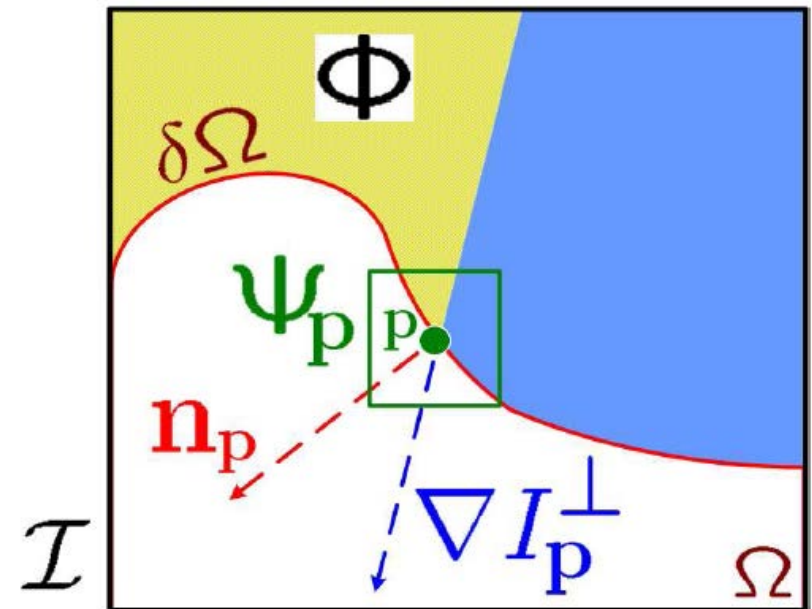
- 1) Computing patch priorities at fill front
→ see next slide
- 2) Find patch with max priority
- 3) Find most similar exemplar (source region)
→ SSD in CIE lab color space
- 4) Copy image data & update confidences

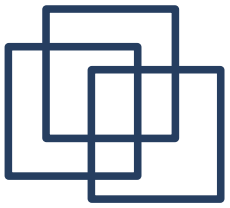




Patch priorities

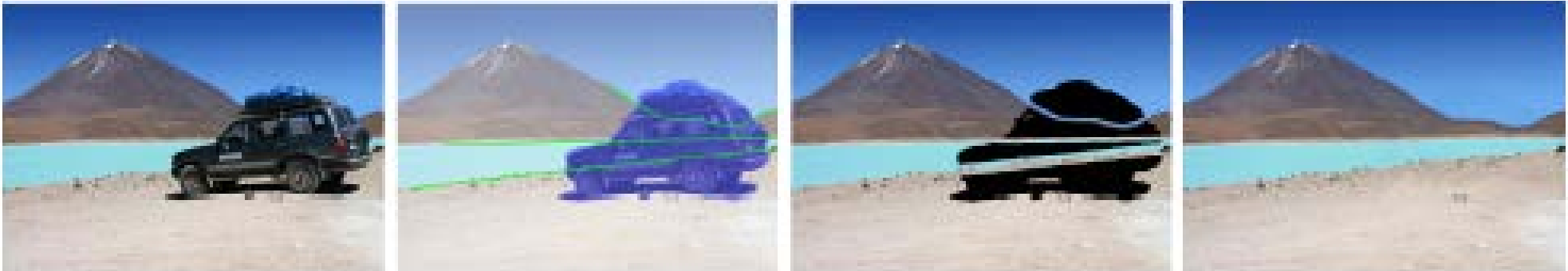
- $P(p) = C(p) * D(p)$
- Confidence term: amount of reliable information surrounding pixel p
- Data term: encourages linear structures to be synthesized first





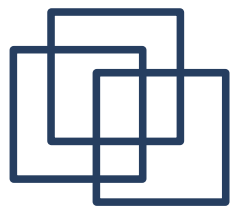
Limitations

- Need similar patches for synthesis
- Only linear structures (curves?)



- Cannot handle depth ambiguities





Competitive work & Impact

- Diffusion-based techniques [Bertalmio et al., 2000]



- No blur / faster

→ Patch-based approach wide-spread

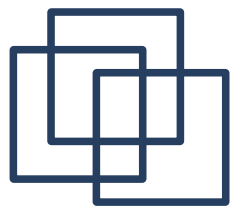
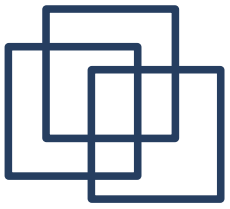


Image completion with Structure Propagation

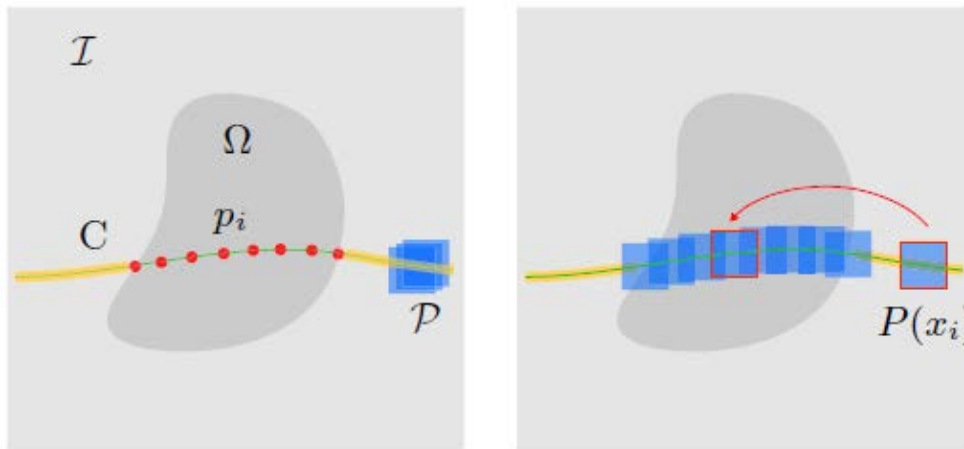
- Previous approaches have difficulties with salient structures in unknown regions
- Structure propagation along user-specified curves



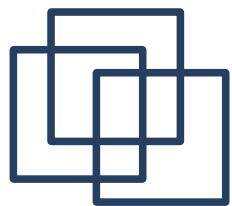


Key Ideas

- Synthesis ordering
 - Salient structures first
 - Then texture propagation into other regions

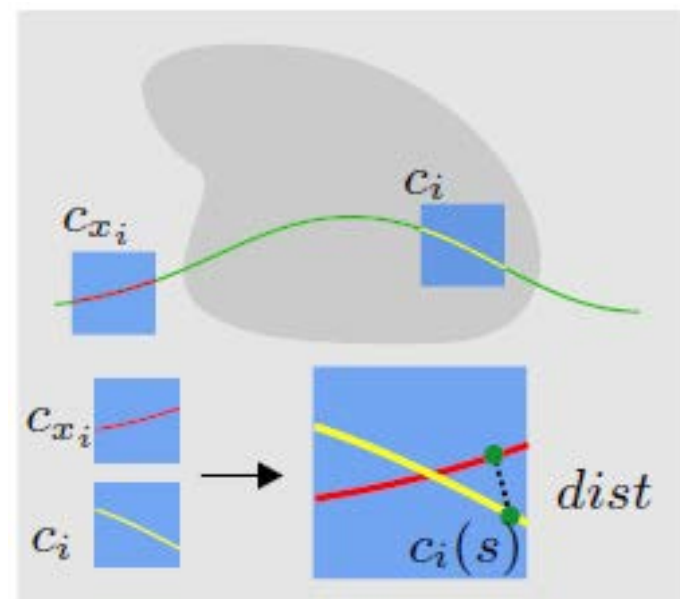


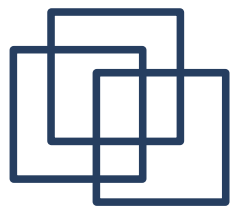
→ Graph labeling problem



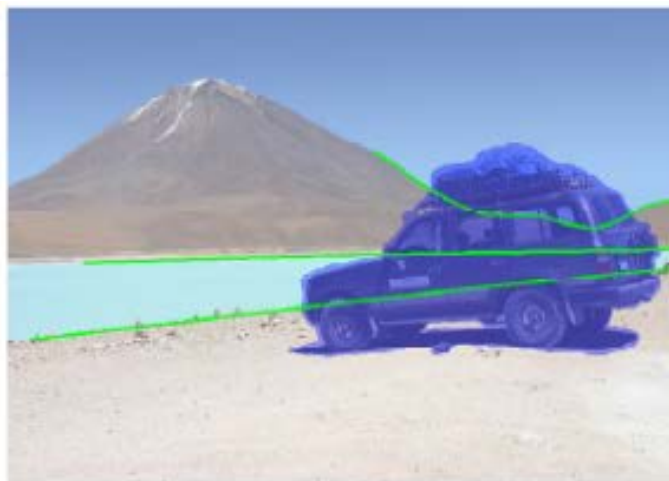
Key Ideas (2)

- Formulate structure propagation as global optimization problem
 - Similar structure
 - Overlapping patches should match
- Solve effectively using
 - Dynamic Programming
 - Belief Propagation





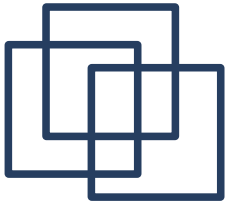
Results & Competitive Work



Criminsi et al., 2003

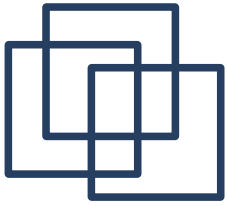


Sun et al., 2005



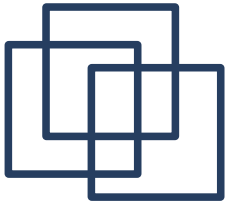
Discussion

- Questions?



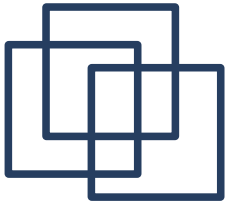
Discussion

- Differences?
 - Combination structure and textures vs. separation of structure and texture
 - Linear vs. curves
 - Amount of user input



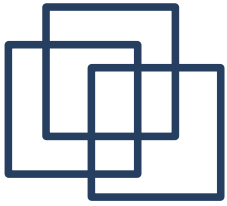
Discussion

- Limitations?
 - Depth
 - Areas for sampling
 - Guidance by user



Discussion

- Solutions?
 - Layers and Bayesian Matting
 - Patch Matching



Discussion

- Future work?
 - Applying Belief Propagation to other graphical work
 - Video/Meshes